ROUNDWOOD CHIPPER

Operation & Maintenance Manual

PRECISION
HUSKY

Precision Husky Roundwood Chipper Manual - Version 1.0

PN 97-4702

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About This Manual

What's in the Manual

The Precision Husky Roundwood Chipper Operation & Maintenance Manual includes instructions for setting up, operating and maintaining the chipper.

This manual is divided into five major sections:

1. Introduction
- General product definition and description

2. Safety Precautions
- Precautions when operating or servicing the chipper
- Safety Decal Information

3. Operating Instructions
- Pre-operating setup and instructions
- Chip Quality Information

4. Preventive Maintenance & Service
- Maintaining the chipper
- Suggested maintenance schedule and servicing tips

5. General Troubleshooting

Appendices
- Specifications
- Parts & Assembly
- Operating guides and engine manuals for optional equipment
- Glossary
- Service log
- Service bulletins
- Index

NOTE

Read all sections of the manual before operating the chipper. The information provided is essential in understanding operating and safety concerns.

Safety, mechanical and product information are emphasized throughout the manual. The **DANGER, WARNING** and **CAUTION** boxes displayed in the text identify important safety messages. For complete safety definitions, read the *Warnings and Precautions* section. **NOTE** boxes emphasize general product information, or operating procedures that require special attention.

Operator's Responsibilities

Certain terminology has been used in this manual that is common for most machine operations. As a reader of this manual, you should be familiar with these words and terms. A glossary is provided in the Appendix for the words or terms that might be unfamiliar.

Please read this manual carefully before attempting to set up or operate the machine. Make sure you always follow safety directions.

Warnings & Precautions

For Your Protection

Before you read the operating instructions and other information, it is important that you understand the Signal Words and Color Codings used on the machine's decals. They identify information relating to your safety while operating the equipment, as well as ensuring that the machine will run in a safe manner.

Hazard Safety Message Boxes

Safety messages concerning the operation and care of the machine are displayed on the decals on the machine. Similar boxes appear throughout the manual. Carefully read each box that appears in the text and how it relates to you and the machines operation. The different kinds of boxes are displayed below. The immediacy their hazard information carries is defined below.

DANGER

Immediate hazards which **WILL** result in severe personal injury or death.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Hazards or unsafe practices which **COULD** result in severe personal injury or death.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Hazards or unsafe practices which **COULD** result in minor personal injury or property damage.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Informational Message Box

Throughout the manual important informational messages concerning the operation of the machine are displayed. Make sure you carefully read each of these boxes to avoid damaging the equipment.

NOTE

Information to which you should pay special attention.

A **NOTE** box message contains special information, usually about the operation of the machine.

PRECISION HUSKY CORPORATION

LIMITED WARRANTY

PRECISION HUSKY CORPORATION - P. O. Drawer 507, Leeds, Alabama 35094 ("PRECISION") warrants to the original purchaser that this product will be free from defects in materials and workmanship, under normal use and service, for a period of one hundred and eighty (180) days from the date of original delivery following purchase. This Limited Warranty is expressly conditioned on the purchaser's use of the product in conformance with the instructions provided with this product. This Limited Warranty is void if the product has been damaged by accident or unreasonable use, neglect, improper service or other cause not arising out of defects in material or workmanship. PRECISION will not repair or replace the product or be responsible for any damages or injury to persons or property resulting from any attempt by the purchaser or by any unauthorized person or service personnel, to repair, adjust, assemble or otherwise tamper with the product, or its wiring, controls or components. Excluded from this Limited Warranty are engines and engine components, hydraulic motors and pumps, batteries, tools, and electrical equipment, other similar equipment not manufactured by PRECISION are covered only by the standard warranties of the manufacturers of such equipment and are not under warranty by PRECISION. Such items or components, while not covered by this Limited Warranty, may in some instances be covered by warranties of the manufacturers of such items or components, but PRECISION makes no representations and assumes no responsibility in this regard.

The exclusive remedy of the purchaser in the event that the product does not meet this express Limited Warranty shall be repair or replacement of the product at the option of PRECISION without charge to the purchaser, when the product is returned to PRECISION at the above address, or at such other location as may be designated in writing by PRECISION. PRECISION is not responsible for the cost of any labor, transportation or related charges in connection with return of any product to PRECISION under this Limited Warranty. The acceptance by PRECISION of any product returned shall not be deemed an admission that the product is defective or in violation of any warranty, and if PRECISION determines that the product is not defective, the product shall be reshipped to the purchaser at such purchaser's expense. FOR THIS LIMITED WARRANTY TO BE EFFECTIVE, THE WARRANTY VALIDATION REPORT FORM MUST BE COMPLETED AND SIGNED BY THE PURCHASER AND THE AUTHORIZED DEALER. THIS LIMITED WARRANTY WILL NOT BE EFFECTIVE UNLESS PRECISION IS SUPPLIED WITH THE COMPLETED FORM AS PROOF OF THE ORIGINAL DELIVERY DATE OF THE RETURNED PRODUCT.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, WHETHER EXPRESS OR IMPLIED, EXCEPT OF TITLE.

PRECISION SHALL NOT BE Liable for any special, incidental or consequential damages if this product is defective or does not confirm with any express or implied warranty.

NO representative, agent or dealer of PRECISION has authority to modify, expand, or extend this Limited Warranty in any manner; nor is any oral warranty effective.

PRECISION

Standard Warranty Procedure

1. Upon notice of warrantable failure, information should be gathered specific to the cause and results of the failure.
   Warranty claim requests must be filed within 30 days of the failure.

2. Contact your Precision Husky Dealer or the Factory Service Department and explain the situation, including model and serial number of the machine, hours on machine, etc...

3. The Precision Husky Dealer or Factory Service Department will advise as to the warranty coverage available and the proper procedures to either repair or replace as necessary.

4. If replacement parts are determined necessary, they will be shipped the same day or as soon as possible.

5. Customers will be billed, including freight, for replacement parts. All defective parts, as well as the completed Warranty Claim Form, must be returned to Precision Husky Corporation within 30 days of failure. Please request a Return Goods Authorization Form from our parts or service department. This number should be placed on the outside of the package and returned to Precision Husky Corporation with the freight prepaid. A copy of the Returned Goods Authorization Form and a copy of the Warranty Claim Form should be included with all return parts.

6. The original Warranty Claim Form should be mailed to :
   Precision Husky Corporation
   850 Markeeta Spur Road
   Moody, Alabama, USA 35004
   Attn: Warranty Administrator

7. Any repairs made should be done with prior authorization from the Precision Husky Service Department, if a Warranty Claim Request will be made. Material and labor claims will be paid as deemed appropriate by Precision Husky Corporation, upon receipt of request, if claim is filed within 30 days of failure.

8. All transportation charges for returned parts shall be prepaid and Precision Husky Corporation shall in no event pay any transportation or mileage expenses.

Warranty Claim Form

☐ Equipment Warranty
☐ Parts Warranty

Claim No.

Dealer Name		Date of Claim
Address	Shipped Via:	Model No.
City, State		Serial No.
Owner Name	B/L No.	Equipment Location
Address		Date in Service
City, State	Tracking No.	Date of Failure
		Hours on Equipment
		Date Parts Returned

Iten No.	Qty.	Part Number	Part Description	Qty Rec'd	Invoice Price	Total
				Accounting Use Only		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
			Subtotal			
			Labor			
			Total			

Please furnish details for consideration of claim:

Dealer Signature

Factory Comments:

Disposition of Material

Received and Inspected By:

Final Credit Approval

☐ Standard Warranty
☐ Parts Warranty
☐ Courtesy Warranty
☐ Warranty Denied

Total Parts	
Total Labor	
Issue Credit	

Date: Signature:

Introduction

The Precision Husky Roundwood Chipper

Congratulations, on your purchase of your new Precision Husky Roundwood Chipper. The roundwood chipper employs advanced concepts in engineering and design, and if properly maintained and serviced, will provide excellent performance.

The chipper is primarily designed to produce high quality chips from 5/8″-1″[1.6-2.5 cm] in size from any species of wood usually in the form of full tree lengths.

Related Documents

In addition to reading this manual, be sure to read any engine manuals or other operating guides included with the machine. This information is located in *Section C - Engine and Service Manuals*.

Proficiency Requirements

Proper operation and maintenance of this product is critical to ensure adequate levels of system performance and safety. Anyone involved in the day-to-day operation and maintenance of this machine must read and understand this manual.

It is highly recommended that anyone who will use this machine be thoroughly instructed on its operation.

Special Information

Contact your local authorized Precision Husky dealer, if you have questions or need service on the machine. In addition to system accessories and professional technicians, the dealer has a complete line of replacement parts.

Figure 1.1-A. The Roundwood Chipper.
Complete knowledge of the Precision Husky Roundwood Chipper is required before operating the unit.

When operating the chipper, ***always*** wear a hard hat, safety glasses and gloves. All onlookers should also wear these safety items.

Figure 1.2-A. Safety Equipment.
A hard hat, safety glasses and gloves should always be worn when operating the chipper.

Other Tools and Equipment Needed

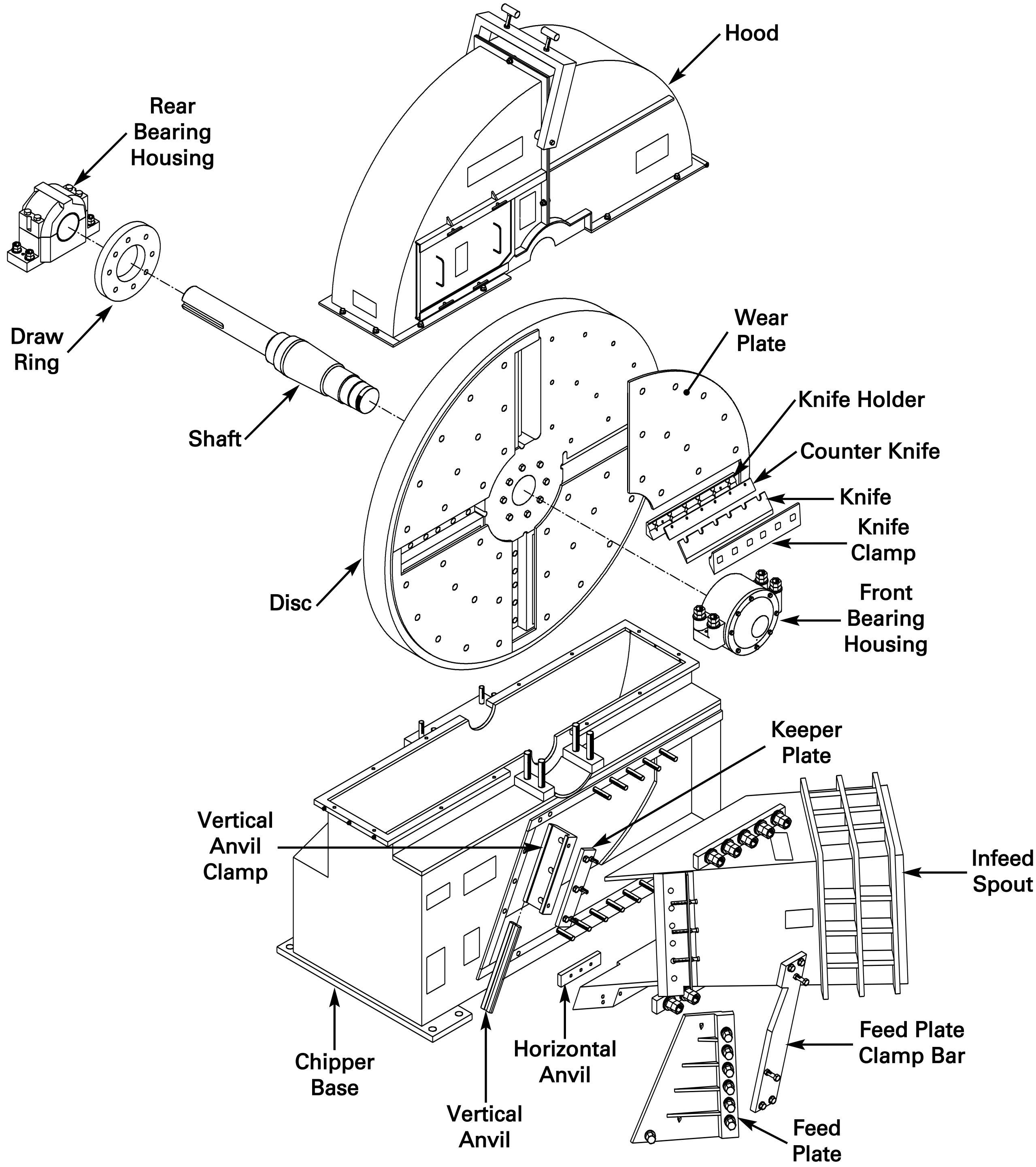
Additional tools/materials needed for efficient operation and for performing all standard maintenance on the machine:

- Set of wrenches
- Knife grinder
- Lock and tag
- Torque wrench
- Wooden wedge
- File
- Air impact wrench
- Air compressor and air hose
- Feeler Gauge
- Crescent Wrench
- Babbitt Pouring Ladle
- Babbitt Metal
- Pry Bar
- Crane
- Spout shims
- Dial caliper
- Knife gauge shims
- Grease and grease gun
- Spanner wrench
- Medium sized hammer
- Tubular drift/sleeve
- Socket Extension
- Pull Handle
- Torch
- Set of Allen Wrenches

Knowing the Precision Husky Roundwood Chipper

The main parts of the machine are labeled below. Definitions for each part are on the following page.

84"[2.1 m] Right Hand, Horizontal Feed, Bottom Discharge Roundwood Chipper



Precision Husky Roundwood Chipper Definitions

Chipper Base - The metal housing that covers the lower half of the chipper disc.

Counter Knife - As the knife cuts through the material, the counter knife breaks the chips into the desired length.

Disc - Large round plate inside the base that rotates the knives to cut the material into chips.

Discharge Chute *(Top Discharge Chippers)* - The passage through which the chips exit the chipper.

Feed Plate - Steel plate, attached to the canted side of the infeed spout that directs incoming material toward the vertical anvil.

Feed Plate Clamp Bar - Plate that is bolted to the chipper base and has adjustment screws that are used to help keep the feed plate properly positioned.

Hood - The metal housing that covers the chipper disc and is fastened to the chipper base.

