ASTEC INDUSTRIES, INC.

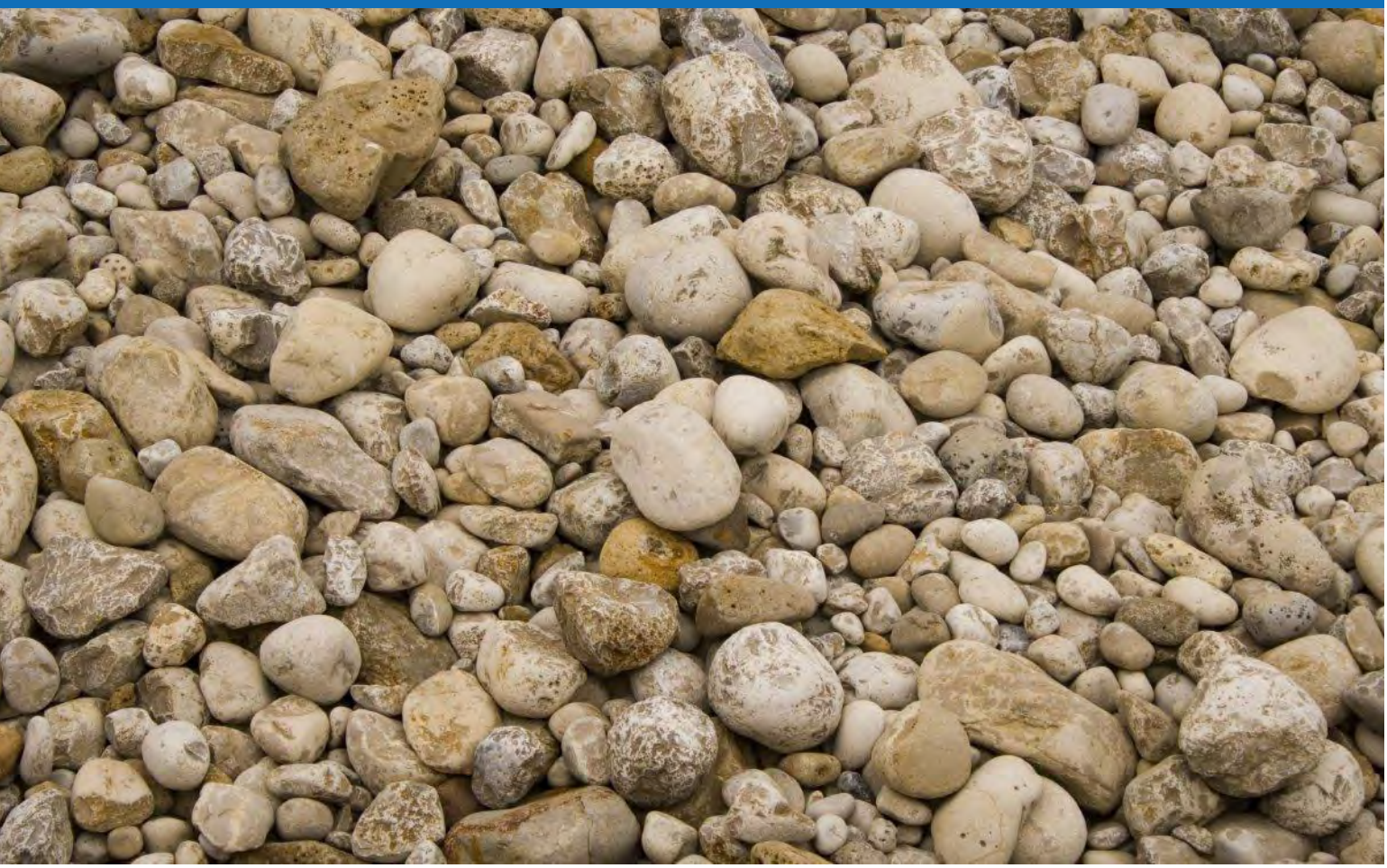
KPI-JCI ASTEC COMPANIES | ASTEC MOBILE SCREENS

Vertical Shaft Impactor

Crushing & Screening

Vertical Shaft Impactor

OPERATION AND MAINTENANCE MANUAL



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Record your vertical shaft impactor serial number and order number in the space below. Please include these numbers when requesting service or ordering replacement parts.

KPI-JCI
ASTEC COMPANIES
Kolberg-Pioneer, Inc.

JOB ORDER

MODEL | S/N

MANUFACTURED BY KOLBERG-PIONEER, Inc. YANKTON, SD, U.S.A.

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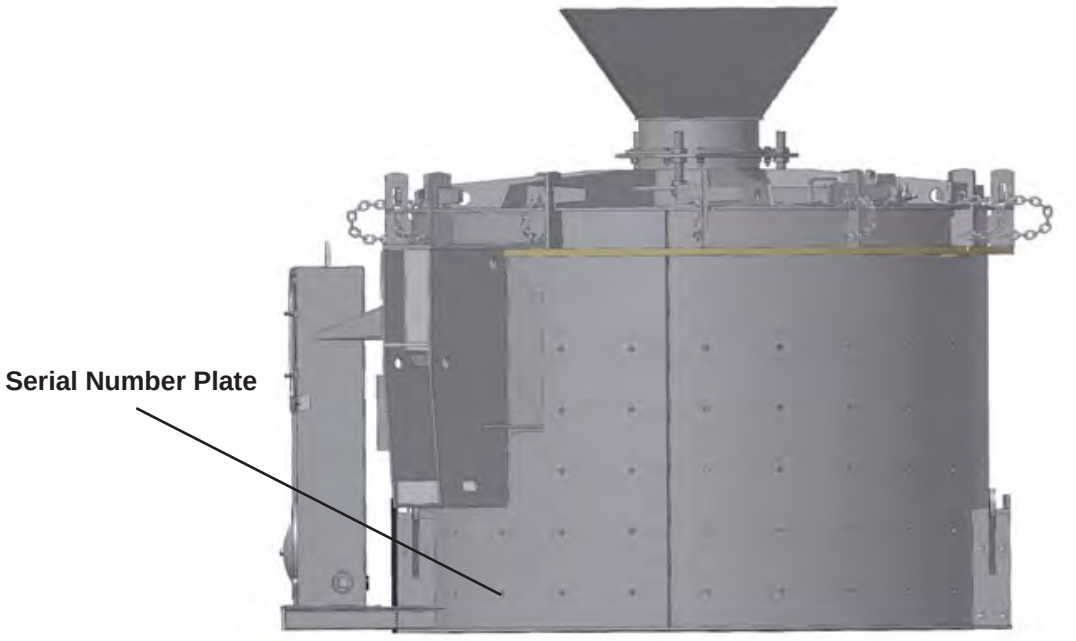


CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, an other reproductive harm.

Vertical Shaft Impactor

OPERATION & MAINTENANCE MANUAL

Models Covered:

1500	82
2500	120
4500	

Printed in the USA

This manual contains operating instructions and lubrication-maintenance information. Application of this information should maximize the performance and life of your equipment and minimize down time.

Safe and efficient operation requires that anyone who will be operating or maintaining this equipment read and understand the safety, operation, maintenance and troubleshooting information contained in the operator's manual.

Continuing improvement and advancement of KPI-JCI products may cause changes to your equipment which may not be reflected in this publication.

KPI-JCI reserves the right to make changes or add improvements to its products at any time, without incurring any obligation to make such changes on previously manufactured equipment.

Although care has been taken to assure the accuracy of this publication, KPI-JCI does not assume any liability for loss, damage or injury caused by errors or omissions.

Contents

About This Manual

Purpose

The purpose of this manual is to help you get the best value from your equipment. It can do so by helping you decide what work must be done, even if you decide to have it done by a dealer service department or a repair shop. It also provides information and procedures for routine maintenance and servicing.

Using the Manual

Procedures, once described in the text, are not normally repeated. When it is necessary to refer to another chapter, the reference will be given as page number.

Even though this manual has been prepared with extreme care, KPI-JCI can not accept responsibility for errors in, or omissions from the information given.

Special Notations

Within this manual procedures or situations that require special attention are indicated with the words, **DANGER,WARNING, CAUTION and IMPORTANT.**

DANGER, WARNING and **CAUTION** are used to indicate procedures or situations where personal safety is involved.

IMPORTANT is used to indicate special procedures or situations which, if not observed, could result in damage to the equipment or affect the operation of the machine.

Serial Number Plates

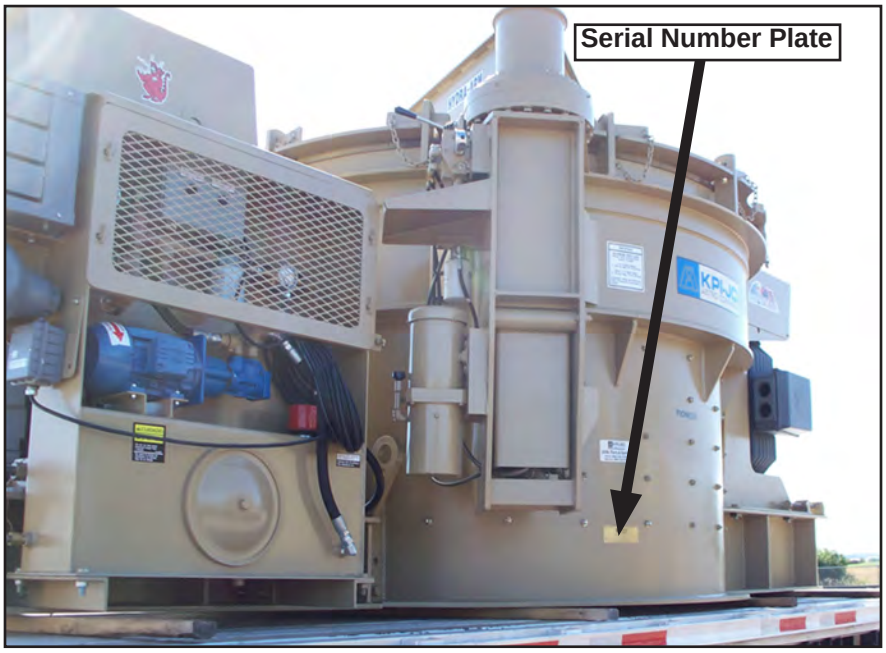
Modifications are a continuing process in the manufacture of this equipment. Since replacement parts, manuals, and lists are compiled specifically for each unit, the serial numbers are essential to correctly identify the component required.

The serial number plate will show the serial number, job order number and model number.

Vertical Shaft Impactor Serial Number

The serial number for the vertical shaft impactor is stamped on a plate which is located at the bottom of the vertical shaft impactor near the lubrication panel and/or the hydra-arm

The plant serial number is the number that should be referred to when ordering parts or requesting service.



Vertical Shaft Impactor Serial Number Plate Location

Buying Replacement Parts

Authorized Dealer Parts Department

An authorized dealer parts department is the best source for parts, particularly parts which are unique to this equipment. If you do not know who the authorized dealer is in your area contact KPI-JCI. Dealerships are located throughout the United States and some parts of the world.

Purchased Components

Replacement parts for components purchased by KPI-JCI such as gear reducers, electric motors and engines are available through your authorized dealer. However, items like engine parts are typically not stocked by the dealer or KPI-JCI.

Serial Number

Since replacement parts manuals and lists are compiled specifically for each unit, the serial numbers are essential to correctly identify the component required.

Maintenance Techniques and Tools

Tools

Although a minimal number of tools are needed for operation and maintenance, a good selection of basic tools is required.

The following is a list of recommended tools for servicing and maintaining the vertical shaft impactor.

- Tool box
- 3/4” drive socket set (socket to 2”) with ratchet and extension and breaker bar (up to M50)
- 1/2” drive socket set
- Box end open wrench set 3/8” to 1” (M10-M24)
- Allen wrench set 1/8” to 1” (M3-M24)
- Punch and chisel set
- 3 pound sledge
- Pry bar set (dog leg)
- Line bar set
- 1 set of Phillips screwdrivers
- 1 set of standard screwdrivers
- 2 - 8” Vise grip curved
- 18” pipe wrench
- 18” crescent wrench opening to 1-3/4”
- Scraper
- Spanner wrench (p/n 257017)

These items can be purchased from KPI-JCI as a kit.

Order part number 289470 for the vertical shaft impactor tool kit.

Order part number 363742 for the vertical shaft impactor metric tool kit.

Waste Oil and Fluids

Waste oil and fluids drained from the engine and hydraulic system during normal maintenance and repair can present a disposal problem.

To avoid pouring them on the ground or into the sewage system, pour the used fluids into large containers, seal them and take them to an authorized disposal or recycling center.

Fasteners

All threaded fasteners should be clean and straight, with undamaged threads and undamaged corners on the hex heads.

It is a good habit to replace all damaged fasteners when performing maintenance, never reuse a damaged fastener.

Special locknuts with nylon inserts can only be used once. If they are removed, they lose their locking ability and must be replaced.

Rusted nuts and bolts should be treated with a penetrating fluid to ease removal and prevent breakage. Badly rusted fasteners may have to be chiseled, sawed or torched off.

Flat washers and lockwashers, when removed from an assembly, should always be replaced exactly as removed. When replacing nuts and bolts, be sure to use the correct grade. Never use a different grade of bolt than the original equipment.

Any nuts and bolts that are torqued can only be used once. If they are removed, replace them with new nuts and bolts.

Lubricants and Fluids

Factory Fill Lubricants

The lubricants listed below in bold type are factory fill lubricants. Other lubricants may be used, provided they meet the lubrication requirements specified.

Cold weather lubricants are listed after the factory fill, see **Cold Weather Startup** for more information.

Bearings and Hydra-Arm

- **Philube High Temp EP 2**

Hydra-Arm

- **Hydrex MV60**
- Hydrex MV22

For extremely cold temperatures -58 degrees F and below (-50 degrees C), Hydrex MV 22 is recommended. When using an ISO 32 hydraulic oil with a viscosity index less than 100, the temperature limit is 10 degree F above zero.

Oil Circulating System

- **Mobilgear 600 XP 68**

Storage

When the machine will not be used for a period of a few months, use the following procedure for storage to minimize corrosion and deterioration.

General Storage Guidelines

- Remove all dirt and debris from all areas in and around the machine.
- Lubricate all points as specified in the maintenance and lubrication section of this manual.
- Bearings must be rotated and lubricated every 30 days (they are in storage) to prevent them from drying out.
- Loosen and remove v-belts to prevent them from stretching.
- Clean the outside of the machine and repaint any areas where needed.
- Attach a tag to the plant indicating what storage procedures have been done.
- To help prevent corrosion, the fuel and hydraulic tanks should be filled to their proper level.

Electric Motor Storage Guidelines

The following guidelines should be followed when storing equipment with an electric motor.

- Loosen and remove v-belts from the electric motor to reduce the load on the bearing.
- Fill the bearing cavities with grease to prevent condensation.
- Rotate and lubricate the bearing every 30 days it is in storage to prevent them from drying out.
- If storing for longer than six months, follow the **Extended Period Storage** in the next column for bearings.

If the equipment will be stored for periods longer than two years, the bearing will need to be removed, cleaned, and regreased; or it should be replaced.

Extended Period Storage
(6 months or more)

If the machine will be stored for a period of six months or more follow the guidelines below.

These guidelines should be completed once every three months to lubricate the bearings and/or to purge condensation and to prevent the bearings from drying out.

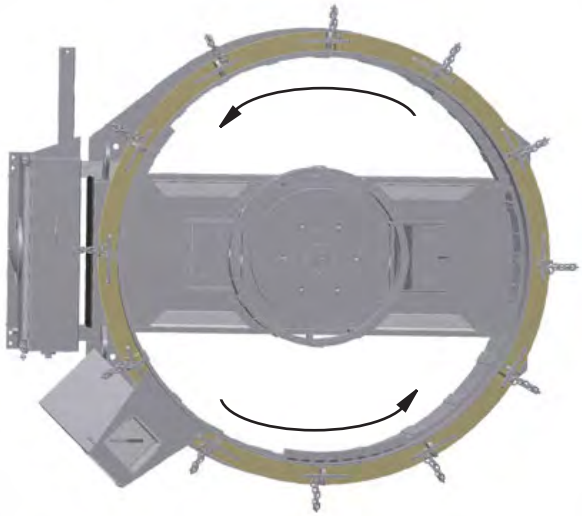
- Lubricate bearings
- Rotate the shaft two revolutions.
- Replace breather cap.

Introduction to the Vertical Shaft Impactor

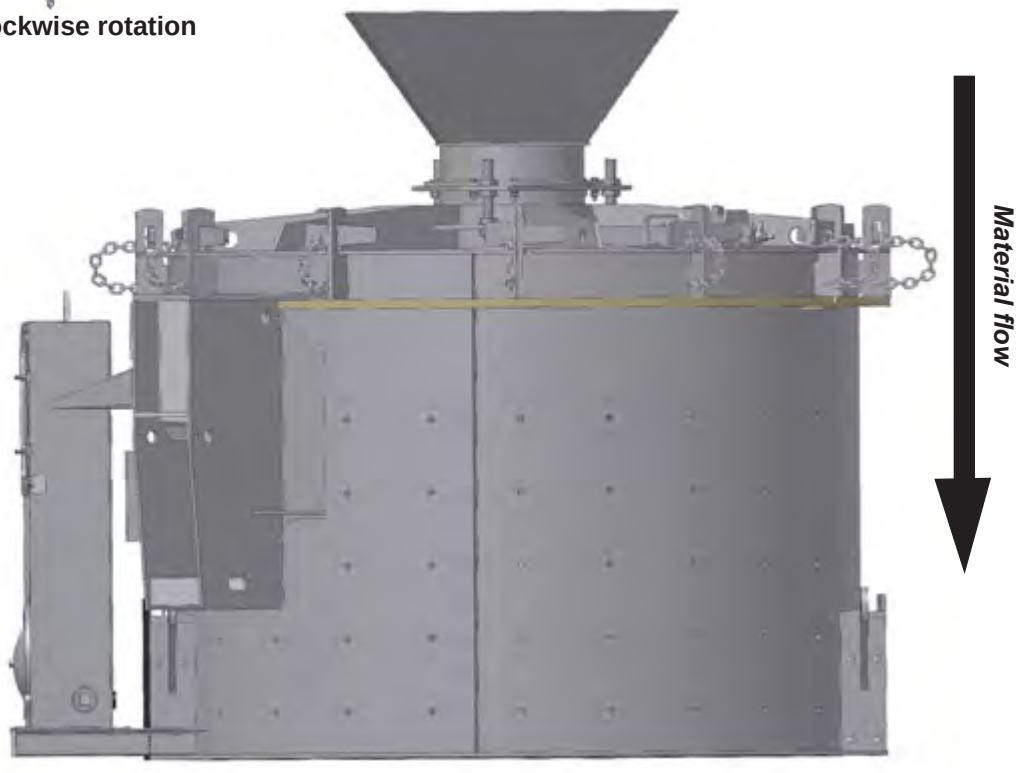
Orientation is determined by standing at the opening of the Vertical Shaft Impactor looking in the direction of material flow.

The feed end of the Vertical Shaft Impactor receives the material to be crushed and the discharge end discharges the crushed material.

References to the right hand and/or left hand side will be as shown below.



Counterclockwise rotation



The following is a brief description of the Vertical Shaft Impactor's basic parts and their function.

Tub

The tub includes the impact ring and tub liners. The tub supports the lid assembly, impact ring and contains the crushing action.

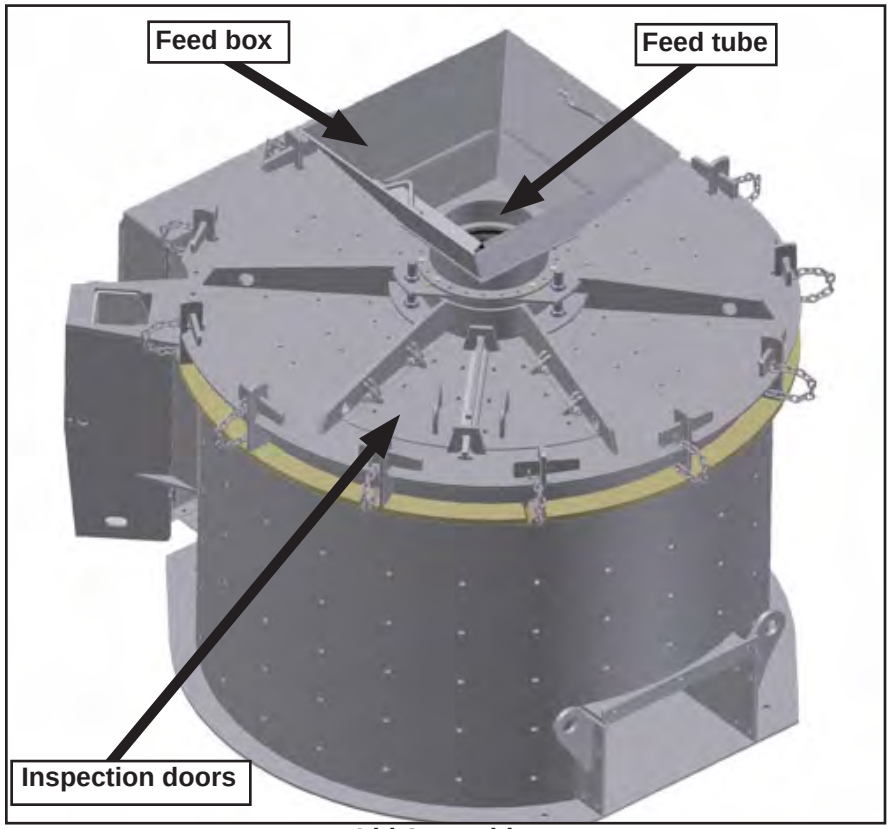
Tub

Base

The base supports the tub and the lid assembly, provides anchoring for the pedestal assembly and motor and provides the discharge area for the crushed material.

Lid Assembly

The lid assembly consists of the feed box, feed tubes, lid liners and inspection doors. The lid contains the crushing action and provides a feed entry point. For access to the complete crushing chamber, the entire lid may be lifted after removing the hold-down wedges. On models equipped with a Hydra-Arm, the lid can be raised and rotated hydraulically. The lid is equipped with bolt-in alloy liners.



Lid Assembly

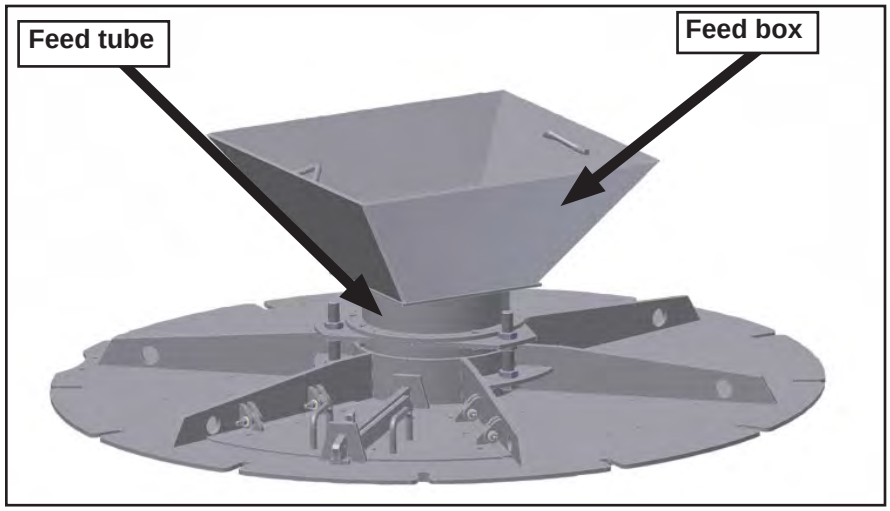
Feed Box

The feed box collects feed material and directs it down the feed tube. The feed box is designed with a rock shelf to provide rock on rock wear protection.

Feed Tube

The feed tube plays a vital role in the overall performance of the crusher. The feed tube directs the feed material directly into the crushing chamber. It is important that proper height adjustment between the feed tube and accelerator is maintained for efficient production.

The feed tubes are reversible and replaceable for abrasion resistance and ease of maintenance.



Feed Box and Tube

Lid Liners

The lid liners are arranged in a circular pattern in order to cover the entire underside of the lid from wear. The inner liners and outer lid liners bolt to the lid with hex head bolts.

Lid Liners

Inspection Doors

The lid is equipped with large inspection doors to facilitate easy internal inspection and allows for certain table wear parts replacement or to check the feed tube measurement. If access cannot be gained through the inspection doors, the Hydra-Arm can be used to lift and rotate the lid to open the crushing chamber.

Hydra-Arm

The optional hydra-arm lifts the lid for a full 360 degree access for safe and efficient maintenance procedures.

Hydra-Arm

Impact Ring

The impact ring assembly includes the anvils and may or may not include a rock shelf.

Anvils

The stationary anvils are arranged in a circular pattern and provide the main striking surface for the material propelled from the table assembly.

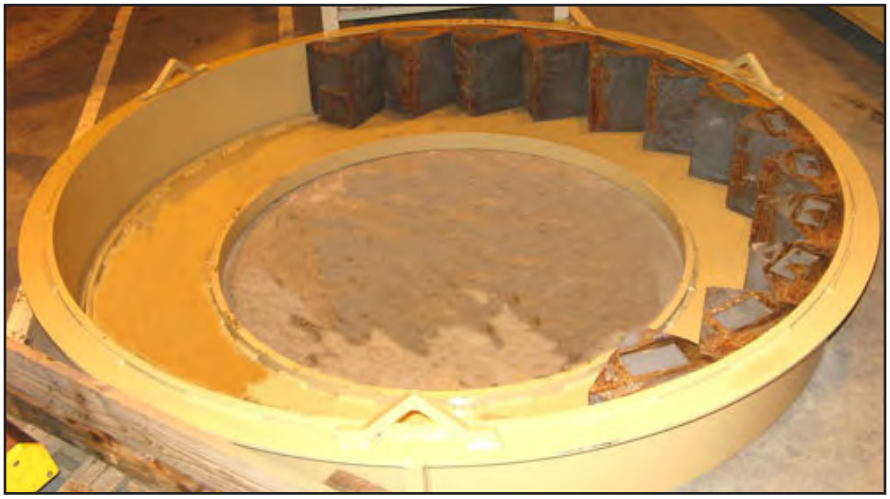
The feed material is accelerated by the revolving impeller table. Crushing takes place when the feed material impacts the anvils. The geometry of the anvils provide a right angle impact. Each crusher is supplied with anvils designed for optimum performance and metal utilization. The anvils are made of high chrome alloy.

The impact ring assembly rests on a multiple step-retaining bracket that can also be used for vertical adjustment.

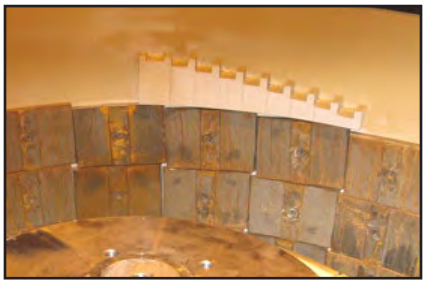
Rock Shelf

The rock shelf supports fractured material from the anvils. This material acts as a cushion to protect the upper tub area from wear. It also provides autogenuous (rock-on-rock) fracturing.

Cluster Ring



Rock Shelf



Retaining Bracket

Rotor/Table Assembly

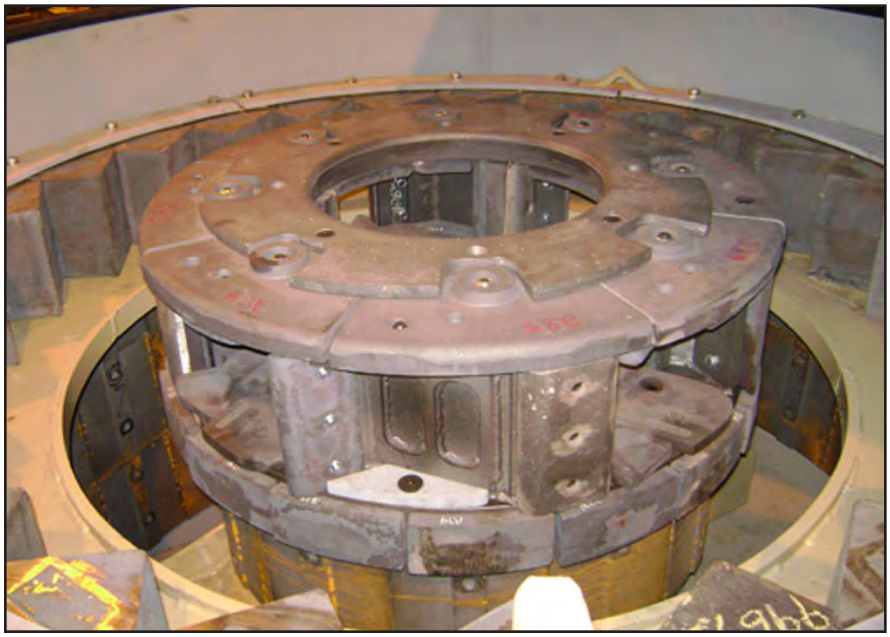
There are two options for an accelerator on a vertical shaft impactor: rotor or table configuration. The accelerator rotates counterclockwise (as viewed looking down on the accelerator) and is bolted to the flywheel that is keyed and secured to the pedestal shaft with a locknut.

A rotor configuration of three or four material ports is available depending on model. 1500 and 2500 model vertical shaft impactors are equipped with a three port rotor and 4500 models are equipped with a four port rotor. A rotor configuration is not available on 82 and 120 models.

Table configuration of three, four, or five shoes is available.

The impeller shoes are a cast chrome iron alloy material and must be replaced prior to wearing through to the steel support brackets. The impeller shoes are held secured to the table assembly with two bolts or a shoe pin.

Each configuration consists of a center feed disc, flat liners and outer liners.



Rotor Assembly

Table Assembly

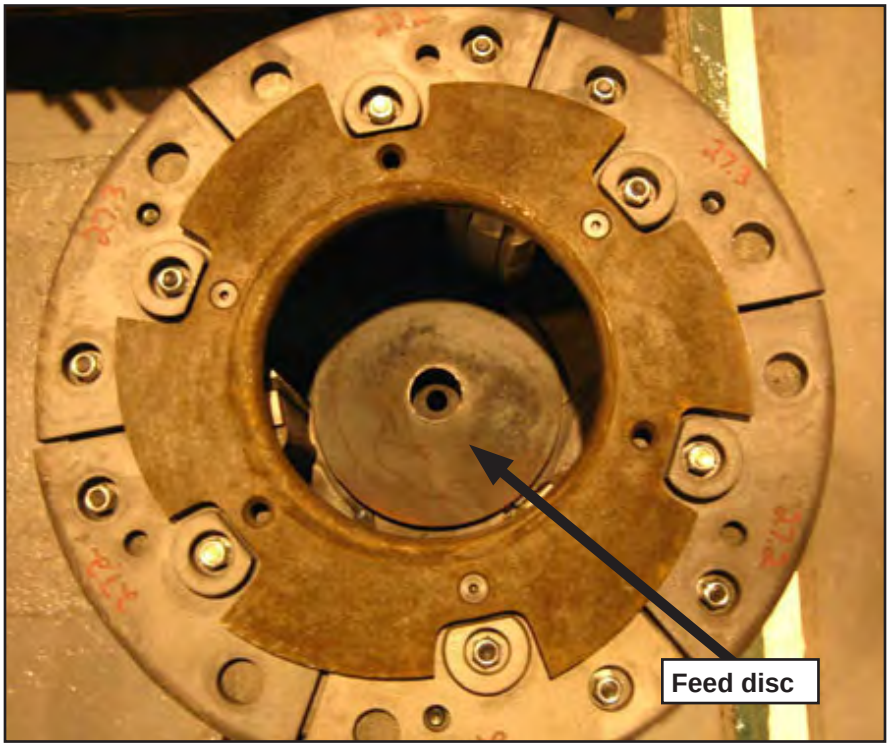
Feed Disc

As the material drops through the feed tube, it lands on the rotating feed disc located at the center of the accelerator. The feed disc distributes the feed material and also provides wear protection for the table or rotor and shaft assembly.

The feed disc affects:

- Distribution of material across the shoe face.
- Trajectory of material to the anvils.
- Rate of wear of top table liners.
- Overall crusher performance.

Feed Disc - Table Configuration



Feed Disc - Rotor Configuration

Skirt Ring Assembly

The stationary skirt ring sits below the accelerator and protects the flywheel and pedestal. The skirt ring is lined with cast alloy skirt liners held in place by hex head bolts (2 per liner).

Skirt Ring

Pedestal

The pedestal assembly consists of the shaft, bearings, housing and seals. The shaft is keyed to the flywheel which is bolted to the accelerator. The driven speed of the pedestal shaft determines the speed of the accelerator. An independent lubrication system with external pumps, filtering and alarm system insures proper bearing lubrication.

Pedestal Skirt Cone

The pedestal skirt cone is located behind the skirt ring assembly and protects the pedestal and related parts.

The conical shaped guard is made of an abrasion resistant polyurethane compound.

Pedestal Skirt Cone

Lubrication Panel

There are two options for the lubrication panel.

The first option includes a temperature and flow monitoring system with an alarm. The pedestal and gearbox assemblies have independent lubrication pumps, oil reservoirs and monitoring panels.

The grease fitting for the pedestal (or gearbox) is located on the lubrication panel. Grease is used to purge the pedestal (or gearbox) seals.

The second lubrication panel option uses sensors in place of the temperature and flow monitoring system as well as a tank sensor to monitor lubrication functions of the VSI.

Lubrication Panel - Gen. 2 Shown

Heat Exchanger

To provide cooling of the pedestal (or gearbox) lubricants, a heat exchanger is used.

The pedestal heat exchanger is normally mounted integral with the pedestal lubrication tank and uses an electric or hydraulic motor for operation.

The gearbox heat exchanger is designed for mounting on the radiator of the diesel engine.

Pedestal Heat Exchanger

Diesel Gearbox/V-belt

The gearbox converts horizontal shaft input power (diesel engine) to vertical shaft output (pedestal) through a modified right-angle gearbox that is v-belt connected to the pedestal shaft.

Correct table speed is available by changing the sheave ratio to match the engine speed.

Safety First!

This symbol is used to bring attention to safety precautions and instructions.

When you see this symbol, be alert and pay attention to all instructions.

YOUR PERSONAL SAFETY IS INVOLVED

Most accidents are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs.

Improper operation is dangerous and could result in injury or death.

Basic safety precautions are outlined in the “SAFETY PRECAUTIONS” portion of this publication and in the description of operations where hazards exist.

Warning decals have also been placed on the equipment to provide instructions and to identify specific hazards which, if not heeded, could cause bodily injury or death to you or other persons.

KPI-JCI cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the equipment are therefore not all inclusive.

If an operation is not performed as specifically recommended by KPI-JCI you must satisfy yourself that it is safe for you and others. You should also ensure that the equipment will not be damaged or made unsafe by the method of operation you choose.

The following signal words may be used in this manual to designate a degree or level of hazard and are defined as follows.

DANGER

DANGER is used for imminently hazardous situations which, if not avoided, WILL result in death or hazardous injury.

WARNING

WARNING is used for potentially hazardous situations which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION with the safety symbol is used for potentially hazardous situations which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION

CAUTION without the safety symbol is used for practices that could result in damage to the machine if not observed.

NOTICE

NOTICE is used for specific practices that are critical to the operation or maintenance of the equipment.

Safety symbols are used with signal words to further demonstrate a safety hazard. The table below illustrates the safety symbols found on decals.

Safety Precautions

The safe operation and maintenance of the plant is the responsibility of the owner/employer and the operator/employee.

The owner/employer must ensure that anyone who operates, maintains, services, transports or works around the machine is familiar with operation, maintenance and safety procedures and information outlined in this manual.

Owner/Operator's Responsibility

It is the owner/operator's responsibility to insure everyone operating the equipment is familiar with safe operation and maintenance of the plant. Do not risk injury or death by ignoring safety practices or failing to instruct.

It is the owner's responsibility to give the operator/employee instruction before allowing them to operate, service, transport or work around the plant. This instruction should be reviewed at least annually.

Operator/Employee's Responsibility

It is the operator's responsibility to read, understand and follow all operation, service and safety information presented in this manual and on the machine.

Untrained operators and maintenance personnel are a hazard to themselves and others and are not qualified to operate or service the plant.

Never modify the plant in any way. Unauthorized modifications can affect the function and/or safe operation and life of the plant.