Horizontal Anvil - Fixed steel block that sits between the infeed spout and the chipper disc and functions as a cutting surface for the knives.

Infeed Spout - The passage through which material is supplied to the chipper.

Knife - Replaceable piece of steel with a sharpened edge that attaches to the chipper disc.

Knife Clamp - Knife clamps keep the knife secured to the chipper disc.

Knife Holder - Mounting base for the knife assembly.

Shaft - Transmits power from the motor to the disc.

Vertical Anvil - Adjustable steel block located between the base and the end of the feed plate that provides a cutting surface for the knives.

Wear Plate - Protects the chipper disc and helps control chip size.

Loose Parts List

Use this chart as a check list to ensure all loose parts have been shipped with your machine. If any parts are missing, contact Precision Husky for immediate replacement.

NOTE

If any parts are missing from the Loose Parts list, contact Precision Husky. Missing items will be promptly replaced.

Part No.	Qty	Description	Use
Varies	1	Knife Gauge	Setting the knife width
97-4702	1	Oper. & Maint. Manual	Instructions for operating and maintaining the chipper
*97-2559	1	Guard Warning Decal	Decal used to warn of possible personal injury when operating chipper without a drive guard.
*97-4260	1	Guard Warning Decal	Decal used to warn of possible personal injury when operating chipper without a drive guard.
*97-4455	2	Blow Pipe Decal	Decal used to warn of possible personal injury when trying to unplug blow pipe before shutting down chipper.

* The two warning decals above (97-2559 & 97-4260) are only shipped loose when you choose to purchase your chipper without a drive guard.

* Decal 97-4455 is shipped with **Top and End Discharge Chippers Only.**

Safety Precautions

You're Responsible for Safety

NOTE

A neglectful, casual act can cause serious injury. Do not allow familiarity *(frequent use of the machine)* to become a part of your operation practice.

Successful operation of this machine requires the use of proper safety guidelines. Safety procedures concerning the operation and maintenance are always in the hands of the operator. Carefully go through Section 1 - Introduction, and Section 4 - Preventive Maintenance of this manual to acquaint yourself with the major components and operating sequences of the machine. In addition, read the engine manual and all other material located in Appendix C, paying close attention to safety measures and special operating messages.

The precautions described in this section provide special safety information about the use and operation of the equipment, and also the safety of the operator and bystanders while the machine is in operation.

Read the Manual

It is recommended that only those persons who have read this manual, are familiar with the machine and have been instructed in its safe operation by a qualified person be allowed to operate the machine.

WARNING

Always wear eye goggles, a hard hat and ear protection when the machine is running. This protective gear is the best protection and prevention against injury when operating or watching the equipment.

Wear Protective Equipment

Take the prescribed safety precautions before starting an operation by wearing the correct protective equipment. The operator should wear leather gloves, safety goggles or glasses, and reinforced work boots. Always make sure your shirt is tucked in.

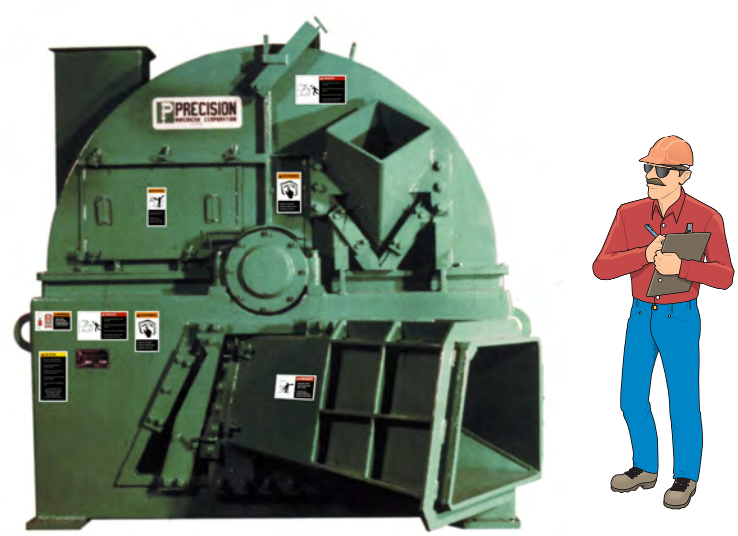


Figure 2.1-A. Inspect the Roundwood Chipper.
Always conduct a thorough inspection of the chipper before operating.

Safety Instructions

NOTE

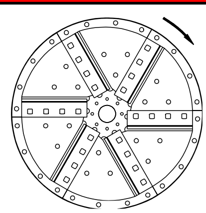
THINK SAFETY! Safety is a combination of operator common sense and alertness at all times when the machine is being operated or serviced.

CAUTION

Accidents can happen in moments of neglect. Do not allow familiarity *(frequent use of the chipper)* to affect your safety habits.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

DANGER

- **NEVER OPERATE CHIPPER WITH MISSING HOOD BOLTS.**
- **NEVER OPERATE CHIPPER WITHOUT HOOD LOCK SECURED.**
- **NEVER OPEN HOOD WHILE DISC IS TURNING.**

Make Safety Checks

Before each use, make a complete visual check to ensure all nuts, bolts and screws are tight. Review the pre-operating instructions for a complete rundown on all checks that should be made.

Improper use or maintenance by the operator or owner of the machinery can result in injury and/or death. Reduce the potential for injury by complying with all safety instructions.

The safety of the operator and bystanders while a machine is in operation is of great importance to Precision Husky. Decals, shields and other safety features are provided for your protection. In addition, we ask you to be a careful operator who uses and services your Precision Husky equipment properly.

Each of the following safety precautions must be observed at all times when operating the machine. Safety should always be practiced, regardless of the operator's familiarity with the machine.

Before Operating

Adhere to the the following safety rules before beginning operation:

1. Read and understand the contents of this manual before operating the machine. To get replacement manuals, send complete model and serial numbers to: **Precision Husky Corporation, 850 Markeeta Spur Road, Moody, AL 35004**.

2. Always wear safety glasses, safety shoes, long pants and a hard hat. This is required by some local ordinance and insurance regulations.

3. Do not allow children to operate the machine, or anyone who hasn't had proper instruction. Inexperienced operators should be supervised by a qualified, trained operator.

4. Become familiar with the controls and know how to stop the machine. Know where the emergency shutdown switch is located.

5. **CHECK THAT THE TWO SECTIONS OF THE CHIPPER HOOD ARE BOLTED TOGETHER AND PROPERLY FASTENED TO THE BASE.**

6. **MAKE SURE THE HOOD LOCK IS IN THE LOCKED POSITION AND THE T-HANDLE BOLTS ARE TIGHT.**

WARNING

Never operate chipper without all access doors closed and secured.

7. **Always check that all access doors are closed and secured.**

8. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is malfunctioning, illegible or damaged, repair or replace it before operating the machine.

9. Always wear substantial shoes. Do not operate machine while wearing sandals, tennis shoes, sneakers or when barefoot. Do not wear loose fitting clothing that could get caught in moving parts and possibly cause personal injury. Confine long hair to avoid possible entanglements. Avoid wearing jewelry *(rings, wrist watches, necklaces and bracelets)*.

10. Clean the infeed spout of any foreign objects.

11. Never operate the machinery while under the influence of drugs or alcohol.

While Operating

DANGER

- **NEVER OPERATE CHIPPER WITH MISSING HOOD BOLTS.**
- **NEVER OPERATE CHIPPER WITHOUT HOOD LOCK SECURED.**
- **NEVER OPEN HOOD WHILE DISC IS TURNING.**

WARNING

Never open access doors while disc is turning.

DANGER

Trying to remove debris from the chipper while it is operating can result in serious or fatal injury.

Follow these safety rules while the machine is in operation:

1. **NEVER UNLOCK THE HOOD LOCK OR TRY TO RAISE THE CHIPPER HOOD WHILE THE DISC IS STILL TURNING.**

2. Keep hands, feet and clothing away from power driven parts.

3. Do not attempt to hang onto material as it is being fed into the chipper.

4. **Never open one of the access doors while the disc is still turning.**

5. Be careful to not overload the infeed spout.

6. Have a fire extinguisher on hand and know where it is at all times, and have it inspected and serviced regularly by a qualified professional.

7. **Never try to clear blow/discharge pipe, infeed spout, or discharge chute of obstructions until chipper has been shutdown, disc has completely stopped, and lockout/tagout procedures have been performed.**

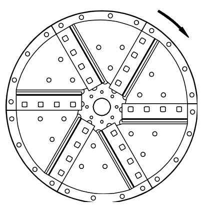
8. If the chipper knives strike a solid object or the machine vibrates abnormally, stop chipper immediately, and wait for all moving parts to come to a complete stop. Inspect for damage. Repair or replace any damaged parts before resuming operation of the chipper.

Maintenance Safety

Adhere to the following safety rules while performing maintenance on the machine:

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

1. **Before servicing or making any adjustments to the chipper, shutdown the chipper and wait for it to come to a complete stop, and then lockout/tagout the chipper power source. Disc will continue to rotate after chipper is shutdown. To confirm disc is stopped, visually check disc shaft or drive wheel.**

2. Always wear gloves when changing or servicing the chipper knives or making any adjustments to the chipper.

3. For optimum performance and safety use, genuine Precision Husky replacement parts and accessories. Replacement parts and accessories made by other manufacturers could be dangerous and will void the product warranty.

4. All nuts and bolts on the machine should be properly torqued. Failure to tighten the nuts properly could permit them to loosen while the machine is operating. Over-torquing can create stress which will cause the studs to break. *See Section 4 Preventive Maintenance* for torque ratings for all fasteners used on the chipper.

5. Any guards or safety devices that may have been removed while performing maintenance on the chipper, should be replaced before restarting it.

6. **OPTIONAL HYDRAULIC HOOD OPENER -** Relieve all pressure in the hydraulic system before disconnecting the lines or performing other work on the system. Make sure all connections are tight and the hoses are in good condition before applying pressure to the system.

WARNING

Escaping fluid under pressure can penetrate the skin, causing personal injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Always check for leaks using cardboard or paper. DO NOT USE YOUR HAND!

7. **OPTIONAL HYDRAULIC HOOD OPENER -** Always wear safety glasses when performing maintenance on the hydraulic hood opener.

8. **OPTIONAL HYDRAULIC HOOD OPENER -** Keep body and hands away from pin hole leaks or nozzles that eject high pressure hydraulic fluid. Use cardboard or paper to find hydraulic leaks. Hydraulic fluid escaping under pressure can penetrate skin and cause injury. Fluid accidentally injected into the skin must be surgically removed within a few hours by a doctor, or gangrene may occur.

9. After completing any maintenance procedure, make sure all tools/materials used to complete the procedure have been removed from the chipping area.

10. When restarting the machine after performing any maintenance procedures, operator's should listen for any abnormal sounds or vibrations. These can indicate that the components were not reinstalled properly or that adjustments were made incorrectly.

Be Careful with Noise

Prolonged or long-term exposure to loud noise made by the machine during operation can cause impairment or loss of hearing. To protect against possible damage to your ears, wear an appropriate hearing protective device such as earmuffs or earplugs *(see Figure 2.5-A).*

Figure 2.5-A. Ear Protection. Earmuffs designed for hearing protection, or earplugs, are appropriate devices to use when guarding against possible hearing damage.

Fire Safety

CAUTION

Fire safety is important in all aspects of operating and maintaining the machine. Make sure you follow all prescribed fire precautions.

DANGER

Never smoke around the machine. Sparks, flames or ashes could cause fire and other potential fire hazards.

Be conscious of all possible fire hazards that may be on or around the machine. When operating, always take the following precautions into consideration:

1. When cleaning any part of the machine, use solvents or cleaning fluid that are non-flammable only. Check container labels for specific instructions.

2. Have the operator watch and check the equipment for 15-20 minutes after shutdown to ensure the machine is adequately cooled.

3. DO NOT SMOKE around the machine.

4. Clean all dirt, wood chips, bark and other flammable debris from around the drive motor.

Safety Decals

Replacement safety decals are easy to re-order and they are free.
For further information contact:

Precision Husky Corporation
P.O. Drawer 507
Leeds, Alabama 35094-0507
Phone: (205)640-5181
Fax: (205)640-1147
Web Site: www.precisionhusky.com
Email: sales@msn.com

Safety decals are placed in convenient locations over the body of the machine providing needed information concerning safety and operating procedures. Read all decals carefully, paying particular attention to CAUTION, WARNING and DANGER messages. If any decal becomes damaged or illegible, replace it as soon as possible. The decal part numbers are listed below the figure (PN=Part Number).

Figure 2.7-A Precision Husky Logo.
The Precision Husky logo is placed at the top of the hood on the back and the front.

PN 97-4271 & 97-3951 - Obsolete

PN 97-8017 - 25″ x 4″

PN 97-8018 - 17″ x 3″
Quantity 2

PN 97-8027 - 38″ x 6″

obsolete -
97-4271
97-3951

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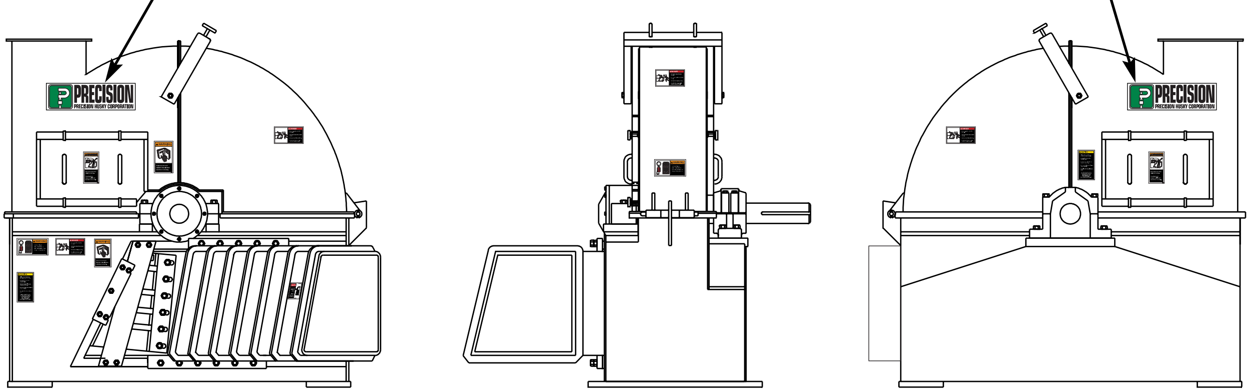


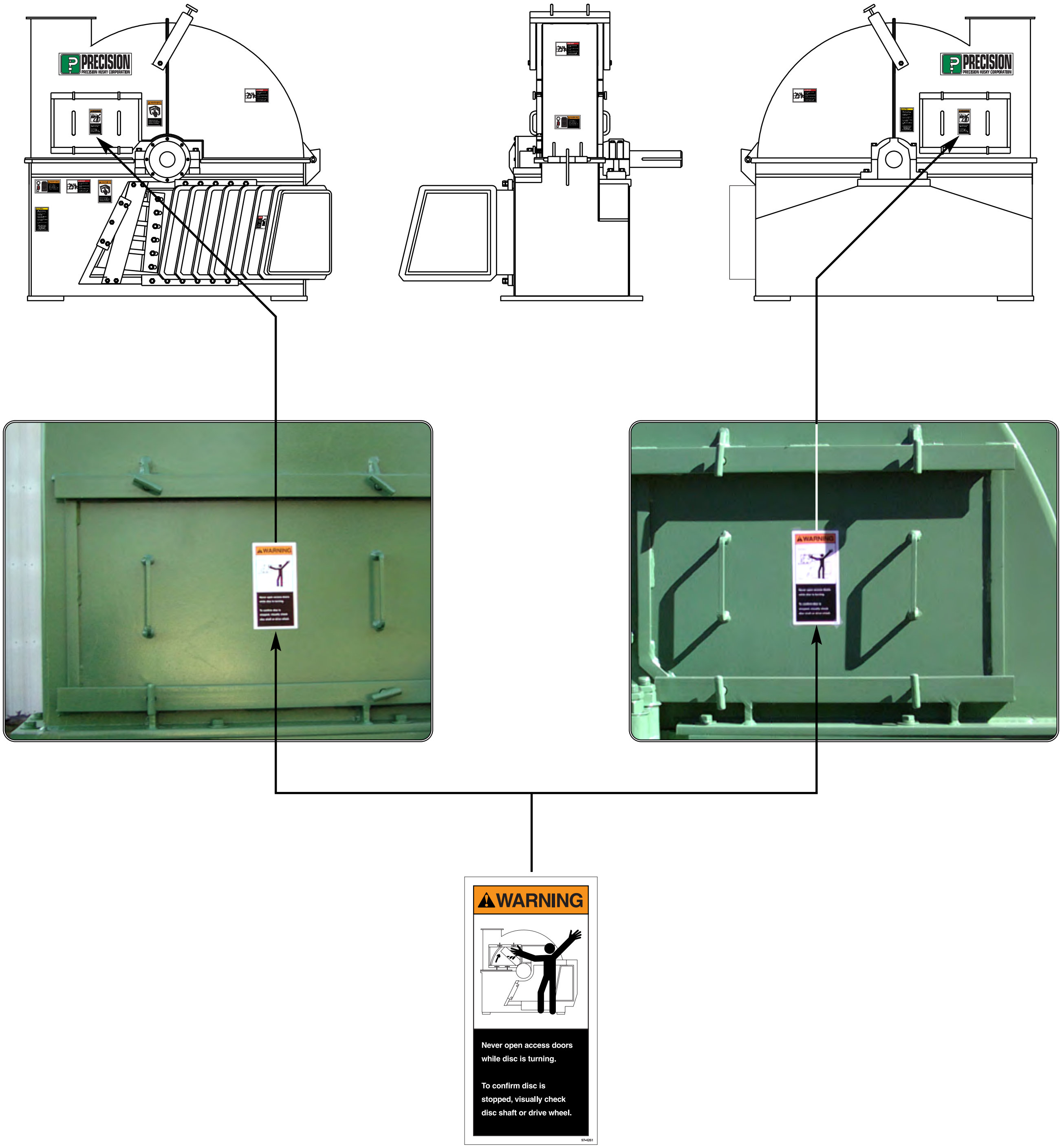


Figure 2.8-A Warning, Never Open Access Doors While Disc is Turning.
Placed on the front and back knife change access doors.

PN 97-4261
Quantity 2

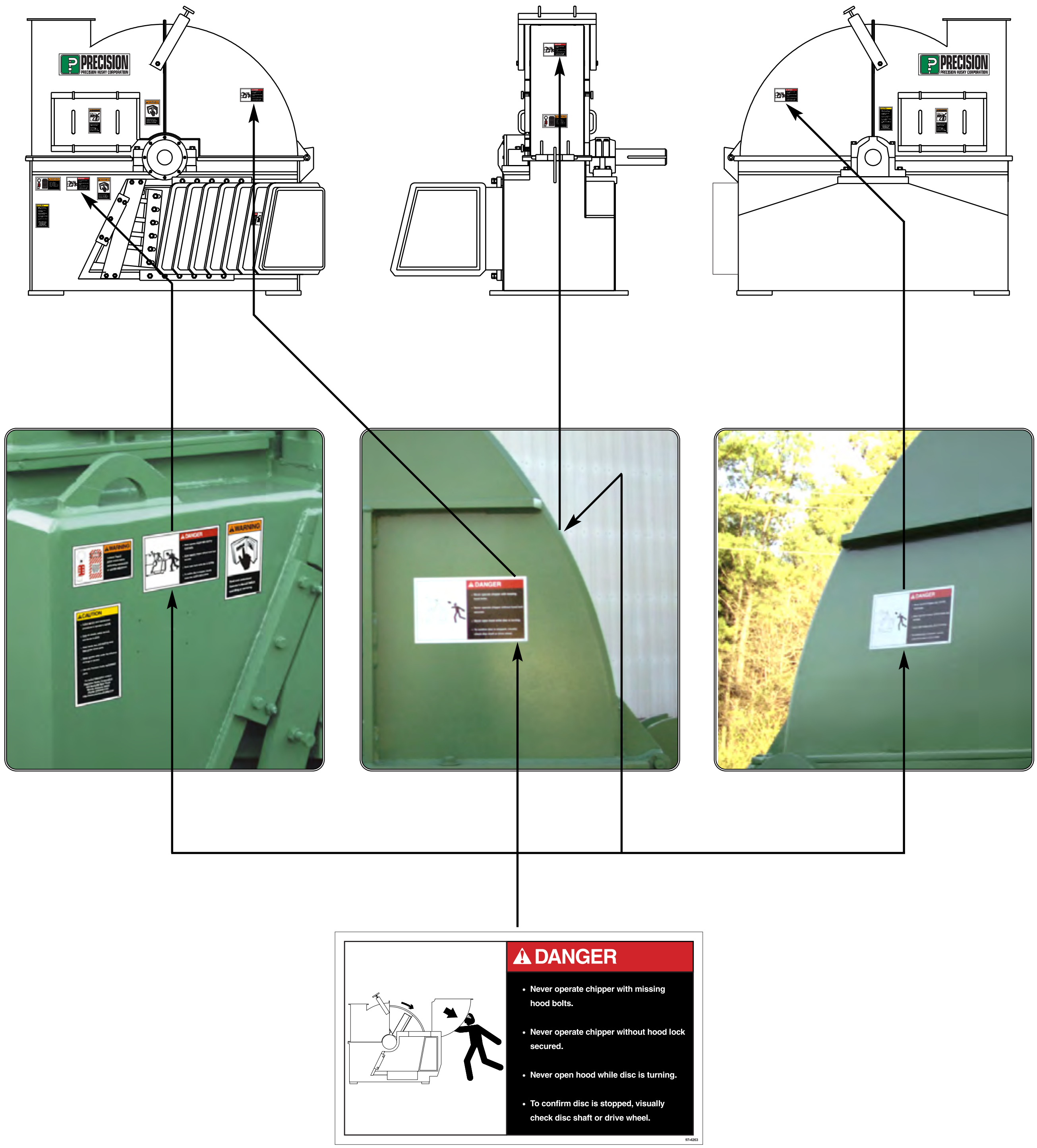


Figure 2.9-A Danger, Never Operate Chipper with Missing Hood Bolts.
Placed on the front of the base, and on the back, front, and side of the hood section that is hinged.

PN 97-4263
Quantity 4

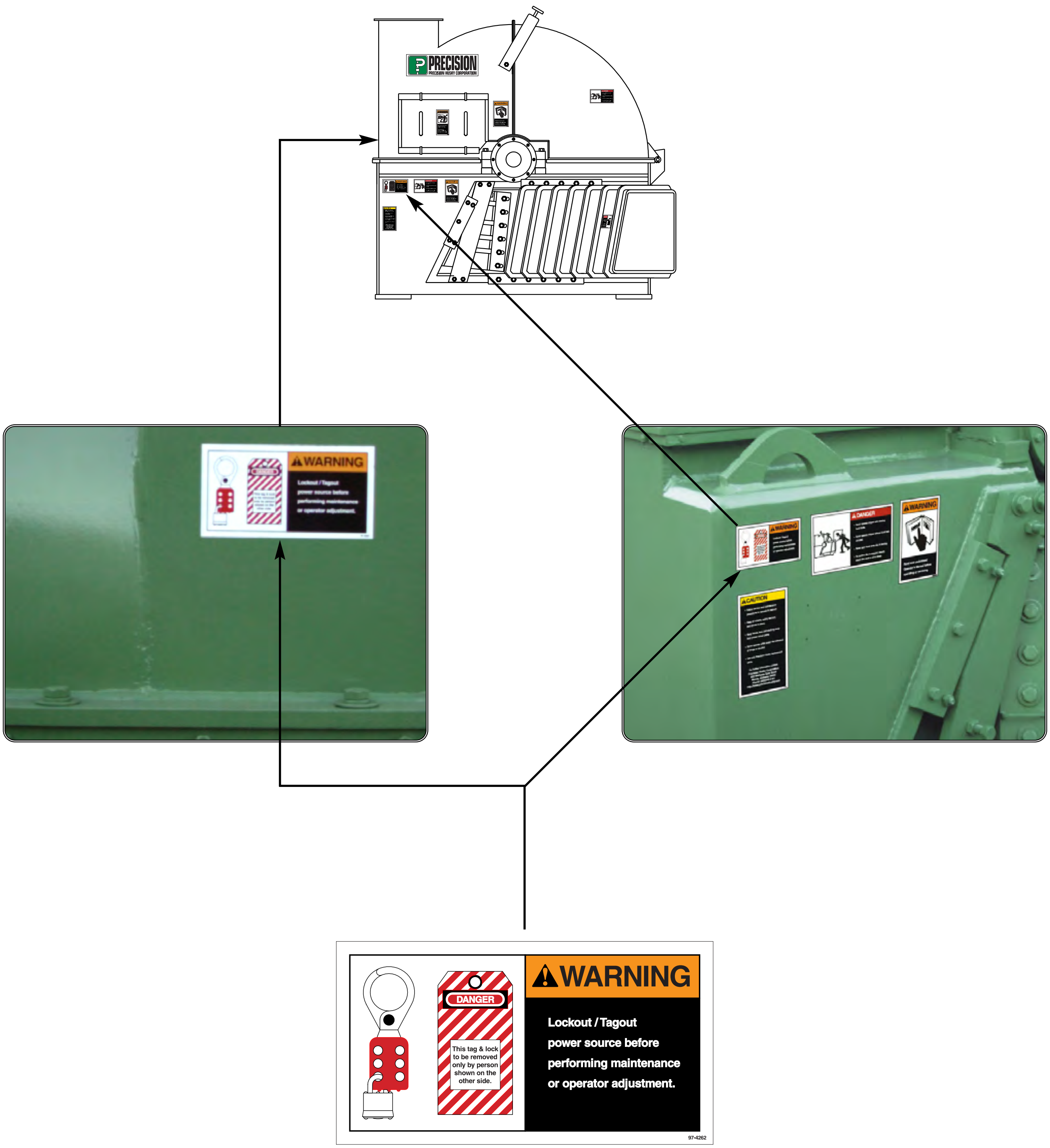


Figure 2.10-A Warning, Lockout / Tagout Power Source Before Performing Maintenance or Operator Adjustment.
Placed on the side of the hood section that is not hinged, and on the front of the chipper base.

PN 97-4262
Quantity 2

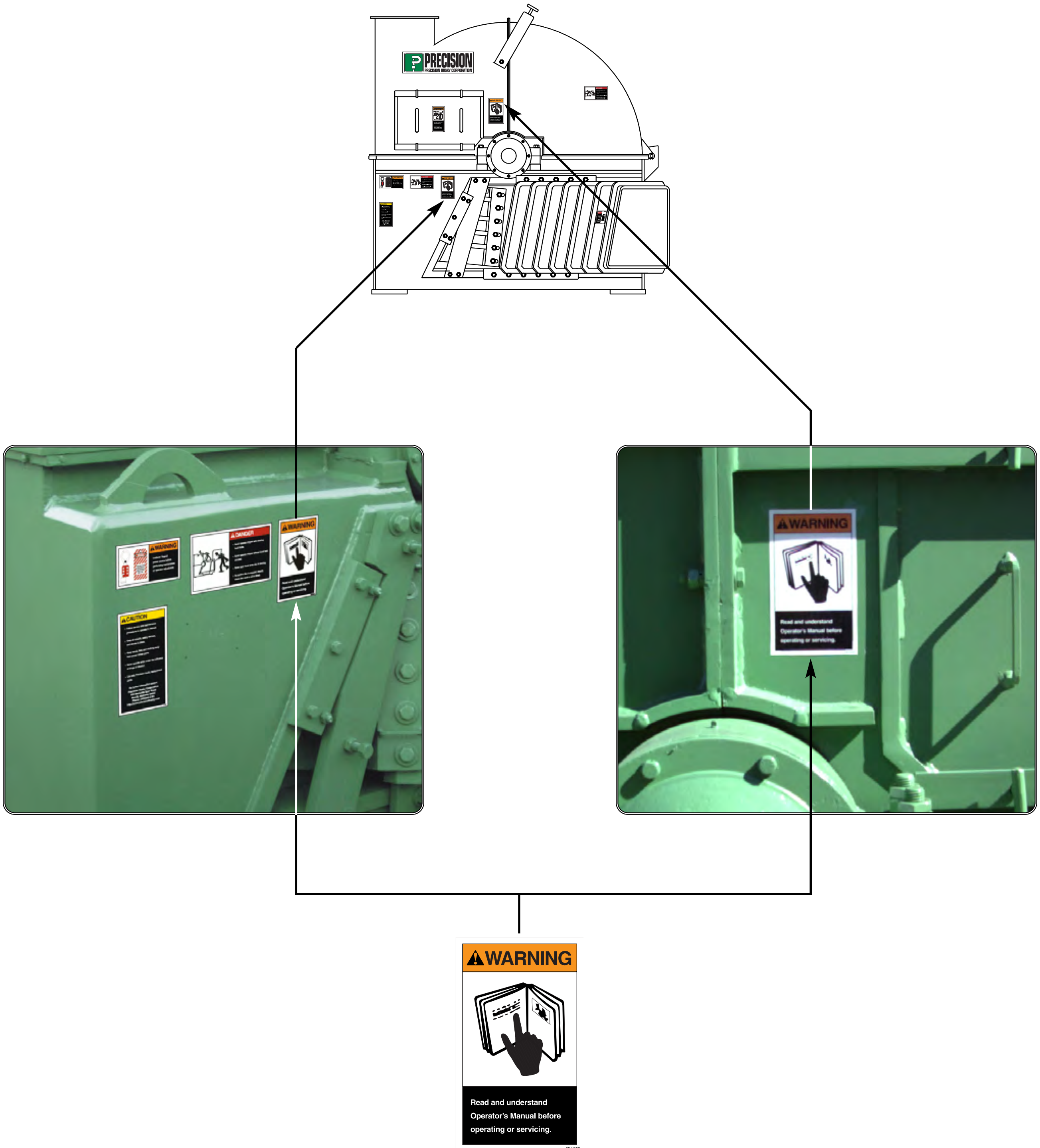


Figure 2.11-A Warning, Read and Understand Operator's Manual Before Operating or Servicing. Placed on the front of the base, and on the front of the hood below the Precision decal on the side of the hood that is not hinged.