Safety Symbol	Safety Meaning
	**Fall Hazard.** Do not stand or sit on frame while in operation. Wear proper safety rigging and gear before climbing on the equipment.
 	**High Pressure Hazard.** The machine's hydraulic system poses a high pressure fluid hazard. Wear proper protective equipment (PPE) when working on the machine. Follow the steps to relieve hydraulic pressure and lockout/tagout machine before servicing.
	**Impact Hazard.** The machine uses counterbalance valves. Wear proper PPE. Follow the steps to relieve pressure and lockout/tagout machine before servicing.
 	**Magnetic Field Hazard.** Pacemaker users should use caution around the magnet.
	**Nip Point Hazard.** The head and tail pulley areas on conveyors pose a nip point hazard. Make sure machine is locked out/tagged out before servicing.
	**Flammable Material Hazard.** Diesel fuel and hydraulic oil pose a flammable material hazard. Do not smoke near machine.
	**Respiratory Hazard.** Machine operation causes dust. Wear a face mask when operating the machine.
	**Flying Debris Hazard.** Crusher operation causes debris and poses a risk of eye injury. Wear approved eye protection when the crusher is operating.
	**Falling Objects Hazard.** Loading the machine causes debris to fall and poses a head injury. Wear an approved hard hat when the machine is operating.
	**High Voltage Hazard.** The electrical components on this machine pose burns or shock risk. Make sure machine is locked out/tagged out before servicing.

The following section presents material on specific safety items. Although specific safety guidelines are given, each situation can have its own peculiarities which can not always be covered by specific rules.

General Safety

1. Read and understand the Operator's Manual before operating, servicing or working around this machine.

2. Have a first aid kit available and know how to use it.

3. Have a fire extinguisher available and know how to use it.

4. Wear necessary protective gear, including but not limited to:

- Hard hat
- Protective shoes with slip resistant soles
- Eye protection
- Protective gloves
- Hearing protection
- Respirator or filter mask

5. Check and secure all guards before operating. Repair or replace any damaged or missing guards or guarding devices.

6. Repair or replace any damaged handrails, ladders, or walkways.

7. Place all controls in neutral, stop engine, remove ignition key, follow lockout/tagout procedure and wait for all motion to stop before lubricating, adjusting, or servicing.

8. Clear area of people before starting the plant.

9. Review safety practices annually.

Assembly Safety

1. Assemble in an area with sufficient space to handle the largest component and access to all sides of the machine.

2. Use only cranes, jacks and tools with sufficient capacity.

3. Do not allow spectators in the assembly area.

Operating Safety

1. Read and understand the Operator's Manual before operating, servicing or working around this machine.

2. Keep hands, feet, hair and clothing away from moving parts.

3. Follow lockout/tagout procedure and wait for all motion to stop before lubricating, adjusting or servicing.

4. Clear the area of people before starting the plant.

5. Place the plant so that it is visible from the operator's station.

6. Never operate the plant if it has been damaged.

7. Keep all hydraulic lines, fittings and couplers free from leaks before operating.

8. Review safety practices annually.

9. Do not stand or sit on catwalk, underscreen frame, or rails while plant is in operation.

10. Safe working load of the platform is 300 lbs. (136 kg) 300.

Operating Safety Area

1. Keep away from receiving hopper and loading area.
2. Keep away from discharge end.
3. Always be aware of the location of other personnel and keep them away from hazard areas.
4. Keep away from power lines when relocating or transporting the plant.

Maintenance Safety

1. It is the owner/operator's responsibility to provide a safe method of access to certain service areas such as head pulley bearings and hub.

   Do not use the conveyor belt as a walkway to access these areas.
2. Read and understand the Operator's Manual before lubricating, servicing or working around this machine.
3. Follow lockout/tagout procedure and wait for all motion to stop before lubricating, adjusting or servicing.
4. Follow good shop practices.
5. Make sure all guards are in place and properly secured when maintenance work is completed.
6. Never wear poor fitting, baggy or frayed clothing when working around or on any of the drive system components.
7. Relieve pressure from the hydraulic circuit before servicing or maintaining system.
8. Keep hands, feet, hair and clothing away from moving or rotating parts.
9. Clear the area of bystanders when carrying out any maintenance or adjustment.

Magnet Safety

1. Magnetic field can be harmful to pacemaker wearers. Pacemaker wearers shall maintain a minimum safe distance of 16.5' (5 meters) from the magnet.
2. Strong magnetic field can produce sudden interaction with metallic objects. Use caution when handling objects near magnet.

Hydraulic Safety

1. Always place all controls in neutral before servicing hydraulic system.

2. Replace any worn, cut, abraded, flattened or crimped hoses or steel lines.

3. Do not attempt any makeshift repairs to the hydraulic lines, fittings or hoses by using tape, clamps or cements.

   The hydraulic system operates under extremely high-pressure. Such repairs will fail suddenly and create a hazardous and unsafe condition.

4. Wear proper hand and eye protection when searching for a hydraulic leak. Use a piece of wood or cardboard as a backstop instead of hands to isolate and identify a leak.

5. If injured by a concentrated high-pressure stream of hydraulic fluid, seek medical attention immediately. Serious infection or toxic reaction can develop from hydraulic fluid piercing the skin surface.

Transport Safety

1. Make sure you are in compliance with all local regulations regarding transporting equipment on public roads and highways.

2. Make sure that all the lights and reflectors that are required by the local highway and transportation authorities are in place, are clean and can be seen clearly by all overtaking and oncoming traffic.

3. Do not allow anyone to ride on the plant during transport.

4. Do not exceed 55 mph when transporting the machine. Reduce speed on rough roads and surfaces.

5. The machine is not grounded. Electrocution can occur without direct contact. Stay away from overhead power lines.

Lockout Procedures

Lockout procedures are a principal means of controlling energy hazards. A lockout procedure is a set of safe work practices and rules that make it impossible for a worker to come into contact with an uncontrolled energy source.

The first step in designing a lockout procedure is to identify all sources of energy that affect the work.

Second, action must be taken to neutralize, redirect or stop the energy from performing its normal function before workers enter the area to make adjustments or perform maintenance.

The third step is to verify that a ***zero energy state*** has been achieved. This means that there is no energy available to cause a hazard.

The final step is to physically prevent the accidental re-energizing of the system until the work is completed and every worker is in a safe place.

This last step often involves placing padlocks on equipment controls, which is the origin of the “lockout” term. For example, five workers might be involved in a maintenance procedure. Each of them might have a color-coded lock. All five locks could be placed on an electrical switch, preventing the power from being turned back on until all of the workers have removed their locks.

Zero Energy State

Achieving a zero energy state is often more complex than the simple example given above. Energy sources are not always obvious. Equipment is often initially powered by electricity. But this “main” energy source may be converted into other forms of energy as part of the operation of the machine. For example, a device might use electricity to power a pump, creating hydraulic pressure to operate the device. The hydraulic pressure remains stored in the system even when the electricity is turned off. Gravity and momentum can be stored in a stationary machine by springs or counterweights. The term zero energy state means that all of these energy sources have been controlled.

Lockout Policy

Every workplace where workers could come into contact with energy sources should have written safe work procedures that implement a lockout policy.

In some cases, job hazard analysis will be required. Training programs need to be designed. Responsibility for specific lockout procedures must be assigned to individuals by the employer.

The exact procedures involved in implementing a lockout will depend on the circumstances of the individual workplace. These general principles apply in every situation.

⚠CAUTION

Failure to follow correct lockout/tagout procedures could result in death or serious injury.

Anyone who will be operating and/or maintaining the machine must read and clearly understand all safety, operating and maintenance information presented in this manual.

Do not operate or allow anyone else to operate this equipment until this manual has been read and clearly understood.

A sign-off sheet has been provided for your record keeping to show that all personnel who will be working with this equipment have read and understand the information in this manual and that they have been instructed in the operation of this equipment.

This manual should be reviewed at least annually.

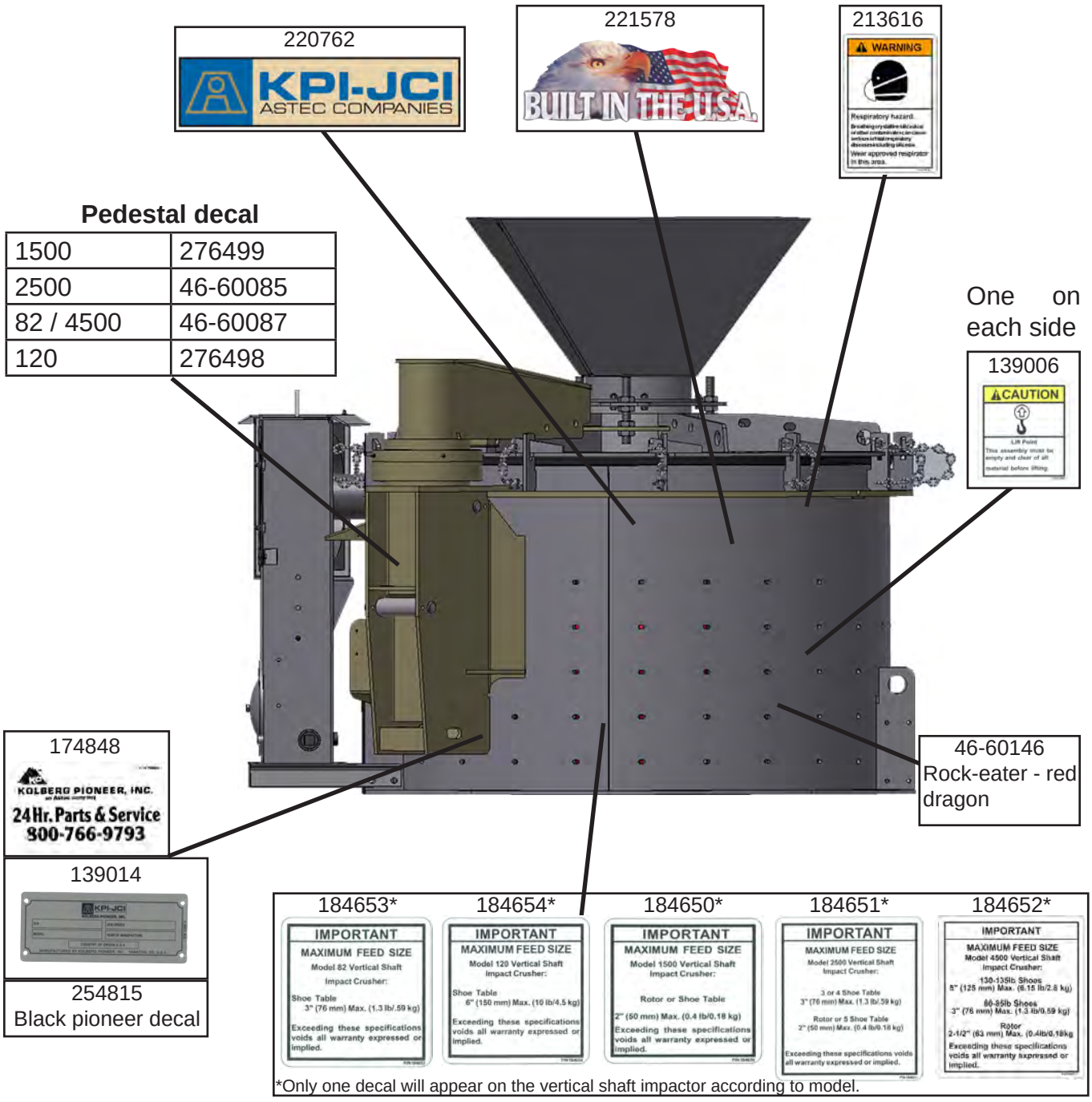
The following personnel have reviewed and have been trained in the proper operation and maintenance of the machine.

Date of review and training completion	Trainee Signature	Trainer Signature

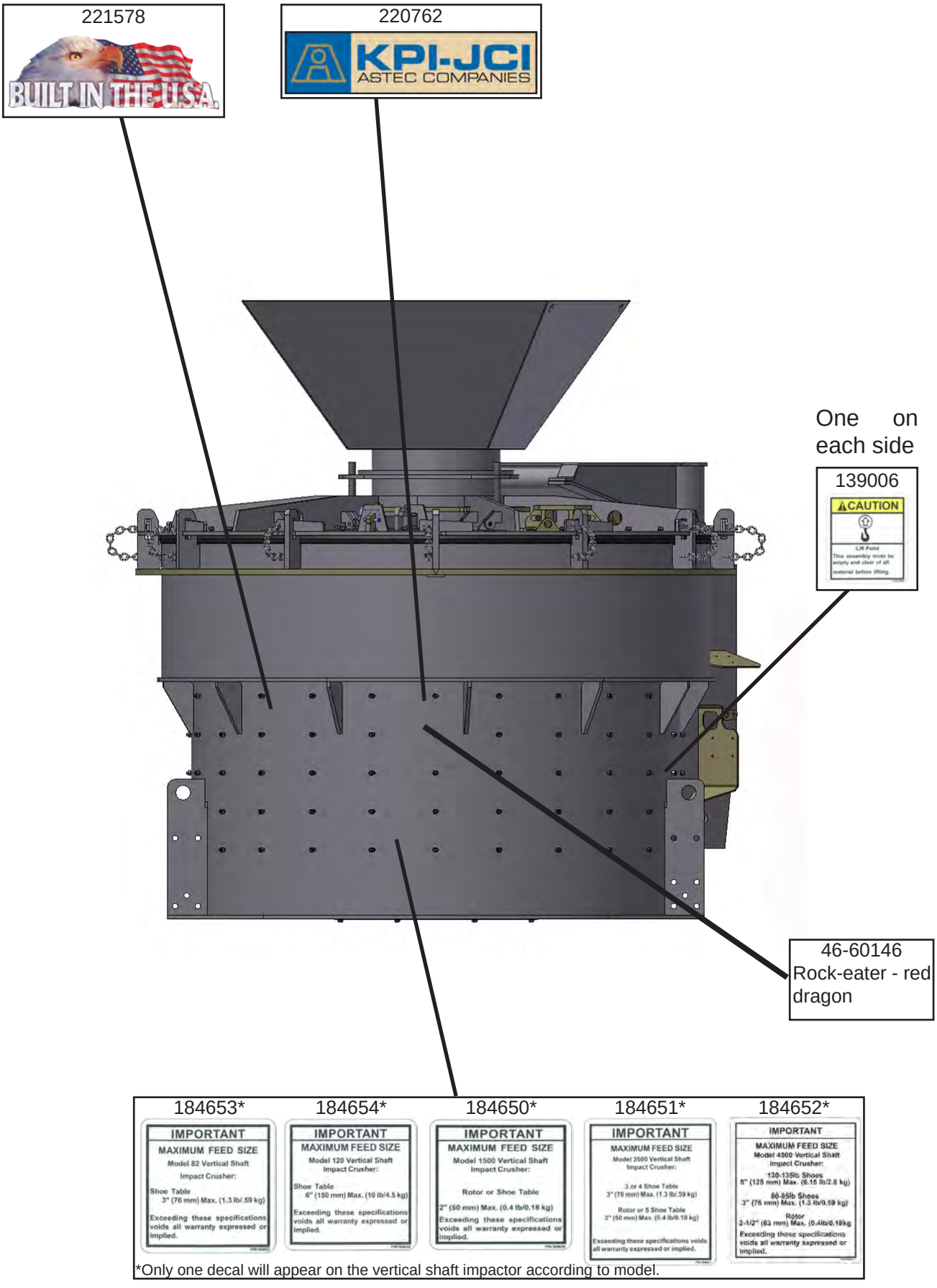
⚠ CAUTION

Safety decals are provided for your personal safety. If they should become damaged, they must be replaced. Contact your local dealer, or the factory at: 605-665-8771.

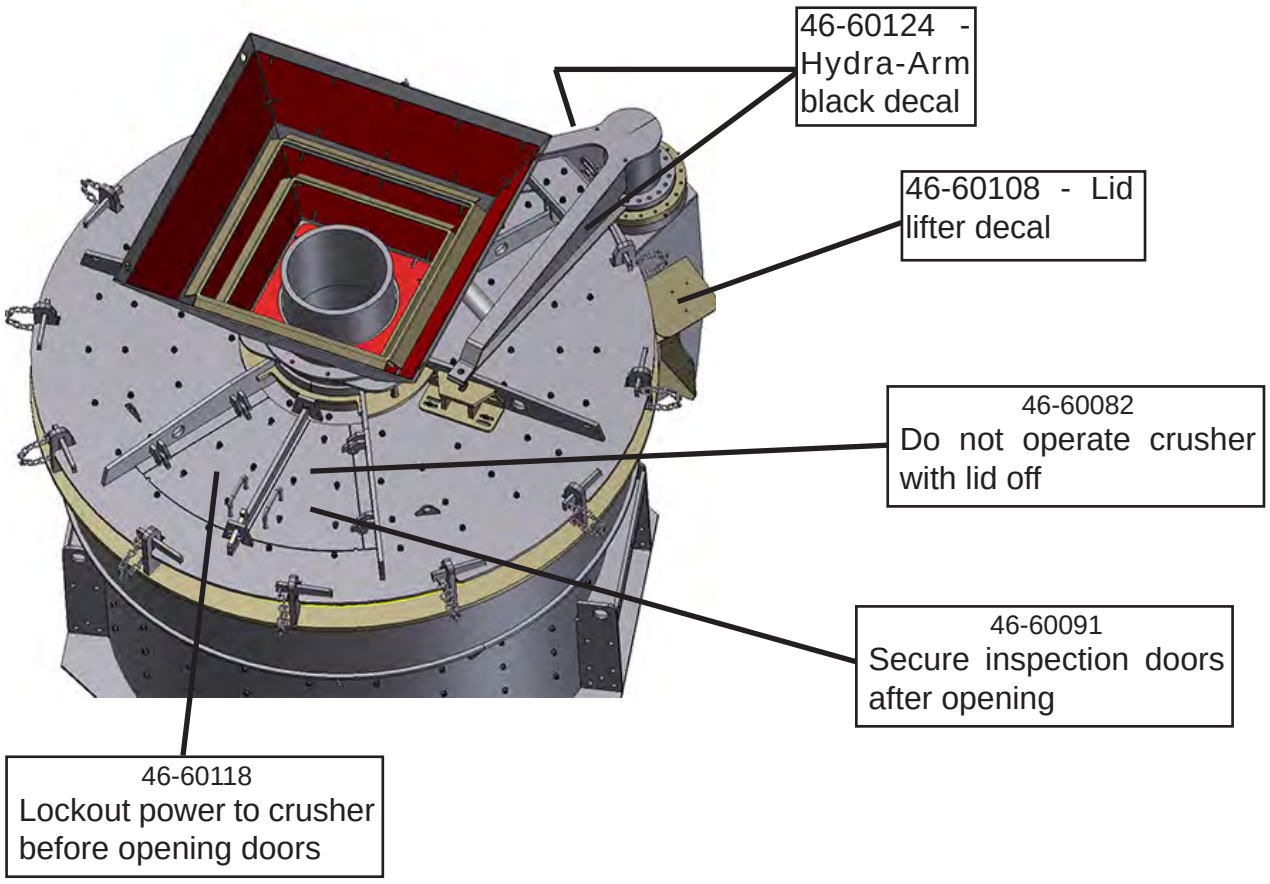
The following illustrations are shown to help identify decals when they require replacement. Make sure machine surface is clean and free from grease and oil before applying new decal.

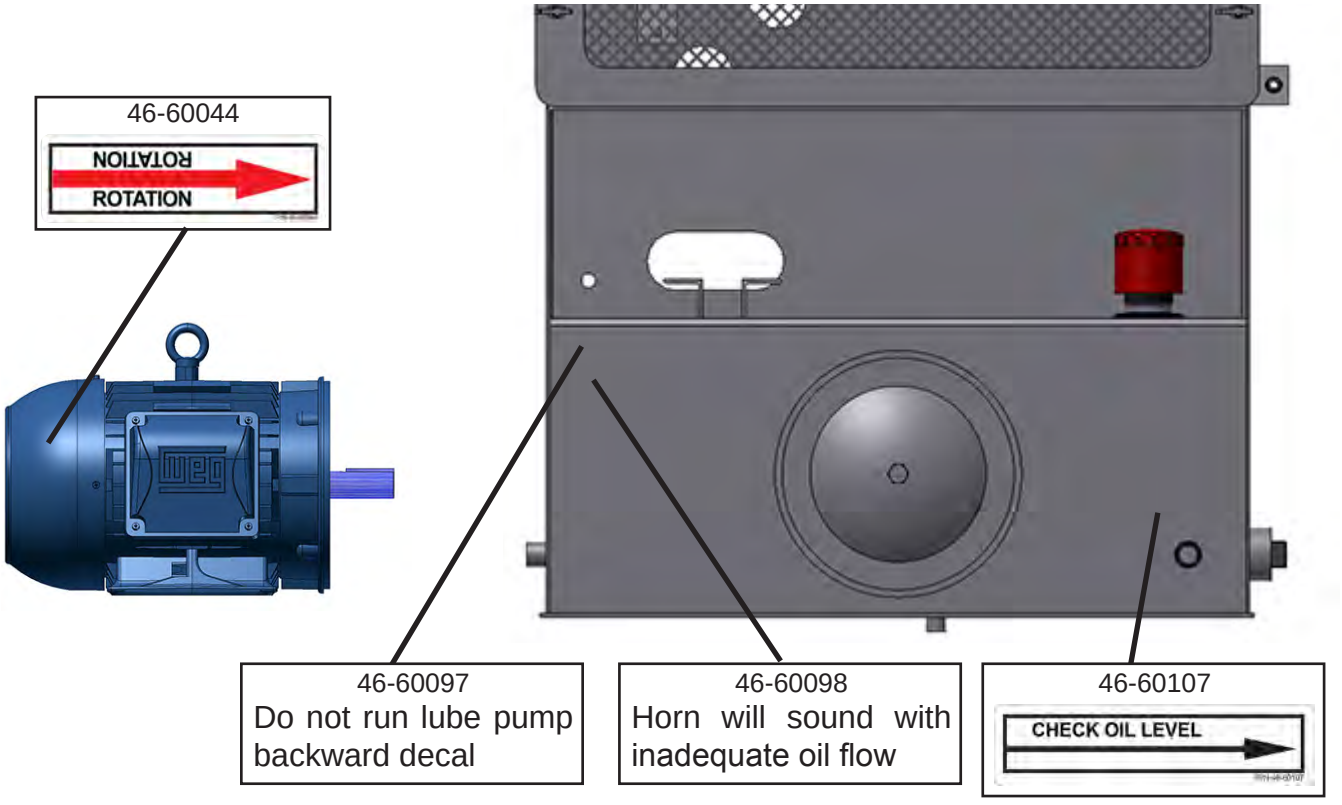


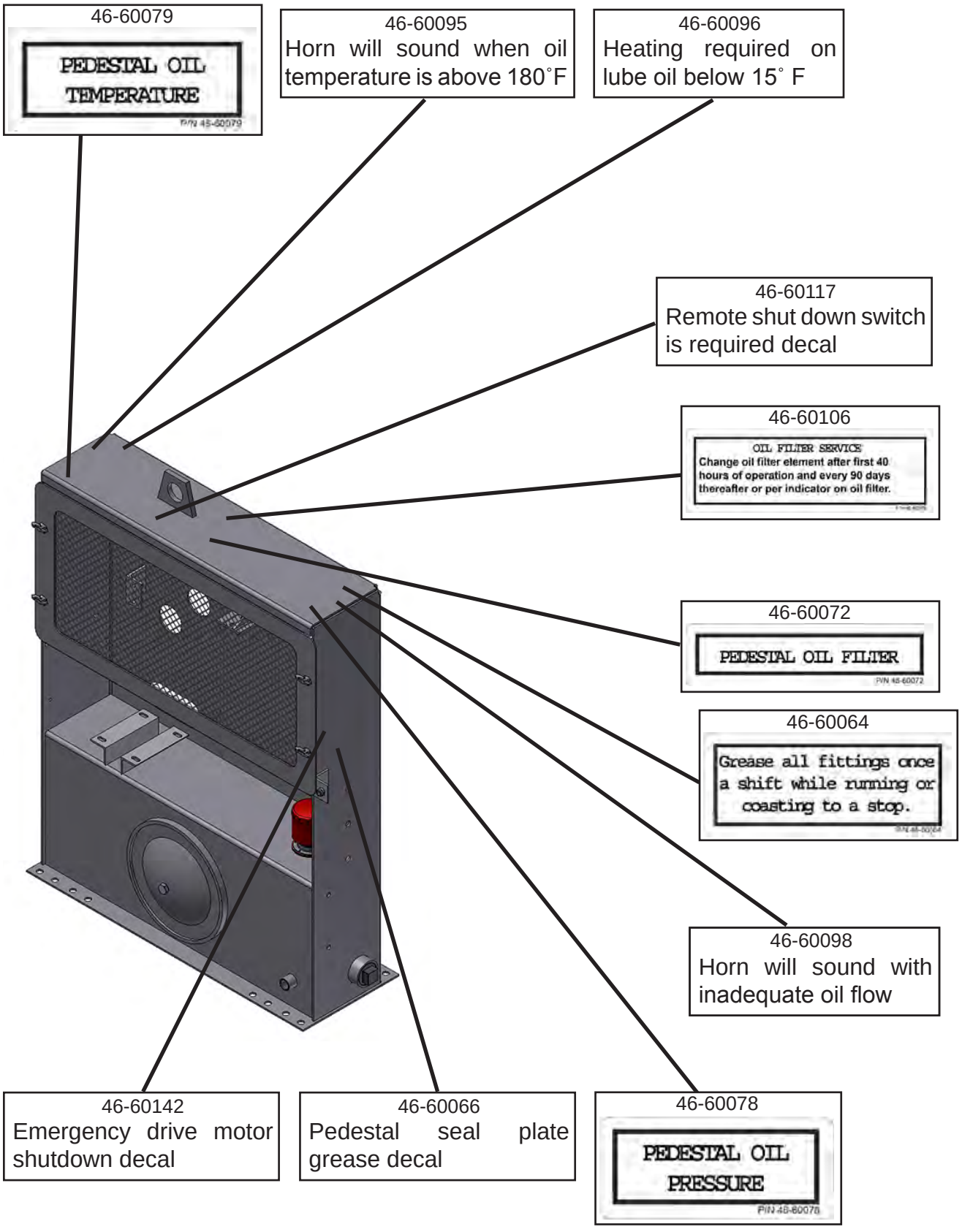
*Only one decal will appear on the vertical shaft impactor according to model.



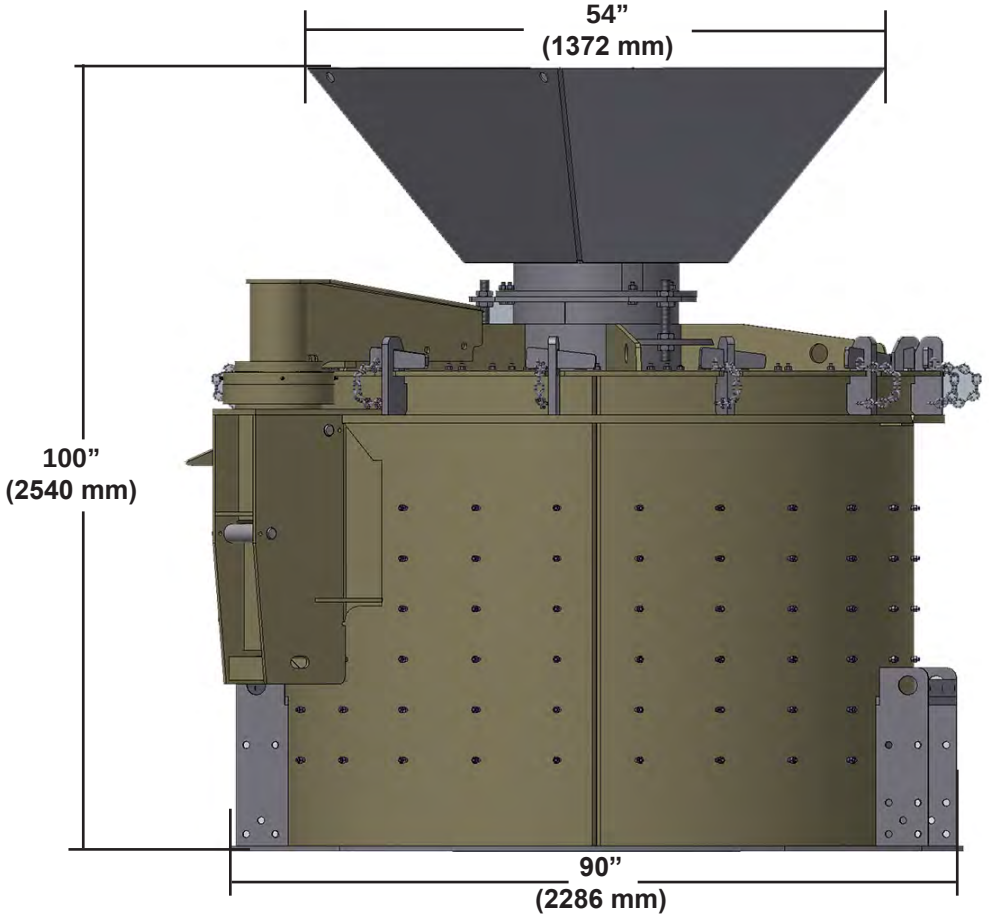
*Only one decal will appear on the vertical shaft impactor according to model.


46-60124 - Hydra-Arm black decal
46-60108 - Lid lifter decal
46-60082
Do not operate crusher with lid off
46-60091
Secure inspection doors after opening
46-60118
Lockout power to crusher before opening doors


46-60044
ROTATION
ROTATION
46-60097
Do not run lube pump backward decal
46-60098
Horn will sound with inadequate oil flow
46-60107
CHECK OIL LEVEL


46-60079
PEDESTAL OIL TEMPERATURE
46-60095
Horn will sound when oil temperature is above 180˚F
46-60096
Heating required on lube oil below 15˚ F
46-60117
Remote shut down switch is required decal
46-60106
OIL FILTER SERVICE
Change oil filter element after first 40 hours of operation and every 90 days thereafter or per indicator on oil filter.
46-60072
PEDESTAL OIL FILTER
46-60064
Grease all fittings once a shift while running or coasting to a stop.
46-60098
Horn will sound with inadequate oil flow
46-60142
Emergency drive motor shutdown decal
46-60066
Pedestal seal plate grease decal
46-60078
PEDESTAL OIL PRESSURE

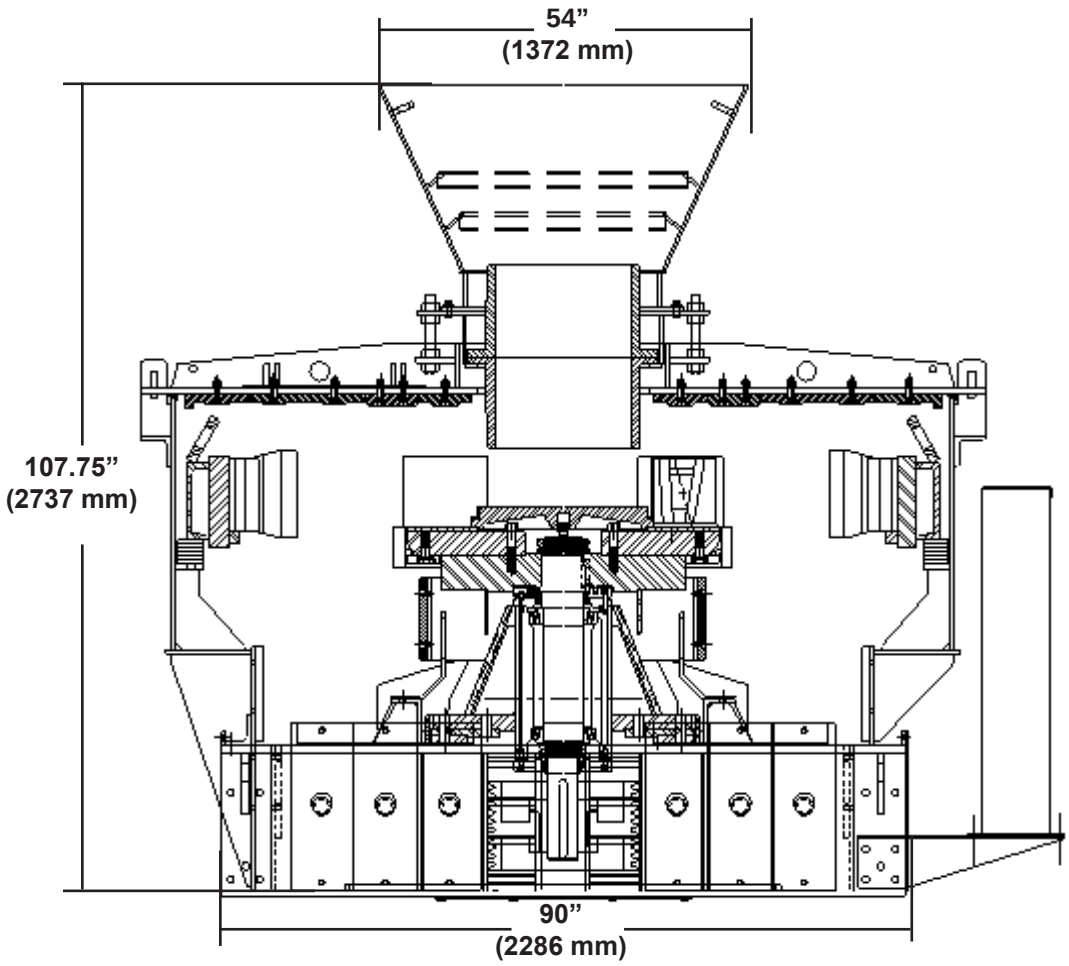
Specifications - 82



	Maximum Feed Size		Minimum Recommended Closed Circuit		Feed Tube Diameter in./cm		Capacity Effective Crushing Range		Standard Impeller Table Speed Range - RPM
	in.	mm	in.	mm	in.	mm	TPH	MTPH	
82	3	75	#16		14	356	250-400	227-356	800-1200

Recommended Horsepower Electric		Table/Anvil Clearance		Explosion Chamber Volume WK(2)		Approximate Weight EV-Models (Electric shown)	
HP	KW	in.	mm	cubic in.	cubic cm	lbs.	kg
400-500	298-373	8.7	218	10.940	179.275	24,000	10.886

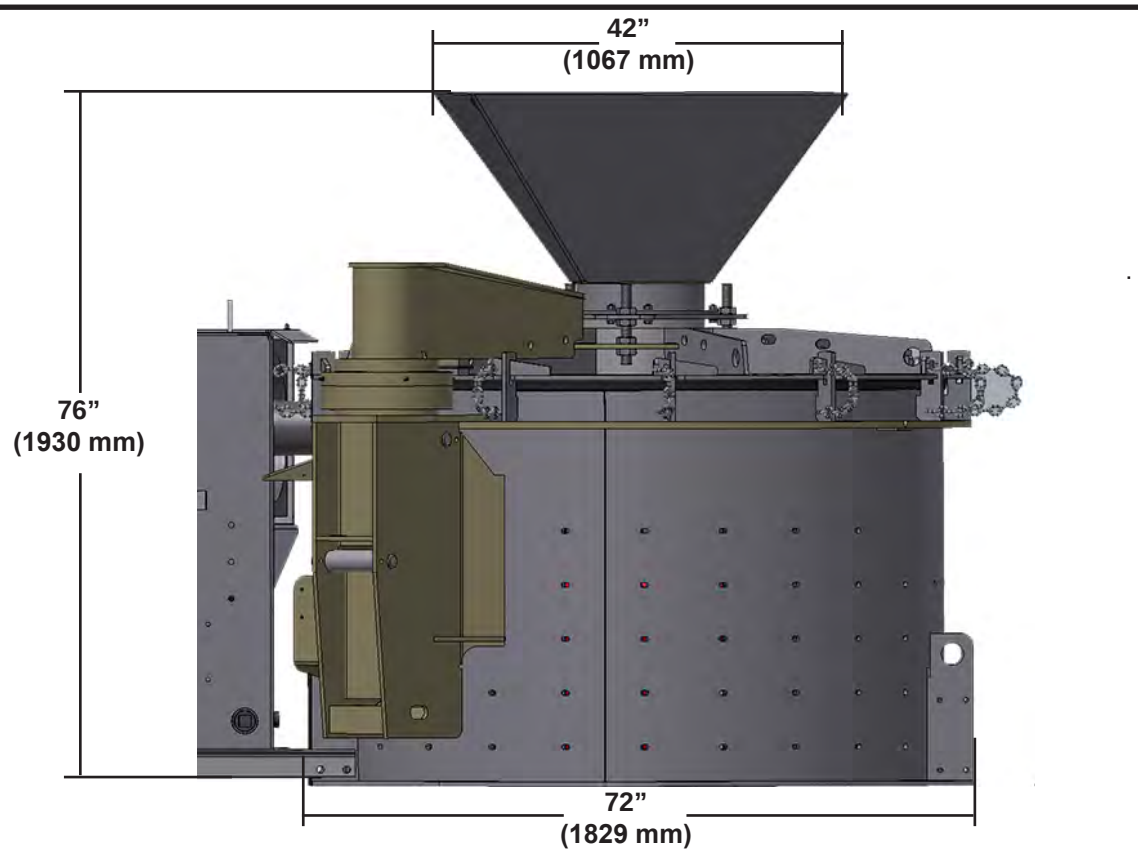
Specifications - 120



	Maximum Feed Size		Minimum Recommended Closed Circuit		Feed Tube Diameter in./cm		Capacity Effective Crushing Range		Standard Impeller Table Speed Range
	in.	mm	in.	mm	in.	mm	TPH	MTPH	RPM
120	6	150	3/8”	9.5	18	457	300-500	267-445	800-1080

Recommended Horsepower Electric		Table/Anvil Clearance		Explosion Chamber Volume		Approximate Weight EV-Models (Electric shown)	
HP	KW	in.	mm	cubic in.	cubic cm	lbs.	kg
400-600	298-447	14.75	369	26.020	426.391	32,100	14.595

Specifications - 1500



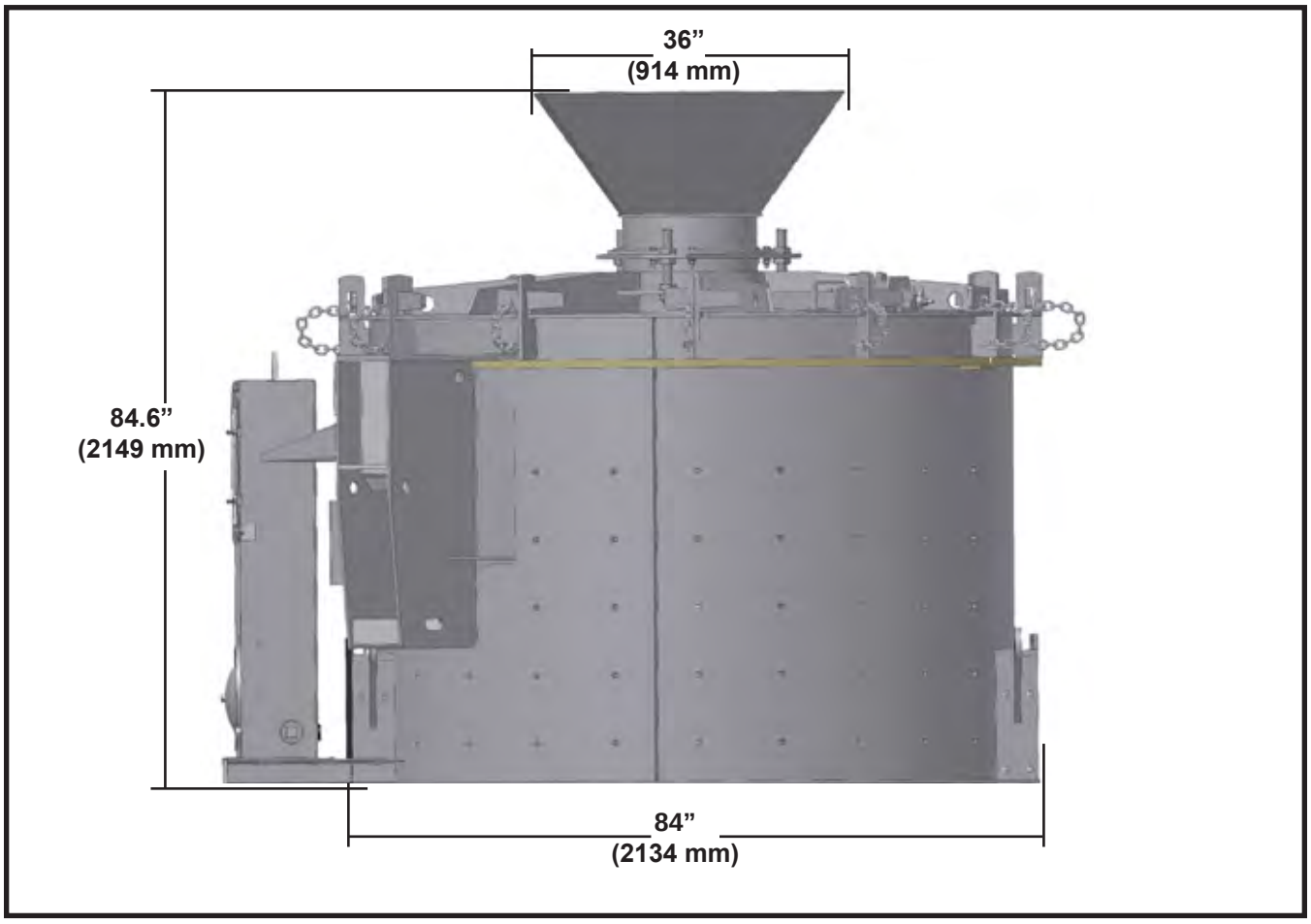
	Maximum Feed Size		Minimum Recommended Closed Circuit		Feed Tube Diameter		Capacity Effective Crushing Range		Standard Impeller Table Speed Range
	in.	mm	in.	mm	in.	mm	TPH	MTPH	RPM
1500 (H)	2	50	#16		8.5	216	75-125	67-112	720-2,000*
1500 (A)	2	50	#4		8.5	216	75-150	67-135	720-2,000*

Recommended Horsepower Electric		Table/Anvil Clearance		Explosion Chamber Volume WK(2)		Approximate Weight EV-Models (Electric shown)	
HP	KW	in.	mm	cubic in.	cubic cm	lbs.	kg
75-150	56-112	10.4	264	4.635	75.954	13,200	5987
150	112	- - -	- - -	4.635	75.954	13,700	6219

*Table speed range refers to serial numbers 407333 and up.