PN 242-150-678
Quantity 2

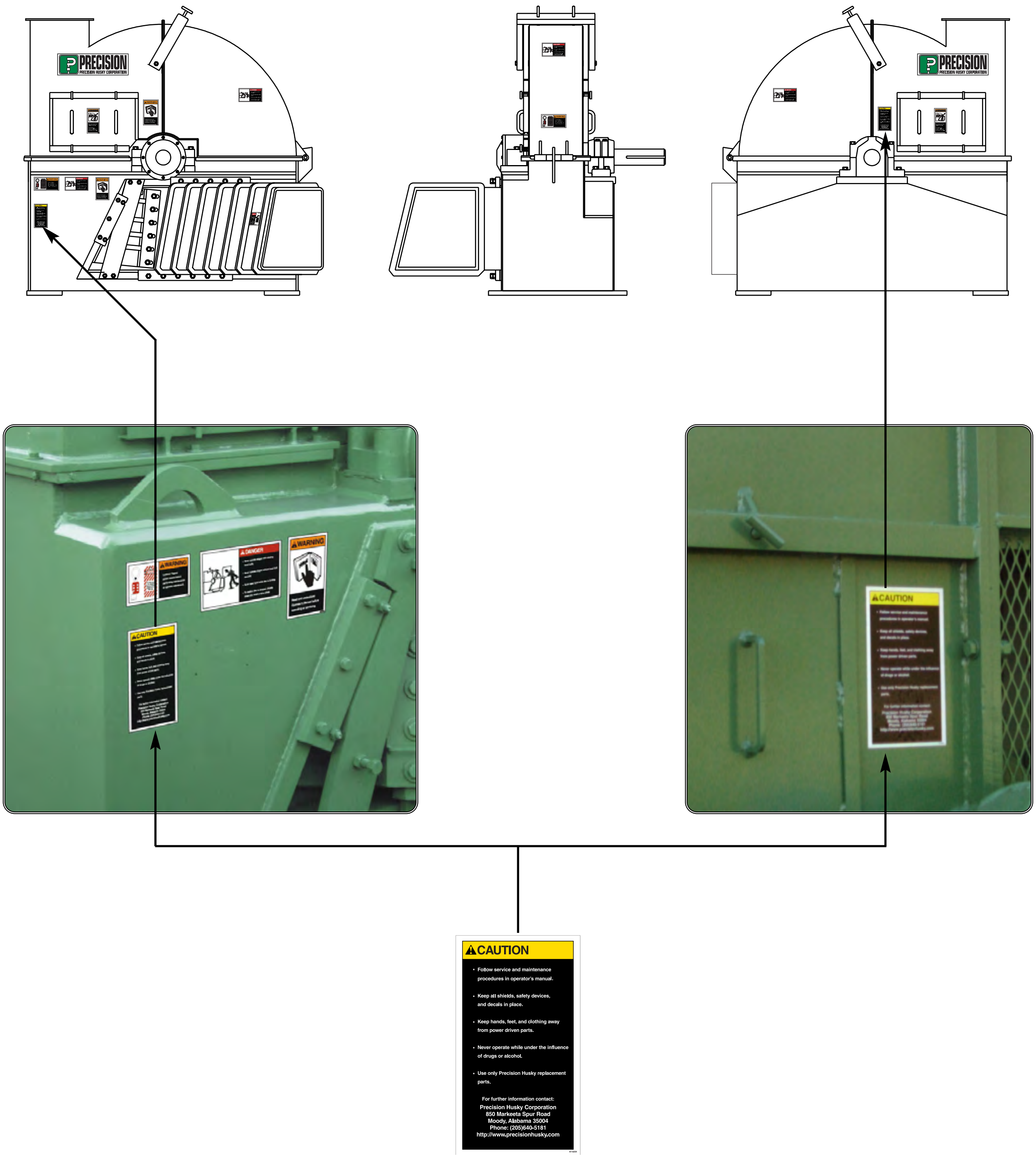


Figure 2.12-A Caution, List
Placed on the front of the base and on the back of the chipper hood below the Precision decal on the side of the hood that is not hinged.

PN 97-4259
Quantity 2

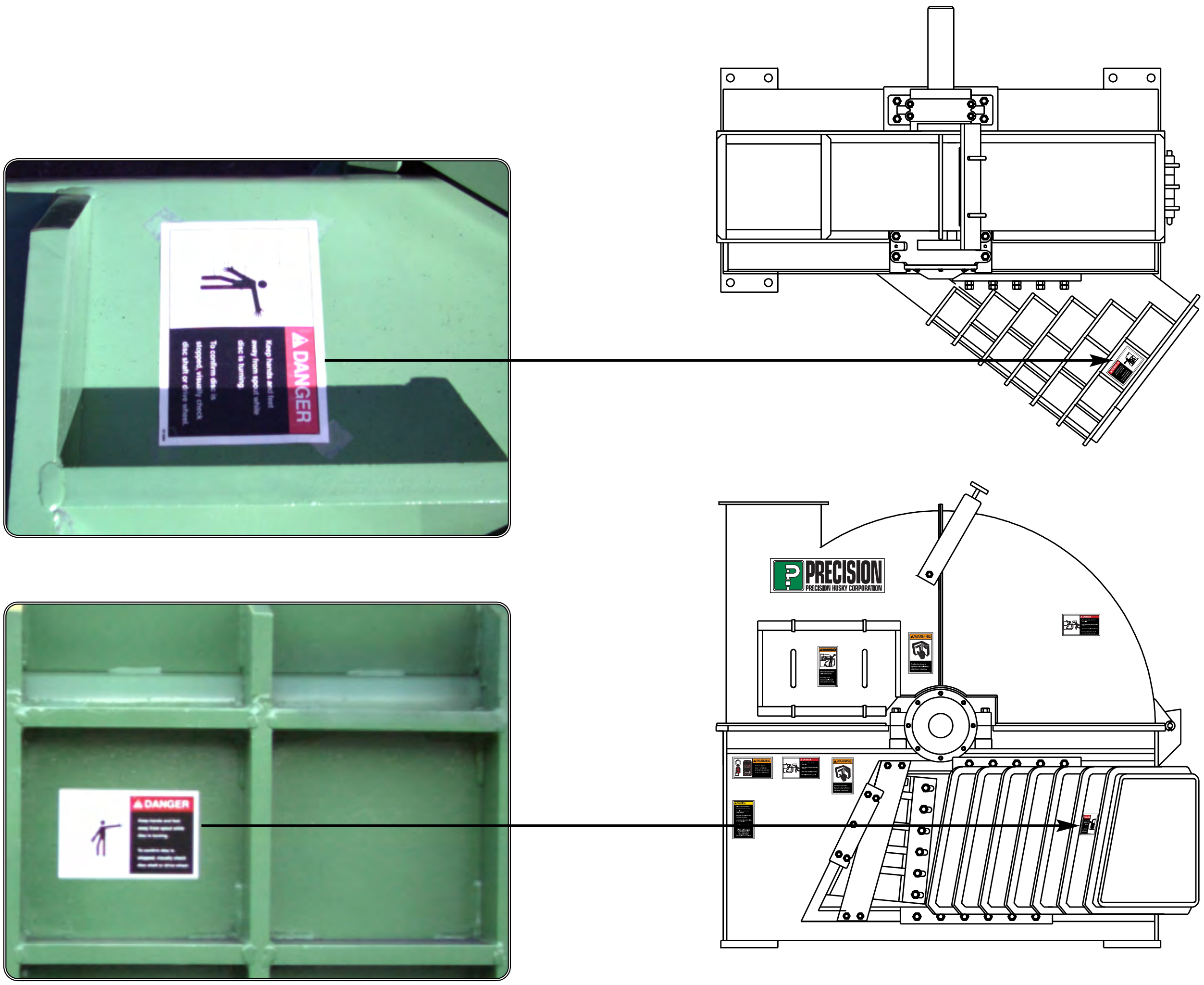


Figure 2.13-A Danger, Keep Hands and Feet Away from Spout While Disc is Turning.
Placed on the canted side of the spout and also on the top.

PN 97-4264
Quantity 2

Figure 2.14-A.
Warning, Do Not Operate Without Guards in Place.
Placed on the belt guard. This decal is shipped with chippers without belt guards.

PN 97-4260
Quantity 1

Figure 2.14-B.
Warning, Shield Not in Place Do Not Operate

Placed on the belt guard. This decal is shipped with chippers without belt guards.

PN 97-2559
Quantity 1

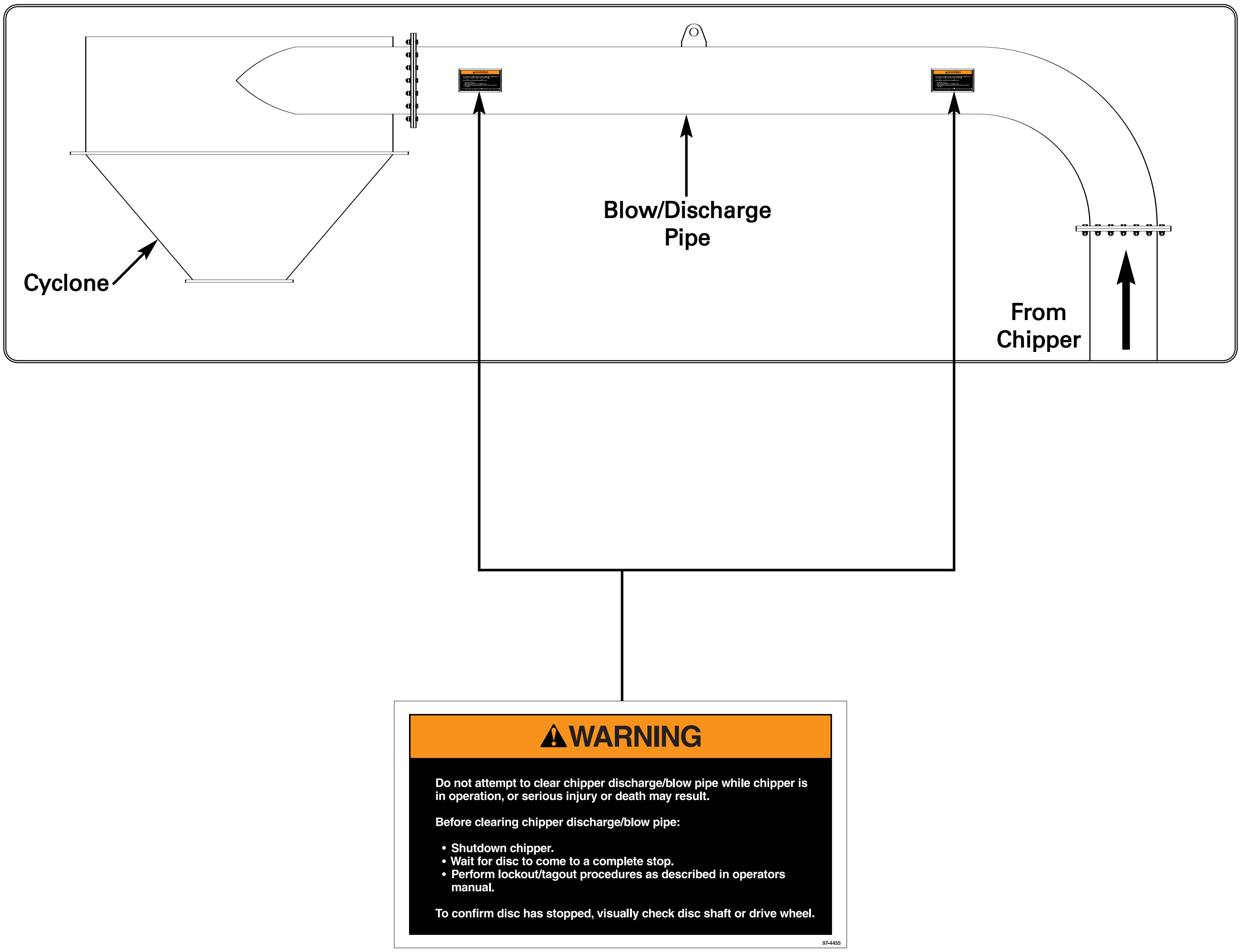


Figure 2.15-A Warning, Blow/Discharge Pipe
Placed at each end of the blow/discharge pipe: one near the chipper and one at the opposite end.

PN 97-4455
Quantity 2

This decal is shipped with Top & End Discharge Chippers only.

Decal Part Number List

Replacement safety decals are easy to re-order and they are free.
For further information contact:

Precision Husky Corporation
P.O. Drawer 507
Leeds, Alabama 35094-0507
Phone: (205)640-5181
Fax: (205)640-1147
Web Site: www.precisionhusky.com
Email: precisionhusky@msn.com

Part #	Description	Quantity
97-3951	Precision Husky Corporation Decal	2
97-4261	Warning, Never Open Access Doors	2
97-4263	Danger, Missing Hood Bolts	4
97-4262	Warning, Lockout/Tagout	2
242-150-678	Warning, Read and Understand	2
97-4259	Caution, List	2
97-4264	Danger, Keep Hands & Feet Away	*2
97-4260	Warning, Do Not Operate	1
97-2559	Warning, Shield Not in Place	1
97-4455	Warning, Blow/Discharge Pipe	2

* Decal 97-4264 quantity is 3 if chipper is equipped with a rechipper spout.

* Decal 97-4455 is shipped with Top & End Discharge Chippers only.

Operating Instructions

Pre-Operating Instructions

There are several pre-operating steps you must complete before starting the Roundwood Chipper for a chipping operation. Each step enhances your safety during the operation, as well as insuring the chipper will run properly in an efficient manner.

Before Starting the Chipper

Make sure each of the following steps have been completed before you start the chipper.

1. Read the operating manual and accompanying documentation carefully before starting a chipping operation. Make note of special safety considerations outlined in *Section 2 - Safety Precautions*.

2. Secure the chipper to a properly designed level foundation. **Contact Precision Husky for information regarding the chipper foundation or for customer specific drawings.**

3. Secure drive system to foundation and connect chipper to drive system.

4. Install a belt guard and apply the 2 belt guard warning decals. *(Belt driven chippers)*

5. Setup infeed conveyor or alternate chipper feed system.

6. Connect blowpipe to chipper discharge chute. *(Top or end discharge chippers)*

7. Setup discharge conveyor or alternate chipper discharge system. *(Bottom & rear discharge chippers)*

8. Check that all the knife clamp nuts, are properly torqued.

WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

Figure 3.1-A. Operating the Roundwood Chipper.
Make sure you have thoroughly read and studied all operating procedures before beginning a chipping operation.

WARNING

Never operate chipper without all access doors closed and secured.

DANGER

- NEVER OPERATE CHIPPER WITH MISSING HOOD BOLTS.
- NEVER OPERATE CHIPPER WITHOUT HOOD LOCK SECURED.
- NEVER OPEN HOOD WHILE DISC IS TURNING.

9. Inspect knives removing any foreign material or loose objects.
10. Turn the chipper disc one full revolution to ensure that there is no interference.
11. **Make sure that all access doors are in place and properly secured.**
12. **CHECK THAT THE TWO SECTIONS OF THE CHIPPER HOOD ARE BOLTED TOGETHER AND PROPERLY FASTENED TO THE BASE.**
13. **MAKE SURE THE HOOD LOCK IS IN THE LOCKED POSITION AND THE T-HANDLE BOLTS ARE TIGHT.**
14. Conduct a thorough visual inspection of the machine, checking for loose bolts, nuts, etc.
15. Check the inside of the chipper spout for any loose debris or other loose objects. Make sure the area is clean.
16. Apply blow pipe decals as shown in *Section 2 Preventive Maintenance*. *(Top & End Discharge Chippers Only)*

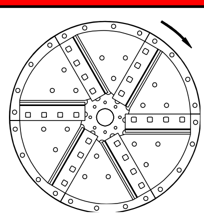
Starting the Chipping Process

Once you have completed all the pre-operating steps you should complete the following steps to break-in the chipper.

1. Make sure the area is clear of all personnel.
2. Start the chipper and let it run for a half hour without any material being fed to it.
3. Check bearing temperature and listen for unusual noise.
   The bearings should heat up immediately after start-up, but the temperature should begin to drop once the grease becomes evenly distributed throughout the bearings. If the bearings are excessively hot release some of the grease from the housing following the instructions in *Section 4 - Preventive Maintenance*. If overheating persists contact Precision Husky.
   The bearings should produce an even purring noise. Whistling or screeching indicates inadequate lubrication, see *Section 4 - Preventive Maintenance* for information on adding lubricant to the bearing. If the noise persists or the bearing makes an uneven rumbling or hammering noise contact Precision Husky.
4. **Shutdown the machine and wait for disc to come to a complete stop. Disc will continue to rotate after the chipper is shutdown.**
   To confirm disc is stopped, visually check disc shaft or drive wheel.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



⚠ WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

5. Lockout/Tagout chipper power source.

6. Visually examine the disc, knives, and check around the bearing housings to ensure that the bearing seals are performing correctly.

7. Check all bolts and fasteners for tightness.

8. Restart chipper and bring the disc up to operating speed. Begin feeding small pieces of wood *(approximately 2″x4″[5x10 cm] or similar size logs)* then progressively larger material. If the vibration or noise is excessive at any point, shut down machine and examine for cause. If no cause is found contact Precision Husky.

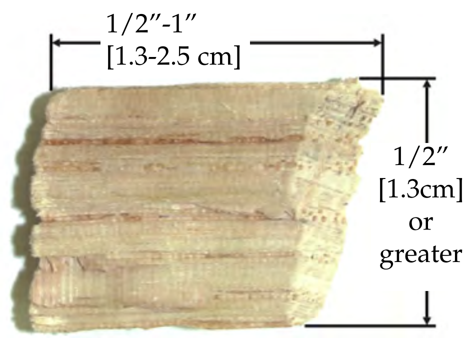
9. Visually check that the chipper is discharging properly.

Chip Quality

NOTE

Even with everything on the chipper set and operating correctly, you will occasionally produce non-acceptable chips caused by poor material or due to accidents at the chipper, such as broken or chipped knives. This is why it is important to use a chip screen to separate the overs and fines from the accepts.

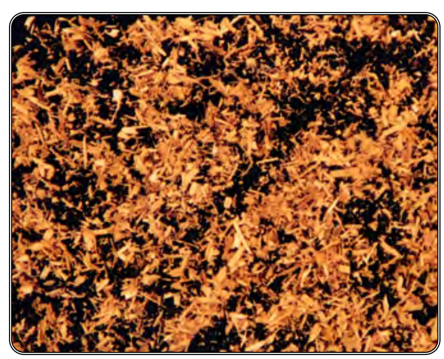
In terms of size, good quality chips should be manufactured to approximately 1/2″-1″[1.3-2.5 cm] in length along the grain, 1/2″[1.3 cm] or greater in width, and 1/8″-1/4″[3.2-6.4 mm] in thickness. However, the size of the chips that you need to produce is greatly dependent on the requirements of the pulp mill or other market to which they are sold.



While the Precision Roundwood Chipper can easily produce acceptable chips*(accepts)*, it is important to be able to recognize poor quality chips and their cause in order to prevent them.

Fines

Fines are chips that are very thin and short in length. They can be caused by:



- Worn counter knives
- Dull chipper knives
- Poorly debarked logs
- Excessively dry material
- Chipper disc speed being too high
- Poor fine screening

Top discharge chippers

- Rough spots or sharp bends in the blow pipe

NOTE

Overs and fines are generally poor indicators of chipper performance, as their production is strongly affected by the characteristics of the material being chipped.

Overs

Overs are any chip that is too thick or too wide. Overs can cause pulp mills problems because the oversize chips take longer for the digester to cook, this results in the smaller chips being overcooked. Overs can be caused by:

- Worn anvils
- Worn wear plates
- Horizontal or vertical anvil to knife clearance is too great
- Chipper disc bearing end play
- Chipping short wood that is able to turn longways toward the chipper disc producing overlong chips

NOTE

Operating the chipper at high RPM's increases the negative effects of worn components.

Pin Chips

Pin chips are long narrow chips. Pin chips can be caused by:

- Worn counter knives
- Dull knives
- Chipper disc speed being too high
- Worn feed plate
- Incorrectly sharpened chipper knives
- Plugged chip slot
- Worn wear plates

Bottom discharge chippers

- Distance from the bottom of the chipper to the conveyor is not large enough to allow the chips to slow down before striking the conveyor

Top discharge chippers

- Rough spots or sharp bends in the blow pipe

Cards

A card is the term used to refer to blocks of chips in which the individual chips have not completely separated. Cards can be formed by:

- Disc speed being too slow
- Chipping excessively dry wood, or cross grained wood

Cards can be reduced by shortening the chip length. They can also be reduced in bottom and end discharge chippers by installing cardbreakers on the back of the disc and chipper base. Speeding up the chipper disc can reduce the production of cards, but it can also increase pin chip production.

Bruised Chips

Bruised chips are chips that have one end that has been visibly compacted and distorted. Some of the problems that can cause bruised chips are:

- Worn counter knives
- Incorrectly beveled counter knives
- Incorrectly sharpened chipper knives.

Preventive Maintenance & Service

Proper Maintenance of the Precision Husky Roundwood Chipper

Regular maintenance and service checks of the chipper not only enhance the machine's performance, but also increase its durability and production life. If you find worn or damaged parts during an inspection, replace them immediately.

Standard maintenance includes:

1. Checking the condition of the knives, and knife clamps before each operation. If they are damaged, replace them before beginning the chipping operation.

2. Cleaning studs and nuts and checking periodically for tightness.

3. Sharpening the chipper knives.

4. Setting the horizontal and vertical anvils.

5. Checking the wear plates, feed plate, knife holders, counter knives, vertical and horizontal anvils, hood, base, disc, and chipper infeed spout for excessive wear or damage.

6. Setting the knife width with the knife gauge.

7. Changing the chipper knives.

8. Checking the fan blades and rim blades.
   (Top Discharge & End Discharge Chippers)

9. Checking the lower casing band for wear.
   (Top Discharge & End Discharge Chippers)

10. Checking the disc brake pads and rotors for excessive wear.
    (Optional Disc Brake)

Maintenance Schedule

Do not attempt any maintenance which you do not fully understand or cannot do accurately and safely. If problems are encountered or you don't understand the solutions, contact Precision Husky.

Maintenance intervals are based on normal operating conditions. When operating under severe and high usage conditions, the maintenance intervals should be shortened.

Maintenance Intervals

Keep and follow a list of all maintenance performed on your chipper. Follow as closely as possible the different time intervals indicated below.

Daily Maintenance *(10 Hours)*

Perform each of the following maintenance functions daily.

- Change or sharpen the chipper knives.
- Reset knife width with knife gauge.
- Clean out chip slot, removing any debris that may have collected around the knife assembly components.
- Check knife points to horizontal and vertical anvil clearance.
- Visually check knives, knife clamps, and wear plates for excessive wear and/or damage.
- Remove debris around bearing platforms.
- Conduct a complete walk-around inspection of the chipper and visually check for loose bolts or fasteners.
- Check the quality of the chips that are being produced.

Weekly Maintenance *(50 Hours)*

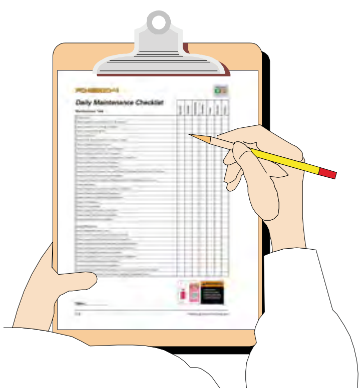
Perform these maintenance functions **every 50 hours**, or on a weekly basis.

- Inspect knife holders and counter knives for signs of wear or damage.
- Visually inspect hood, checking for signs of wear or possible holes.
- Visually check disc and base card breakers.
  (Bottom Discharge Chippers)
- Visually check fan blades, lower casing band and rim blades.
  (Top Discharge & End Discharge Chippers)

Monthly Maintenance *(250 hours)*

Perform these maintenance functions **every 250 hours**, or on a monthly basis.

- Visually check infeed spout, anvils, disc, and chipper base for excessive wear.
- Check hydraulic fluid level. Add if necessary.
  (Optional Hydraulic Hood Opener)



Use the daily checklist provided in *Appendix E - Service Log* to checkoff daily maintenance items as they are performed.

NOTE

- The overall performance of your chipper will be affected by the care and daily maintenance it receives. Follow the suggested maintenance intervals to ensure top performance for the chipper.
- **See *Section C - Engine & Service Manuals* for more maintenance information.**

6 Month Maintenance

Perform these maintenance functions every 6 months.

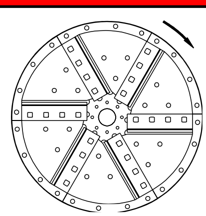
- Repack the front and rear bearings with grease.
- Check the disc brake pads and rotor for excessive wear. *(Optional Disc Brake)*

Maintenance Schedule Checklist

Maintenance Task	Daily (10 Hours)	First 10 Hrs. Then Every 50 Hrs.	Every 50 Hours	First 50 Hrs. Then Every 250 Hrs.	Every 250 Hours	Every 500 Hours	Every 6 months	Every 2000 Hours	As Required
Change or sharpen knives.	✓								✓
Reset knife width with knife gauge.	✓								✓
Clean out chip slot, removing any debris that may have collected around the knife assembly components.	✓								
Check knife points to horizontal and vertical anvil clearance.	✓								
Visually check knives, knife clamps, and wear plates for excessive wear and/or damage.	✓								
Remove debris around bearing platforms.	✓								
Conduct a complete walk-around inspection of the chipper and visually check for loose bolts and fasteners.	✓								
Check the quality of the chips that are being produced.	✓								
Inspect knife holders and counter knives for signs of wear or damage.			✓						
Visually inspect hood, checking for signs of wear or holes.			✓						
Visually check disc and base card breakers. *(Bottom Discharge Chippers)*			✓						
Visually check fan blades, lower casing band, and rim. blades. *(Top and End Discharge Chippers)*			✓						
Visually check infeed spout, anvils, disc, and chipper base for excessive wear.					✓				
Check hydraulic fluid level. Add if necessary. *(Optional Hydraulic Hood Opener)*					✓				✓
Check the disc brake pads and rotor for excessive wear. *(Optional Disc Brake)*						✓			
Repack the front and rear bearings.							✓		

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

Recommended Spare Parts List

It is suggested that you keep spare parts available at all times to avoid major machine downtime. The items on the following list are easy to replace and store and will keep you from losing time due to the possibility of unavailable parts. Check with Precision Husky for parts availability and prices.