(H) in the model number denotes hardparts configuration also referred to as “standard configuration”.
(A) in the model number denotes autogenous configuration. The specification and production rates shown appply to semi and fully autogenous.

Specifications - 2500

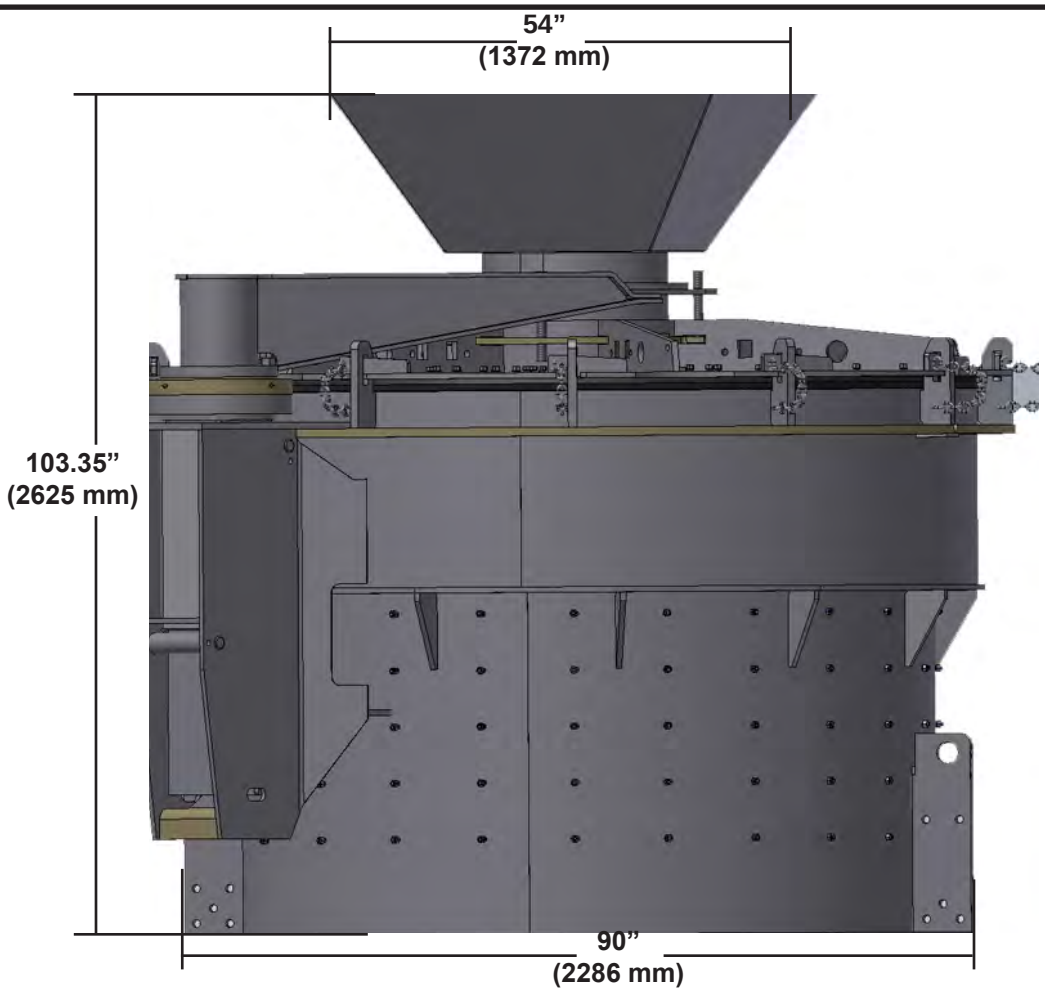


	Maximum Feed Size		Minimum Recommended Closed Circuit		Feed Tube Diameter		Capacity Effective Crushing Range		Standard Impeller Table Speed Range
	in.	mm	in.	mm	in.	mm	TPH	MTPH	RPM
2500 (H)	3	75	#16		11-3/8	289	150-250	135-223	700-1400
2500 (A)	2	50	#4		11-3/8	289	150-300	135-267	700-1400

Recommended Horsepower Electric		Table/Anvil Clearance		Explosion Chamber Volume WK(2)		Approximate Weight EV-Models (Electric shown)	
HP	KW	in.	mm	cubic in.	cubic cm	lbs.	kg
250	186	8.8	224	10.120	165.837	18,000	8165
300	224	- - -	- - -	10.120	165.837	19,000	8618

(H) in the model number denotes hardparts configuration also referred to as “standard configuration”.
(A) in the model number denotes autogenous configuration. The specification and production rates shown appply to semi and fully autogenous.

Specifications - 4500



	Maximum Feed Size		Minimum Recommended Closed Circuit		Feed Tube Diameter		Capacity Effective Crushing Range		Standard Impeller Table Speed Range
	in.	mm	in.	mm	in.	mm	TPH	MTPH	RPM
4500-3 (H)	3	75	4M		16	406	300-450	267-401	800-1200
4500-5 (H)	5	125	3/8”		16	406	300-450	267-401	800-1200
4500 (A)	2.5	63	#4		16	406	300-500	367-454	800-1200

Recommended Horsepower Electric		Table/Anvil Clearance		Explosion Chamber Volume WK(2)		Approximate Weight EV-Models (Electric shown)	
HP	KW	in.	mm	cubic in.	cubic cm	lbs.	kg
400-600	298-373	10.25	256	17.360	284.479	29,600	13426
400-600	298-373	11.75	2.94	17.360	284.479	29,600	13426
400-600	298-373	- - -	- - -	17.360	284.479	29,100	13200

(H) in the model number denotes hardparts configuration also referred to as “standard configuration”.
(A) in the model number denotes autogenous configuration. The specification and production rates shown appply to semi and fully autogenous.

Application

Application Basics

The vertical shaft impactor provides the ultimate in application flexibility through the ability to operate the crusher in a fully autogenous, semi- autogenous, and standard configuration.

Benefits

- Superior product yield
- Cubical particle shape
- Application flexibility
- Simple maintenance
- Non-plugging crusher
- Cost effective

Construction Applications

- Asphalt plant mix
- Concrete stone
- Chips/popcorn/topping rock
- Pea gravel reduction
- Manufactured sand
- Beneficiation
- Soft stone elimination
- Cubing concrete/asphalt recycle
- Fracture count

Mining Applications

- Ore beneficiation
- Pilot plant operation
- Secondary crushing
- Tertiary crushing

Operating Principles

The vertical shaft impactor is a viable and economical impact solution for crushing highly siliceous rock as well as a variety of other materials.

Material is directed down the feed tube to the center of the accelerator. As the accelerator rotates, it projects feed particles outward and forward,throwing them at true right angles against stationary anvils.

The anvils are positioned a sufficient distance from the accelerator to allow for free body impacting. The resulting fragmented cubical product is then gravity discharged. Output gradation, within limits, is controlled by accelerator speed, configuration (number of impeller shoes) and feed material characteristics. Typically, the crusher is operated in a closed circuit configuration with a vibrating screen.

The design of the vertical shaft impactor incorporates a simplified crushing chamber, cast iron high chrome-iron alloy wear parts that eliminate hard surfacing accomplished with simplified structural and mechanical components.

Configurations

The vertical shaft impactor is available in the following three configurations:

- **Standard configuration**

The standard configuration uses a shoe and anvil assembly. The impeller shoes in the crushing chamber fling rock at true right angles to stationary anvils. Rock gradation is controlled by impeller table speed.

This configuration works best with non-abrasive applications such as limestone.

Variable reduction ratios are 3:1 to 12:1 with feed sizes up to 6” depending on the model.

- **Semi-autogenous**

A rotor and anvil is used in a semi-autogenous configuration. This configuration provides intermediate production with stone on stone action in the rotor and stone on steel crushing at the cluster ring.

This configuration works best with more abrasive applications requiring an increase in production and/ or to change the product gradation. For example,

increasing sand production.

Variable reduction ratios are from 3:1 to 12:1 with feed sizes up to 2-1/2” depending on the model.

- **Fully Autogenous**

A rotor and rock shelf is used in a fully autogenous configuration. The rotor flings rock against a bed of rock and exposed anvils on the outer hybrid rock shelf.

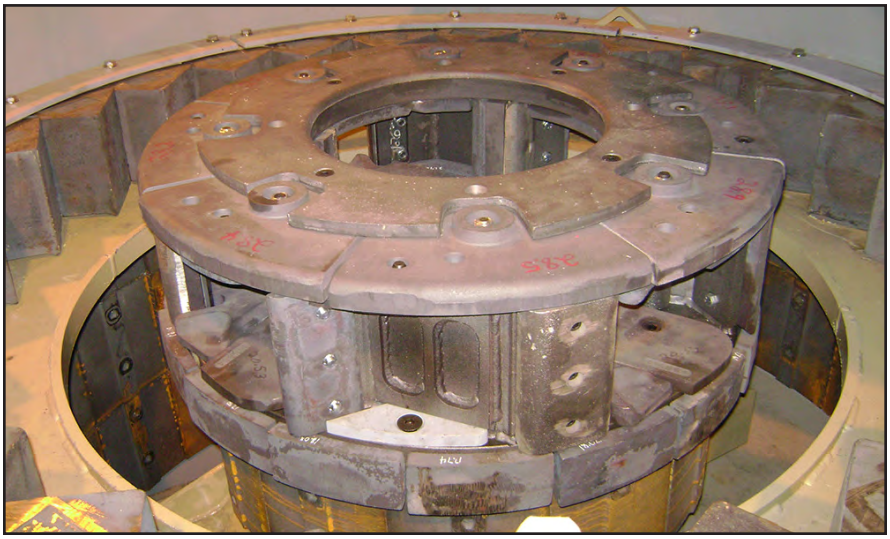
This configuration works best with the most abrasive applications in which the compensation for decreased production is offset by the reduction in wear costs. This configuration is not recommended for soft aggregates such as soft limestone due to the excess production of -200 material.

Variable reduction ratios are from 3:1 to 10:1 with a maximum feed size of 2-1/2”.

Standard

Application Principles

The following application principles will allow the operator to maximize performance of the vertical shaft impactor and its contribution to the crushing circuit.



Fully Autogenous

- **Feed Rate and Gradation**

Optimum performance from a vertical shaft impactor occurs when it is continuously and uniformly choke fed properly sized material. Surges in the feed rate may have pronounced effect on the rate of production, output gradation and wear rate.

A less-than-capacity feed rate or inconsistent feed rate will result in more contact and disruption of the rock as it flows through the crushing chamber and create abnormal wear characteristics on the wear parts. Thin lines of wear on the wear parts will be seen and an increased chance of carbide breakage (rotor) may occur.

For applications with a low feed rate or very small feed size, a feed tube insert may improve wear rates and reduce dust. Contact the factory for more details.

- **Output Gradation**

The vertical shaft impactor is normally operated in a closed circuit configuration with a vibrating screen. Recirculating some or all of the oversized material will result in optimum crusher performance. The feed should be free of undersize material and tonnage must be consistent with the crusher's capacity and horsepower.

Feeds predominantly large, small, or erratically graded, will affect crusher production performance.

- **Screening**

Properly applied, the vertical shaft impactor is capable of producing relatively high volumes of material, but excessive recirculation of already sized product (screen override) will adversely affect the wear rate of the crushing chamber, reduce capacity, and affect product gradation.

Consequently, carefully reviewing the plant's screening capabilities to assure the proper balance with crusher capacity will help achieve optimum crusher/ system performance.

- **Typical Feed Size/ Impeller Table Speed/ Rotation**

When operating the accelerator at or near maximum RPM, reduce maximum allowable feed size by 1/2" (12mm).

Producing Maximum Fines
3/4" X 0 (18mm X 0)
Asphalt plant mix

Minus 5/8" (16mm)
1/2" (13mm)
3/8" (9mm)

Manufactured sand supplement. Normally 80-100% of maximum impeller speed. Four or five shoe table configuration.

Producing Minimum Fines
Concrete Aggregate
Chips
Railroad Ballast
1 1/2" X 0 (38 mm X 0)

Normally 60-80% of maximum impeller speed. Three or four shoe table configuration.

Note: Higher operating speeds generally produce better fragmentation, thus greater production of fine material, as required for asphalt materials and sand supplement.

For applications requiring maximum production of smaller fractions and fines, higher speed on the impeller table, along with the use of the five shoe table will result in optimum production.

For applications requiring a minmum of fines generation, the three and four shoe impeller tables and slower impeller speeds are recommended.

Do not operate the impeller table at speeds above factory recommended maximum.

Contact the factory for more details.

Maximum Feed Size

The following maximum feed sizes must be observed for each VSI model. The feed size, as well as the weight is important in determining the energy that the carbides will receive (on a rotor) without damage.

Feed sizes are based on 100 lb/cubic foot material. **Check the density of your material to determine maximum feed size.**

Models 82, 4500 (H-3"), and 2500 (H) - maximum 3" (76mm) feed size and must not weigh more than 1.3 lbs. (.50 kg).

Model 120 - maximum 6" (150mm) feed size and must not weigh more than 10 lbs. (4.5 kg).

Model 1500 and 2500(A) - maximum 2" (50 mm) feed size and must not weigh more than .4 lbs. (.18 kg).

Model 4500(A) - maximum 2-1/2" (63 mm) feed size and must not weight more than .6 lbs. (.27 kg).

Model 4500 (H-5") - maximum 5" (127 mm) feed size and must not weigh more than 6.15 lbs. (2.79 kg).

- **Accelerator Speed/Wear Relationship**

Adapting the table configuration and optimum speed to the material's crushability allows the operator a wide range of production flexibility. Yet higher impeller speeds usually result in faster wear rates.

Consequently, the speed/ wear relationship must be observed to determine the optimum balance between the crusher production characteristics and the optimum casting wear rate.

- **Accelerator Speed/ Tonnage Relationship**

Contrary to some types of crushers, the tonnage capacity of the vertical shaft impactor throughout is not significantly affected by reducing impeller speed. Crusher throughput ratings published in our general literature are applicable at virtually all impeller speeds and impeller table configuration.

- **Tramp Material and Uncrushables**

Centrifugal impact crushers have no internal tramp metal protection. Do not allow tramp material such as drill bits or bucket teeth to enter the crusher. Severe damage to internal castings and machine components will result. Interior casting or component damage resulting from tramp material voids the warranty.

If tramp material is a persistent problem, contact your dealer for information concerning external protective devices available for an additional cost.

Do not feed steel or metal into the VSI. A metal detector is best as it will detect stainless steel, cast ground engaging components, and those items that a magnet will not pick up. This would ideally be interlocked to the feed conveyor to prevent entry of these steel components into the crusher.

A magnet to remove tramp iron is an alternative, but as noted above it will not remove the stainless steel or any non-ferrous materials.

- **Air Flow At Discharge Point/Dust Suppression**

The design of a centrifugal impactor is such that an enormous amount of air is blown through the discharge point. Discharge chutes should be constructed according to factory recommendations and dust covers installed on the conveyors for a minimum of fifteen feet.

Water may be introduced at the feed opening of the crusher to reduce dust, but doing so can adversely affect casting wear. If water must be introduced, do so at the discharge point of the crusher. The factory can suggest optional dust suppression equipment suppliers.

Application Tables

Typical Limestone in Standard Configuration 1” Feed Size Applications - 1500H, 2500H, 4500H, 82H

Quaternery						
		Approximate Crusher Output				
		Feed	Low Range	High Range	Average	High Range Screened at #4M
Sieve Size Inches	MM			% Passing		
1	25		100%	100%	100%	
3/4	19		95%	99%	97%	
1/2	12.5		80%	90%	85%	
3/8	9.5		62%	78%	70%	
1/4	6.3		40%	63%	52%	
#4	4.75		30%	52%	41%	100%
#8	2.36		15%	33%	24%	75%
#16	1.18		10%	21%	15%	48%
#30	600uM		6%	15%	11%	34%
#50	300uM		5%	10%	7%	22%
#100	150uM		4%	6%	5%	13%
#200	75uM		3%	4%	3%	9%

Crushing 1” top feed size for chips, popcorn, fracture count, or a manufactured sweetner.

Typical Limestone in Standard Configuration - 1500H, 2500H, 4500H, 82H

Tertiary					
		2” Feed		1” Feed	
		Feed	Typical Output	Feed	Typical Output
Sieve Size Inches	MM				
3	75				
2	50		100%		
1-1/2	37.5		98%		
1	25		90%		100%
3/4	6.3		78%		95%
1/2	12.5		60%		80%
3/8	9.5		46%		62%
1/4	6.3		33%		40%
#4	4.75		24%		30%
#8	2		15%		15%
#16	1.18		10%		10%
#30	600uM		7%		7%
#50	300uM		5%		5%
#100	150uM		4%		4%
#200	75uM		3%		3%

Producing a coarse graded material, emphasis.

Typical Limestone in Standard Configuration - 1500H, 2500H, 4500H, 82H

Tertiary					
		2” Feed		1” Feed	
		Feed	Typical Output	Feed	Typical Output
Sieve Size Inches	MM				
3	75				
2	50		100%		
1-1/2	37.5		98%		
1	25		90%		100%
3/4	6.3		78%		95%
1/2	12.5		60%		80%
3/8	9.5		46%		62%
1/4	6.3		33%		40%
#4	4.75		24%		30%
#8	2		15%		15%
#16	1.18		10%		10%
#30	600uM		7%		7%
#50	300uM		5%		5%
#100	150uM		4%		4%
#200	75uM		3%		3%

Producing a dense, graded material, emphasis on fines.

Typical Sand and Gravel in Standard Configuration - 1500A, 2500A, 4500A

Autogenous				
		1-1/2” Feed	Fully Autogenous 100% Speed	Semi-autogenous 100% Speed
Sieve Size Inches	MM			
2	50			
1-1/2	37.5		100%	
1-1/4	31		99%	100%
1	25		95%	96%
3/4	19		90%	90%
1/2	12.5		70%	76%
3/8	9.5		56%	58%
1/4	6.3		38%	45%
#4	4.75		31%	37%
#8	2		22%	25%
#16	1.18		15%	17%
#30	600uM		11%	13%
#50	300uM		8%	8%
#100	150uM		4%	3%
#200	75uM		4%	3%

Producing a dense, graded material, emphasis on fines.

Secondary Crushing, Average Materials, Standard Configuration 4500H, 120H

Secondary					
		Average Materials Crusher Output Using 3 Shoe/4 Shoe Impeller			
Sieve Size		Feed Scalped at 1-1/2”	Max. Speed	50% of Max. Speed Output	80% of Max. Speed Output
Inches	MM	% Passing			
6	152				
5	125				100%
4	100			100%	99%
3	75		100%	99%	97%
2	50		96%	91%	86%
1-1/2	37.5		90%	81%	70%
1-1/4	31.5		86%	77%	63%
1	25		78%	68%	52%
7/8	22.4		74%	64%	48%
3/4	19		68%	56%	40%
5/8	16		62%	51%	36%
1/2	12.5		53%	42%	30%
3/8	9.5		44%	34%	24%
1/4	6.3		35%	27%	19%
#4	4.75		29%	24%	16%
#8	2		17%	15%	11%
#16	1.18		14%	13%	8%
#30	600uM		10%	9%	6%
#50	300uM		7%	6%	4%
#100	150uM		5%	4%	3%
#200	75uM		3%	2%	2%

Site Selection and Setup

Site Selection

When selecting a suitable site for operation, many factors need to be taken into consideration. Selecting a site without anticipating problems could lead to unsatisfactory operation and plant relocation could be required.

Some things to consider when selecting a site:

- Stability of the ground. If the ground is too soft or unstable, proper leveling and loading may be impossible.
- The crusher must be located so ample room is available. Leave plenty of room around the plant to facilitate access of loading equipment, assembly of crusher components and service personnel.
- Proper drainage is important to allow for runoff of normal rainfall.
- Prevailing wind direction and its effect on the operator or loading personnel.

Foundation

A properly constructed foundation that is level is critical for proper operation of the vertical shaft impactor. Foundation drawings are typically provided with the crusher or can be obtained from the factory. These drawings also contain the load information necessary for constructing a proper foundation.

Feed Arrangement

It may be necessary to attach the feed box and/or feed tube to the vertical shaft impactor before starting operation.

The feed box and/or feed tube may need to be removed to allow for service, cleaning and inspection of the impactor.

A properly installed feed assembly will provide even distribution of material to the opening of the vertical shaft impactor.

The vertical shaft impactor is generally used in a closed circuit configuration with a vibrating screen. KPI recommends using a screen to feed the VSI in order to filter out material that is larger than the recommended top size and weight for the VSI.

When using the vertical shaft impactor with any other crushing component such as a vibrating screen, feeder, or conveyor, make sure that enough clearance is available to open and remove the lid on the vertical shaft impactor. The drop height should be no less than 18".

Discharge Arrangement

Where possible, a shelf or ledge should be constructed to provide a bed of material for the discharge material to hit. This ledge will absorb most of the impact before it falls on the conveyor or discharge device.

Material must not be allowed to buildup in the discharge device. If material builds up to the lower part of the crusher, excessive wear and damage to the crusher could occur.

⚠CAUTION

The discharge opening of the crusher must be guarded.

Presizing Material

Before feeding material into the Vertical Shaft Impactor, it must first be presized.

See page 41 for proper feed size by impactor model.

NOTICE

Do not allow tramp material such as drill bits or bucket teeth to enter the crusher. Damage to internal castings and machine components may result.

Preoperation Checklist

The preoperational check should be performed any time the equipment is moved to a new site, or if it has been in storage for an extended period. Check each component to insure that it is in operational condition. This check should include, but not be limited to the following items.

PREOPERATIONAL CHECKS	OK	Adjust
1. Sheet Metal/Appearance/Paint	☐	☐
2. Circulating Oil System		
a. All fittings greased	☐	☐
b. Oil reservoir level (1” below top of site glass)	☐	☐
c. Oil filters	☐	☐
d. Hoses and fittings	☐	☐
e. Oil breathers clean and free of blockage	☐	☐
3. V-belts tight	☐	☐
4. Grease lube points	☐	☐
5. Inspection doors closed	☐	☐
6. Lid hold-down wedges installed in lid	☐	☐
7. All liners in place and secure.	☐	☐

	OK	Adjust
8. General		
a. Operator’s manual on unit	☐	☐
b. Decals in place and readable	☐	☐
c. Safety guards in place	☐	☐

No Load Operational checklist

OPERATIONAL CHECKS OK Adjust

1. Unit Vibration - if chains on unit are shaking there is too much vibration. ☐ ☐

2. Accelerator Rotation (counterclockwise as viewed from above) ☐ ☐

3. Accelerator RPM

Model 82 (800-1200 RPM) _____ ☐ ☐

Model 120 (800-1080 RPM) _____ ☐ ☐

Model 1500 (720-2000 RPM) _____ ☐ ☐

Model 2500 (700-1400 RPM) _____ ☐ ☐

Model 4500 (800-1200 RPM)_____ ☐ ☐

4. Alarm System Functions Properly ☐ ☐

5. Oil Flow Pedestal - 1 gpm or more ☐ ☐

6. Oil Temperature (180 deg. max.) ☐ ☐

a. 4 Hours _____

b. 8 Hours _____

7. Oil Fittings for Leaks ☐ ☐

Operation

Use the following procedure to start the vertical shaft impactor.

The vertical shaft impactor should be run empty initially to insure everything is operating properly and there are no misaligned or binding parts. Operate a new vertical shaft impactor empty for two hours. After this run-in period, check bearing temperatures and relubricate as required.

CAUTION

Before starting the impactor, be sure all tools and foreign objects have been removed and everyone is clear.

1. On electric models, ground chassis with standard grounding rod driven at least six feet into the ground.

2. Block crusher chassis or skid mounting so that it is solid and level in both directions. If the machine is not level, uneven wear on the feed tube, feed disc and anvil ring will result.

3. Set the crusher feed conveyor chute so the rock will flow to the center of the feed tube. Use a bang board or deflection chute if necessary. If the crusher feed is concentrated to one side of the feed tube, the result will be uneven wear on the feed tube, anvil ring and other stationary wear parts.

WARNING

Do not under any condition, remove crusher lid or open inspection door while the crusher is running or in shutdown procedure. Never run the crusher when the lid or inspection door is not in place and properly secured. Never stand on top of crusher while crusher is operating.

4. Inspect crushing chamber.

   a. Check position of shoe pins (if equipped).

   b. Check for loose bolts on liners, table, tub, and lid liners.

   c. On units equipped with a table assembly, check location of feed tube. It should be no more than 3/8" above the impeller shoes. Adjust the feed tube as necessary.

      On units equipped with a rotor assembly, make sure feed tube is not adjusted down inside of the rotor.

5. Inspect the top of the crusher.

   a. Close inspection door and secure with the bar and wedge.

   b. Check to see that the feed box bolts are secure.

NOTICE

Do not operate pedestal lubrication pump counterclockwise as severe damage will result. Verify that you're building pressure in the system, not suction.

   c. Check to see that all lid hold down wedges are in place and tight.

6. Inspect lubrication system:

   a. Electric or diesel v-belt drives:

      1. Check oil level in pedestal oil tank. Level should be within 1" of top of sight glass.

      2. Grease crusher grease points.

b. Diesel gearbox drives:

1. Check crusher lubrication as listed above in item a.

2. Check oil level in gearbox oil reservoir. Level should be at the center on the sight glass.

3. Grease "U" joints in drive line and engine PTO bearings.

4. Check oil and water levels in diesel engine where applicable.

7. Check rotation of oil pump and start oil pump if rotation is correct.

8. Inspect main drive belts for proper belt tension or check drive line to see if it is secure, clear of obstructions and that all drive guards are in place.

After installing a new set of belts, run the vertical shaft impactor for two hours, then recheck belt tension and adjust if necessary.

9. Check rotation of the accelerator (table should rotate counterclockwise as viewed from above).

10. For diesel driven crusher, warm engine at idle 3-5 minutes, then engage clutch. Increase speed slowly to recommended range.

11. Immediately after start-up, check the following:

a. Check to see that the alarm system functions correctly during start-up.

b. Check for correct oil flow.

Pedestal: >1 gpm flow

c. Check to see that the oil temperature stabilizes after several hours of running time. The temperature alarm system is set to react at 180 degrees Fahrenheit. Air to oil coolers are supplied with all crushers. Keep maintained properly.

d. Check all oil fittings for leaks.

Note: On EV-Model crushers operating 3,300 feet above sea level or higher - do not exceed full load nameplate amperage. At higher elevation the motor cooling system is affected.

The following information pertains to the Gen. 2 lubrication system. If your VSI is equipped with a Gen. 3 lubrication system refer to that section in the manual for more information.

Lubrication System Operation (Gen. 2)

The VSI lubrication system consists of a lubrication oil pump and motor assembly, pressure and temperature gauges, temperature and flow monitoring systems, thermal bypass valve, oil filter, oil cooler and oil tank. These components make up the standard vertical shaft impactor lubrication panel that supplies the lubrication oil to the crusher pedestal bearing.

Oil from the tank is pumped to the lubrication panel containing the manifold with the gauges, switches, filter, and bypass valve. The temperature of the oil will determine the direction of flow at this point.

When the oil is cold, the resistance of the by-pass valve is less than the resistance of the oil cooler lines and the oil cooler. The oil pressure will be sufficient to open the valve and the oil will flow directly to the filter through the flow switch and on to the pedestal by passing the oil cooler.

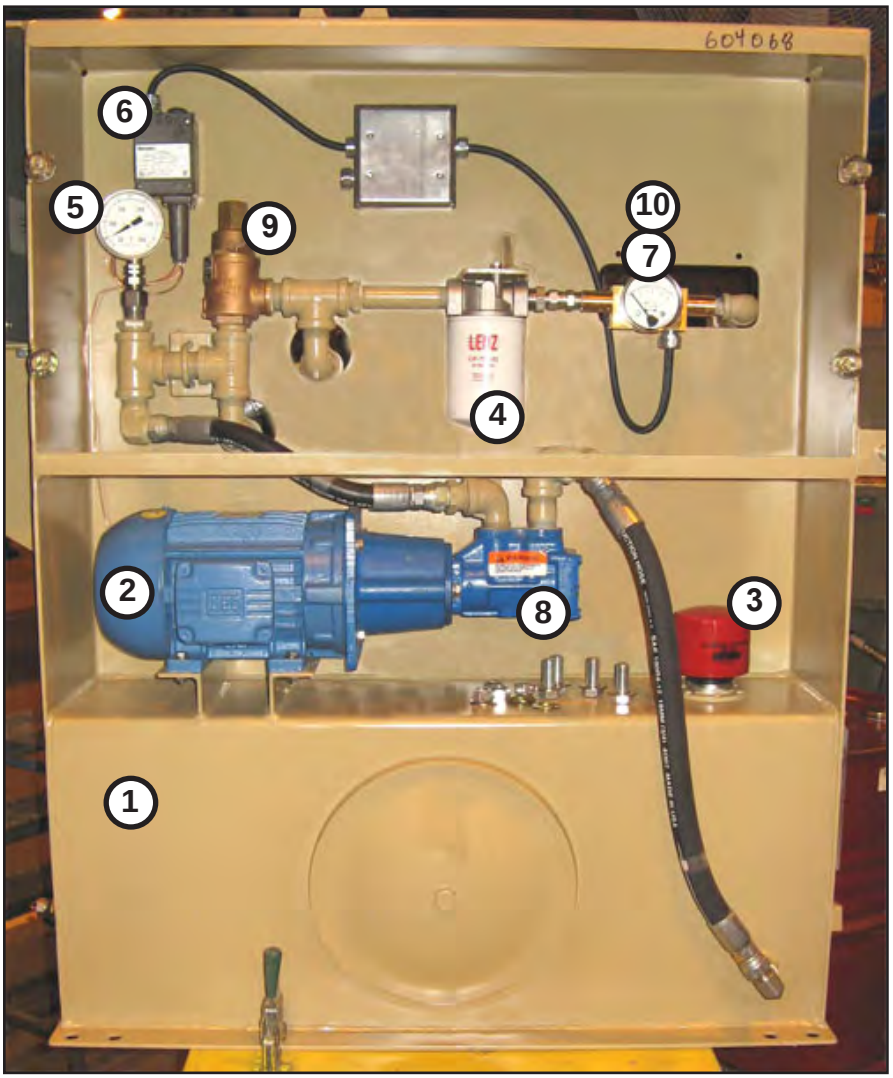
As the temperature rises, the resistance of the oil cooler lines and the oil cooler decreases, allowing the oil to begin to pass through the cooler. When the oil reaches a sufficient temperature, the resistance of the by-pass valve will be greater than the resistance of the oil cooler lines and the cooler, allowing the oil to pass through the cooler. The system is self-balancing and works well to maintain the proper oil temperature. Oil from the cooler flows through the filter and flow switch and on to the pedestal.

The oil enters the pedestal through the bottom pedestal pressure line and passes through a port in the pedestal housing to the top where it is discharged and allowed to flow through the top bearing.

At this point, it drains down through the upper bearing to the bottom of the pedestal, through the lower bearing and flows back to the tank through a gravity return line. The tank is situated lower than the bottom of the pedestal to facilitate proper gravitational flow.