NOTE

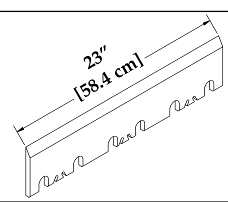
For optimum performance and safety, use genuine Precision Husky replacement parts and accessories. **Replacement parts and accessories by other manufacturers could be dangerous and will void the product warranty.**

⚠ CAUTION

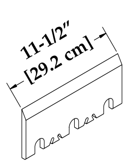
Do not use non-Precision Husky knives, counter knives, knife clamps, or knife holders in the chipper. Knife assemblies can come apart causing serious damage to the chipper or personal injury to operators and bystanders.

NOTE

Knife assembly components are available in full or half length.



75" Chipper Full Length Knife. One used in each knife assembly.



75" Chipper Half Length Knife. Two used in each knife assembly.

Part Number	Description	Quantity
	75"[1.9 M] CHIPPER	
235 750 022	Chipper Knives - Full Length	3 Sets
235 750 008	Counter Knives - Full Length	1 Set
See Section B	Wear Plates	1 Set
237 750 176	Knife Clamp - Full Length	1
237 750 148	Feed Plate, R.H	1
235 750 027	Standard Horizontal Anvil	1
235 000 021	Standard Vertical Anvil	1
	84"[2.1 M] CHIPPER	
235 840 022	Chipper Knives - Full Length	3 Sets
235 840 008	Counter Knives - Full Length	1 Set
See Section B	Wear Plates	1 Set
237 840 176	Knife Clamp - Full Length	1
237 000 071	Feed Plate, R.H.	1
235 000 026	Standard Horizontal Anvil	1
235 000 021	Standard Vertical Anvil	1
	96"[2.4 M] CHIPPER	
235 960 022	Chipper Knives - Full Length	3 Sets
235 960 008	Counter Knives - Full Length	1 Set
See Section B	Wear Plates	1 Set
237 960 141	Knife Clamp - Full Length	1
237 000 071	Feed Plate, R.H.	1
235 000 026	Standard Horizontal Anvil	1
235 000 021	Standard Vertical Anvil	1
	112"[2.8 M] CHIPPER	
235 120 008	Chipper Knives - Half Length	3 Sets
235 120 001	Counter Knives - Half Length	1 Set
See Section B	Wear Plates	1 Set
237 120 108	Knife Clamp - Half Length	1
237 120 078	Feed Plate, R.H.	1
235 000 028	Standard Horizontal Anvil	1
235 120 015	Standard Vertical Anvil	1
	118"[3.0 M] CHIPPER	
235 160 008	Chipper Knives - Half Length	3 Sets
235 160 001	Counter Knives - Half Length	1 Set
See Section B	Wear Plates	1 Set
237 160 001	Knife Clamp - Half Length	1
237 160 010	Feed Plate, R.H.	1
235 000 028	Standard Horizontal Anvil	2
235 160 015	Standard Vertical Anvil	1

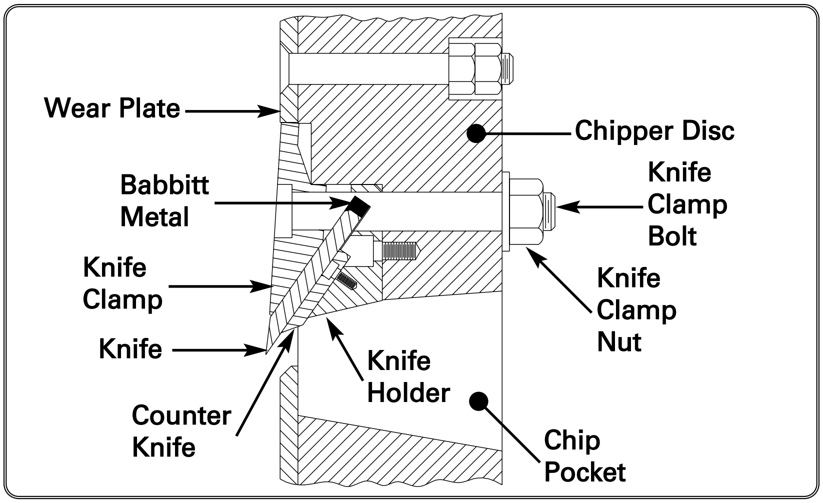
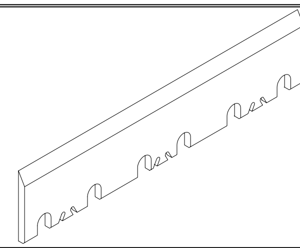


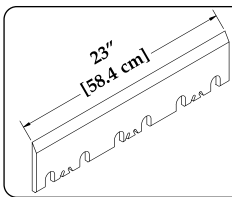
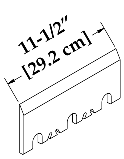
Figure 4.6-A. 84"[2.1 m] Roundwood Chipper Knife Assembly.
The illustration to the right is a cross sectional view of the chipper knife assembly.

Knives

Figure 4.6-B. Standard Knife for a 75"[1.9 m] Roundwood Chipper.
When operating the chipper periodically stop the chipper and check the knives. Their condition helps determine the units overall productivity.



The knives and the anvils are the major components of the chipper. They are responsible for producing the material output *(chipping of the wood)*. When the knives become dull they should be resharpened.

> **NOTE**
>
> Knife assembly components are available in full or half length.
>
> 
>
>
> **75"[1.9 m] Chipper Full Length Knife. One used in each knife assembly.**
>
> 
>
>
> **75"[1.9 m] Chipper Half Length Knife. Two used in each knife assembly.**

> **CAUTION**
>
> Tramp metal can cause considerable damage to the various components of the chipper. This is why it is important to use a metal detector to screen out the tramp metal before it is fed into the chipper.

Knife Conditions

The life of a chipper knife is determined by the time and care spent in keeping the cutting edge sharp. Its life between regrinds and the quality of work it produces depends largely on the care taken in resharpening.

Maintenance of the chipper knives should be a high priority to add longer life and superior performance, which in turn lowers cost. The knife is no better than its cutting edge.

Conditions that can cause frequent resharpening of the knives:

- Stopping the chipper before the material being fed has been completely chipped.
  This allows the knives to rub against the unfed material until the disc completely stops.
- Use of incorrect cutting angles and bevels.
- Poor grinding procedures.
- Tramp metal or excessive dirt or grit among the material being fed to the chipper.
- Knife to anvil clearance is incorrect.
- Wire or feather edge left by knife grinder was not removed after sharpening.

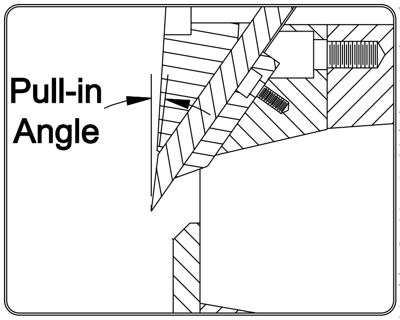


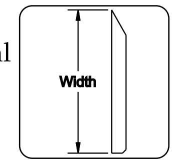
Figure 4.7-A. Pull-in Angle.
The pull-in angle is the angle formed between the knife edge and an imaginary line parallel to the face of the disc starting at the knife point. This angle causes the material fed to the chipper to be pulled toward the disc.

When the knives are becoming dull you should see an increased production of fines and/or have feeding problems. This is because as the material being chipped wears down the knife tip, the pull-in angle is reduced. As the pull-in angle nears 0° the material being chipped is not pulled in far enough, resulting in smaller chips.

NOTE

Hand honing dull knives while they are still in the chipper can sometimes gain you a few more hours of operation.

The width of a standard new knife is approximately **5 inches[12.7 cm]**. The knives can be sharpened several times, but once the width of a knife has been reduced to less than **3-1/8 inches[7.9 cm]** it must be discarded.



Sharpening the Knives

If the material you are chipping is excessively hard, dry, or knotty you should try counter grinding the knives *(Step 3)*. This can on some occasions increase the length of time before the knife has to be resharpened. The proper counter grind setting for your particular situation is best determined by experimenting with the different allowable angles and lengths and taking note of the results.

TO SHARPEN THE KNIVES:

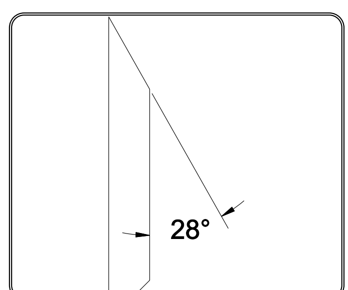
The materials/tools required to complete this procedure are:
- Knife grinder
- 1 set of knives
- Hone

NOTE

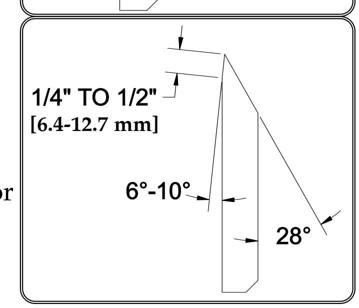
- Knives should be kept together in a set.
- Knives will tend to wear equally and require resharpening as a set.
- Installing knives that vary in width can unbalance the disc which can reduce the life of the bearings.
- More knives are ruined by excessive heat than any other cause. Excessive heat can be caused by excessive grinding speed, insufficient cooling, and/or the grinding wheel being too hard.

1. Follow instructions for setting up knife grinder and set grinding angle to **28°**.

2. Sharpen all knives, maintaining the **28°** grinding angle. When sharpening, the knives should be kept as close as possible to the same width.



3. **THIS STEP IS OPTIONAL.** Change the knife grinder grinding angle and counter grind knives. The counter grind angle can vary from **6-10°** and from **1/4" - 1/2"[6.4-12.7 mm] long**.



4. When grinding is completed, use a hone to remove a possible wire or feather edge left by the knife grinder.

Knife Gauge

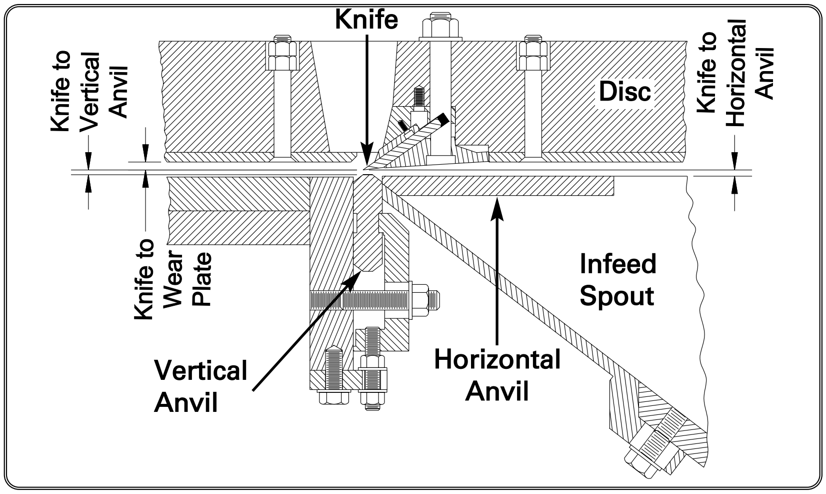


Figure 4.8-A. The Chipping Area on a 84″[2.1 m] Roundwood Chipper. The illustration to the right, is a cross sectional view of the chipping area on a roundwood chipper.

The distance from the knife points to the wear plates and anvils must remain fixed, in order to maintain a consistent chip size. This is why after every sharpening, the width of the knives must be reset with the babbitt knife gauge.

Babbitt Knife Gauge

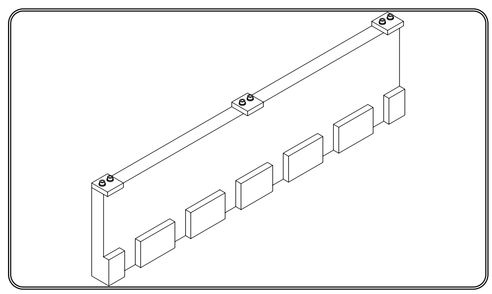


Figure 4.8-B. Babbitt Knife Gauge for a 96″[2.4 m] Roundwood Chipper.

Setting the Knife Width with the Babbitt Knife Gauge

TO SET THE WIDTH OF A KNIFE WITH THE BABBITT KNIFE GAUGE:

The materials/tools required to complete this procedure are:

- Cleaning rag
- Babbitt knife gauge and accompanying hardware
- Gloves and face protection
- Torch
- 1 set of knives
- Melted babbitt metal
- Babbitt pouring ladle
- File

1. Clean the knife and knife gauge with a rag.
   This removes any dirt or grit that could get between the knife and the knife gauge and result in a non-uniform setting.

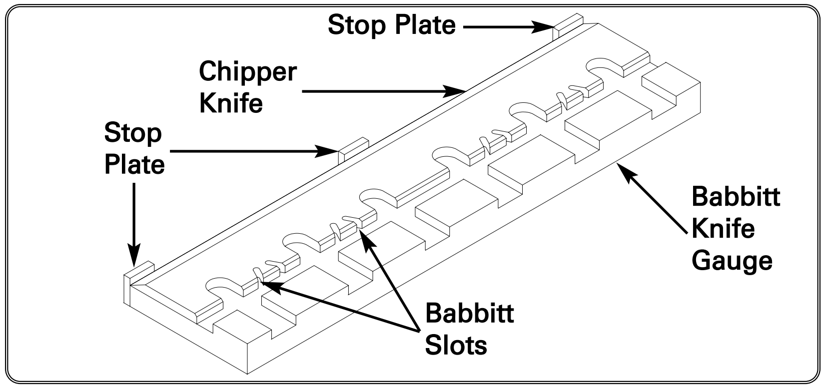
2. Remove any existing babbitt metal from the chipper knife.
   This material may be melted and reused.