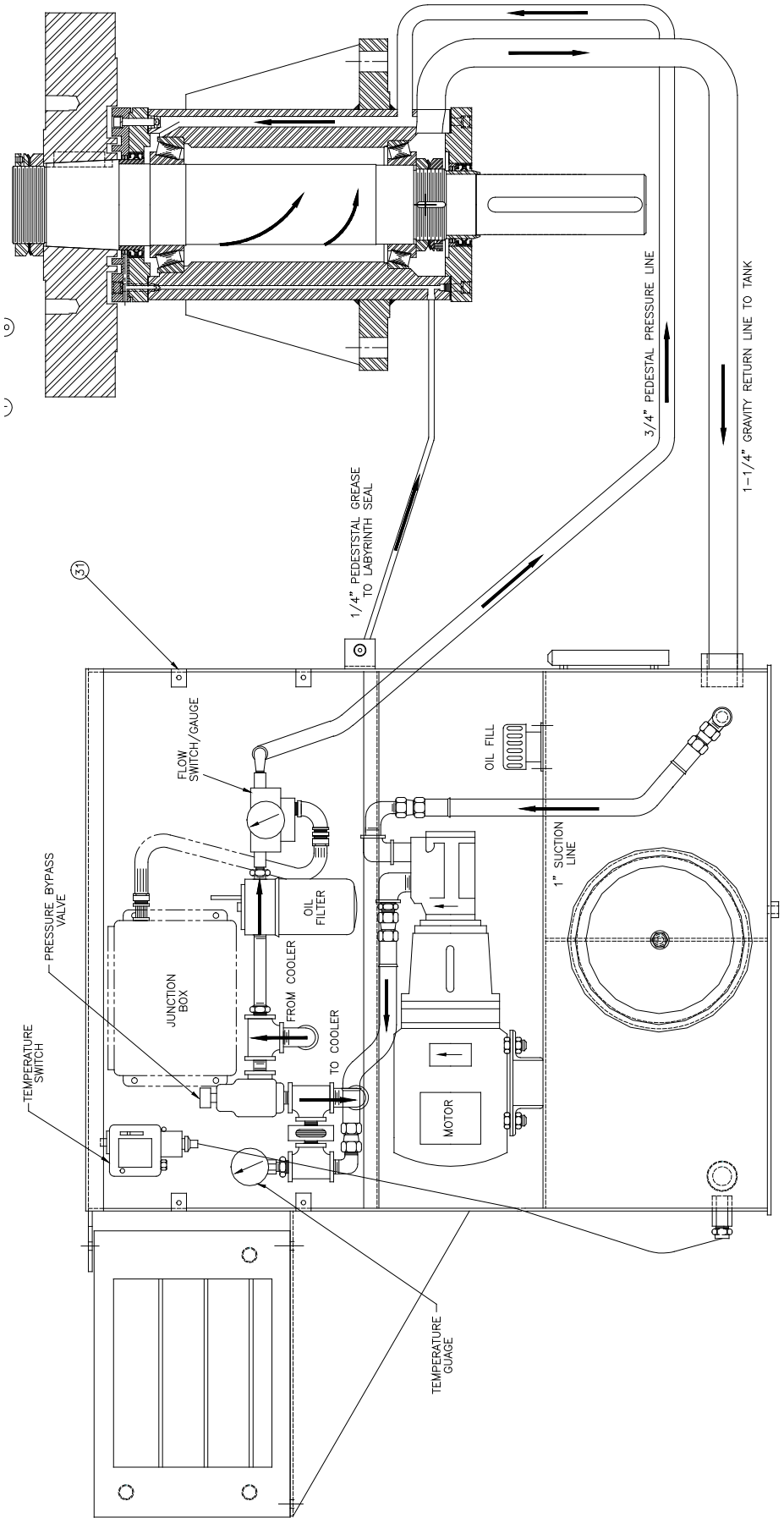
This lubrication system is designed to be flow-sensitive and will sound the warning horn should the flow drop below the factory setpoint of 1 GPM refer to Cold Start-up procedure on page 54.

During operation, if the lube alarm sounds, immediately shut down the feed conveyor while starting a countdown so that all material can be cleared out. This countdown is important because if the crusher motor shuts down before the crusher hopper is clear, it could experience vibration on the rotor that could damage the bearings.



Lubrication Panel (Gen. 2)

1. Oil tank
2. Motor
3. Breather cap
4. Oil filter
5. Temperature gauge
6. Temperature switch
7. Flow gauge
8. Oil pump
9. Bypass valve
10. Flow switch



Electric Lube Panel (Gen. 2)

Hydra-Arm

The following adjustment has been made at the factory.

Unclamp lid and remove wedge locks and start hydra-arm pump. When the lever is activated, the lid will raise. Make sure to lift lid for proper clearance.

Rotate lid by lifting stop and manually rotating lid. Replace stop to secure lid. Follow the same procedure to rotate lid back to operating position.

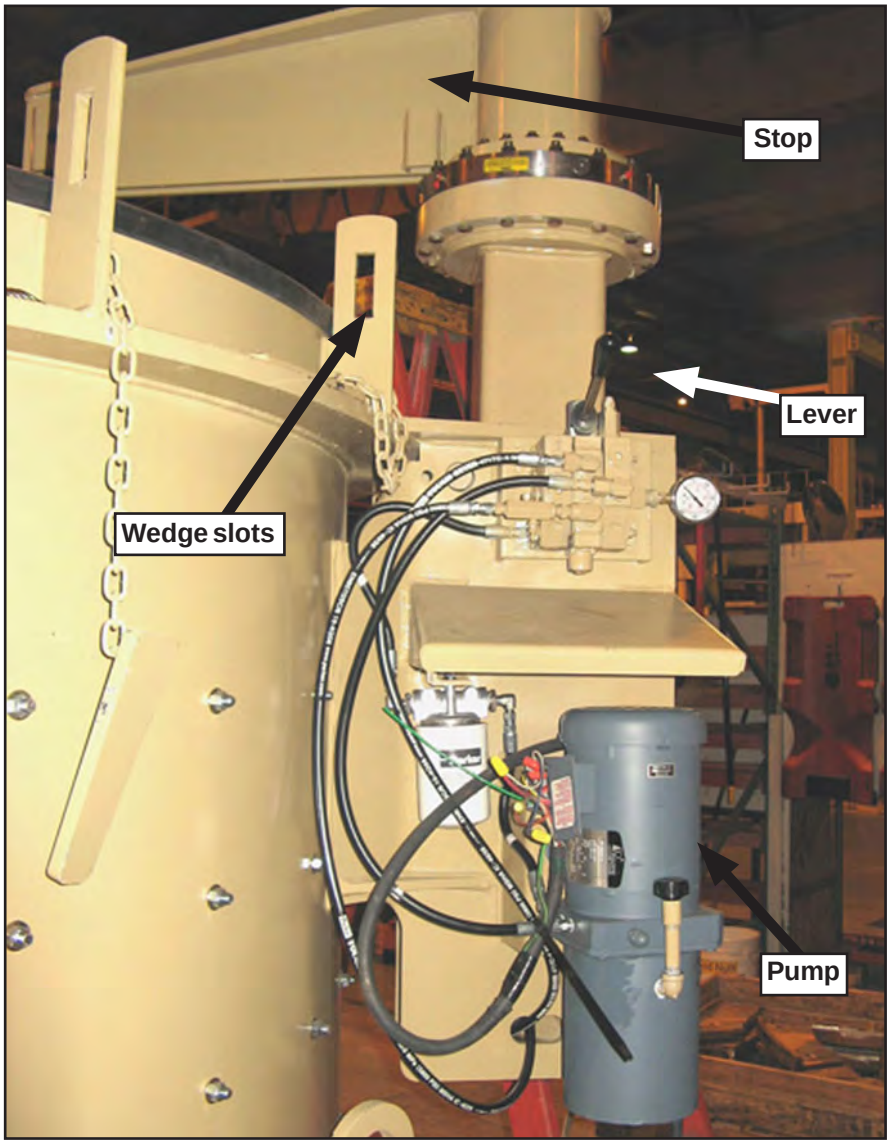
NOTICE

Only rotate the lid when it is in the raised position.

Before positioning and securing the lid, check the inside of the machine completely to insure that tools or any other foreign materials are not left inside the crusher.

When positioning and securing the lid:

1. Align slots with lugs and lower into place.
2. To secure, drive lid wedges through the slot in the lugs.
3. Always drive wedges in the direction of the table rotation (counterclockwise as viewed from above).



Hydra-Arm Assembly (Gen. 2 Lubrication Panel)

For units not equipped with a Hydra-arm:

1. Lockout/tagout all power to the vertical shaft impactor.
2. Fasten lifting chains around lifting lugs on the crusher lid. The crusher lid weighs approximately 2500 lbs.
3. Drive lid wedges out of slots.
4. Carefully lift the crusher lid out of the way.

Startup

Use the following procedure to start the crusher.

1. Inspect the accelerator for loose bolts.

2. Pour two to three buckets of dry sand into the accelerator at startup to seat parts and to fill voids for later maintenance. This will make wear part removal easier.

3. Check motor rotation. Remove v-belt(s) and run motor to verify that it is operating counter clockwise.

NOTICE

Proper motor rotation is counter-clockwise looking at the motor from the top.

If the vertical shaft impactor has dual motors, only run one motor at a time to verify proper rotation.

4. Assure that everything is operational. Start crusher discharge and feed conveyors.

5. After two hours, shut down the crusher and related equipment. With power locked out, inspect crushing chamber for loose bolts and wear plates.

6. Inspect rotor daily for wear, particularly the carbide tips.

7. Observe rock shelf wear. Accelerated wear will be apparent if the rock shelf is set too high. A straight line from the bottom of the rotor should pass just above the top of the leading edge of the rock shelf.

NOTICE

Keep all tramp iron out of the crusher circuit. Tramp iron can cause chipped or broken carbide tips and will result in outer cap wear on the rotor.

8. Feed tube clearance to the top of the rotor should be 3/8”.

9. Make sure any free water has been eliminated from the material. Water in the material will significantly affect the life of the wear parts of the VSI.

10. Refer to pages 40-41 for top feed size and mass.

Lubrication System (Gen. 2)

The following information pertains to the Gen. 2 lubrication system. If your VSI is equipped with a Gen. 3 lubrication system refer to that section in the manual for more information.

Cold Startup

The lubrication system is designed to reliably pump oil at +15˚ F with Mobilgear 600 XP 68 engine oil. If the oil temperature is below +15˚ F (9.4˚C), turn on the oil pump for 3-4 mintues and make sure the oil is heated to +15˚ F (9.4˚C) before crushing. Failure to do this may result in premature pedestal bearing failure.

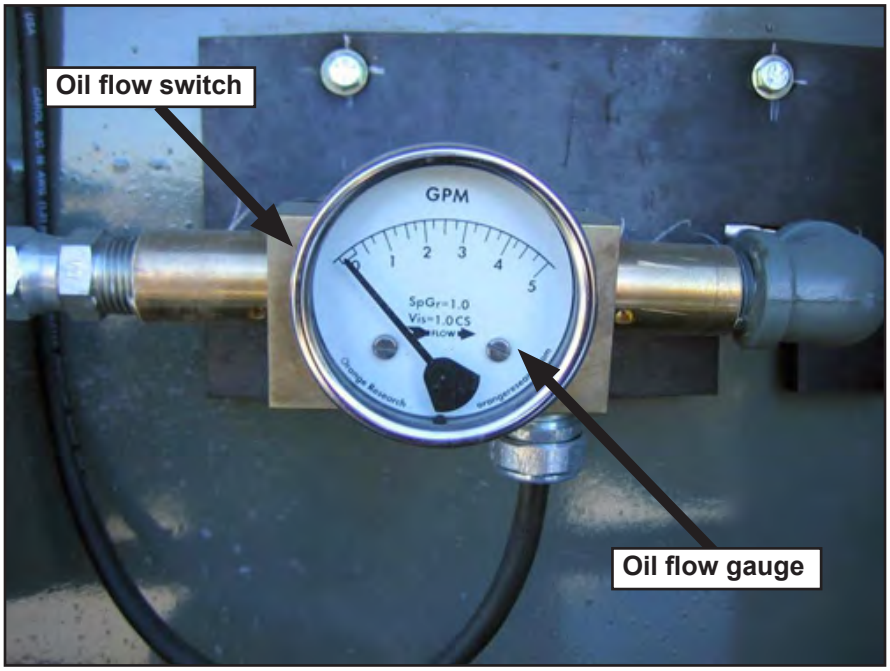
NOTICE

Heat oil to +15˚ F before starting the crusher.

The flow switch incorporated in the lubrication system will warn you if the oil flow drops below 1 GPM (2 GPM is the normal flow). However, the flow switch is calibrated with warm oil. With cold, thick oil, the flow switch will indicate adequate flow when there may actually be very little flow. It still functions reliably as a flow/no-flow indicator, but it is not accurate enough to detect low oil flow with very cold oil.

In addition, the oil pump used does not give any obvious indication when the oil gets too cold or thick, it just pumps less. Testing shows that at 0˚ F the pump is only pumping about one-half gallon per minute; however, there is no cavitation or unusual noise.

This is why it is very important to heat the oil when it is below +15˚ F. Otherwise, the oil flow may be inadequate, the lubrication warning horn will not sound, and there is no easy way to see that the oil system is not working.



Oil Flow Switch and Gauge

Electrical (Gen. 2 Lubrication System)

The following information pertains to the Gen. 2 lubrication system. If your VSI is equipped with a Gen. 3 lubrication system refer to that section in the manual for more information.

Electrical Requirements

All crushers use externally mounted lube pumps for the pedestal and gearbox lubrication systems. These systems are independent of each other and require separate pumps. The pump motors are typically 1 HP, 220/440/3 phase and are factory wired for 440V operation.

Power to the lube pump motors must be connected so the pumps will be energized before the crusher is started. The pump motors must be wired independently of each other and to circuits dedicated for their own use only. Connecting pump motors across an existing circuit such as a conveyor drive motor may cause a bearing failure should the circuit be disabled during crusher operation.

If power to the lube pumps and the lube warning system is supplied by an auxiliary generator, the crusher must never be operated while the generator is off. Both the lubrication pump and the 120V lubrication warning system (on the electric motor powered crushers only) would be inoperative and serious damage to the pedestal and gear box would result. When the crusher and lube pumps are off and the generator is on, the lube warning horn will sound (if properly wired). You may wish to leave the lube pumps running to prevent the horn from sounding until the generator is shut down.

NOTICE

Never operate the crusher while the lubrication pump is off. Always leave the lubrication pump on while the crusher is coasting to a stop. Consult KPI-JCI for interlock options.

All models use fan cooled heat exchangers for pedestal oil cooling. The fan motor for the heat exchanger is typically 1/2 HP, 220/440V/3 phase and is factory wired for 440V operation. The motor should be wired to its own circuit - properly protected and wired in accordance with local codes. The unit is typically for warm weather operation and may be left off during cold weather.

The lube failure warning system operates on one of two voltages depending on crusher drive power type.

1. 120 VAC for electric motor powered crusher.

2. 24 VDC for models (DGV, DCV, DV).

The system components may vary slightly but the operating principal will remain the same. The warning system consists of temperature sensing switches, temperature and pressure gauges, flow sensing switches, control relay and a warning horn.

All switches are wired in series.

1. The 120 VAC system uses a 120 VAC control relay and 120 VAC horn.

2. The 24 VDC system uses a 24 VDC control relay and a 24 VDC horn.

Factory advises that the supply power for the lube warning system come from the crusher drive motor power supply (on full voltage start motors only). Never wire the lube failure warning system across an already claimed circuit. If the warning system is to be wired to its own individual circuit, it should be ahead of the lube pump motor and behind the crusher drive motor. The sequence of start would be:

1. Lube pump motor
2. Lube failure warning system
3. Crusher drive motor

The 120VAC lube failure warning system is completely wired at the factory.

The 24VDC system utilizes the crusher drive engine 24V battery system for power. When the diesel engine is installed by the factory, the lube warning system is completely wired and ready for operation. When the customer installs the engine, the power to the warning system will have to be installed by the customer also. Contact factory for details and refer to the warning system electrical schematic found in this section of the Operation and Maintenance manual.

On diesel powered crushers, the lube warning system is activated by a "whisker" type limit switch controlled by movement of the clutch handle. When the clutch is engaged, the warning system is activated. When the clutch is disengaged, the system is deactivated.

NOTICE

Never shut off the lube pump while the crusher is coasting to a stop. Never operate the crusher while the lube warning system is off.

The lube pump should be started before the lube failure warning system is activated. However, in order to test the warning system for proper operation, follow these instructions:

1. Apply power to the warning system first and the horn will sound.

2. Start the lube pump and when the pressure or flow is normalized, the horn will silence.

Operation of Events

1. Power to the warning system is turned on.

2. The horn will sound. If the horn sounds, the system is working properly.

3. The flow switch contact is open.

4. The temperature switch contact is closed.

5. The lubrication pump starts.

6. Oil flow is brought to normal (1 GPM or above for cold oil).

7. The temperature switch contact remains closed.

8. The flow switch contact closes.

9. Current passes through both switches to energize the control relay coil.

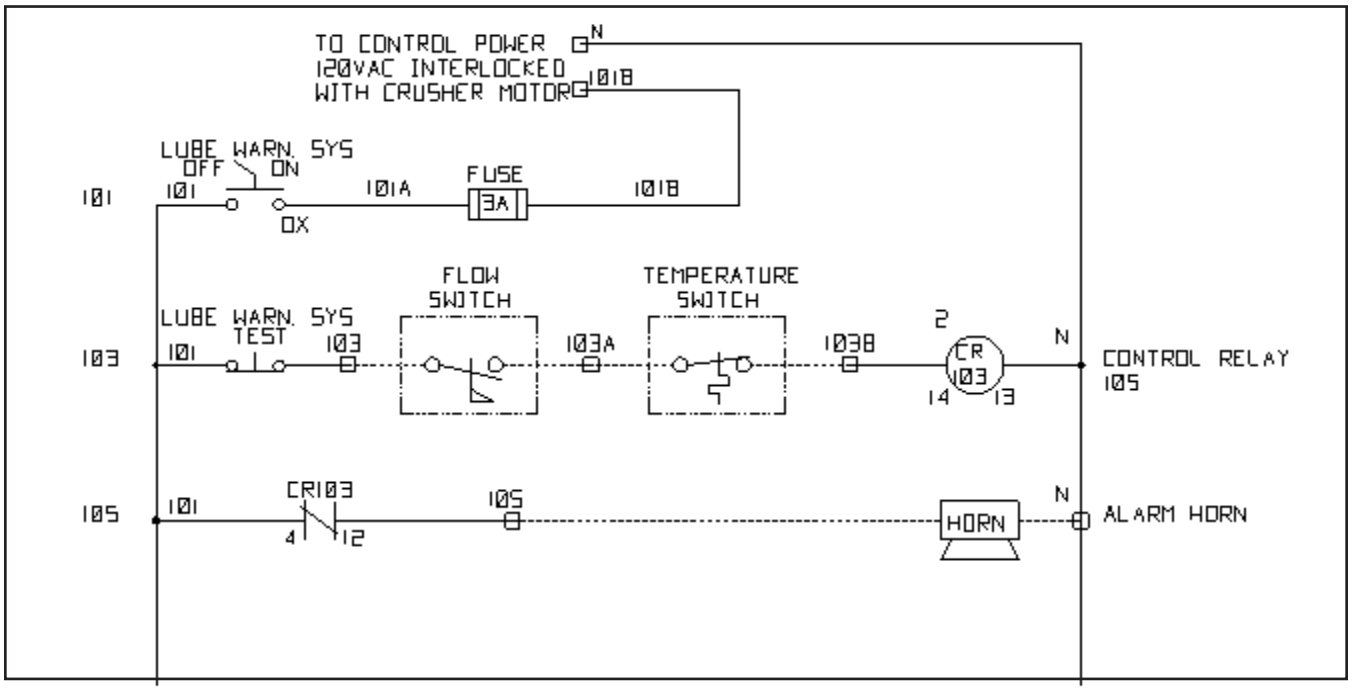
10. The relay contact (normally closed) opens and stops current flow to the horn.

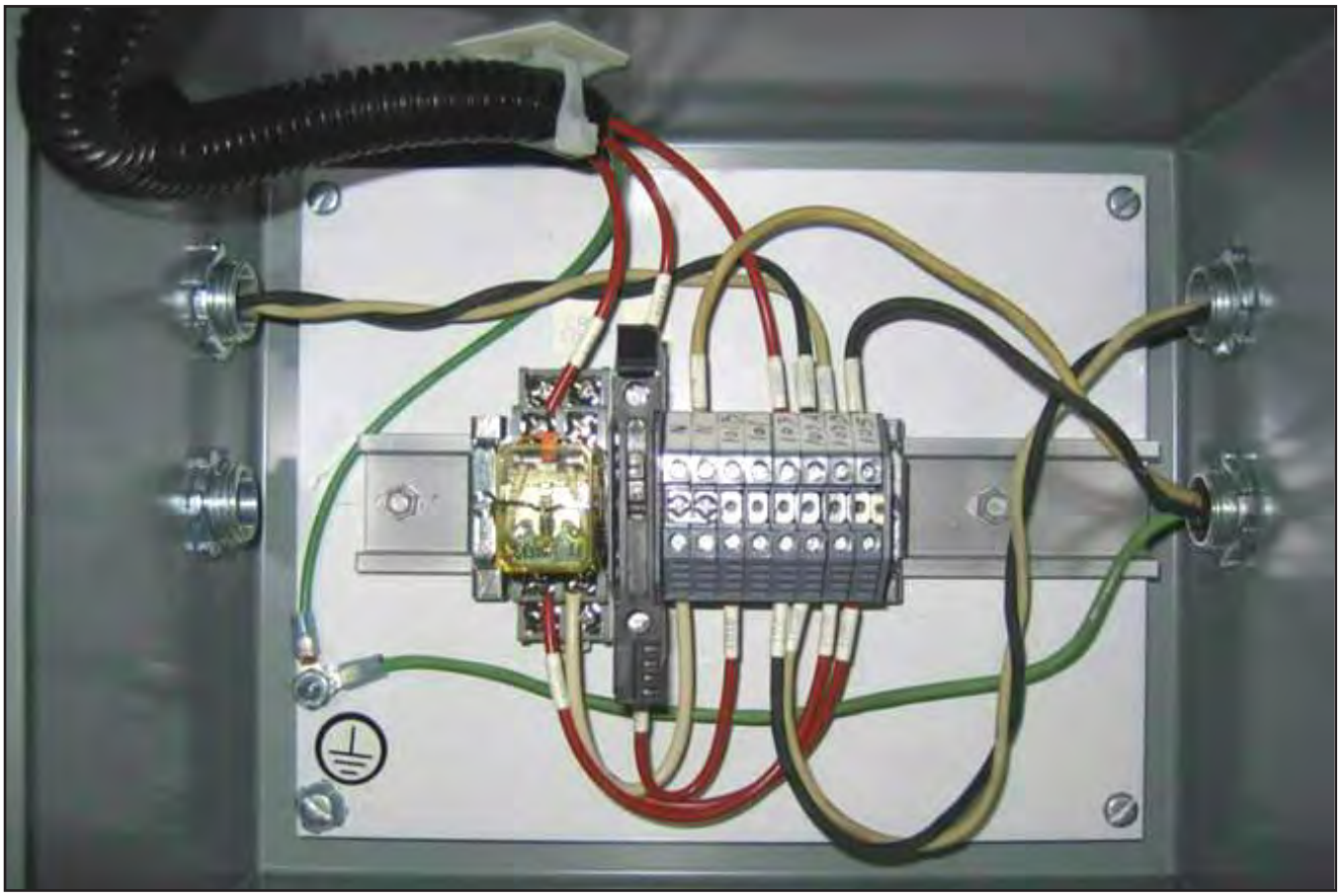
11. The relay contact (normally open) closes and allows the drive motor interlock to start the drive motor (if so wired).

12. If the crusher oil temperature rises above 180 degrees F or the oil flow falls below 1 GPM, the sensing switches will open and break the current flow to the relay coil.

13. This will close the relay contact (normally closed) and sound the horn.

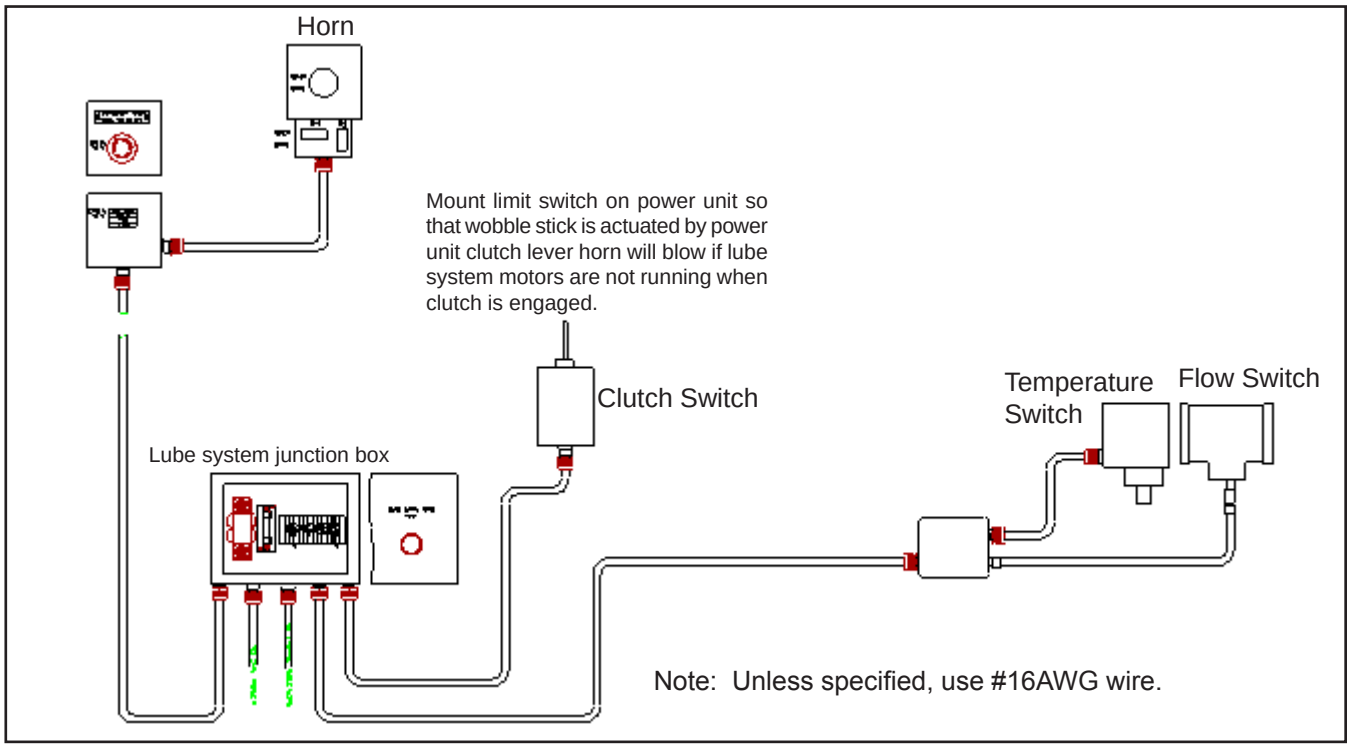
Electric Drive Wiring Diagram (Gen. 2)

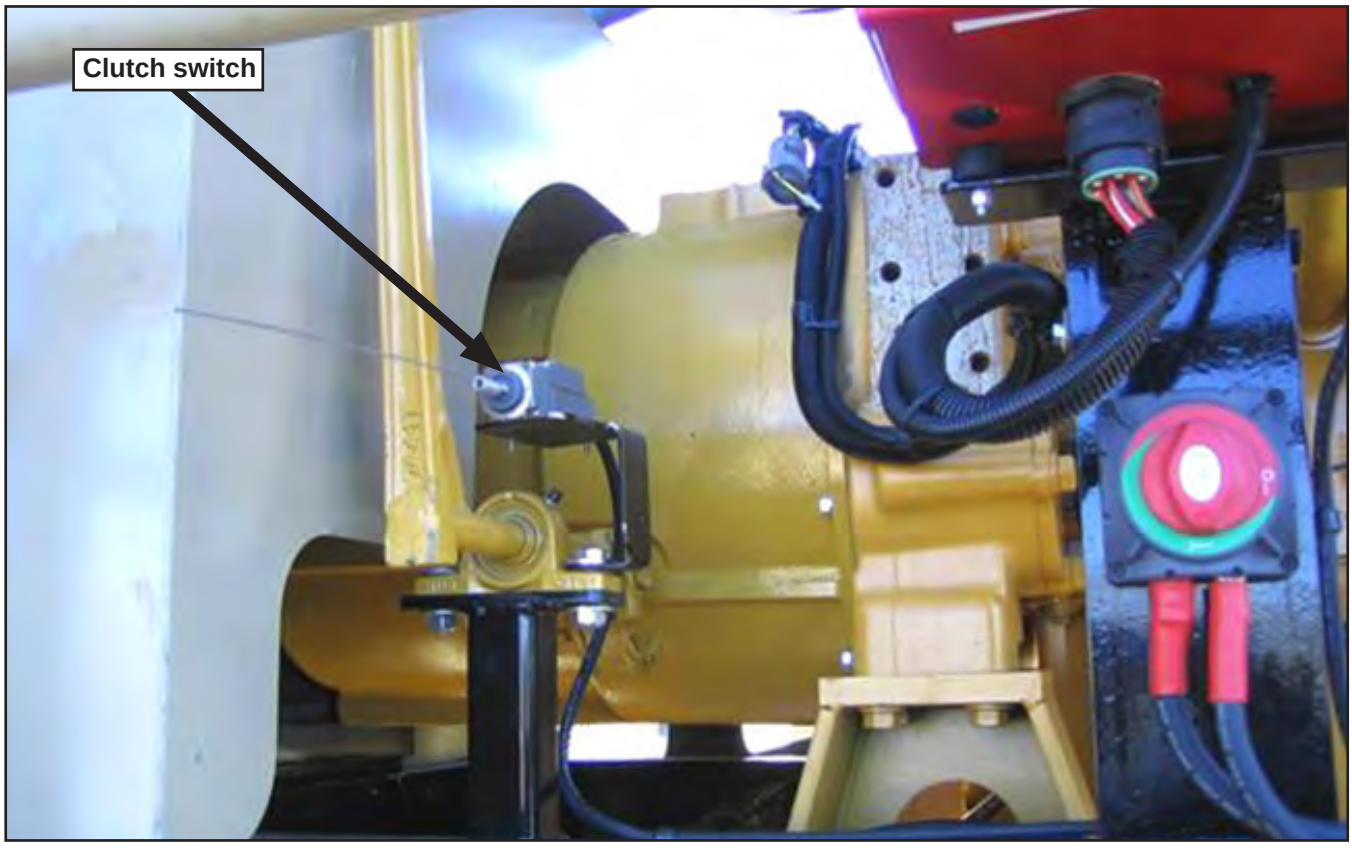




Electric Drive Wiring Panel

Diesel Lube Panel (Gen. 2)





Clutch Switch - Diesel Units Only

Lube System (3rd Gen)

Overview

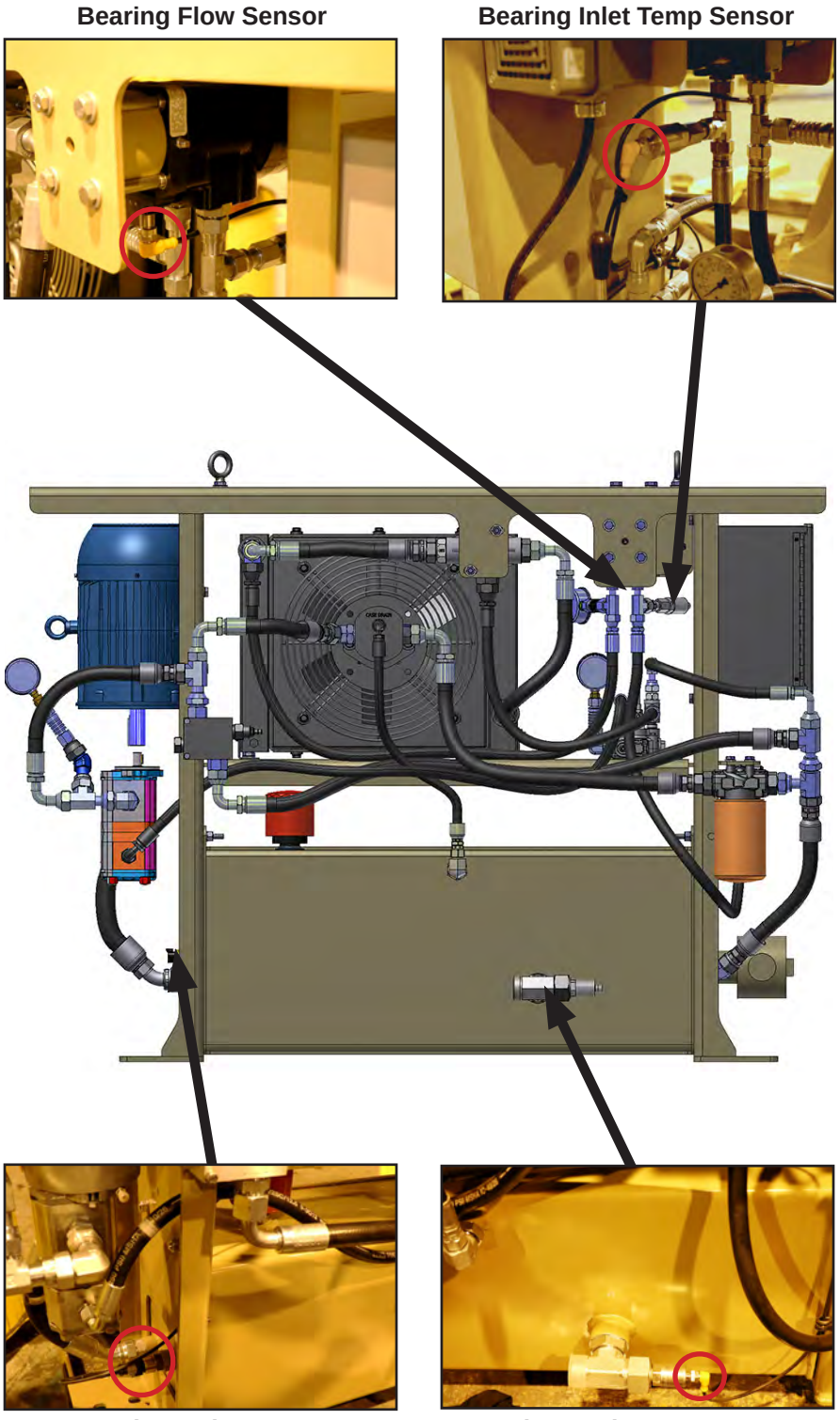
The VSI lubrication system uses an HMI (human machine interface) and an I/O (input/output) interface module that both communicate over a CAN network. The system consists of four sensors located on the lubrication module. Based on these inputs, the controller can enable or disable operation of the crusher, lubrication system, and feeder.

Sensors

The bearing flow, tank level, bearing inlet temp, and bearing outlet temp sensors monitor lubrication system functions.

The bearing flow sensor is a speed sensor on a hydraulic motor in the bearing flow circuit. It is designed to sense whether there is proper flow to the bearing.

The tank level sensor is a capacitance style, normally open fluid indicator switch. When the sensor is wet (sufficient fluid level), the contacts will be closed. When the sensor is dry (low fluid level), the contacts will be open. It is designed to protect the bearing and the pump in the event that fluid leaks from the system.



The bearing inlet temp sensor is a temperature sensor in the bearing flow circuit before the bearing. It is designed to sense system fluid temperature.

The bearing outlet temp sensor is a temperature sensor in the bearing flow circuit after the bearing. It is designed to sense max fluid temperature.

VSI Lubrication System Quick Reference

Application

VSI Models	1500, 2500, 82, 4500, 120	Compatible with all KPI models
Ambient Temp Range	-20˚ F to 120˚ F (-29˚ C to 49˚ C)	Requires heater below 32˚ F (0 C)

Hydraulics

Bearing Flow (nominal)	3.8 GPM (14.4 LPM)	3 phase 60 Hz electrical supply
Cooler flow	up to 3.8 GPM (14.4 LPM)	above 125˚ F fluid temperature
Fan Speed (nominal)	2500 RPM	Factory default. Max speed 4000 RPM
Fan circuit pressure	300 PSI (21 bar)	factory default
Fluid type	Mobil 600 XP 68	Refer to lubricant manual for substitutes
Fluid Temp Range	32-180˚ F (0-82˚ C)	Below 32˚ F (0 C) use a heater

Electrical

Electric Motor	5 HP	Available in different voltages
Controls	24V, PLC	Customer supplied voltage
Relay outputs	CR1, CR2, CR3	Bearing Flow, High Temp, Tank Level
Bearing Flow Alarm Point	.5 GPM (1.9 LPM)	Minimum flow allowed
High Temp Alarm point	180˚ F (82˚ C)	Max fluid temp allowed
Low temp alarm point	20˚ F (-6˚ C)	Below 32˚ F use a heater

Lubrication System Startup

Use the following procedure to start the lubrication system.

1. Inspect lubrication panel for damaged hoses, sensors, and components.

   If damaged components are found, repair them before moving forward.

   Make sure there is adequate amount of oil in the oil tank.

2. If temperature is below 32˚F (0˚C), plug in the heater and monitor the temperature gauge. Confirm the fluid is above 32˚ F (0˚ C).

3. If control power is not connected, it must be connected before the electric motor will start. At this point, the horn will sound until the pump is running (next step). You can also press OK to silence the horn.

4. If this is a new installation, rapidly start/stop the electric motor once to confirm correct rotation of the motor and pump. If the pressure gauge on the pump does not show momentary pressure, then reverse the electric motor rotation. Re-wire and move to next step.

5. Once rotation and temperature are confirmed, start the electric motor and allow a few moments for the fluid to begin circulating.

6. The lubrication system should come ready to use when new, but if you are starting up a used machine, it is recommended you check the fan circuit pressure. The pressure gauge mounted off the pump should read near 300 psi (21 bar). Actual pressure shown on the gauge will vary based on temperature of the fluid. 275-325 psi (19-22 bar) is normal.

Lubrication System Shutdown

Use the following procedure to shut down the lubrication system.

1. Stop feeding material to the VSI. Allow a few minutes for the VSI to clear all the material already in the crushing chamber.

2. Turn off the VSI. Allow several minutes for the VSI to slow down and come to a stop.

3. Turn off the lubrication system motor. The horn will sound at this time.

4. Turn off the control power. The horn will turn off.

Electrical System

The electrical system includes three relay contacts each with a normally open dry contact. These contacts respond based on temperature, flow, and tank level conditions and are described below.

CR1: "OK TO FEED"

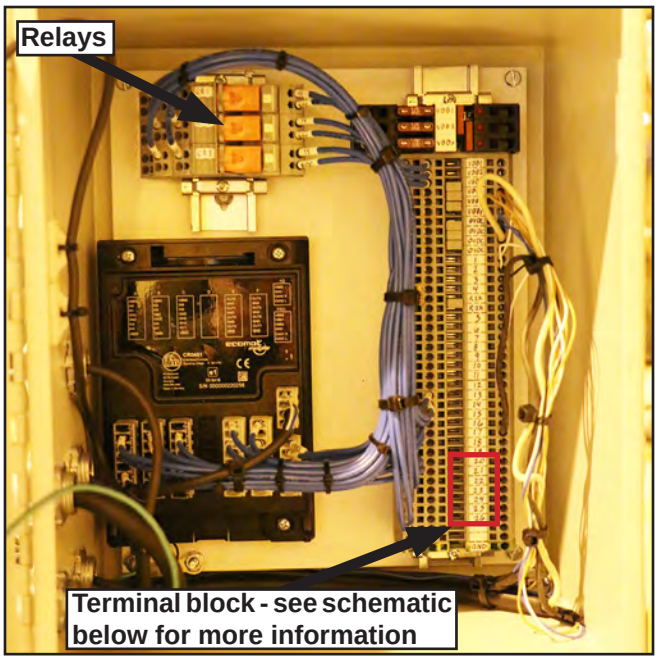
CR1 is provided as a recommended option to interlock the feed conveyor with crusher operation. It is designed to prevent material pile-up on the crusher when the crusher shuts down. When this relay is closed, the feed conveyor can run.

CR2: "OK TO CRUSH"

CR2 is a REQUIRED interlock that the customer MUST wire in to their control system in order for the controller to turn off the crusher when there is an alarm. It is designed to prevent damage to the crusher bearings. When this relay is closed, the crusher can run.

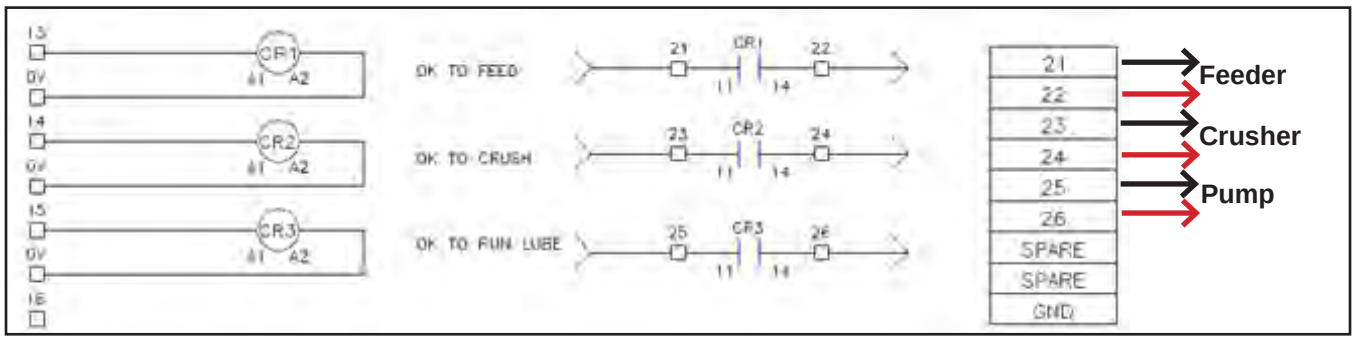
CR3: "OK TO RUN LUBE"

CR3 is a REQUIRED interlock that the customer MUST wire in to their control system in order for the controller to turn off the pump when there is an alarm. It is designed to prevent damage to the pump. When this relay is closed, the pump can run.



Temperature Rise Alarm

The controller has an additional bearing protection option that works by measuring the temperature rise of fluid before and after the bearing (shown on screen as Delta T). If this value exceeds the setpoint, the controls will sequentially shutdown the feeder and VSI. The lube pump will continue to run to cool the oil. This control is disabled by default from the factory, but can be enabled by lowering the setpoint to help identify bearings that are producing abnormal amounts of heat. The setpoint will vary by installation and must be based on temperature history.



Electrical Schematic - Relays

Alarm Condition	Setpoint	Alarm Response
Low Flow Alarm	<.5 GPM/min	Sequential shutdown - feeder, crusher, pump
Low Tank Alarm	Dry sensor	Immediate shutdown of feeder, crusher, and pump
High Temp Alarm	>180˚ F (82˚ C)	Sequential shutdown - feeder, crusher
Low Temp Alarm	<20˚ F (-6˚ C)	Pump will not start (Note that >32˚ F is recommended)
Temp Rise Alarm	>200˚ F (93˚ C)	Sequential shutdown - feeder, crusher

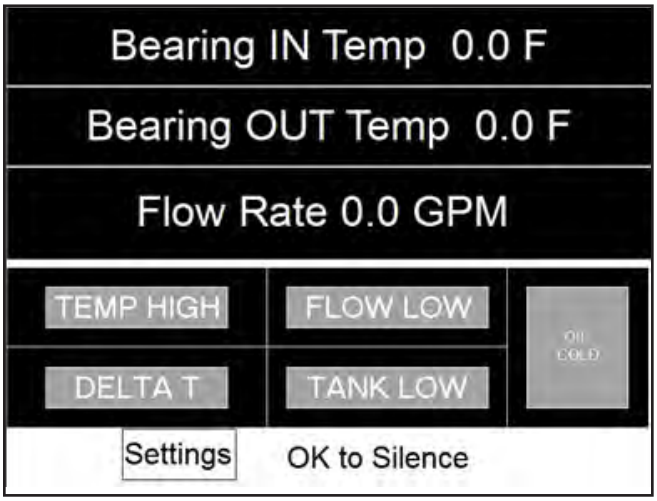
Adjusting Factory Defaults

In the event that the factory defaults are not suitable for your application, some of them can be adjusted. The table below illustrates what adjustments can be made.

Alarm Condition	Setpoint Range
Low Flow Alarm	.5 - 1.5 GPM (1.9 to 5.7 LPM) Minimum
Low Tank Alarm	Not adjustable
High Temp Alarm	170-180˚ F (76-82˚ C)
Low Temp Alarm	Not adjustable
Temp Rise Alarm	0-200˚ F (-18 - 93˚ C)

Navigating the HMI

Once control power is connected, the HMI screen will display status information and settings. The user may make adjustments to the settings page at any time during operation by pressing the “Settings” button. The screen will display the current flow rate and bearing inlet and outlet temperatures. If an alarm is triggered, the field labled Temp High, Flow Low, Delta T, Tank Low, or Oil Cold will turn red to indicate the condition that needs to be addressed.



Clearing Alarms

If there is an alarm, one or more of the HMI display fields will turn red like the picture below. To clear the alarm, identify the root cause of the alarm. For help on this, see the troubleshooting section. After the cause is addressed, the alarm will clear and the HMI will display the field in white text again. Note that the flow alarm will clear only once the pump has started.

Hydraulic System

The hydraulic system of the lubrication panel is detailed on the hydrualic schematic. The information below is meant to help the customer interpret this schematic in the event they need to troubleshoot issues or re-assemble the plumbing.

Note that the diagram below is a simplified representation of the system and not all of the components are shown.

Components

Heat Exchanger - This component has two parts: the core cools the lubricant to extract heat from the system. The fan blows air over the core and is driven by hydraulic fluid. Fan speed is designed to be 2500 RPM.

Pump - The pump is a two-section gear pump and creates flow for both the fan motor circuit and the bearing flow circuit.

Thermal Bypass - In the bearing flow circuit, the thermal bypass sends hot oil to the cooler and allows cool oil to bypass the cooler. The thermal bypass will start sending oil to the cooler at 100˚ F and will send all of the oil to the cooler at 125˚ F.

Control Valve - The directional control valve controls the motion of the Hydra Arm Lid Lift. Pushing and pulling the lever will raise or lower the VSI lid. It also sets relief pressure of the circuit at 2500 psi (172 bar).

Fan Speed Valve - The fan speed valve is a direct operated relief valve. This is nominally set to 300 psi (21 bar) in order to achieve a fan speed of 2500.

Cooling Fan Circuit - The only purpose of the cooling fan circuit is to spin the fan motor. The speed of the fan motor is regulated by the fan speed relief valve. Most fluid will flow from the pump to the motor and back to tank through a filter. Some amount of oil may flow over relief and back to tank without spinning the motor.

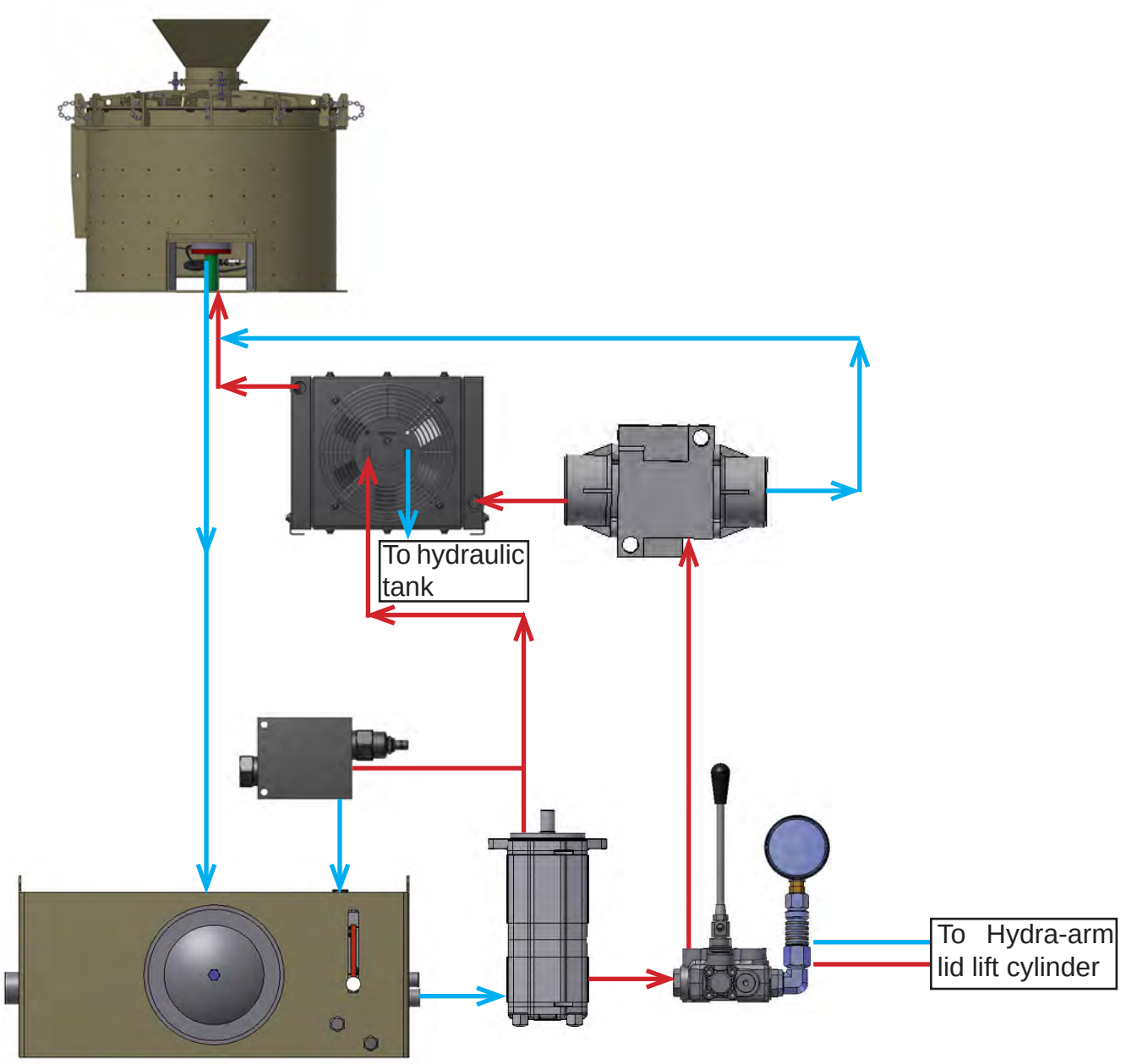
Bearing Flow Circuit - The bearing flow circuit exists to both cool the oil and send oil to the bearing. The pump sends oil first to the control valve, then to the thermal bypass valve. The thermal bypass valve sends hot oil to the cooler and cold oil around the cooler. All of the oil goes to the beraing where it cools and lubricates the bearing. In the event that the lever of the control valve is pulled, the fluid is diverted to the lid lift cylinder and then goes to the bearing. Once the lever springs back to neutral, all of the fluid will go directly to the bearing again. All of the flow through the bearing is filtered before entering the tank.

Changing Fan Speed

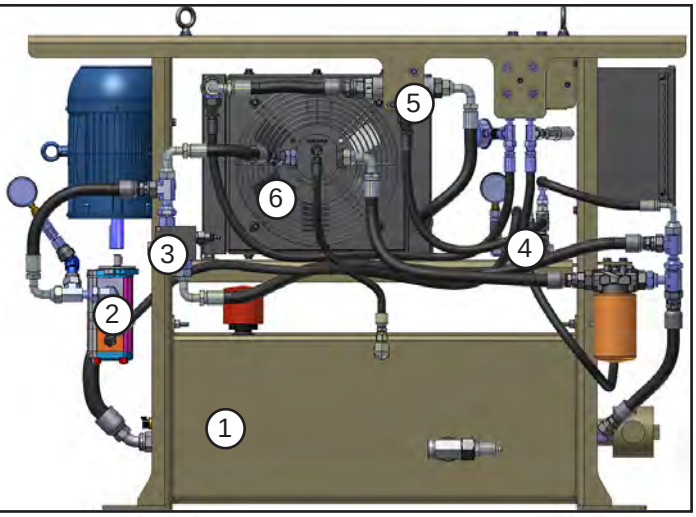
The factory setting for the fan speed valve is 300 psi (21 bar). In order to adjust the valve, use a hex key to turn the stem of the relief cartrdige. Watch the pump pressure gauge to find the desired pressure. Higher pressure will yield faster fan speed. Do not exceed 500 psi (34 bar).

Maintenance

- Change hydraulic oil first at 250 hours, then every 1000 hours.
- Inspect filters weekly while the pump is running and change as needed. The dirt alarm will reach the yellow zone when they need to be changed.
- Inspect cooler fins weekly and clean as needed.



1. Hydraulic oil tank
2. Pump
3. Fan speed valve
4. Control valve
5. Thermal bypass
6. Heat Exhanger



Tank line

Pressure line

Sympton	Causes	Remedy
High Temp Alarm	Heat exchanger is plugged with dirt. Bearings are damaged. Ambient temperature is too high.	Clean heat exchanger. Review temperature history.
Low Level Alarm	Leaky hose connection. Sensor is unplugged.	Fix all leaks and refill tank.
Low Flow Alarm	Pump is off (normal). Broken hose. Malfunctioning pump.	Turn pump on. Replace broken hoses. Replace pump.
Pump will not start	Fluid is too cold. Temperature sensor unplugged.	Plug in heater and heat oil. Plug in sensor.
Pump not building pressure	Motor might be wired incorrectly.	Turn off immediately and re-wire.
Fan blowing little air	Heat exchanger is plugged with dirt. Fan speed valve is out of adjustment.	Clean cooler. Adjust fan speed valve to 300 psi (21 bar).
VSI lid will not open.	Wedges still in place. Relief pressure has been adjusted. Too much material buildup on the lid.	Remove remaining wedges. Reset relief pressure to 2500 psi (172 bar). Clear material buildup from lid.
Alarms do not shut off crusher power.	Relays are not wired correctly.	Review schematic for correct wiring.
Delta T Alarm	The Delta T setting is too low The bearing is worn and is heating abnormally.	Compare temperature rise to

Adjustments

Cluster Ring

To maximize anvil life, it is possible to vertically adjust the cluster ring assembly. Adusting the cluster ring assembly allows the anvil to "pocket" in the lower half first and the top half second. When feed size is at or near maximum allowed, this adjustment is not recommended.

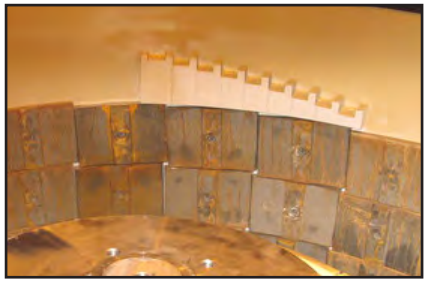
82, 1500, 2500, 4500 Models

82, 1500, 2500, and 4500 vertical shaft impactor models incorporate a 1/2" "step adjustment" retaining bracket.

Use the following procedure to adjust the cluster ring assembly.

1. Lockout/tagout all power to the vertical shaft impactor.
2. Remove crusher lid.
3. Fasten lifting chains around lifting holes/brackets installed on the cluster ring assembly.
4. Lift cluster ring just enough to rotate it clockwise or counterclockwise for adjustment on the retaining bracket.
5. Verify that the cluster ring is adequately seated on the retaining bracket before removing lifting chains.

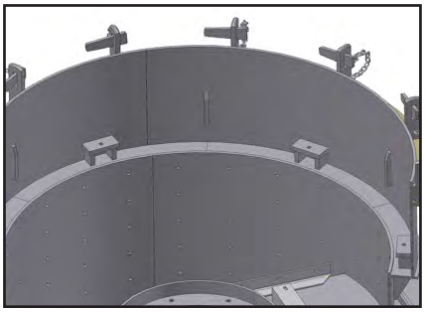
Impact Ring Assembly



Retaining Bracket

120 Model

The model 120 VSI relies on shims for adjusting the impact ring. These shims may be stored in a kingpin or parts box shipped with the unit.

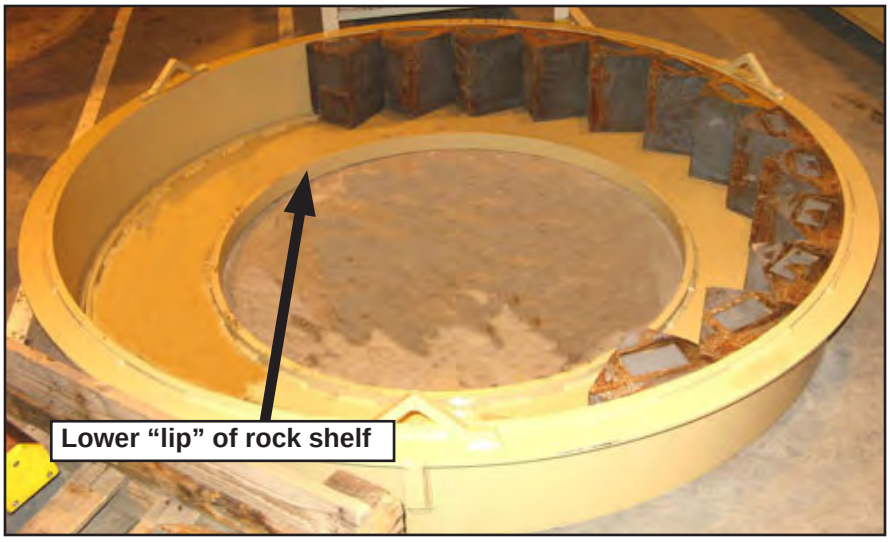


Use the following procedure to adjust the impact ring assembly on 120 models.

1. Lockout/tagout all power to the vertical shaft impactor.
2. Remove crusher lid.
3. Fasten lifting chains around the lifting holes/brackets installed on the impact ring assembly.
4. Lift impact ring out of the tub completely. Carefully set the impact ring on the ground.
5. Install shims according the the wear utilization on the anvils. Shims come in 1/4"-1/2" thickness.
6. Add shims equally to all sides of the impact ring assembly.

Rock Shelf

When adjusting the rock shelf, remove the lower pocket liner and use a straight edge to measure from the rotor base to the rock shelf. The lower “lip” of the rock shelf should sit 1/4” below the straight edge laying on rotor base.



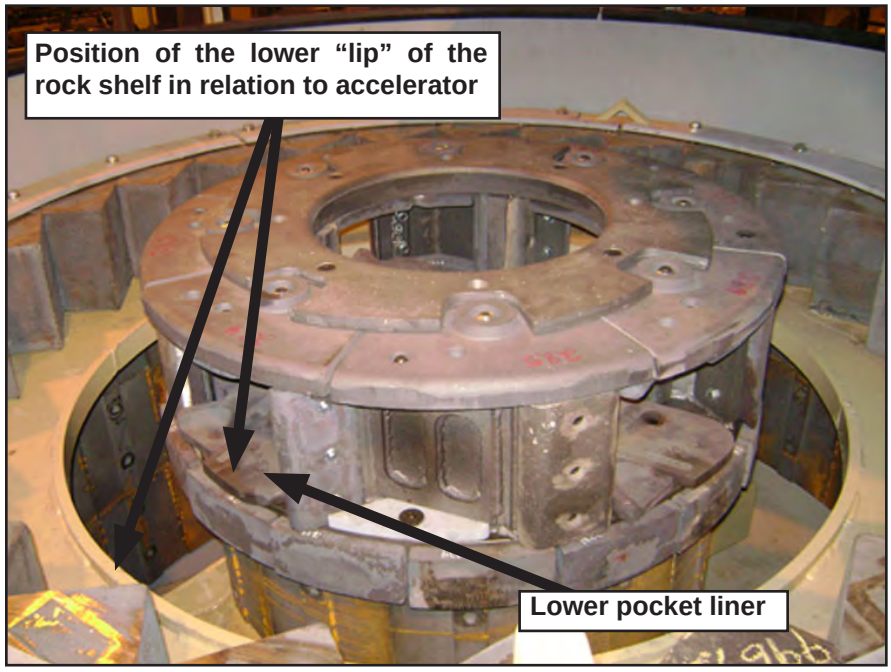
Rock Shelf

82, 1500, 2500, 4500 Models

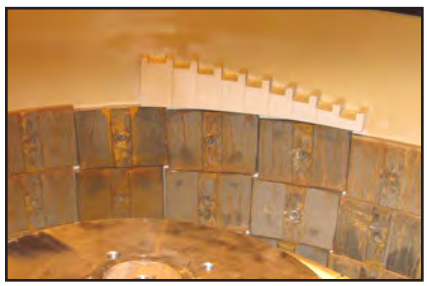
82, 1500, 2500, and 4500 vertical shaft impactor models incorporate a 1/2” “step adjustment” retaining bracket.

Use the following procedure to adjust the impact ring assembly.

1. Lockout/tagout all power to the vertical shaft impactor.
2. Remove crusher lid.
3. Fasten lifting chains around lifting holes/brackets installed on the impact ring assembly.
4. Lift impact ring just enough to rotate it clockwise or counterclockwise for adjustment on the retaining bracket.
5. Verify that the impact ring is adequately seated on the retaining bracket before removing lifting chains.
6. Replace crusher lid and remove lockout/tagout.



Rock Shelf Assembly



Retaining Bracket

Skirt Ring Adjustment

The skirt ring can be adjusted using shims to ensure that the flywheel and pedestal is protected.

Use the following procedure to adjust the skirt ring.

1. Lockout/tagout all power to the vertical shaft impactor.

2. Open the crusher lid (page 52).

3. Measure the clearance between the accelerator and skirt assembly. Tolerance should be between 1/8" and 3/8".

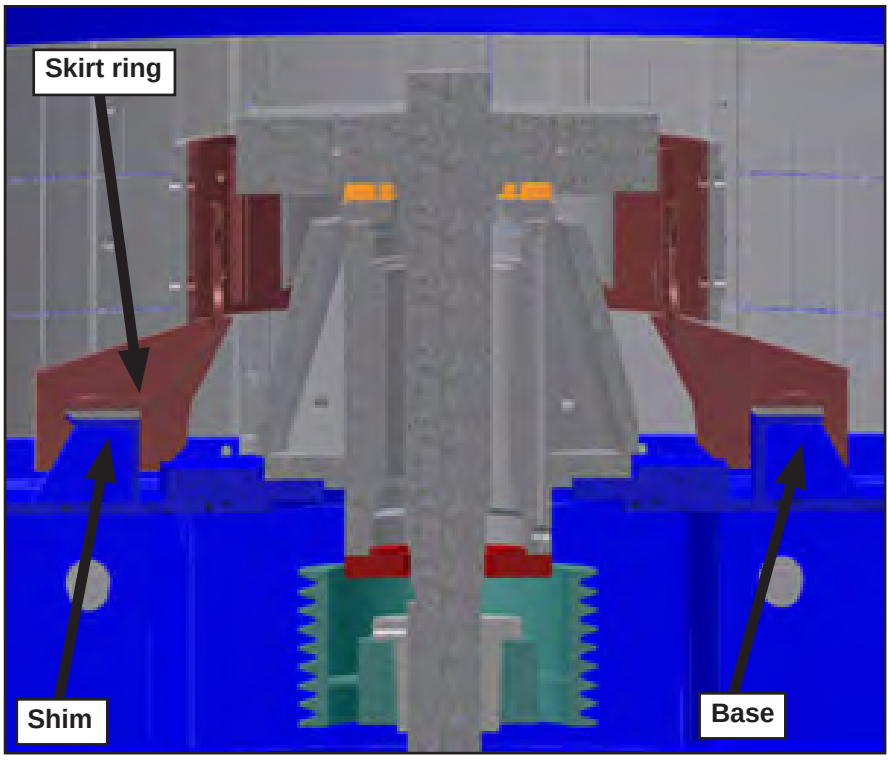
   If tolerance is greater than 3/8", shim adjustment is required.

4. Remove accelerator assembly from the crusher.

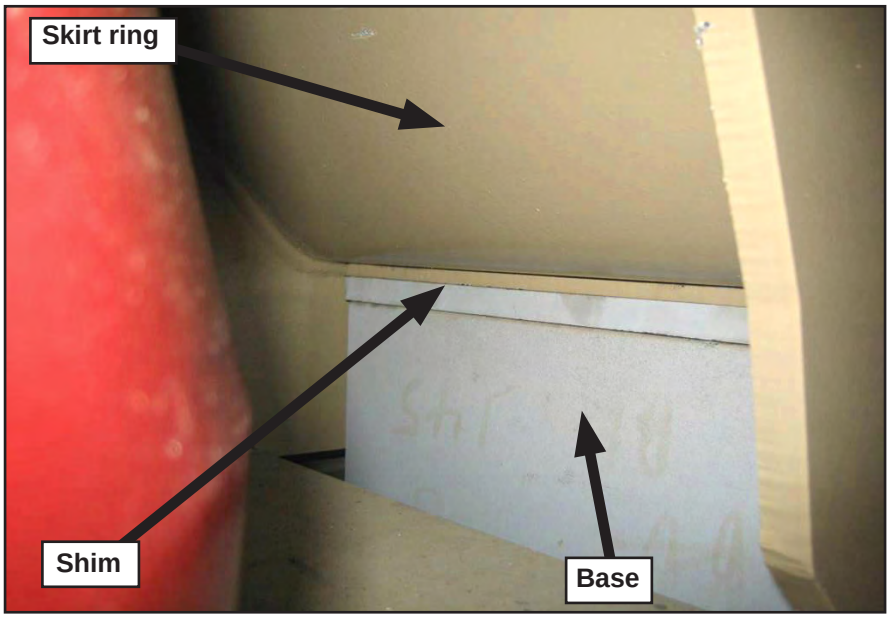
5. Unbolt skirt ring (2 bolts on each side - 4 bolts total).

6. Add shims. A shim pack is located on one side of the lubrication panel. Add shims equally to both sides.

Shim Pack - Storage Location



Vertical Shaft Impactor - Cross Section View



7. Bolt skirt ring back on to the base.

8. Re-install accelerator.

9. Reinstall crusher lid.

10. Remove lockout/tagout.

Feed Tube Adjustment

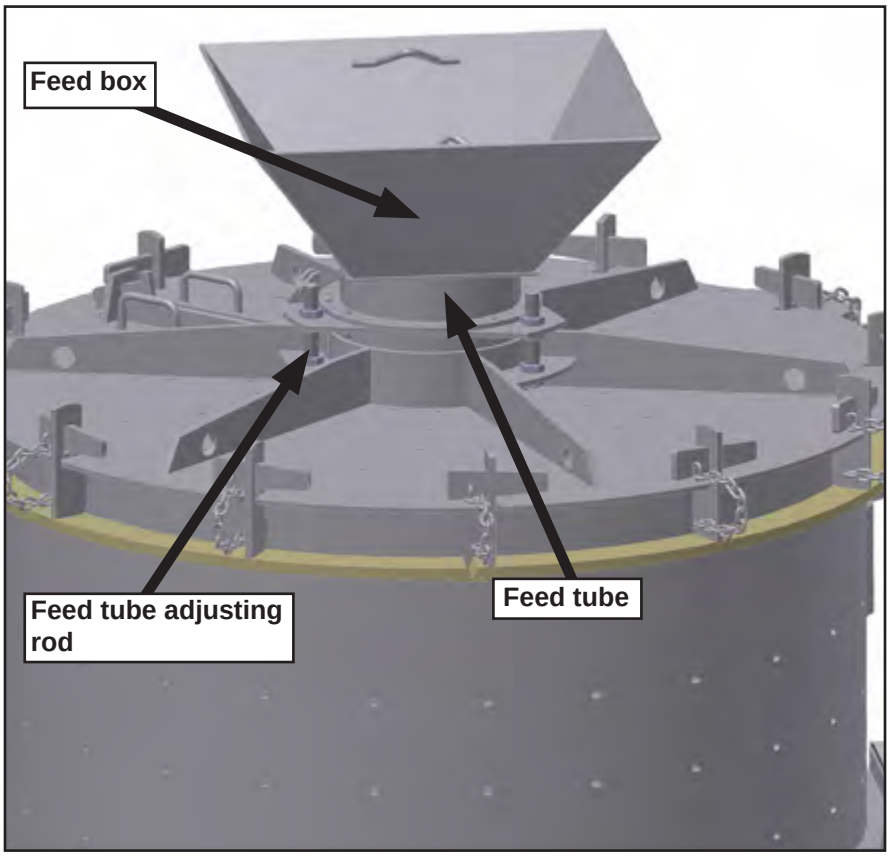
Feed tube height can be adjusted by threading the rod on the feed box up or down.

Make sure that all power to the vertical shaft impactor is locked out/tagged out before adjusting the feed tube.

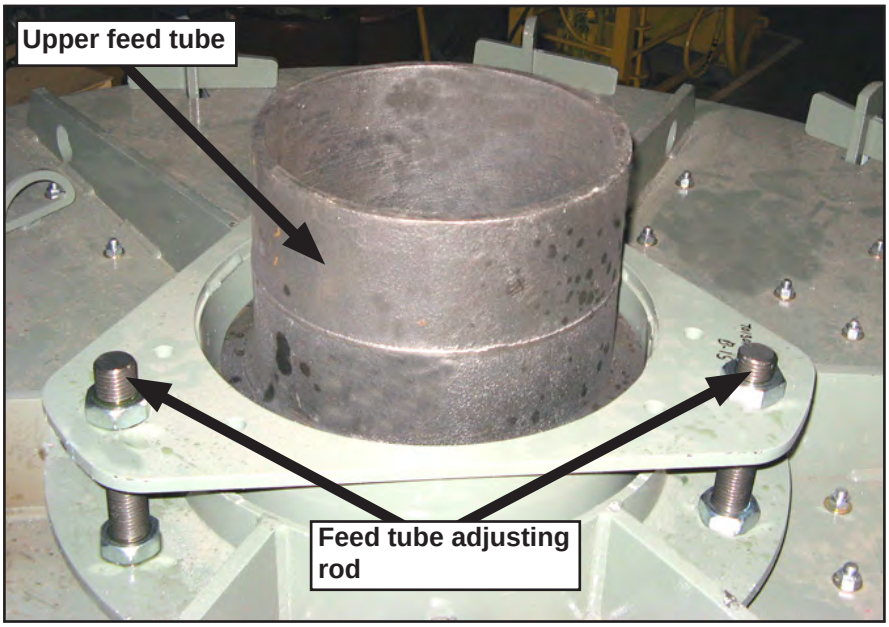
The distance between the bottom of the feed tube and the top of the impeller shoes should be no less than 3/8” depending on application. This adjustment should be made after the lid is in place.

⚠CAUTION

The feed tube should never touch or intrude inside of the accelerator.



Feed Box and Feed Tube



Feed Tube Assembly

Temperature Switch Adjustment (Gen. 2 Lubrication System only)

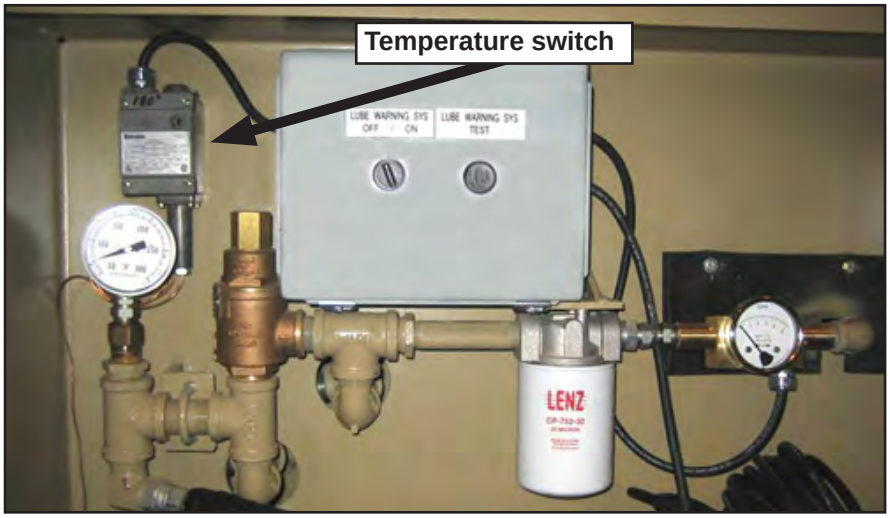
The temperature switch for the lube alarm system must be set to 180˚ F (82˚ C). If the temperature switch is set at a temperature other than 180˚ F (82˚ C), use the following procedure to adjust the temperature switch.

1. Lockout/tagout all power to the vertical shaft impactor.

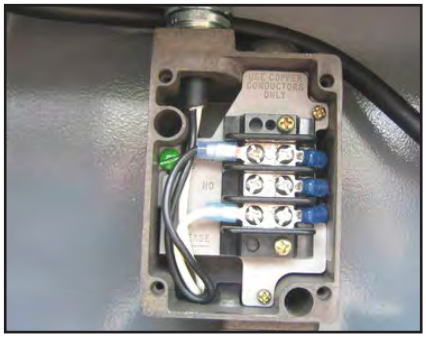
2. Locate the temperature switch on the lube panel and remove the four screws on the cover.

Temperature Switch

3. Remove the temperature switch box from the lubrication panel by removing two screws.



Lubrication Panel



4. Remove two screws located on top of the temperature switch.

Temperature Dial Cover

5. After removing the cover, verify temperature setting. If temperature switch is not set at 180 degrees F (82 degrees C), turn the switch clockwise until it is set at 180 degrees F (82 degrees C).

Temperature Dial Switch

6. Install the dial cover. Secure with two screws.

7. Reinstall the temperature switch to the lubrication panel with two screws.

8. Reinstall the front cover. Secure with four screws.

Flow Switch Adjustment (Gen. 2 Lubrication System only)

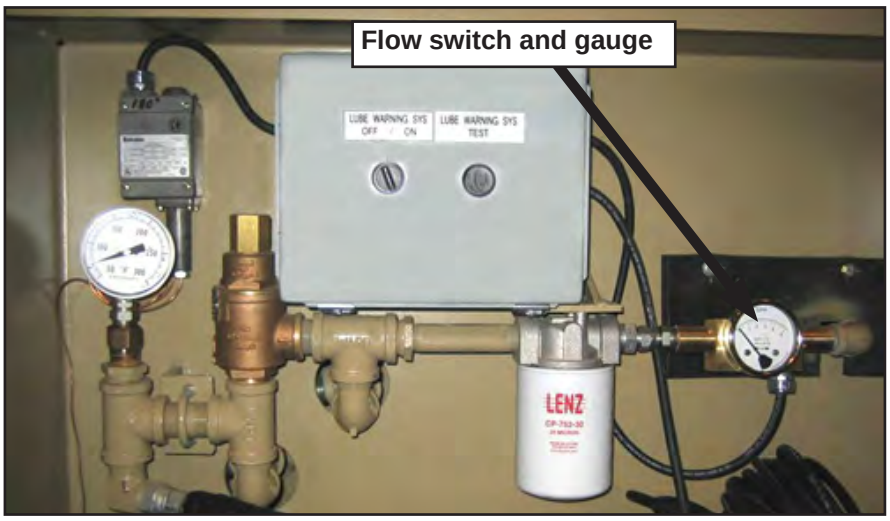
The flow switch monitors oil flow through the lubrication system. The process fluid flows through the flow switch meter at a rate of 1-3.5 GPM. The flow causes the sensor, a spring loaded cone/magnet assembly, to move from a large precision orifice. As flow increases, the sensor magnet moves toward the pointer magnet and causes the reed switch to actuate. The cone-orifice combination results in variable area flow measurements and an easy-to-read linear scale. The reed switch alerts the operator of problem conditions.

The flow switch can be adjusted as needed. Use the following procedure to adjust the flow switch.

1. Lockout/tagout all power to the vertical shaft impactor.

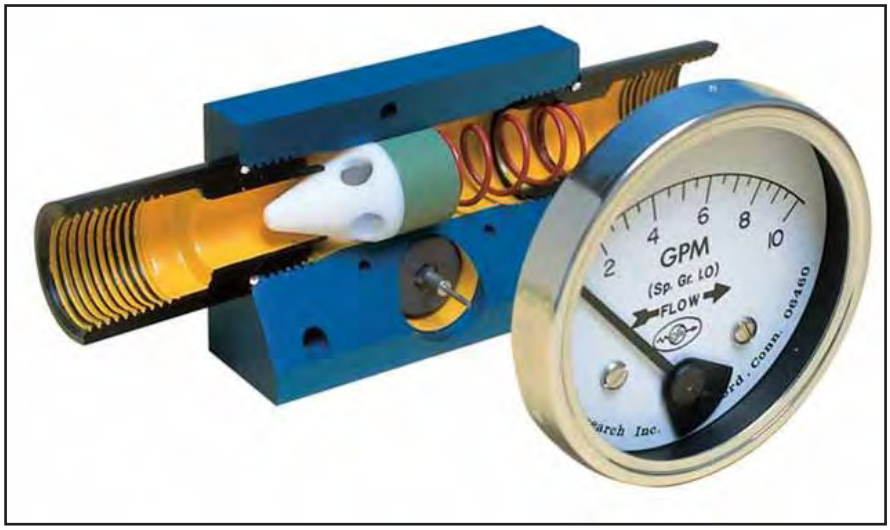
2. Remove the flow switch assembly from the lubrication panel by disconnecting it at the inlet and outlet ports.

3. Remove all four screws from the back panel of the flow switch.



Lubrication Panel

Back Cover of Flow Switch



Cross Section of Flow Switch

4. Remove back cover.

5. Use the supplied allen wrench (stored on the back cover) to loosen the set screw on the reed switch.

6. To change the flow setting, grasp the switch tube at one end of the reed switch and slide the wires in or out until the switch activates.

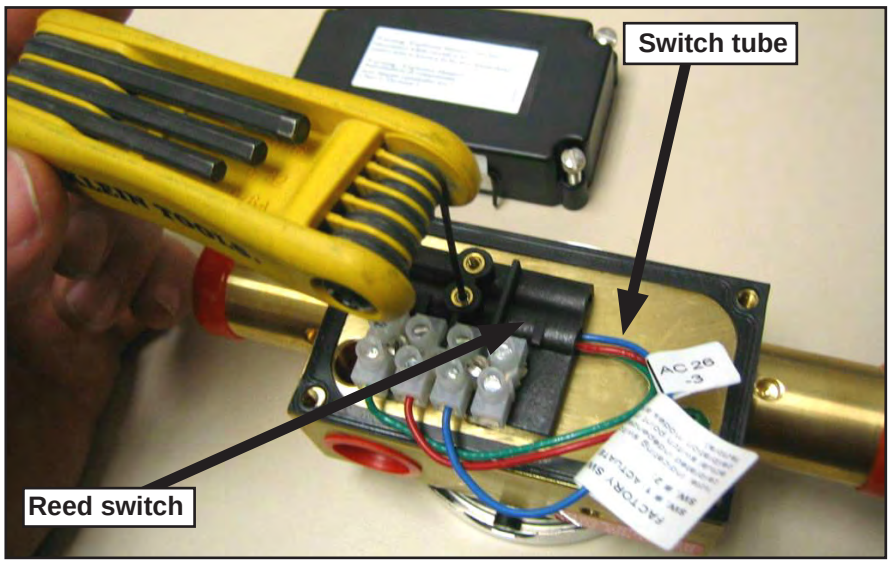
   Sliding the switch tube in decreases the flow rate setting.

   Sliding the switch tube out increases the flow rate setting.

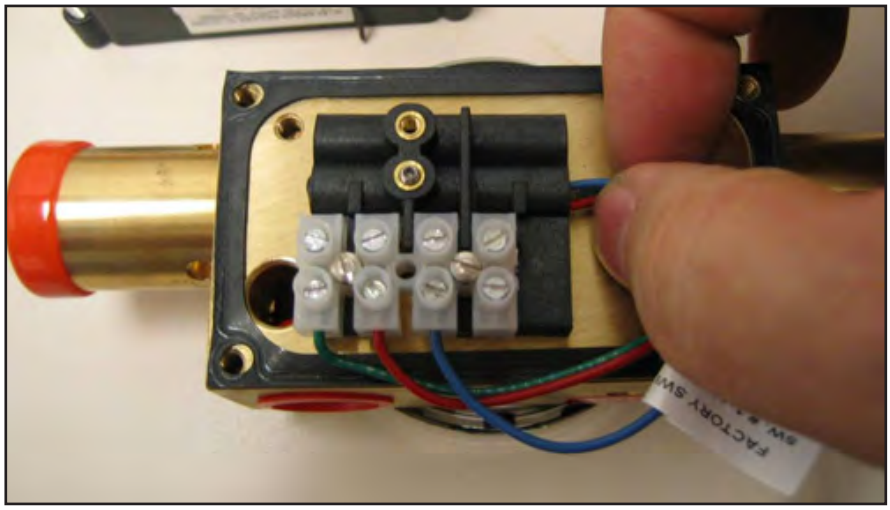
7. Tighten the set screw to hold the switch in place and recheck the new actuation point.

⚠CAUTION

Do not overtighten the set screw. This is a cone point screw that digs into the tube with light pressure. In some cases, it might be necessary to reverse the switch tube end for end to locate the new actuation point. This is normal procedure.



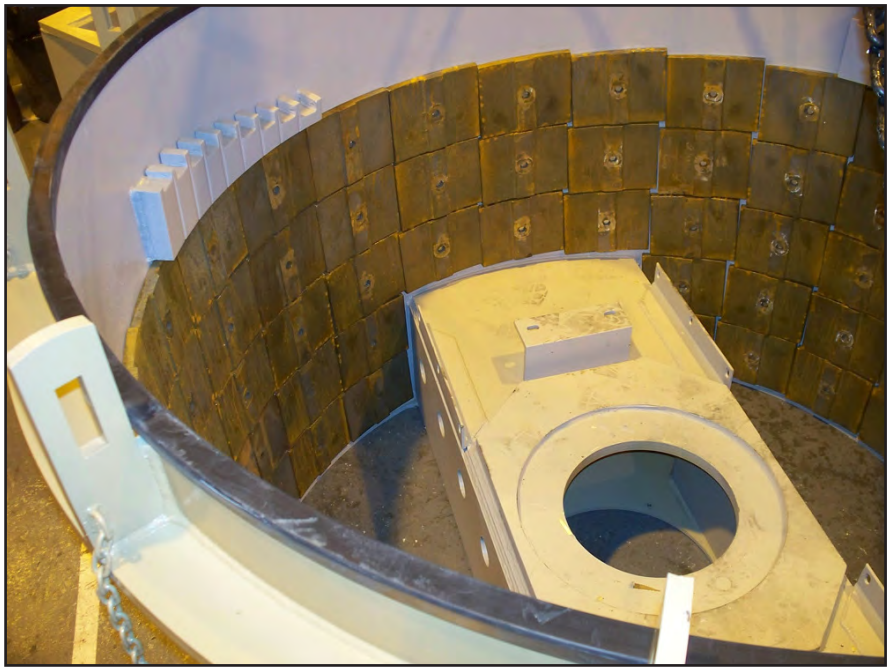
Loosening Set Screw



Adjusting Switch Tube

Wear Parts

Tub Liner Replacement

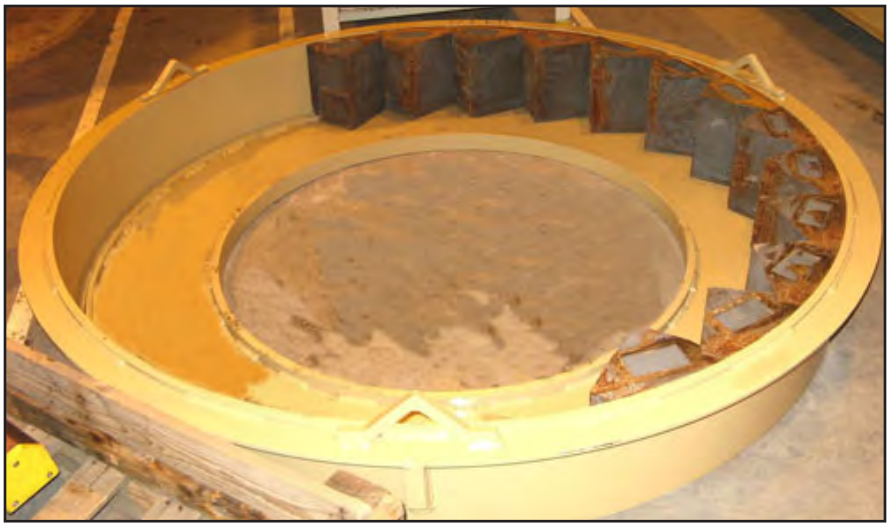


Use the following procedure to replace tub liners.

1. Open crusher lid (page 52).
2. Remove the impact ring assembly from the tub.
3. Unbolt and remove worn liners.
4. Install new liners using new M12 hex bolts. Torque to 45 ft.lbs (61 n-m).

   Tub liners weigh 18 lbs. each.

Anvil Replacment - Rock Shelf



Use the following procedure to replace anvils in a rock shelf assembly.

1. Open crusher lid (page 52).
2. Use a hammer to knock one anvil out of place. This should loosen the other anvils.
3. Slide anvil out of slot and replace with new anvil.
4. When finished, close crusher lid.

Anvil Replacement - Cluster Ring

When the anvils have become worn to within 1/2" from the back of the anvil, or 1/4" of the face edge, they should be replaced.

NOTICE

Before beginning the procedure to replace anvils, check the condition of the steel brackets and ring. If the bracket is damaged, a new bracket can be purchased and welded into place after removing the damaged one(s).

Use the following procedure to replace the anvils.

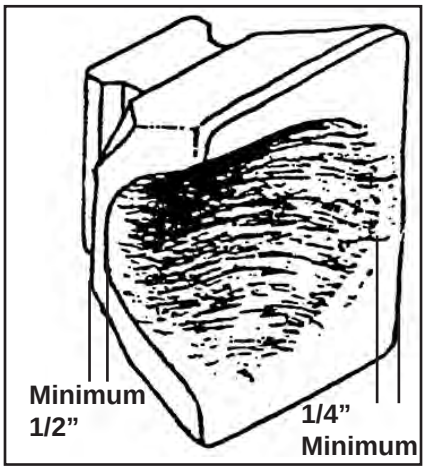
1. Open crusher lid (page 52).
2. Attach lifting device to the steel brackets on the cluster ring.
3. Lift the entire cluster ring assembly from the base.
4. Flip the cluster ring assembly upside down.
5. Tap on anvils so they drop out onto the ground.

⚠CAUTION

Anvils weigh 80 pounds. When flipping cluster ring assembly, be aware of falling anvils.

NOTICE

The anvil/cluster ring assembly is designed to form a "material" or "rock" shelf above the assembly and thereby protect the upper tub area.



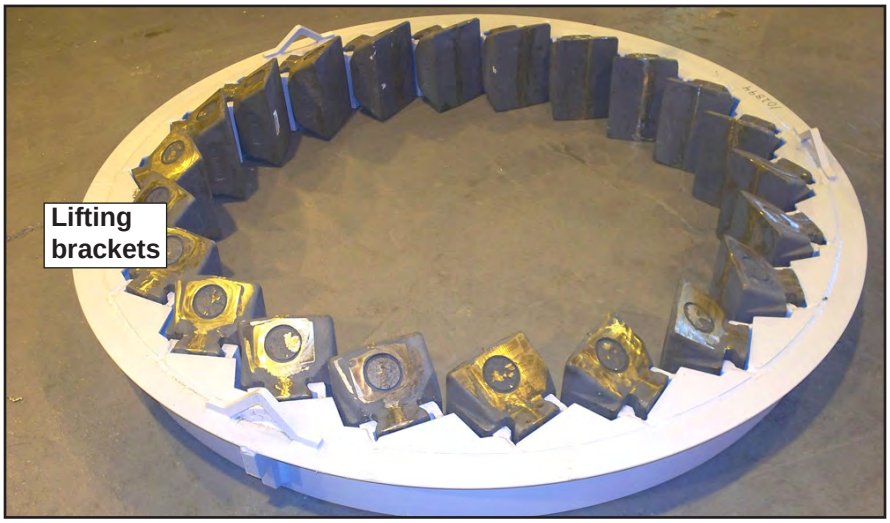
Anvil Wear Pattern

6. Flip cluster ring upright onto a safely supported structure.
7. Install new anvils.
8. Re-install cluster ring.
9. Close crusher lid.

NOTICE

The entire set of anvils is normally replaced at the same time.

Note: A spare cluster ring assembly with anvils is advantageous where frequent anvil changes are required in very abrasive applications.



Feed Tube

The feed tube assembly consists of two identical feed tubes stacked on top of each other. The feed tube is designed to feed material directly to the center of the impeller table. The feed tubes are interchangeable to extend the life of each feed tube.

Use the following procedure to reverse the feed tube.

1. Lockout/tagout all power to the vertical shaft impactor.

2. Attach lifting chains to the lifting lugs on the feed box.

3. Remove feed box from the upper feed tube. Remove the rubber seal between the feed box and the upper feed tube.

4. Unscrew and remove three feed tube adjusting rods.

5. Remove both feed tubes. Each feed tube section weighs 71 lbs.

6. When re-installing, reverse the feed tubes so that the worn feed tube(lower) is on the top next to the feed box.

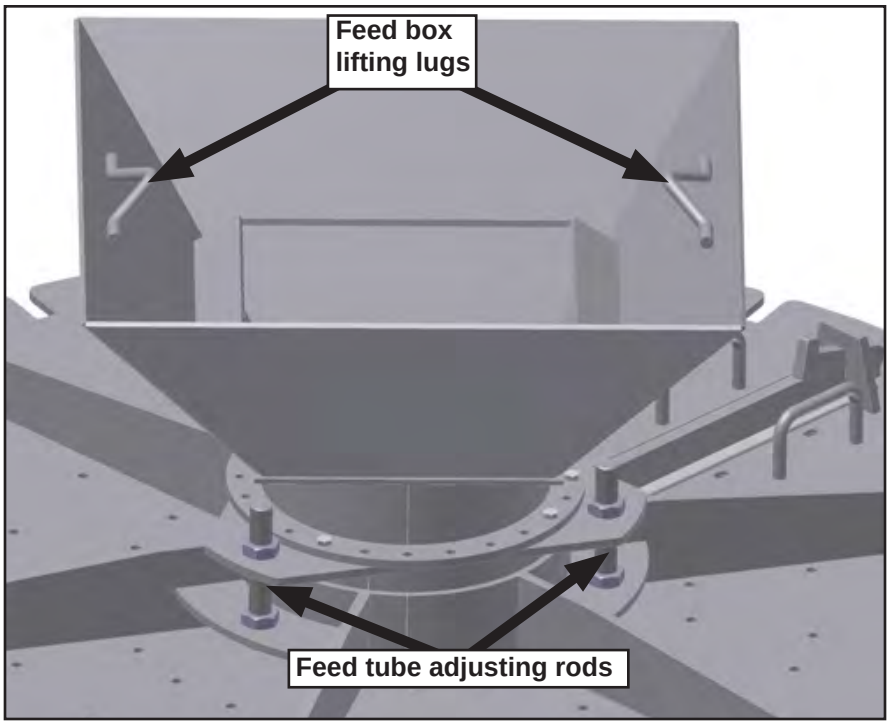
Inspect the seals for damage. Make sure they are intact.

7. Verify that the lid is in place. Measure the clearance between the bottom of the feed tube and the top of the rotor or table assembly. Clearance should be 3/8".

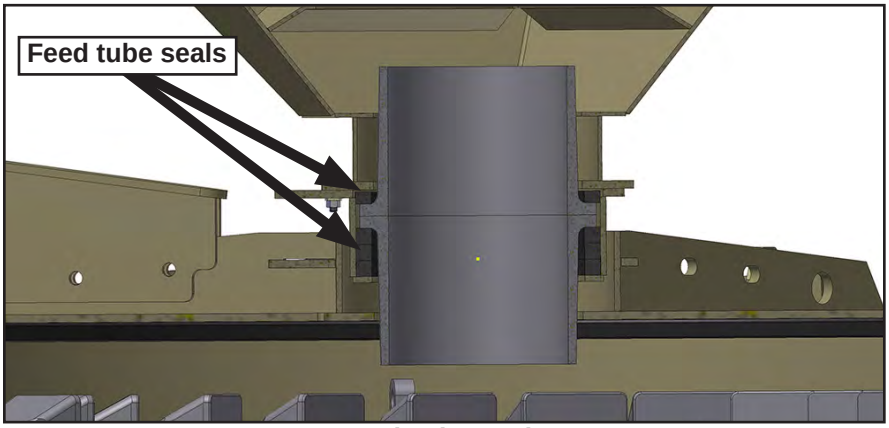
8. Replace the feed box.

WARNING

Never attempt to service or adjust this machine until all motion has stopped and power has been disconnected and locked out or the engine control key has been removed and the control panel has been locked.



Feed Box Lifting Lugs



Feed Tube Seals

Lid Liners

The lid assembly is made up of three different size liners. There are twelve outer liners, twelve middle liners and six inner liners. Replace lid liners when they wear to 1/2 their original thickness.

Use the following procedure to replace the lid liners:

1. Remove two bolts from the inner end of the lid rim and two bolts that fasten the lid to the arm. Raise arm and swing to one side.

2. Fasten lifting chains around crusher lid.

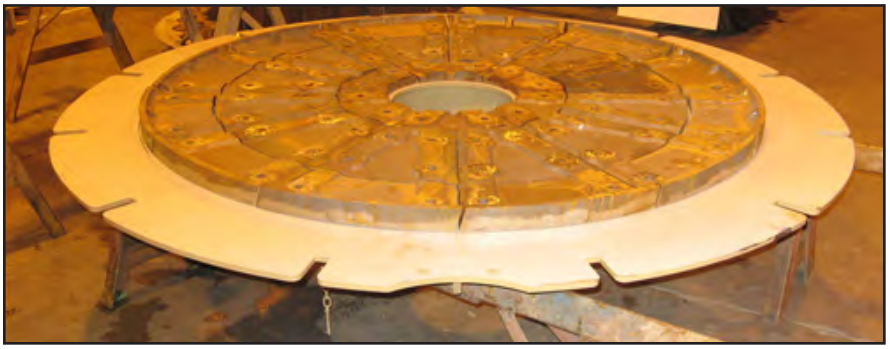
3. Remove lid from the vertical shaft impactor and turn upside down.

4. Remove lid liner bolts and worn lid liners.

NOTICE

When removing worn lid liners it is often easier to cut the bolts on the top side of the lid.

5. Install new lid liners using new grade 5 bolts and coating bolts with blue Loctite 242.



Crusher Lid Assembly

The following are weights for the lid liners:

Outer lid liners: up to 31 lbs.
Middle lid liners: up to 60 lbs.
Inner lid liners: up to 22 lbs.

Note: The 4500 VSI has four sets of liners. 82, 1500, 2500 only have three sets of liners.

6. When installing inspection door liners, steel spacers will need to be installed.

7. Re-install crusher lid by aligning slots with lugs and lowering into place.

8. Reattach hydra-arm to the lid.

9. To secure lid, drive lid wedges through the slot in the lugs. Always drive wedges in the direction of table rotation (counterclockwise).

Feed Disc

NOTICE

The feed disc should never be allowed to wear completely through as serious damage can be caused to crusher components.

Feed disc wear is evident by a rounding off of its outer edge immediately in front of the impeller shoe. While wear is normal, rotating the feed disc approximately 30 degrees clockwise will present a fresh corner. Properly maintained, the feed disc allows for optimum feed distribution and optimum material trajectory to the anvils.

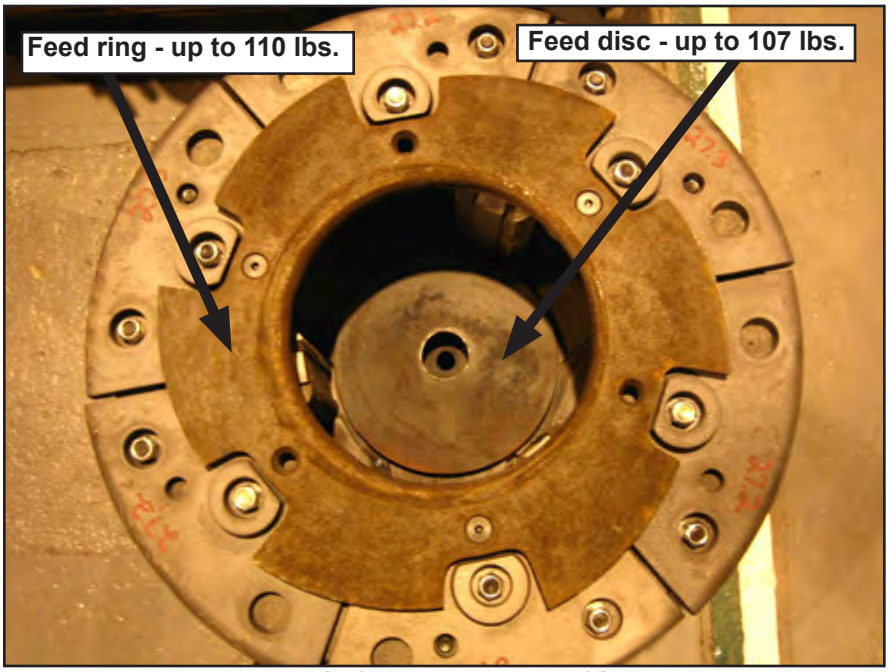
Improperly maintained, a worn feed desk can result in:

- "Slotting" of the impeller shoes or carbides.
- Accelerated wear on flat table liners.
- A poor wear pattern
- Overall reduced crushing efficiency.

When replacing a feed disc make sure it is centered on the accelerator.

On a table, the bevel on the impeller shoes helps accomplish this.

Feed Disc - Table Assembly



Feed Disc - Rotor Assembly

On a rotor, the center bolt accomplishes this.

However, casting tolerances prevent a close tolerance fit, and serious accelerator vibration can occur if the feed disc is not centered.

When the feed disc is replaced, torque the center bolt to 199 ft.lbs. (1500 models) or 480 ft.lbs. (2500 and 4500 models).

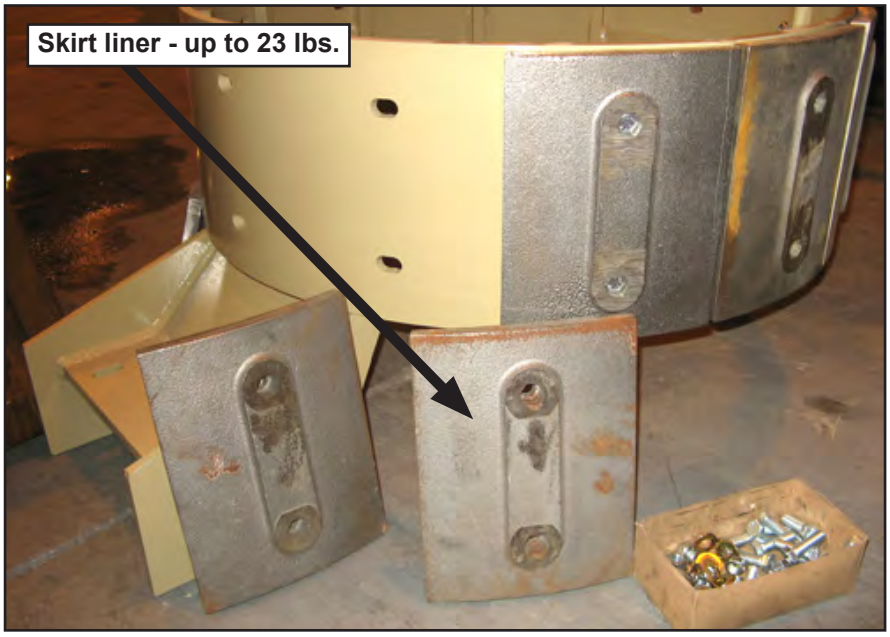
Skirt Ring Assembly

The skirt ring sits below the accelerator and protects the flywheel and pedestal. The skirt ring is faced with cast alloy skirt liners held in place by hex head bolts.

Liners must be replaced as a set.

To extend liner life, remove two bolts and rotate skirt liners 180 degrees. Check distance between skirt ring and flywheel.

To replace skirt liners, remove crusher lid, accelerator, and skirt ring. Unbolt and remove skirt liner and replace with new skirt liner and bolts.



Use progressive torque locknuts with the bolts on the skirt liners. Tighten nuts until the bolts are snug.

Pedestal Skirt Cone

Use a lifting device to remove and install the pedestal skirt cone from the top of the pedestal with the accelerator and flywheel removed. The pedestal skirt cone slides over the pedestal.

Replace when worn thin or if a hole appears.

Ensure that material hasn't built up under the skirt cone pushing up flywheel.

Reference VSI service manual for instructions on removing and installing the flywheel.

Wear Parts - Table Assembly

Outer Table Liners

Use the following procedure to remove outer table liners.

1. Open crusher lid (page 52).

2. Remove impeller shoes, feed disc, and flat table liners.

3. Unbolt and remove table from flywheel.

4. Secure lifting chains around table assembly. Remove table from tub. Turn table upside down. Set carefully on a firm, level surface.

CAUTION

Use caution when rotating table, weight shifts when lifting from the crushing chamber and turning it upside down.

5. Unbolt and remove outer table liners. If broken liners are being replaced, the broken liner and the liner on the opposite side must be replaced to maintain proper table balance.

If liners are being removed and installed on another table, be sure they are placed on the new table in the same position to maintain proper balance. If table balance is not maintained, a vibration will result causing premature pedestal bearing failure.

Outer Table Liners

6. Install the heaviest liners first and mount them across from each other.

In order to keep the table balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

7. Apply blue Loctite 242 to the bolts.

8. Snug tighten the bolts.

The heat-treating process may cause a slight warp in the liners and overtightening the bolts may cause them to break.

9. Repeat steps 6-8 until all liners are installed on the table.

If no other wear parts are being replaced, proceed to step 10, otherwise, repair all other wear parts as needed.

10. Install table on flywheel using new bolts. Apply blue Loctite 242 to the new bolts.

On 82, 2500 and 4500 VSI models, torque bolts to 600 ft.lbs.

On 1500 models, torque bolts to 281 ft.lbs.

11. Install flat table liners, feed disc, and impeller shoes.

12. Replace crusher lid.

Impeller Shoes

Two impeller shoe types are available: pin-on shoes and bolt-on shoes.

NOTICE

Bolt-on and pin-on shoes are not interchangeable.

Bolt-on Shoes

Use the following procedure to remove worn bolt-on impeller shoes.

1. Remove the bolts and then remove shoe from bracket.

Once worn shoes have been removed, use the following procedure to replace the shoes.

1. Clean all material out of the shoe opening in the bracket.

2. Inspect all table liners and surfaces.

3. When installing new shoes, be sure matching weights are opposite to insure impeller table balance. Shoe weights are marked on the back side of the shoe in pounds and ounces.

   On tables with four shoes, keep balanced shoe pairs opposite as with table liners.
   Three and five shoe tables use all the same weight.

4. Check the impeller shoe/ bracket fit tolerance.

The centrifugal force exerted on the shoe and the constant hammering by material will eventually wear on the front and back of the shoe bracket. These two critical areas, if left unchecked, will allow the shoe to be thrust outward and leave a gap between the shoe and the shoe bracket. This gap will fill with material and a wedging action may occur causing excessive stress on the shoe bolts and promote failure of the shoe stob.

5. If tolerance between the shoe and bracket is greater than 1/8", insert pieces of shim (10 gauge material, 1" wide by length of the vertical face of the shoe bracket) between the shoe and the shoe bracket with the pin installed.

   Tack weld shims in place and grind flat.

6. Insert new shoe into bracket.

7. Install two shoe bolts. Torque to 100 ft.lbs.

8. Inspect the ID and OD of the shoe brackets for wear.

9. Inspect hard-faced surfaces.

   At the factory, the ID and OD of the shoe brackets are hardfaced with Stoody #133 wire. This surface must be maintained or serious table damage will result. Stoody wire #31 or #35 stick rod may be used to repair surfaces on the shoe bracket where the hardfacing has worn off.

Table Assembly - Bolt-on Style Shoes

Impeller Shoes

Pin-on Shoes

Use the following procedure to remove worn pin-on impeller shoes.

1. To remove worn shoes, strike the face of the shoe sharply with a hammer to loosen.

2. Pull out the securing pin and remove the shoe.

⚠CAUTION

Wear proper protective equipment when using a hammer to remove the shoes. Debris may fly into eye or body causing injury.

3. If worn shoes cannot be removed by using steps one and two, then cut the pins off the shoe with a torch.

NOTICE

Be careful not to cut into the brackets with the torch.

Many times when the pin is cut to remove the shoe, the area of the bracket right behind the pin is cut into. This area of the bracket should be cleaned and welded up to its original thickness with a stainless steel welding rod.

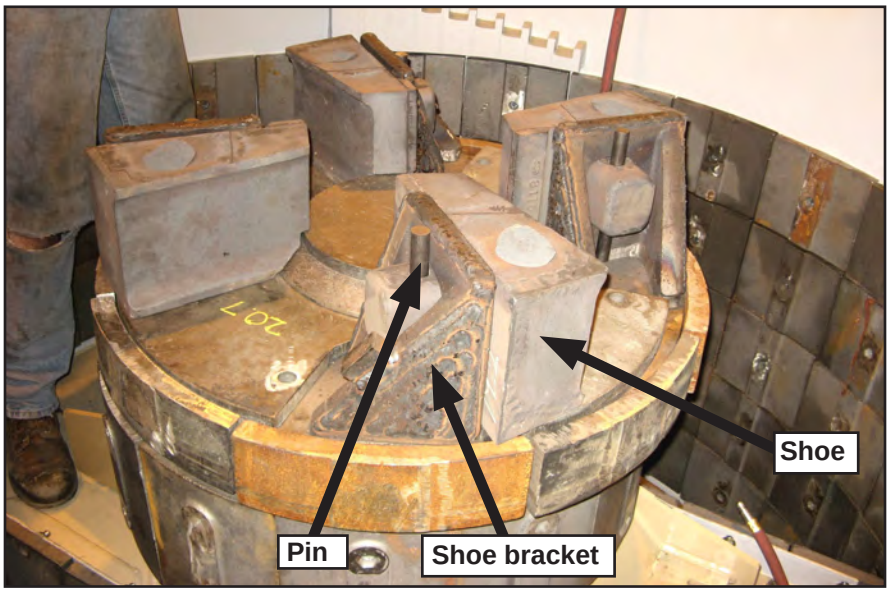


Table Assembly - Pin-on Style Shoes

Pin-on Style Shoe - Weight Marking

Stainless steel is difficult to cut with a torch, thus saving the bracket from future cuts. Where the pin makes contact with the top of the bracket it will “wear in” and allow more distance between the shoe and the bracket. A small amount of weld metal applied in the indentation will tighten up the fit. The weld metal must not extend beyond the original thickness of the shoe bracket.

NOTICE

Once the pin has been cut from a shoe, under no circumstances may that particular shoe be reused. Wear alloys are extremely heat sensitive and cracking is usually a result of applied heat.

Once worn shoes have been removed, use the following procedure to replace the shoes.

1. Clean all material out of the shoe opening in the bracket.

2. Inspect all table liners and surfaces.

3. When installing new shoes, be sure matching weights are opposite to insure impeller table balance. Shoes weights are marked on the back side of the shoe in pounds and ounces.

   On tables with four shoes, keep balanced shoe pairs opposite as with table liners.

   Three and five shoe tables use all the same weight.

4. Check the impeller shoe/ bracket fit tolerance.

   Maximum allowed plug is 1/8" (pin-on style shoes).

The centrifugal force exerted on the shoe and the constant hammering by material will eventually wear on the face of the shoe bracket and the back of the bracket where the pin is located. These two critical areas, if left unchecked, will allow the shoe to be thrust outward and leave a gap between the shoe and the shoe bracket. This gap will fill with material and a wedging action may occur causing excessive stress on the shoe pin and promote failure of the shoe stob.

5. If tolerance between the shoe and bracket is greater than 1/8", insert pieces of shim (10 gauge material, 1" wide by length of the vertical face of the shoe bracket) between the shoe and the shoe bracket with the pin installed.

   Tack weld shims in place and grind flat.

6. Install new shoe into bracket.

7. Secure with shoe pin.

   Use only factory supplied pins . They are specifically designed to support the shoes.

The pin should slip in easily.

NOTICE

Use only factory supplied pins, as they are specifically designed to support the shoes.

Do not hammer into place. If interference occurs and shims were used to decrease the shoe to bracket tolerance, use a thinner shim.

If this is not the issue, check as to what might be the problem.

8. Inspect the ID and OD of the shoe brackets for wear.

9. Inspect hard-faced surfaces.

   At the factory, the ID and OD of the shoe brackets are hardfaced with Stoody #133 wire. This surface must be maintained or serious table damage will result. Stoody wire #31 or #35 stick rod may be used to repair surfaces on the shoe bracket where the hardfacing has worn off.

Outer Shoe Bracket Liners

Replace outer shoe bracket liners when they become worn.

Use the following procedure to replace outer shoe bracket liners.

All outer shoe bracket liners must be replaced at the same time.

1. Open crusher lid (page 52).
2. Loosen and remove outer shoe bracket liner bolts.
3. Remove the liner.
4. Install new liner with new bolts. Be sure matching weights are opposite to insure balance of the impeller table.

Table Assembly - Bolt-on Style Shoes

In order to keep the table balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

5. Bolt the new liner in place and torque to 150 ft.lbs. Do not over-tighten the liner bolts. The heat-treating process causes a slight warp in the liners.
6. Close crusher lid.

Flat Table Liners

Impeller table liners should be replaced before they wear through to the impeller table. Replace flat table liners in matching pairs.

Use the following procedure to replace flat table liners.

Opposing liners may need to be replaced at the same time to keep the table balanced.

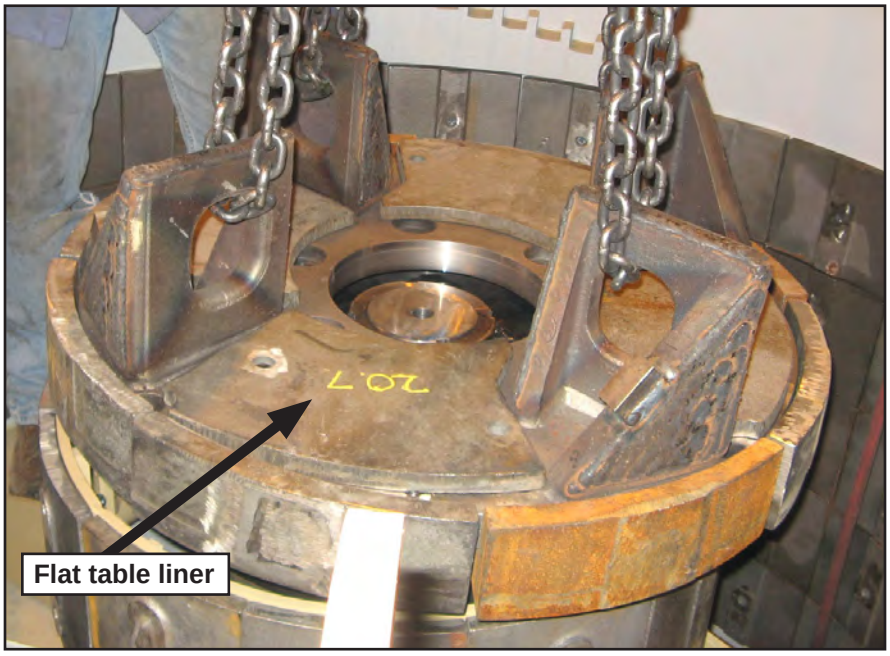


Table Assembly - Pin-on style shoes shown

1. Open crusher lid (page 52).

2. Remove impeller shoe.

See page 81 for procedure on removing bolt-on impeller shoes.

See page 82 for procedure on removing pin-on impeller shoes.

3. Loosen and remove table liner bolts. It may be necessary to strike the liner sharply with a hammer near the bolt head and turn the wrench at the same time.

4. Remove the liner. Any table liners or shoes that will be reinstalled must be tagged as to opposing pairs so that an imbalance does not occur due to improper positioning.

5. Install the new liner. Be sure matching weights are opposite to insure balance of the impeller table.

In order to keep the table balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

6. Coat new bolts with blue Loctite 242.

7. Install the new liner in place and tighten (snug only). Do not over-tighten the liner bolts. The heat-treating process causes a slight warp in the liners.

CAUTION

Overtightening flat table liners may cause them to break.

8. Close crusher lid.

Wear Parts - Rotor Assembly

Outer Rotor Liners

Use the following procedure to replace the outer rotor liners.

1. Open crusher lid (page 52).

2. Unbolt and remove feed disc and lower pocket liners.

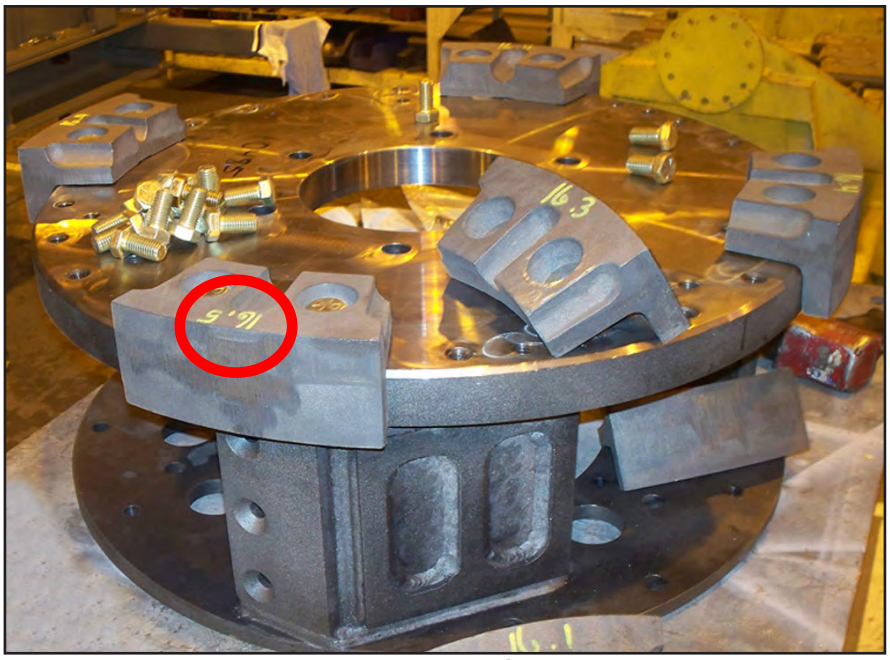
3. Unbolt and remove rotor from flywheel.

4. Secure lifting chains around rotor assembly.

5. Remove rotor from tub and turn upside down. Place carefully on level surface.

6. Unbolt and remove outer rotor liners. If broken liners are being replaced, the broken liner and the liner on the opposite side must be replaced to maintain proper rotor balance.

If liners are being removed and installed on another rotor, be sure they are placed on the new rotor in the same position to maintain proper balance. If rotor balance is not maintained, a vibration will result causing premature pedestal bearing failure.



Outer Rotor Liners

7. Install the heaviest liners first and mount them across from each other.

In order to keep the rotor balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

8. Apply blue Loctite 242 to the bolts.

9. Torque bolts as specified in Appendix B.

The heat-treating process may cause a slight warp in the liners and overtightening the bolts may cause them to break.

10. Repeat steps 7-9 until all liners are installed on the rotor.

If no other wear parts are being replaced, proceed to step 11, otherwise, repair all other wear parts as needed.

11. Install rotor on flywheel using new bolts. Apply blue Loctite 242 to new bolts.

On 82, 2500 and 4500 VSI models, torque bolts to 600 ft.lbs.

On 1500 models, torque bolts to 281 ft.lbs.

12. Install lower pocket liners and feed disc.

13. Replace crusher lid.

Inner Cap with Carbide Tip

Use the following procedure to replace the inner caps.

1. Open crusher lid (page 52).

2. Unbolt and remove upper or lower pocket liners. If removing lower pocket liners, feed disc will need to be removed first for access to lower pocket liners.

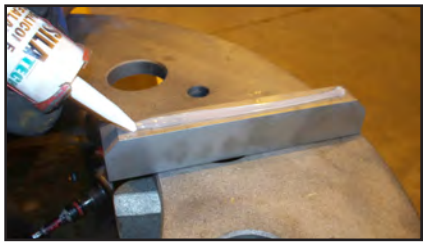
3. Unbolt and remove inner cap assembly.

4. Set new inner wear caps into position and secure with capscrews and nuts. Hand tighten.

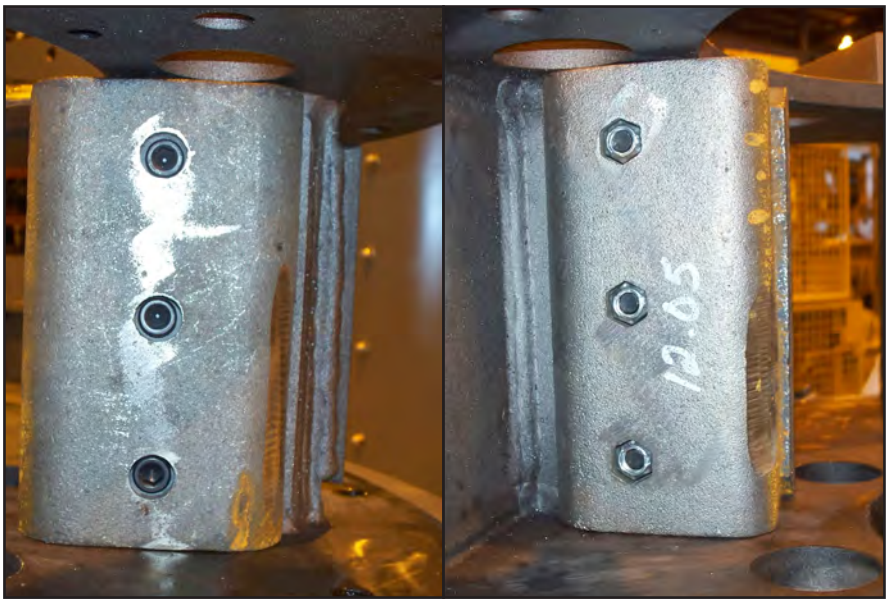
NOTE: Replace all inner caps at the same time to keep the rotor balanced.

In order to keep the rotor balanced, inner caps should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

5. Apply a line of silicone to the inside surface of the new carbide insert.



Vertical Shaft Impactor



Inner Caps

Inner Cap Showing Carbide Tip Installed

7. Slide into position between the inner caps.

8. Install new bolts and nuts. Torque to 45 ft.lbs.

9. Reinstall pocket liners and feed disc.

10. Close crusher lid.

Outer Cap and Carbide Tip Assembly

Use the following procedure to replace outer caps and carbide edges.

1. Open crusher lid (page 52).
2. Unbolt and remove feed disc and pocket liners.
3. Unbolt and remove worn outer cap assembly. A torch may be used to heat the bolts for easier removal.
4. Install new outer cap with carbide tip with new bolts and square nuts.

NOTE: Replace all inner caps at the same time to keep the rotor balanced.

In order to keep the rotor balanced, outer caps should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

5. Torque bolts to 45 ft.lbs.
6. Verify that carbide edge is installed properly. There should be no gap between the outer cap and carbide tip assembly.
7. Reinstall pocket liners and feed disc.
8. Close crusher lid.

Outer Cap

Carbide Tip Assembly

Upper and Lower Liners

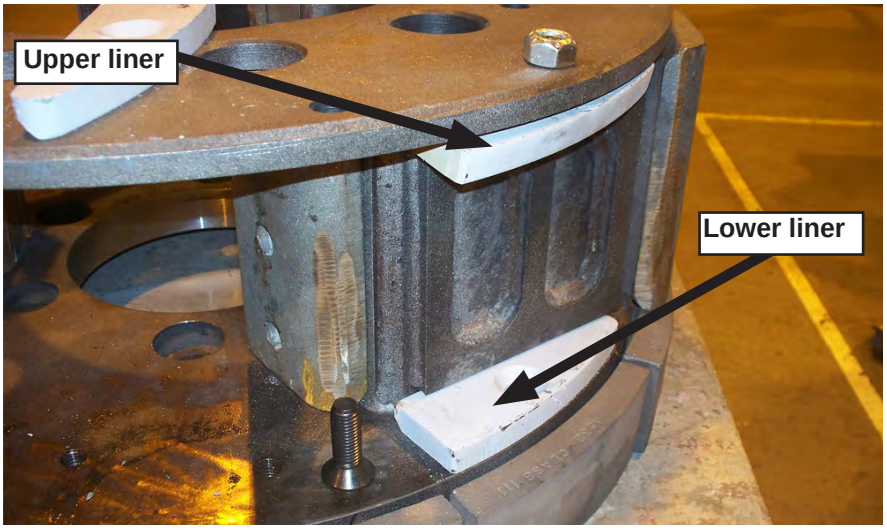
Use the following procedure to replace upper and lower liners.

All upper and lower liners must be replaced at the same time.

1. Open crusher lid (page 52).
2. Unbolt and remove worn upper and lower liners.
3. Install new liners:

   Upper - Install new flat head socket capscrews and locknuts. Torque to 160 ft.lbs.

   Lower - Apply blue Loctite 242 to screws and install. Snug tighten.



Upper and Lower Liners

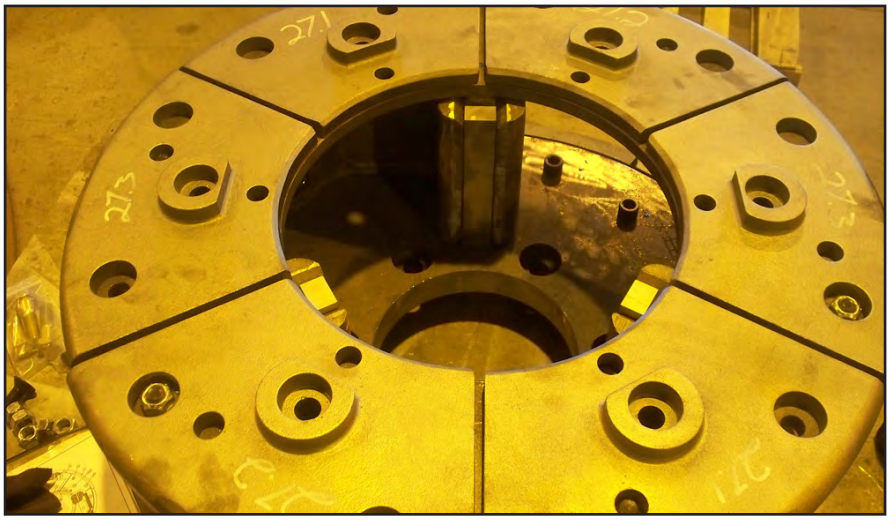
4. Close crusher lid.

Top Rotor Liners

Use the following procedure to replace top rotor liners.

1. Open crusher lid (page 52).
2. Unbolt and remove feed ring.
3. Unbolt and remove worn liners.
4. Install the new liner. Be sure matching weights are opposite to insure rotor balance.

   In order to keep the rotor balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.



Top Rotor Liners - Feed Ring Not Shown

5. Apply Loctite 242 to new bolts. Install and torque to 160 ft.lbs.
6. Reinstall feed ring.
7. Close crusher lid.

Upper and Lower Flat and Pocket Liners

Use the following procedure to replace the upper and lower flat and pocket liners.

1. Open crusher lid (page 52).

2. Unbolt and remove feed disc for access to lower flat and pocket liners.

3. Unbolt and remove feed ring for access to upper flat and pocket liners.

4. Unbolt and remove worn flat and pocket liners.

5. Install new flat and pocket liners using new hardware.

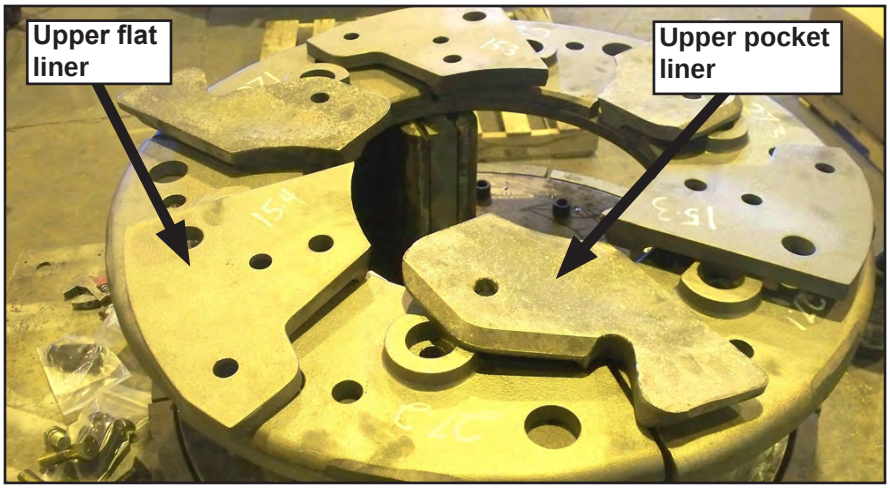
   The new pocket liners must be installed in a balanced arrangement.

   In order to keep the rotor balanced, opposing liners should be no more than 1/4 pound difference on 1500, 2500, and 82 models, and 1/2 pound difference on 4500 models.

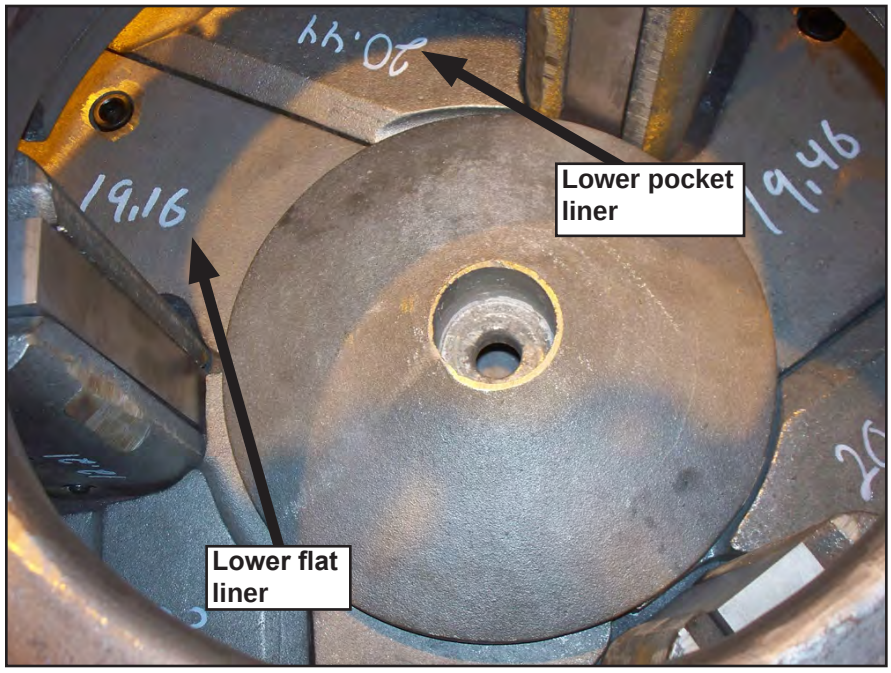
6. Apply Loctite 242 to new bolts. Install and snug tighten.

7. Re-install feed disc and feed ring.

8. Close crusher lid.



Upper Flat and Pocket Liners - Not Installed



Lower Flat and Pocket Liners - Installed

Maintenance

The following section contains instructions for maintaining and lubricating the impactor.

Maintenance intervals shown are for normal operating conditions. If the impactor is operated under severe or adverse conditions maintenance may need to be performed more often.

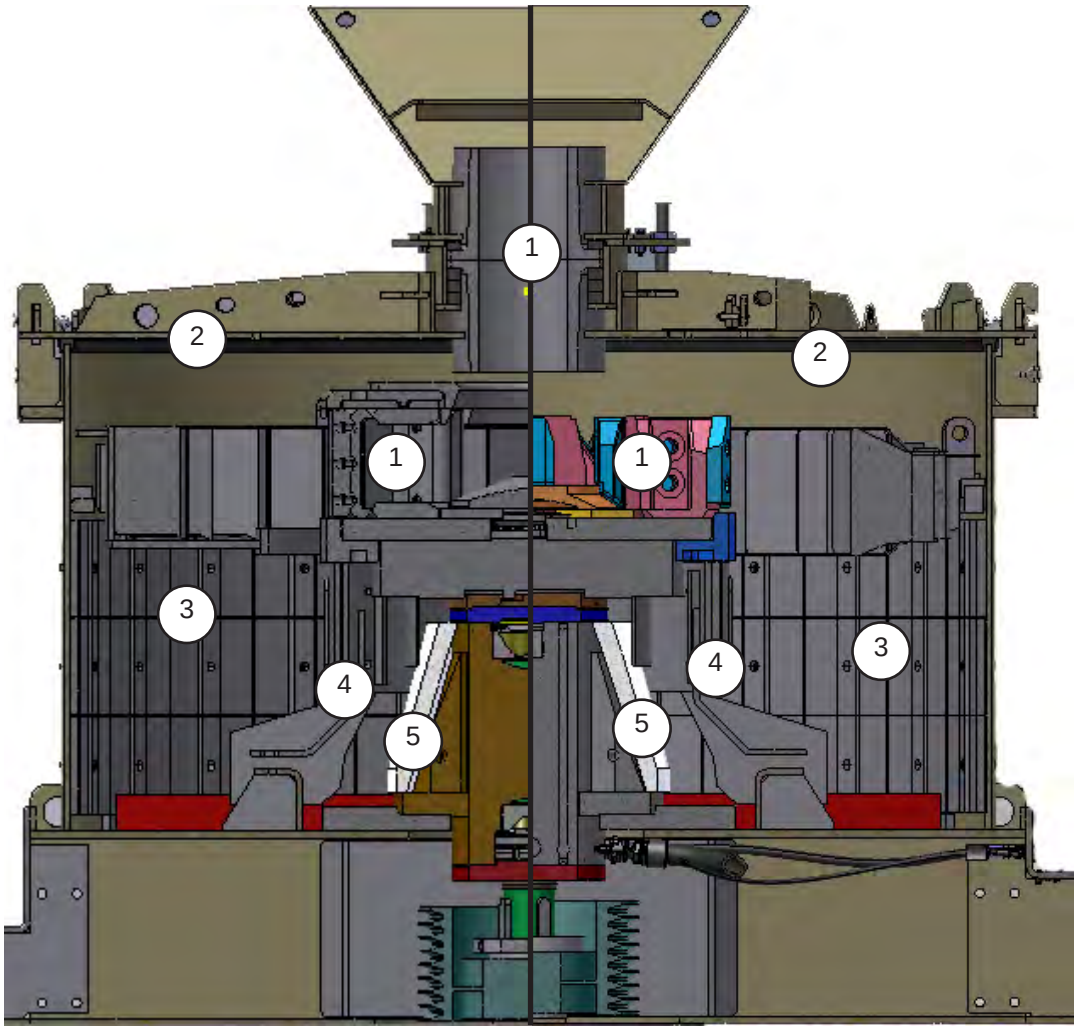
Failure to perform regular maintenance may result in impactor failure or damage.

⚠WARNING

Lockout/tagout all power to the machine.

⚠WARNING

Never attempt to open inspection doors while crusher is in operation.



Rotor **Table**

Interval	Ref. No.	Notes	
10 Hours	--	General Inspection	Loose bolts, set screws, hoses, leaks, or cracks.
	--	V-belt Drives and Tension	Check for proper tension. Check for dust buildup, loose bushings, loose or missing mounting bolts.
	--	Gearbox Drives	See page 11-5 for more information.
	1	Rotor/Table Wear parts (feed tube, liners, shoes, feed disc, anvils)	Check for wear. Replace when necessary. See wear parts section for replacement instructions.
50 Hours	1	Shoe Brackets	
250 Hours	2	Lid Liners	
	3	Tub Liners	
	4	Pedestal Skirt Ring	
	5	Pedestal Skirt Cone	Inspect to ensure there is no material build-up under the skirt cone.

General Inspection
(10 hours)

A walk around inspection should be made on a daily basis. By taking a few minutes each day to inspect the plant, potential problems can be spotted and taken care of before they become serious.

Generally, you should check the following items:

1. Make sure all guards are in place and functional. Repair or replace any damaged or missing guards or guarding devices.
2. Repair or replace any damaged handrails, ladders, or walkways.
3. Check for loose nuts, bolts, and set screws.
4. Hydraulic fluid leaks. If leaks are found or suspected, repair right away. Be sure to monitor the hydraulic fluid level closely.
5. Oil leaks. If leaks are found, repair them right away. Monitor the oil level in the sight glass closely.
6. Clear away built up dirt and debris.

V-belts
(10 hours)

Check v-belt tension. See Appendix B for instruction on measuring v-belt tension and adjustment.

Crushers with hydraulic v-belt drives. Check the following:

- Check the sheaves for dust build-up.
- Check for loose bushings in the sheaves.
- Check for loose or missing bolts in the hydraulic motor mount.

Gearbox Drives
(10 hours)

Crushers with diesel and right angle gearbox drives. Check the following:

a. Inspect engine PTO for possible outboard bearing failure.

b. Inspect driveline for the following items.

1. Worn or loose “U” joints.
2. Missing bolts in the driveline couplings.
3. Missing balance weights on drivelines.
4. Possibility of a bent driveline.

c. Inspect the right angle gearbox for the following items:

1. Check for loose or missing bolts in the gearbox mounting.
2. Check input and output shafts of the gearbox for possible bearing failure.

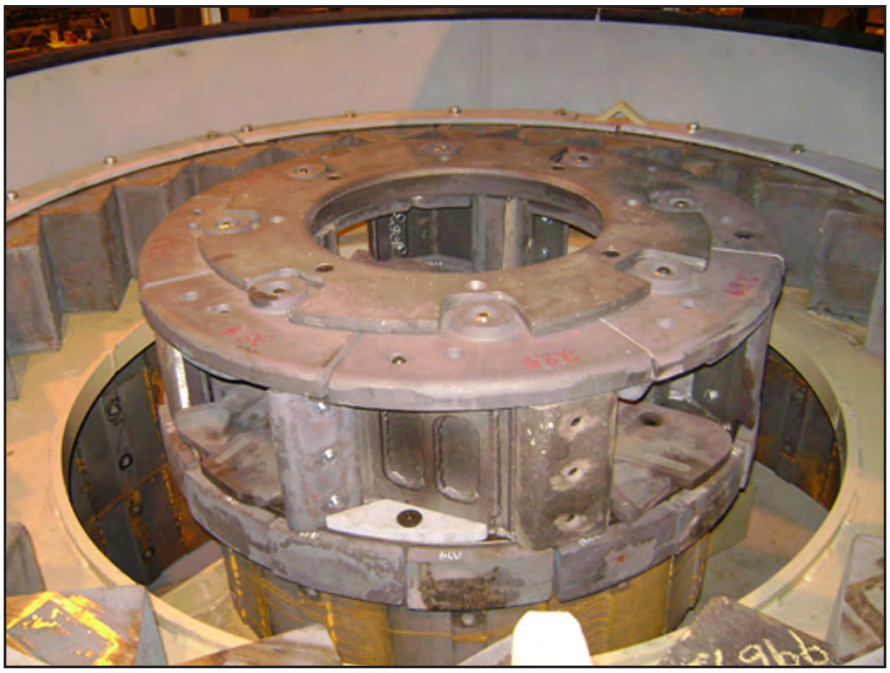
d. Inspect engine mounting for loose or missing mounting bolts.

Rotor
(10 hours)

Inspect the rotor, carbide tips, and liners for wear.

Keep all tramp iron out of the crusher circuit. Tramp iron can cause chipped/broken carbides and will result in accelerated outer cap wear.

See page 86 for instructions on replacing rotor wear parts.



CAUTION

Under no circumstances should the base material of the rotor be allowed to wear. This will cause the rotor to become unbalanced and damage to the crusher will occur

Feed Disc
(10 hours)

Check feed disc for excessive wear.

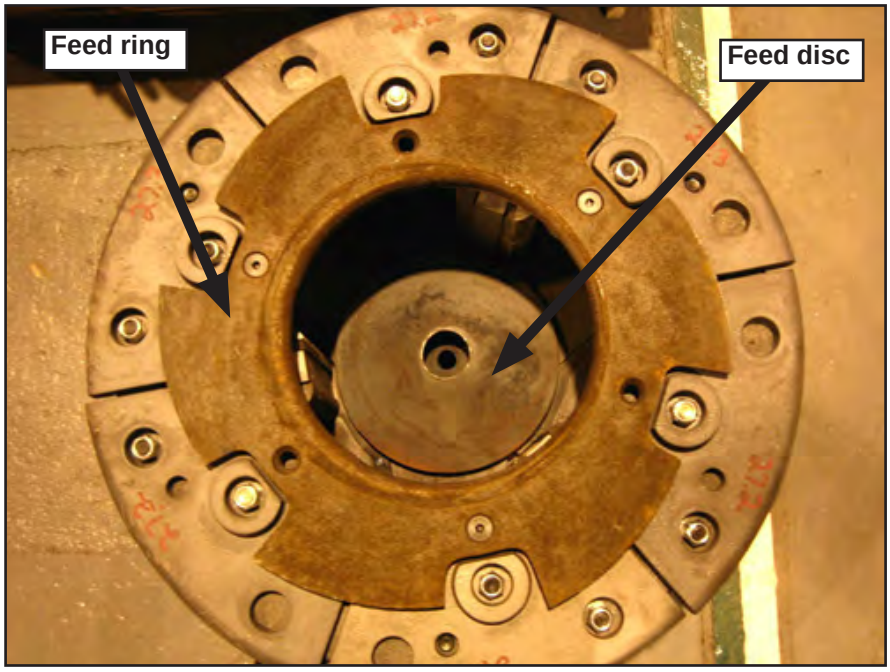
Rotate feed disc 30 degrees clockwise every time the shoes (table) or carbides (rotor) are changed.

Feed Disc - Table

Feed Ring
(10 hours)

On units with rotor installed, also check the feed ring on the top part of the rotor for wear. Replace as needed.

See page 78 for procedure on replacing the feed disc.



Feed Disc - Rotor

Table
(10 hours)

Check the table and all liners for wear. Replace any parts if necessary.

See page 80 to 85 for instructions on replacing the flat and outer table liners.

Inspect impeller shoes for wear . Change worn shoes and anvils before they break or wear through their holding brackets. Replace shoes in matching pairs only.

See page 81 to 83 for information on removing and replacing the impeller shoes.

NOTICE

Expect to change a complete set of anvils for every four to twelve sets of impeller shoe replacement.

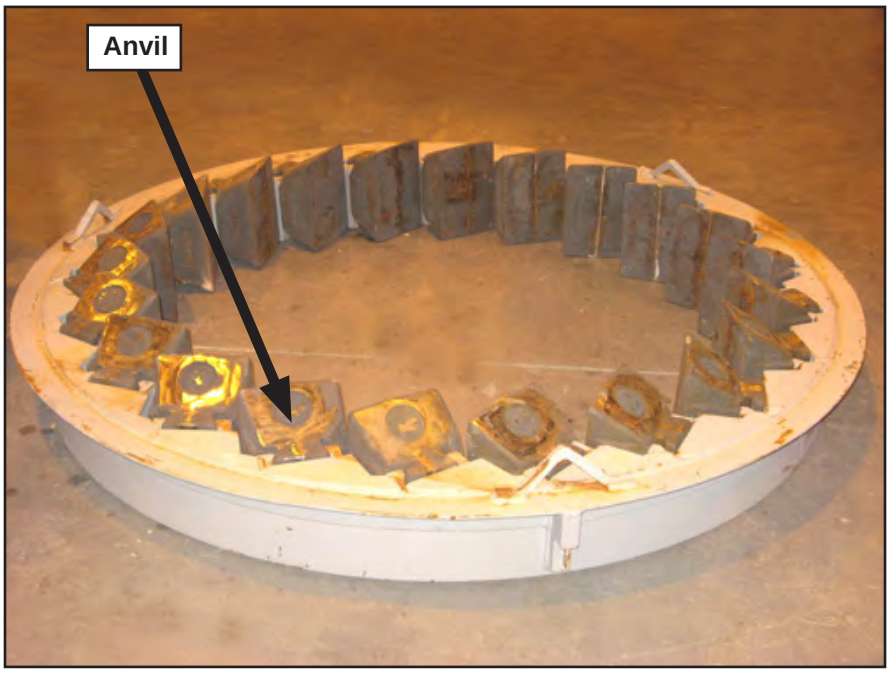
Table Assembly

Impeller Shoe

Anvils
10 hours)

Check for excessive wear and replace anvils as needed.

See page 75 for information on anvil replacement.



Cluster Ring Assembly

Shoe Brackets
(50 hours)

Check shoe brackets for excessive wear and sloppy shoe fit.

See page 81 to 83 for information on maintaining and servicing shoe brackets and hardfaced surfaces.

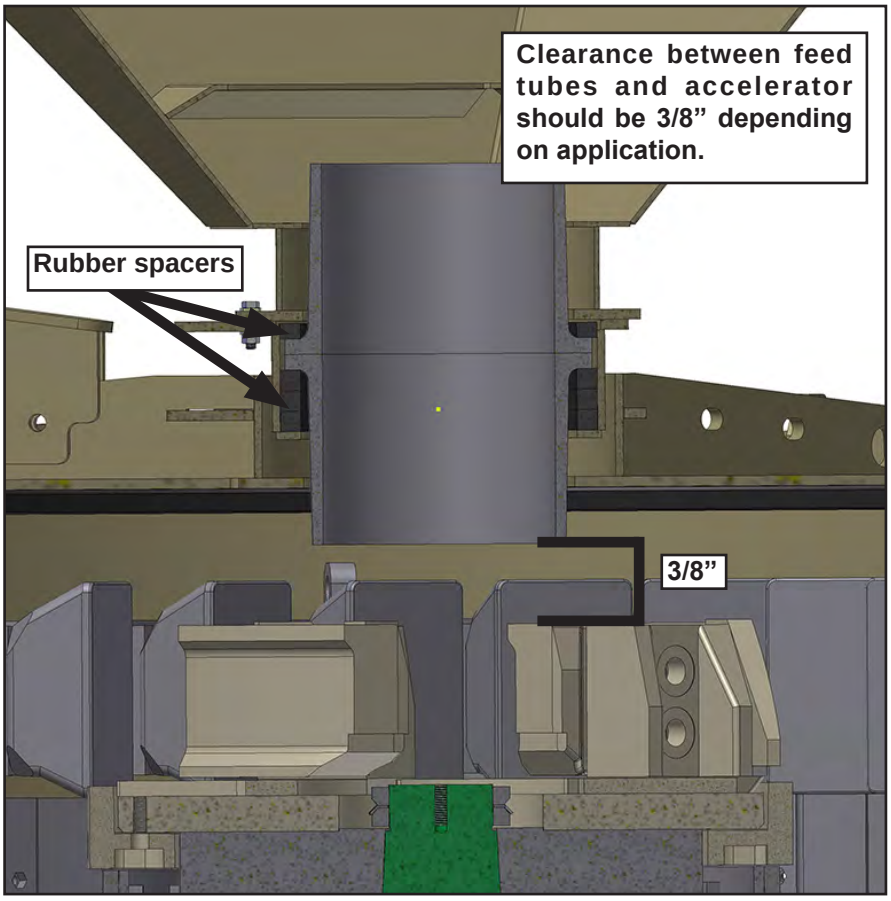
Feed Tube
(50 hours)

Measure the clearance between the bottom of the feed tube and the top of the rotor or table assembly.

Clearance should be 3/8” depending on application. Use the adjusting bolts to lower or raise the feed tube as needed. See page 76 for more information.

If bottom feed tube is worn, exchange it with the upper feed tube. See page 68 for the procedure on reversing the feed tubes.

Make sure that the rubber spacers below and above the feed tube connection point are intact and undamaged.



Lid Liners
(250 hours)

Inspect liners for excessive wear.

Lid liners should be replaced when they have worn to 1/2 their original thickness.

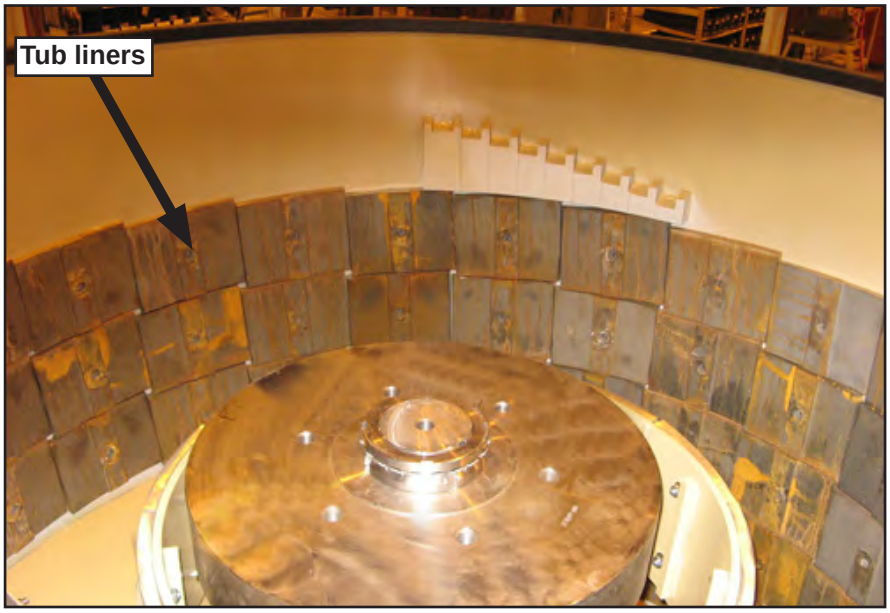
See page 77 for procedure on replacing lid liners.

Lid Liners

Tub Liners
(250 hours)

Inspect tub liners for excessive wear. Liners should be inspected every 250 hours of operation and replaced as necessary.

Tub liners should be replaced when they have worn to 1/2 their original thickness.



Pedestal Skirt Ring
(250 hours)

Check pedestal skirt ring mounting brackets for wear or loose bolts.

Inspect pedestal skirt ring for excessive wear or broken liners.

Skirt ring liners should be replaced when they have worn to 1/2 their original thickness.

See page 79 for information on replacing the pedestal skirt ring liners.

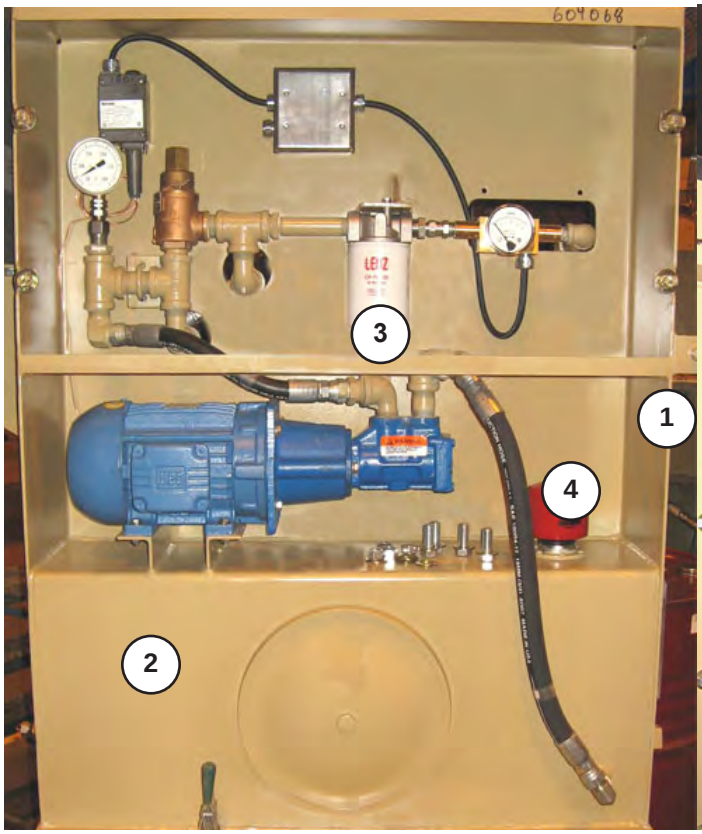
Skirt Ring Assembly

Pedestal Skirt Cone
(250 hours)

Inspect the pedestal skirt cone to ensure that material hasn't build up under the skirt cone pushing up flywheel.

Replace the pedestal skirt cone when worn thin or if a hole appears.

Lubrication



Interval	Ref. No.	Notes	
10 Hours	1	Pedestal Dust Seal	Grease - 10-15 pumps.
	--	Gearbox Shaft Seal	Grease - 1-2 pumps.
	2	Pedestal oil tank	Check oil level in sight glass, add as needed.
50 Hours	3	Oil Filters	Replace after first 50 hours of operation. After that, change as needed depending on operating conditions.
150 Hours	4	Breather cap	Replace.
500 Hours	5	Hydra-Arm	Grease turntable bearing.
1000 Hours	2	Pedestal Oil Tank	Drain and refill.

NOTICE

Quantities of grease are designated by ounces.

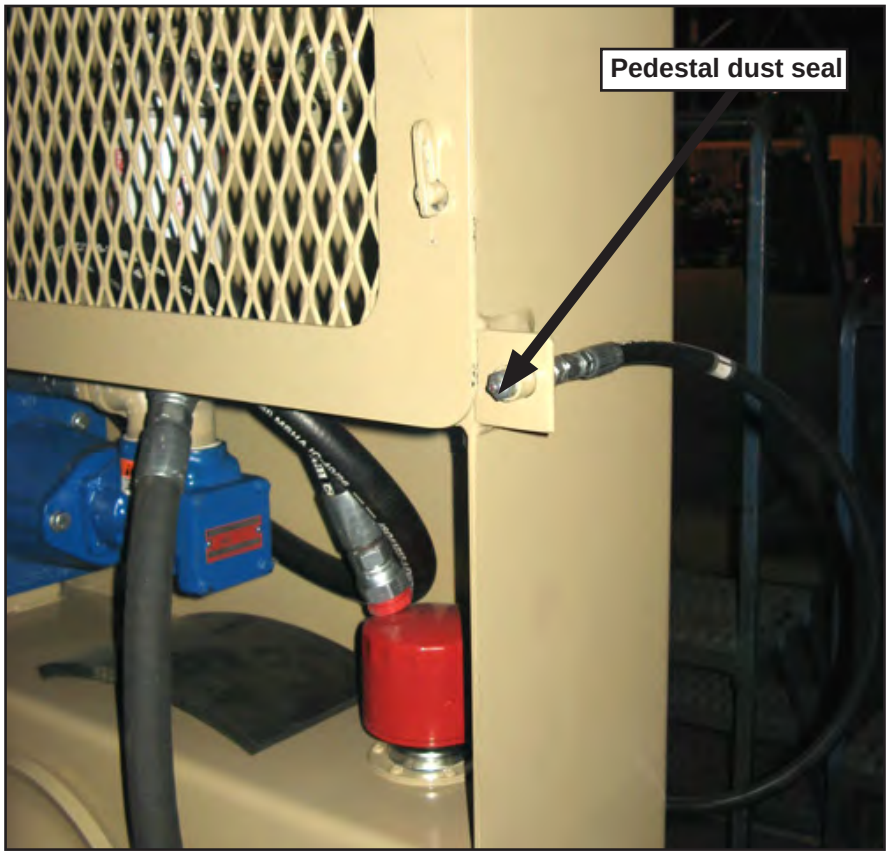
Calibrate your bucket pump and grease gun to qualify how many pumps are equivalent to an ounce.

CAUTION

Failure to calibrate your bucket pump and grease gun may cause damage to your bearings.

Pedestal Dust Seal
(10 hours)

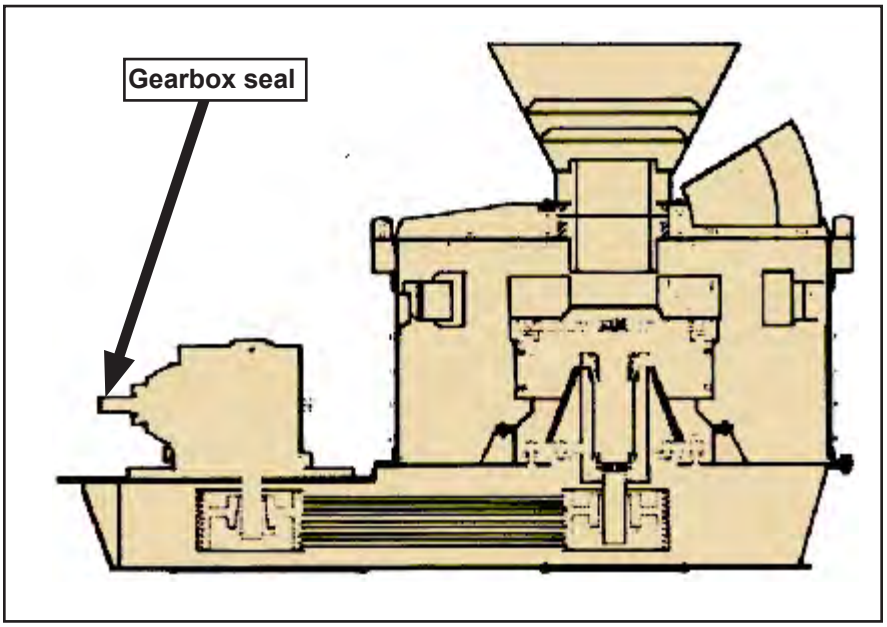
Pedestal dust seal should be greased while the crusher is running or coasting to a stop (10 to 15 pumps required).



Gearbox Shaft Seal
(10 hours)

Grease the gearbox input shaft .

One to two pumps of grease is required for proper seal protection.



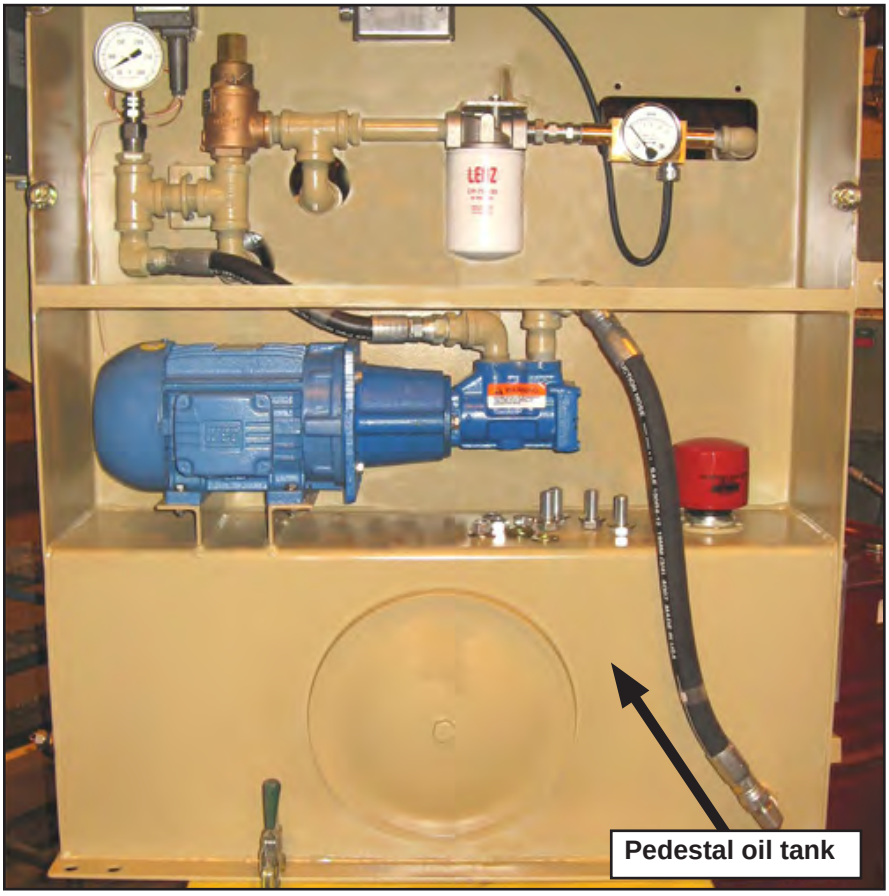
Pedestal Oil tank
(10 hours)

Keep oil level in upper half of sight glass.

The sight glass is located on the side of the lubrication panel.

The oil tank is located on the bottom of the lubrication panel.

Sight Glass



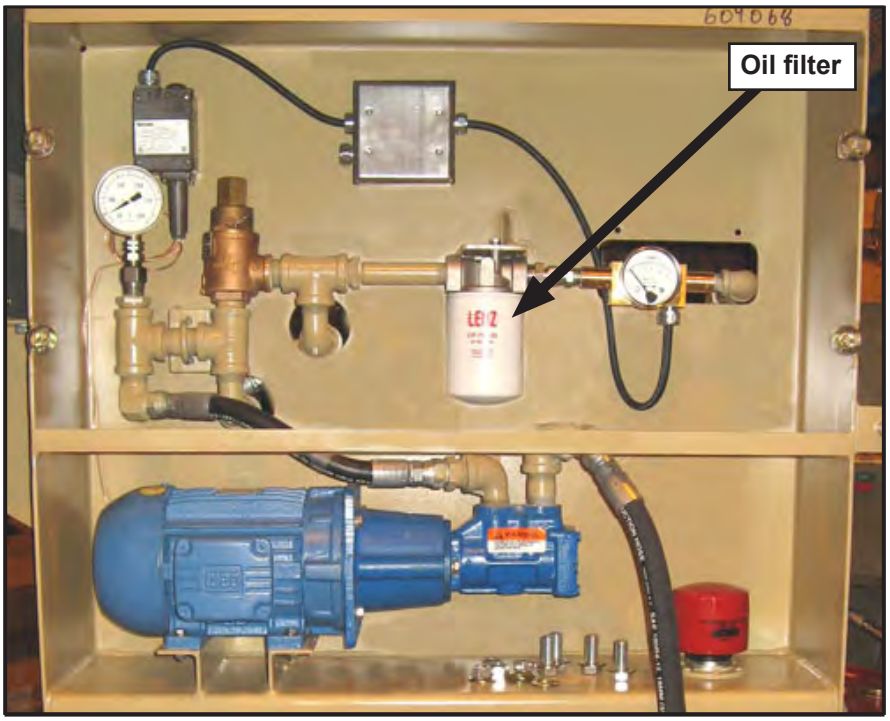
Gen. 2 Lube Panel Shown

Oil Filter
(50 hours)

The oil filter should be changed after the first 50 hours of operation.

After that, change filters on 250 hour operation intervals or sooner if conditions dictate. Do not use an automotive type filter.

On Gen. 3 Lubrication systems, there are two filters located on the side of the lubrication panel.



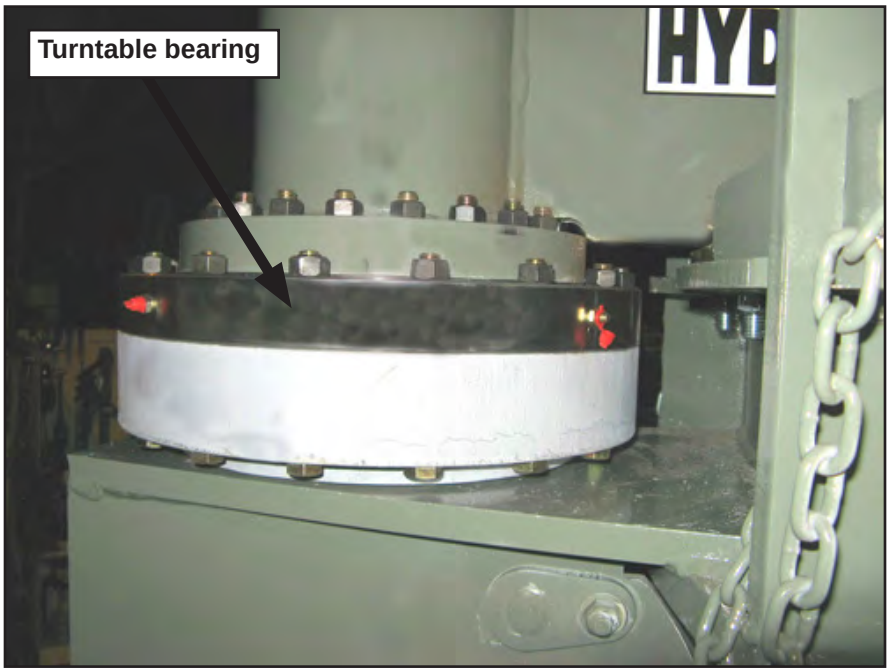
Gen. 2 Lube Panel Shown

Hydra-Arm
(150 hours)

Turntable bearing has four grease fittings.

Each grease fitting should get two pumps of high temp EP-2 lithium based red grease every 150 hours.

Grease should purge past the bearing seals.

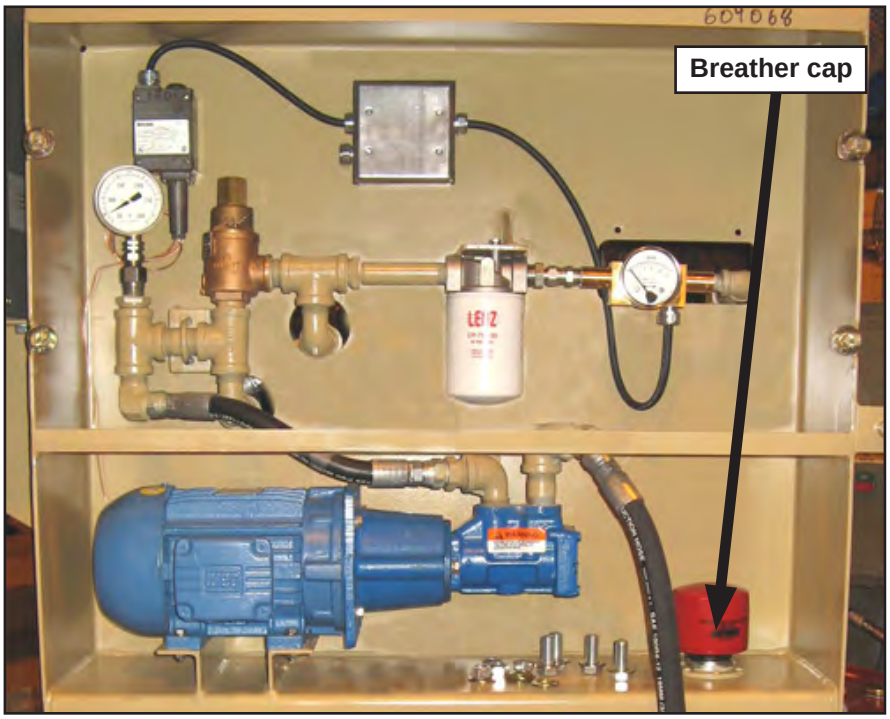


Breather Cap
(500 hours)

Replace the breather cap.

The breather cap is located above the pedestal oil tank on the lubrication panel.

Depending on operating conditions, the breather cap may need to be inspected and replaced more often.



Gen. 2 Lube Panel Shown

Pedestal Oil Tank
(1000 hours)

On initial startup, the oil should be changed at 250 hours. After that, drain and refill the pedestal oil tank every 1000 hours.

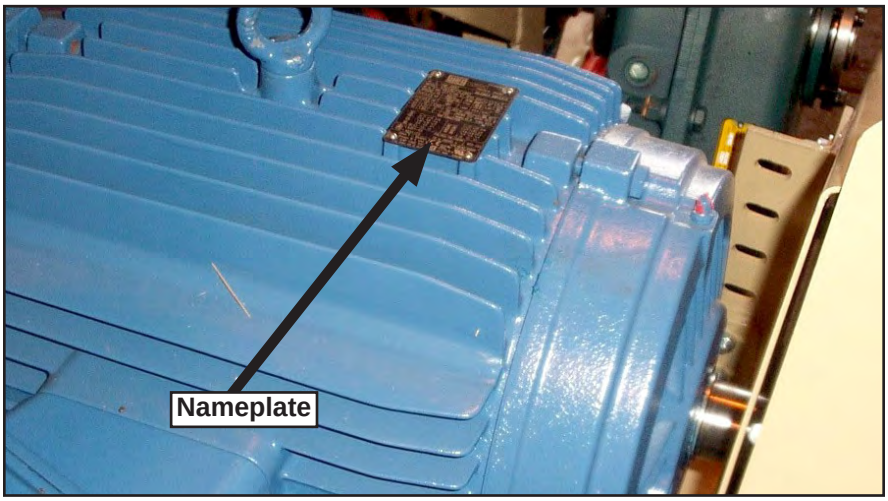
Gen. 2 Lube Panel Shown

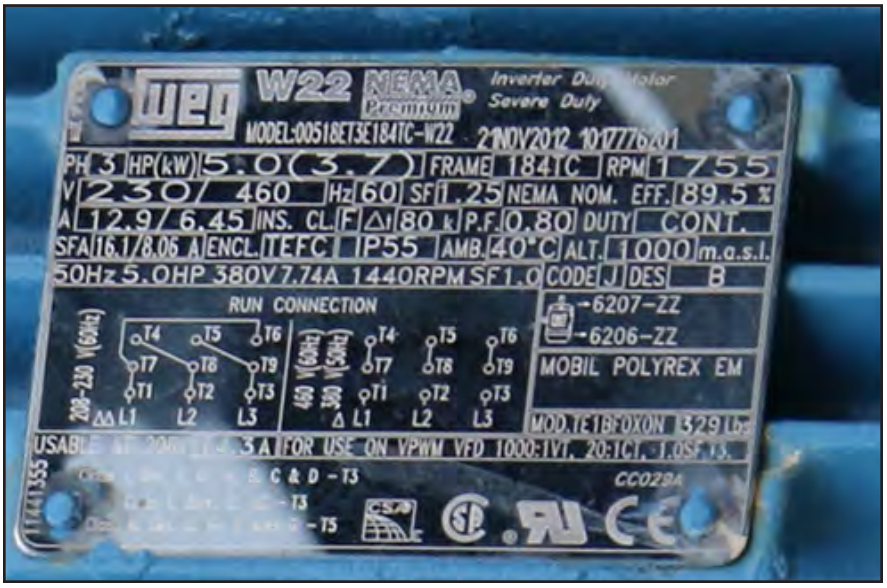
Electric Motors
(See WEG namplate)

Lubrication information for the WEG electric motor can be found in the bottom left hand corner of the nameplate.

Frame size, speed, lubrication interval should be verified on the nameplate before lubricating.

WEG recommends to lubricate bearings with Polyrex Em Grease.





Electric Motor Nameplate

Motors without Grease Nipples

Motors up to frame 215/6T are normally fitted without grease nipples. Regrease using the following procedure.

1. Carefully disassemble the motor.
2. Drain all the grease out of the motor.
3. Clean the bearing with diesel.
4. Regrease the bearing immediately.

Motors with Grease Nipples

Clean the area around the grease nipple. Lubricate the bearing with half the total grease and run the motor for one minute at full speed. Turn off the motor and apply the rest of the grease.

Hydra-Arm Maintenance

Leaks
(10 hours)

Check thoroughly for oil leaks.

Hydraulic Oil Filter
(As needed)

The hydraulic oil filters should be changed after the first 50 hours of operation.

After that, change filters annually or as needed depending on operating conditions

The hydraulic oil filter is located on the hydra-arm assembly just above the hydraulic tank.

Hydraulic Oil Tank
As needed)

Drain and refill the hydraulic oil tank annually or as needed.

Check hydraulic oil for contamination every 250 hours. Change if contamination is found.

Troubleshooting

Excessive Vibration

If the vertical shaft impactor is vibrating excessively, it might be caused by unlevel operating conditions or a piece of material (such as a rock or uncrushable) wedged in between impellershoes or on the feed disc.

Check the following:

1. Make sure crusher is level.

2. Make sure blocking is adequate and solid.

If this has not solved the problem then open the crusher lid and check for wedged material.

3. Remove any rock or tramp iron.

4. Verify that the feed disc is centered.

5. Make sure all liners are intact and worn evenly.

6. Check application. Do not use rotor with limestone.

Oil Leaks

If an oil leak is discovered it might be caused by the loss of the bottom oil seal or bearing on the pedestal.

To fix the oil leak:

1. Check whether or not the oil seal is missing and replace.

2. Make sure all hoses are tight.

Hydra-Arm

If the Hydra-arm will not operate as it should it might be caused by the relief valve, a change in pressure or because the hydraulic filter may need to be changed.

Check the following:

1. Pressure gauge. The pressure gauge reading should be at 2500 PSI.

2. Relief setting. Verify that the relief setting is at 2500 PSI.

3. If both the pressure gauge and relief setting is correct, change the hydraulic oil filter.

Sonic Belt Tension Instructions

Use the following procedure to use the Gates sonic belt tester to measure belt tension.

1. Attach the sensor and turn the power on.

2. Press the blue **MASS** button and enter belt unit weight in grams/meter.

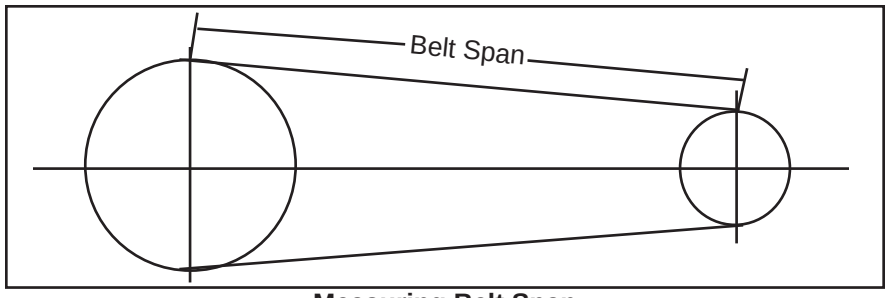
Belt Mass

Poly Chain GT Carbon		007.9
Single v-belts	B	168
	BX	144
	3V	72
	3VX	61
	5V	200
	5VX	158
	8V	510
Multiple rib/ strand v-belts (per strand)	B	200
	3V	96
	3VX	70
	5V	241
	5VX	185
	8V	579

3. Press the blue **WIDTH** button and enter the width in millimeters for the belt.

   For v-belts, enter the number of strands.

4. Measure the belt span. Press the blue **SPAN** button and enter span length in millimeters.



Measuring Belt Span

5. Press the gray **MEASURE** button. The green light below the number pad will begin flashing to indicate measurement is in progress.

6. Pluck or tap the belt to make it vibrate. In some cases, it may be necessary to tap the belt with the handle of a screwdriver to achieve sufficient vibration for measurement.

NOTICE

Be careful not to damage the belt or other drive components.

7. Hold the sensor approximately 3/8" from the belt. Do not touch the belt with the sensor.

   The green light will turn off after a signal is received and remain off for approximately 1-2 seconds during calculation. The measured belt tension is then displayed.

   The red light will display if there is no reading or a measurement error.

Sonic Belt Tester (p/n 296097)

Gates Corporation. 2009. Sonic tension meter powerpoint. www.gates.com/stm

Belt Tension Gauge Instructions

Use the following procedure to measure v-belt tension.

1. Lockout/tagout all power.

2. Measure the belt span length of the drive (see drawing).

3. Set the large O-ring on the body of the tension gauge at the dimension equal to 1/64" for every inch of span length.

For example:

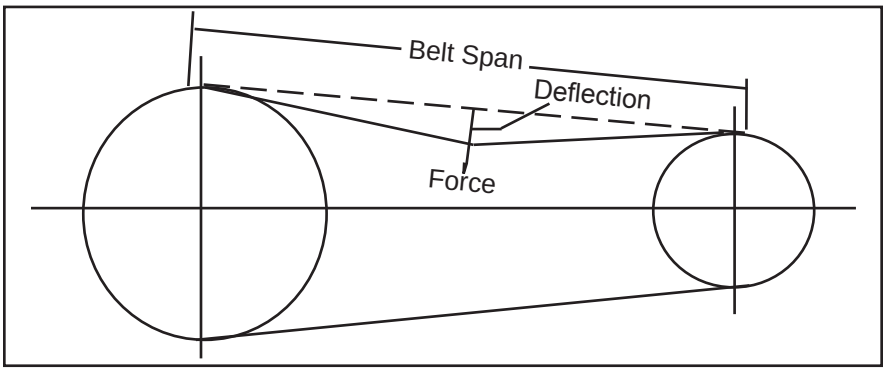
32" belt span

1/64 x 32 = 1/2"

4. Set the O-ring on the plunger at zero (0) against the body of the tension gauge.

5. Press the v-belt tension gauge perpendicular to the belt at the midpoint of the belt span.

   Deflect the belt until the bottom of the large O-ring is even with the top of the next belt, or the bottom of a straight edge laid across the top of the other belt(s) on the drive. Release pressure and read pounds of force used at O-ring on plunger.



Measuring Belt Span and Deflection Force

6. Compare the force required in step 5 with the ranges in the table on the next page.

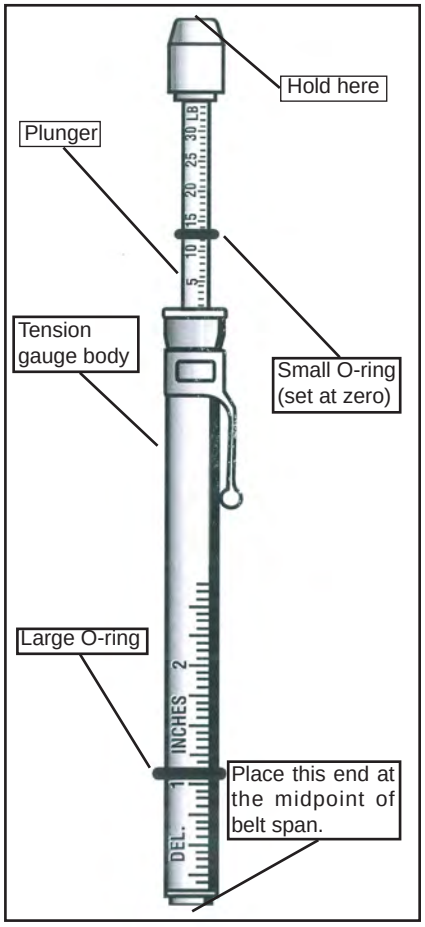
   Tighten or loosen belts as needed to bring them within the recommended ranges.

NOTICE

The proper tension for v-belt drive is the lowest tension at which the belt(s) will not slip under peak load conditions.

NOTICE

For new belts, tighten to the initial installation deflection force shown in the table on the next page. Check tension frequently during the first 24 hours of operation. Subsequent retensioning should fall between the minimum and maximum forces shown in the table.



Single Barrel V-belt Tensiometer

Appendix A: Belt Tension Instructions

V-belt Type	Small Sheave Dia. Range (in.)	Recommended Deflection Force (lbs.)		
		Initial Installation	Retensioning	
			Maximum	Minimum
B	- 4.6 4.7 - 5.6 5.7 - 7.0 7.1 -	7.3 8.7 9.3 10.0	6.4 7.5 8.1 8.8	4.9 5.8 6.2 6.8
BX	- 4.6 4.7 - 5.6 5.7 - 7.0 7.1 -	10.0 11.0 11.5 12.0	8.7 9.5 9.9 10.1	6.7 7.3 7.6 7.8
3V	2.65 - 3.35 3.65 - 4.50 4.75 - 6.0 6.5 - 10.6	4.6 5.5 6.4 7.3	4.0 4.8 5.6 6.4	3.1 3.7 4.3 4.9
3VX	2.2 - 2.5 2.65 - 4.75 5.0 - 6.5 6.9 -	4.8 5.7 7.2 8.7	4.2 4.9 6.2 7.5	3.2 3.8 4.8 5.8
5V	7.1 - 10.3 10.9 - 11.8 12.5 - 16.0	16.5 19.5 21.0	14.3 16.9 18.2	11.0 13.0 14.0
5VX	- 5.5 5.9 - 8.0 8.5 - 10.9 11.8 -	15.0 19.0 21.0 22.0	13.0 16.9 18.2 19.5	10.0 13.0 14.0 15.0
8V	12.5 - 16.0 17.0 - 20.0 21.2 - 24.4	39.0 45.0 51.0	33.8 39.0 44.2	26.0 30.0 34.0

Prevailing Torque Locknut

Bolts must be tightened to the proper torque as listed in the table below and on the next page. These values represent a torque value at 75% of proof load. The torque values are given for both grade 5 and grade 8 fasteners with unified coarse threads (UNC) and unified fine threads (UNF) along with standard hex nut and prevailing torque locknut. Both imperial and metric units are listed (ft.lbs. and n-m).

Bolt Torque Chart - UNC

	Grade 5		Grade 8	
Nominal Size bolt/nut	**Standard Hex Ft.-lb. (N-M)**	**Prevailing Torque Ft.-lb. (N-M)**	**Standard Hex Ft.-lb. (N-M)**	**Prevailing Torque Ft.-lb. (N-M)**
1/4 - 20	6 (9)	5 (7)	9 (12)	7 (10)
5/16-18	13 (18)	10 (14)	18 (25)	15 (20)
3/8-16	23 (31)	18 (25)	33 (44)	26 (35)
7/16-14	37 (50)	30 (40)	52 (71)	42 (57)
1/2 - 13	56 (76)	45 (61)	80 (108)	64 (86)
9/16 - 12	81 (110)	65 (88)	115 (156)	92 (124)
5/8-11	112 (152)	90 (122)	158 (215)	127 (172)
3/4-10	199 (270)	159 (216)	281 (381)	225 (305)
7/8-9	321 (435)	256 (348)	453 (614)	362 (491)
1 - 8	481 (652)	385 (521)	679 (921)	543 (737)
1-1/8- 7	600 (813)	480 (651)	963 (1305)	770 (1044)
1-1/4 - 7	846 (1147)	677 (918)	1358 (1842)	1087 (1473)
1-3/8 - 6	1109 (1504)	888 (1203)	1781 (2414)	1424 (1931)
1-1/2 - 6	1473 (1997)	1178 (1597)	2363 (3204)	1891 (2564)
2-1/2 - 4	5000 (6779)			

Bolt Torque Chart - UNF

	Grade 5		Grade 8	
Nominal Size bolt/nut	Standard Hex Ft.-lb. (N-M)	Prevailing Torque Ft.-lb. (N-M)	Standard Hex Ft.-lb. (N-M)	Prevailing Torque Ft.-lb. (N-M)
1/4 - 28	7 (10)	6 (8)	10 (14)	8 (11)
5/16-24	14 (20)	12 (16)	20 (28)	16 (22)
3/8-24	26 (35)	21 (28)	37 (50)	30 (40)
7/16-20	41 (56)	33 (45)	58 (79)	47 (63)
1/2 - 20	63 (86)	51 (69)	90 (122)	72 (97)
9/16 - 18	91 (123)	72 (98)	128 (174)	102 (139)
5/8-18	127 (172)	102 (138)	179 (243)	143 (195)
3/4-16	222 (301)	178 (241)	314 (425)	251 (340)
7/8-14	354 (480)	283 (384)	500 (678)	400 (542)
1 - 12	526 (713)	421 (571)	743 (1008)	595 (806)
1-1/8- 12	673 (912)	538 (729)	1079 (1463)	864 (1171)
1-1/4 - 12	937 (1270)	750 (1016)	1504 (2039)	1203 (1631)
1-3/8 - 12	1263 (1712)	1010 (1370)	2027 (2748)	1622 (2198)
1-1/2 - 12	1657 (2246)	1325 (1797)	2659 (3605)	2127 (2884)

Metric Bolt Torque Chart

	Class 10.9		Class 12.9	
Diameter (mm)	Standard Hex (N-M)	Prevailing Torque (N-M)	Standard Hex (N-M)	Prevailing Torque (N-M)
5	7	8	8	10
6	11	15	13	18
7	19	25	22	29
8	27	36	32	43
10	54	72	63	84
12	94	125	110	147
14	150	200	175	234
16	235	313	274	365
18	323	430	377	503
20	458	610	535	713
22	622	830	727	970
24	791	1055	925	1233
27	1157	1543	1352	1803
30	1572	2095	1837	2450
33	2138	2851	2500	3332
36	2746	3662	3210	4279

Warranty Registration & Preoperational Check

Vertical Shaft Impactor

Kolberg-Pioneer, Inc.
700 W 21st. St., Yankton, SD 57078
1-800-532-9311 Fax: 1-800-514-6115
Email: mail@kpijci.com

Form may be Sent, Faxed or Emailed

IMPORTANT
Warranty will be void if this registration is not returned within ten (10) day after the equipment is put into service.

Date Put Into Service (Month / Day / Year)	Hours on Unit	Sale ☐	Lease ☐	Rental ☐	Unit Serial Number	Engine Serial Number

Job Order	Dealer Order Number	Unit Model Number	Engine registered with manufacturer ☐

Dealer Name	Dealer Signature	Date	City	State	Zip
Owner/Lessee Name	**Signature**	**Date**	**City**	**State**	**Zip**

☐ **The safe operation of this product was explained and a complete operator's manual was with the product.**

IMPORTANT

Preoperational Check must be completed as part of warranty registration. The preoperational check should also be performed any time equipment is moved to a new site, changed renters, or if it has been in storage for an extended period. Check each component to insure that it is in operational condition. This check should include, but not be limited to the following items.

PREOPERATIONAL CHECKS	OK	Adjust
1. Sheet Metal/Appearance/Paint	☐	☐
2. Lubrication		
Circulating Oil System:		
a. All Fittings Greased	☐	☐
b. Oil Reservoir Level (1" below top of site glass)	☐	☐
c. Oil Filters	☐	☐
d. Hoses & Fittings	☐	☐
e. Oil Breathers Clean and Free of Blockage	☐	☐
3. V-Belts Tight	☐	☐
4. Grease Lube Points	☐	☐
5. Inspection Doors Closed	☐	☐
6. Lid Hold-down Wedges Installed in Lid	☐	☐
7. All liners in place and secure.	☐	☐
8. General		
a. Operator's Manual on Unit	☐	☐
b. Decals in Place and Readable	☐	☐
c. Safety Guards in Place	☐	☐

OPERATIONAL CHECKS	OK	Adjust
1. Unit Vibration - if chains on unit are shaking there is too much vibration.	☐	☐
2. Table/Rotor Rotation (counterclockwise)	☐	☐
3. Table/Rotor RPM		
Model 82 (800-1200 RPM) _____	☐	☐
Model 120 (800-1080 RPM) _____	☐	☐
Model 1500 (720-2000 RPM) _____	☐	☐
Model 2500 (700-1400 RPM) _____	☐	☐
Model 4500 (800-1200 RPM) _____	☐	☐
3. Alarm System Functions Properly	☐	☐
4. Oil Flow Pedestal - 1 gpm or more	☐	☐
5. Oil Temperature (180 deg. max.)		
a. 4 Hours _____	☐	☐
b. 8 Hours _____	☐	☐
6. Oil Fittings for Leaks	☐	☐

If Adjustments are made please note change: _____

_____

_____

_____ Date Inspection Completed

_____ Inspector's Signature

www.kpijci.com

Crushing and Screening Solutions

KOLBERG-PIONEER, INC.
700 W 21st Street, Yankton, SD 57078 USA

SERVICE
800-532-9311 - 605-665-9311; Fax 800-514-6115 - 605-665-9348

PARTS
800-766-9793 - 605-665-9793; Fax 605-665-9348

JOHNSON CRUSHERS INTERNATIONAL
86470 Franklin Boulevard, Eugene, OR 97405 USA

SERVICE
866-875-4058 - 541-736-1400; Fax 541-988-9501

PARTS
888-474-0115 - 541-736-1400; Fax 541-988-9487

ASTEC MOBILE SCREENS
2704 West LeFrevre Road, Sterling, IL 61081 USA

SERVICE
800-545-2125; Fax 815-626-6430

PARTS
800-545-2125; Fax 815-626-6430

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