3. Preheat the knife gauge and all babbitting hardware with torch.

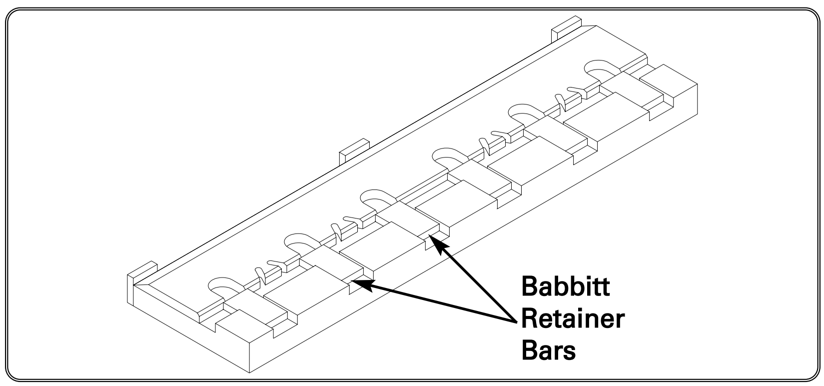
NOTE

- When the width of a standard knife has been reduced to less than **3-1/8"[7.9 cm]** it must be discarded.
- A cold babbitt gauge can cause the babbitt to harden before it has a chance to properly flow into the cavities, resulting in a weak joint.

4. Place the knife in the knife gauge as shown with the point against the stop plates.



5. Place babbitt retainer bars in the slots in the knife gauge and slide them all the way against chipper knife.

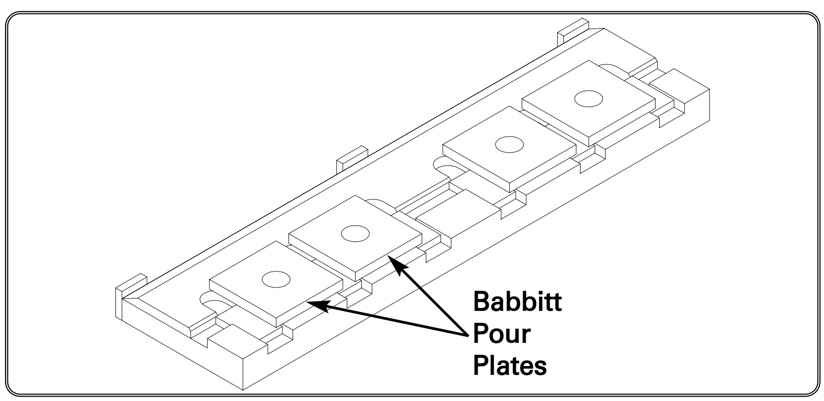


CAUTION

Babbitt pouring is a hazardous operation, the following procedures must be followed:

- Use face protection and gloves at all times.
- Adequate ventilation must be provided to prevent inhalation of fumes.
- Do not let any moisture to come in contact with molten babbitt. *(Will explode.)*
- To prevent possible lead injestion, wash hands thoroughly after handling babbitt.

6. Place babbitt pour plates with the largest hole facing up, just below babbitt slots and between the two babbitt retainer bars.



7. Use pouring ladle to pour the melted babbitt metal through the hole in the babbitt pour plates.

8. Let knife and babbitt metal cool.

9. Remove knife from knife gauge.

10. Use a file to clean up the knife, removing any excess babbitt metal.

Changing the Knives

Under normal operating conditions the knives should be changed at least once a day, and more often when the volume of material or foreign matter dull the knives. Be sure to thoroughly clean out the chip pocket, and remove any debris that may have collected around the knife assembly components with each change.

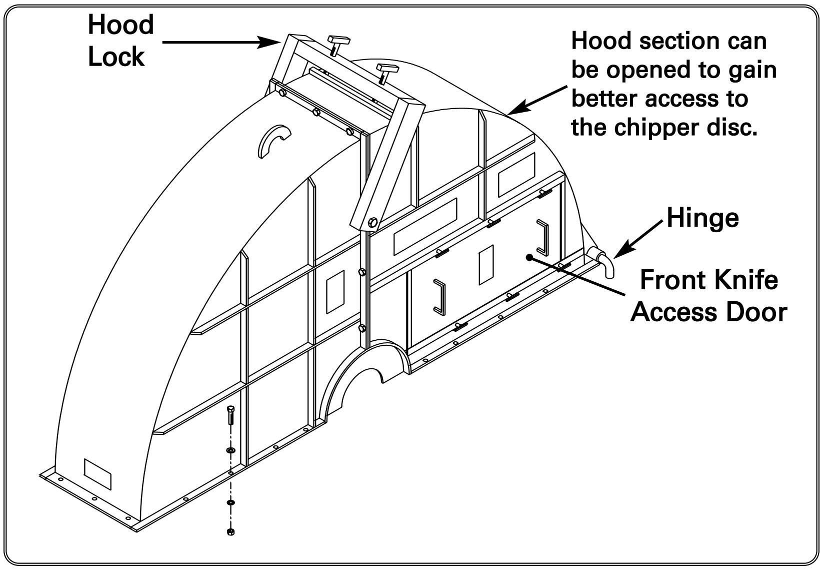


Figure 4.11-A. Chipper Hood for a 112"[2.8 m] Roundwood Bottom Discharge Chipper.

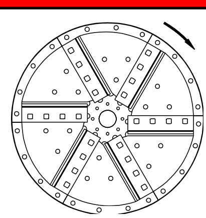
DANGER

Half of the chipper hood can be opened to gain better access to the chipper disc. Adhere to following safety rules if you need to open the hood:

- **NEVER OPEN HOOD WHILE DISC IS TURNING.**
- **ALWAYS REPLACE ALL FASTENERS THAT JOIN THE TWO SECTIONS OF HOOD TOGETHER AND THAT ATTACH HOOD TO BASE.**
- **NEVER OPERATE CHIPPER WITHOUT HOOD LOCK SECURED.**

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

Changing the Chipper Knives

TO CHANGE THE CHIPPER KNIVES:

The materials/tools required to complete this procedure are:

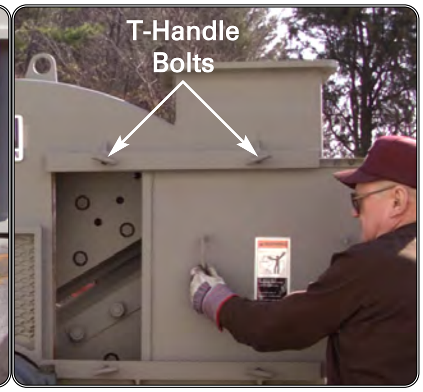
- 1 set of sharpened and gauged knives
- Lock and tag
- 1 set of wrenches
- Wooden wedge
- Air impact wrench and socket set
- Air compressor and air hose
- Short piece of wood
- 1 extra person
- Torque wrench
- Feeler gauge

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.

3. Lockout/Tagout chipper power source.

4. Loosen the t-handle bolts and remove the front and rear knife access doors.

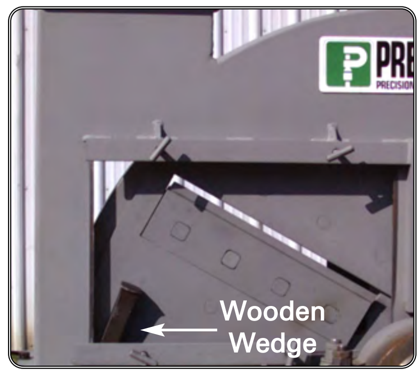


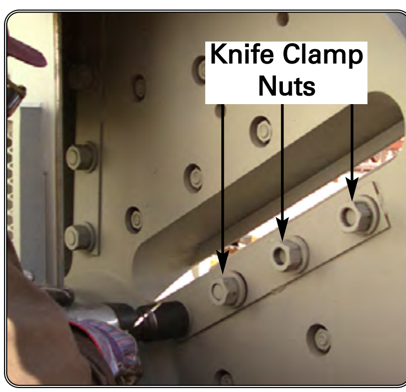
> **⚠ CAUTION**
>
> - When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
> - Secure chipper disc before removing any attached components.
> - Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.

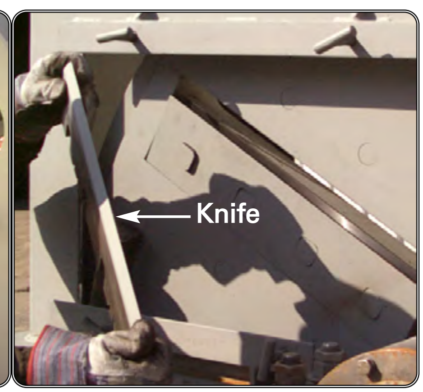
5. Rotate disc until knife is in an easily accessible position.

6. Secure disc in place by inserting wooden wedge in the space between the chipper disc and the hood.

7. Use an air impact wrench to loosen the knife clamp nuts. *It is not necessary to remove them.*

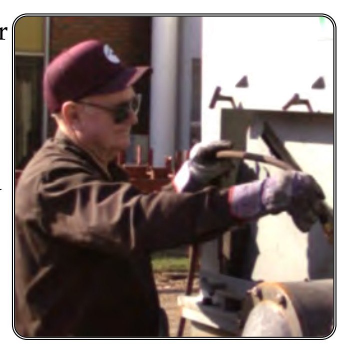






8. **Full Length Knives:** Remove chipper knife.
   Half Length Knives: Remove both half knives.

9. Using compressed air, clean out any debris that may have collected around the components of the knife assembly.



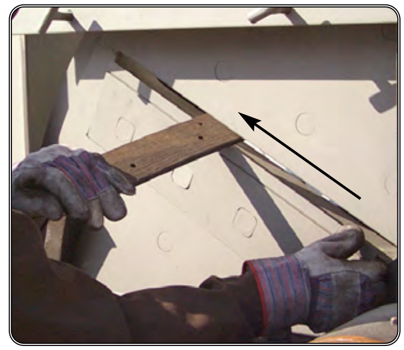
NOTE

- Installing knives that vary in width in the chipper can unbalance the disc which can reduce the life of the bearings.

- The heads of the knife clamp bolts are tapered to sit flush with the knife clamp. Be sure that they are oriented correctly before tightening the stud nuts. *See Figure 4.5-A 84"[2.1 m] Chipper Knife Assembly.*

10. Inspect knife assembly components for wear. Replace if necessary.

11. **Full Length Knives:** Place a newly sharpened and gauged knife between the knife clamp and the counter knife.
    Half Length Knives: Place a newly sharpened and gauged half knife between the knife clamp and the counter knife.



12. Push the knife toward the outside rim of the chipper disc. Place the short piece of wood into the chip slot and press down on the end to hold the knife in place.

13. While holding the knife in position, have another person use the air impact wrench to tighten the knife clamp nuts.

14. **Full Length Knives:** Remove the short piece of wood and torque the knife clamp nuts.
    Half Length Knives: Remove the short piece of wood and torque the knife clamp nuts, then repeat the previous three steps using the other half knife to complete the assembly.

15. Remove wooden wedge.

16. Repeat the previous eleven steps, until all knives have been replaced.

17. Using a feeler gauge check the clearance between the knives and the horizontal and vertical anvils *Refer to the sections entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance and Setting the Horizontal Anvil to Knife Clearance.*

⚠ CAUTION

Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils.
If any one knife is below the allowable tolerance damage to anvils or knives could occur.

WARNING

Never operate chipper without all access doors closed and secured.

CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

18. Replace front and rear access doors and tighten the t-handle bolts.

Knife to Anvil Settings		
Chipper Size	Vertical Anvil to Knife Clearance	Horizontal Anvil to Knife Clearance
75″ [1.9 m]	0.010″- 0.015″ [0.254-0.381 mm]	0.040″- 0.050″ [1.02-1.27 mm]
84″ [2.1 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
96″ [2.4 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
112″ [2.8 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]
118″ [3.0 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]

To produce acceptable chips both the vertical and horizontal anvils must be in good condition and set to an exact tolerance in relation to the knife points in the chipper. The vertical anvil can be adjusted by tightening or loosening the anvil clamp adjustment nuts. The horizontal anvil can adjusted by adding or removing the infeed spout shims. Use the graphic below and the chart to the left of the graphic to determine the correct settings for your chipper.

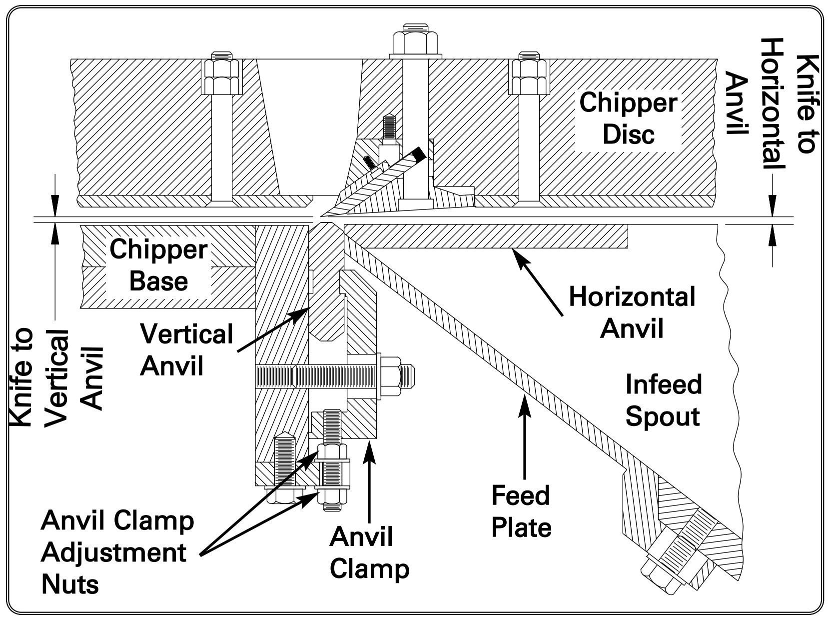
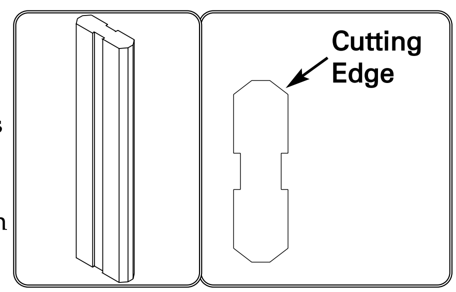


Figure 4.15-A. The Chipping Area on a 84″[2.1 m] Roundwood Chipper. The illustration to the right, is a cross sectional view of the chipping area on a roundwood chipper. Use the graphic and the chart above to determine the correct position of the vertical and horizontal anvils in relation to the knives.

Vertical Anvil

The vertical anvil is the adjustable steel block located between the base and the end of the feed plate, that provides a cutting surface for the chipper knives. The anvil has four useable cutting edges, so when a cutting edge becomes worn the anvil can be rotated.



Figures 4.15-B and 4.15-C. Standard 75″[1.9 m] Roundwood Chipper Vertical Anvil.

Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance

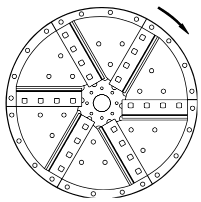
TO ROTATE THE VERTICAL ANVIL AND SET THE KNIFE TO ANVIL CLEARANCE:

The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- Feeler gauge
- Torque wrench
- 1 extra person.

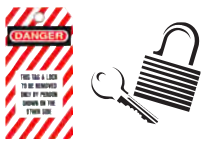
1. Shutdown chipper.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

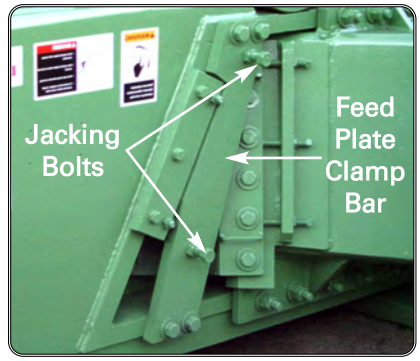


Lockout/Tagout power source before performing maintenance or operator adjustment.

NOTE

A worn anvil can cause an excessive production of oversize chips.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.



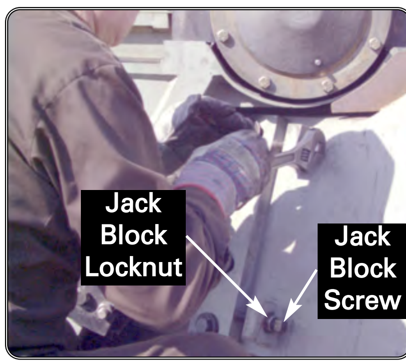
3. Lockout/Tagout chipper power source.

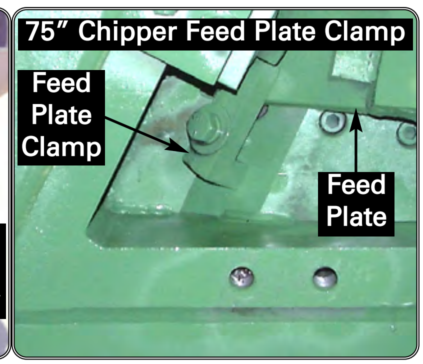
4. Loosen feed plate clamp bar jacking bolt locknuts and then the jacking bolts.

5. Remove feed plate clamp bar bolts and the feed plate clamp bar.

6. Loosen feed plate jack block locknuts.

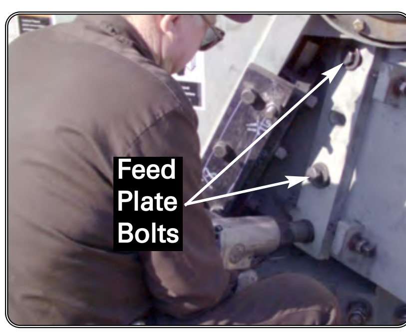
7. Loosen feed plate jack block screws.





8. **75″[1.9 m] & 112-118″[2.8-3.0 m] Chippers Only:**
   Remove feed plate clamp.

9. Remove feed plate bolts and washers.

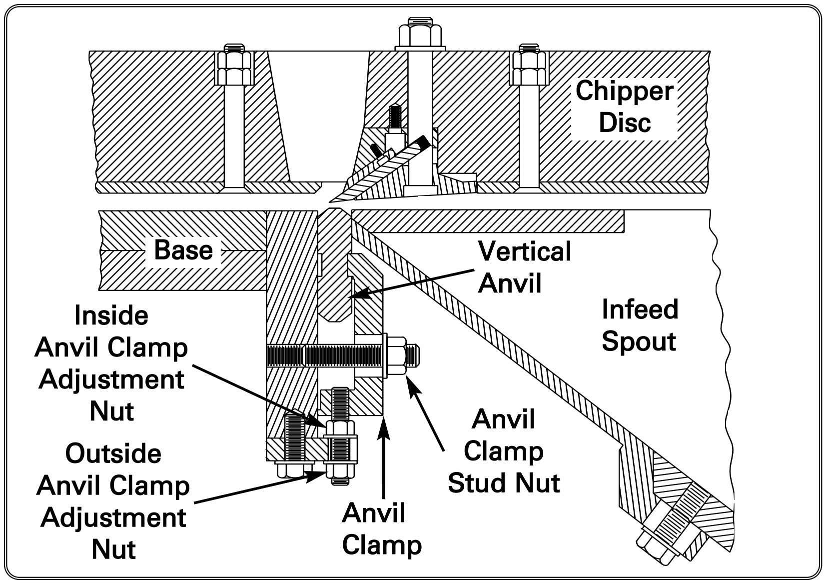


10. Remove feed plate.

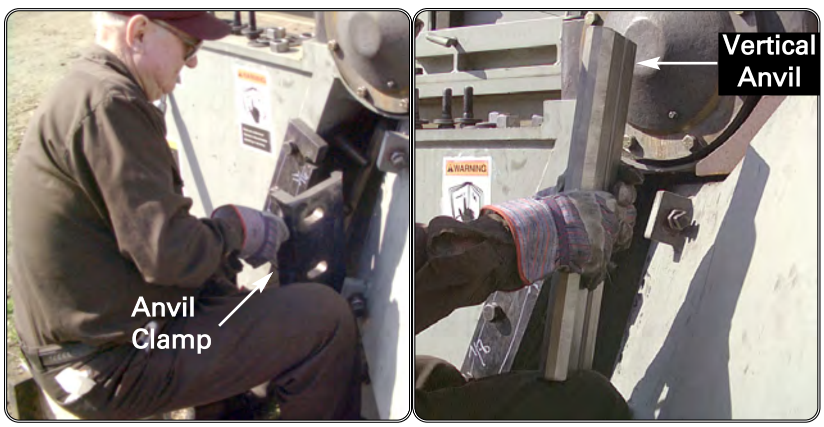
11. Remove anvil clamp stud nuts and washers.

12. Loosen outside anvil clamp adjustment nuts.

13. Loosen inside anvil clamp adjustment nuts.



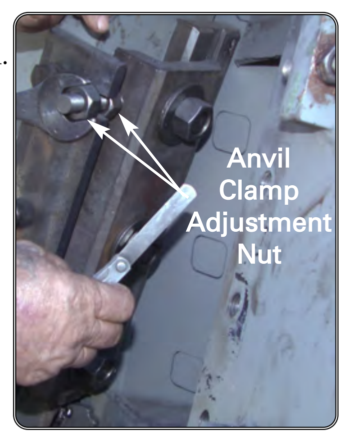
14. Remove anvil clamp and vertical anvil.



15. Rotate anvil to an unused edge, and place it back into position.

16. Replace anvil clamp, washers, and stud nuts.
    Leave nuts loose enough to adjust anvil position with anvil clamp adjustment nuts.

17. Using a feeler gauge, check clearance from the vertical anvil to the knife point.



NOTE

Both the vertical and horizontal anvils should be visually inspected when setting the knife to anvil clearance. When the edge of the anvil facing the knives becomes rounded, the anvil should be rotated to a useable cutting edge or replaced.

Knife to Anvil Settings

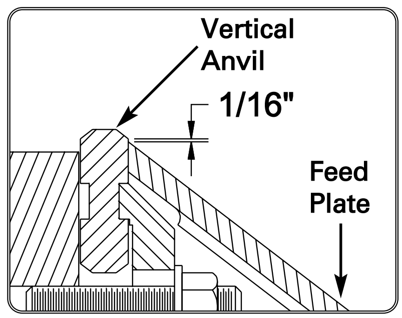
Chipper Size	Vertical Anvil to Knife Clearance	Horizontal Anvil to Knife Clearance
75″ [1.9 m]	0.010″- 0.015″ [0.254-0.381 mm]	0.040″- 0.050″ [1.02-1.27 mm]
84″ [2.1 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
96″ [2.4 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
112″ [2.8 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]
118″ [3.0 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]

> **⚠ CAUTION**
>
> - Always check the vertical anvil to knife clearance on all knives. **If the knife clearance is less than the allowable tolerance on any knife, possible damage to the knife or vertical anvil could occur.**
> - When rotating the chipper disc always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.

18. Using the anvil clamp adjustment nuts, adjust anvil position until clearance between anvil and knives is within the allowable tolerance.
    Check knife point to anvil clearance at top & bottom of anvil and check all knives.

19. Torque anvil clamp stud nuts.

20. Replace feed plate and use feed plate jacking bolts to position feed plate approximately **1/16"[1.6 mm]** from anvil edge.
    To determine if the feed plate is properly aligned you will have to look through the end of the infeed spout.



21. **75"[1.9 m] & 112-118"[2.8-3.0 m] Chippers Only:**
    Replace feed plate clamp.

22. Replace the feed plate clamp bar and tighten the feed plate clamp bar jacking bolts.

23. Tighten the feed plate jacking bolt locknuts and the feed plate clamp bar locknuts to lock feed plate in position.

24. Torque feed plate bolts.

> **⚠ CAUTION**
>
> Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

Horizontal Anvil

The horizontal anvil is the fixed steel block that sits between the chipper infeed spout and the chipper disc, and functions as a cutting surface for the knives. The anvil has two useable cutting edges, so when an edge becomes worn the anvil can be rotated.

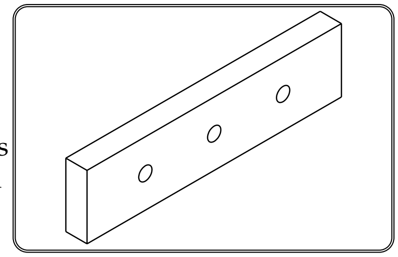


Figure 4.19-A. Standard 84"[2.1 m] Roundwood Chipper Horizontal Anvil.

NOTE

THE HORIZONTAL ANVIL IS AN OPTIONAL COMPONENT ON THE FOLLOWING MACHINES: **WTC-1858, WTC-2366, WTC-2675, & WTC-3084.**

Before attempting this procedure make sure that you have read and understand the concepts in the following sections: *Changing the Knives and Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.*

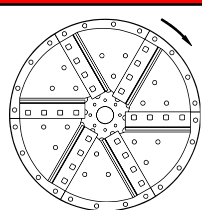
Rotating the Horizontal Anvil

NOTE

Rotating the horizontal anvil more than once, can allow material to pack in the gap between the worn anvil edge and the infeed spout.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

TO ROTATE THE HORIZONTAL ANVIL:

The materials/tools required to complete this procedure are:

- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- Feeler gauge
- Torque wrench
- 1 extra person
- 1 set of allen wrenches
- Wooden wedge

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.

3. Lockout/Tagout chipper power source.

4. Remove feed plate clamp bar.
   See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

5. Remove the feed plate.
   See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

6. Remove the vertical anvil clamp and the vertical anvil.
   See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

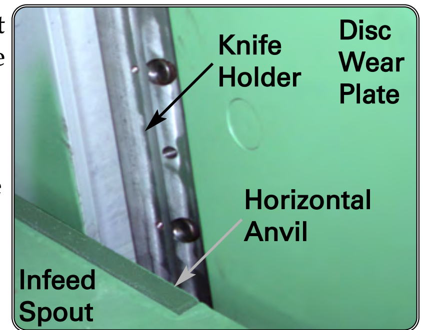
7. Remove one full length knife or two half knives from a knife assembly.
   See the section entitled Changing the Knives.

⚠ CAUTION

- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Secure chipper disc before removing any attached components.
- Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.

8. **Full Length Knife Clamps:** Remove the knife clamp nuts and the knife clamp.
   Half Length Knife Clamps: Remove the knife clamp nuts and both half knife clamps.

9. Turn the disc until the pocket where you removed the knife and the knife clamp is in front of the horizontal anvil.



View looking through infeed spout.

10. Use wooden wedge to secure the disc with the missing knife positioned in front of the horizontal anvil
    See the section entitled Changing the Knives.

NOTE: 118"[3.0 M] CHIPPERS HAVE TWO VERTICAL ANVILS. COMPLETE STEPS 11, 12, AND 13 FOR ONE OF THE ANVILS THEN REPEAT THE STEPS FOR THE SECOND ANVIL

11. Remove all but one of the horizontal anvil bolts.

12. Take hold of horizontal anvil, to keep it from falling into base and then remove last horizontal anvil bolt.

13. Remove horizontal anvil and replace it and anvil bolts with worn cutting edge of anvil facing the ground.

14. Replace knife or knives and knife clamp(s).

15. Torque knife clamp nuts.

16. Using a feeler gauge, check that clearance between knife point and horizontal anvil is within tolerance. Reset, if necessary.
    See the section entitled Setting the Horizontal Anvil to Knife Clearance.

NOTE

Rotating the horizontal anvil more than once, can allow material to pack in the gap between the worn anvil edge and the infeed spout.

⚠ CAUTION

Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils.
If any one knife is below the allowable tolerance damage to anvils or knives could occur.

WARNING

Never operate chipper without all access doors closed and secured.

17. Replace front and rear knife access doors and tighten the t-handle bolts.

18. Set vertical anvil to knife clearance.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

19. Torque anvil clamp stud nuts.

20. Replace feed plate, and correctly align with feed plate jack block bolts.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

CAUTION

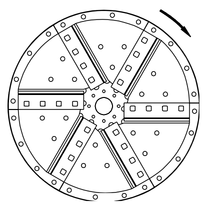
Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

21. Replace feed plate clamp bar.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

Setting the Horizontal Anvil to Knife Clearance

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

Knife to Anvil Settings		
Chipper Size	Vertical Anvil to Knife Clearance	Horizontal Anvil to Knife Clearance
75″ [1.9 m]	0.010″- 0.015″ 0.254-0.381 mm	0.040″- 0.050″ 1.02-1.27 mm
84″ [2.1 m]	0.015″- 0.020″ 0.254-0.381 mm	0.050″- 0.060″ 1.27-1.52 mm
96″ [2.4 m]	0.015″- 0.020″ 0.254-0.381 mm	0.050″- 0.060″ 1.27-1.52 mm
112″ [2.8 m]	0.025″- 0.030″ 0.635-0.762 mm	0.070″- 0.080″ 1.78-2.03 mm
118″ [3.0 m]	0.025″- 0.030″ 0.635-0.762 mm	0.070″- 0.080″ 1.78-2.03 mm

NOTE

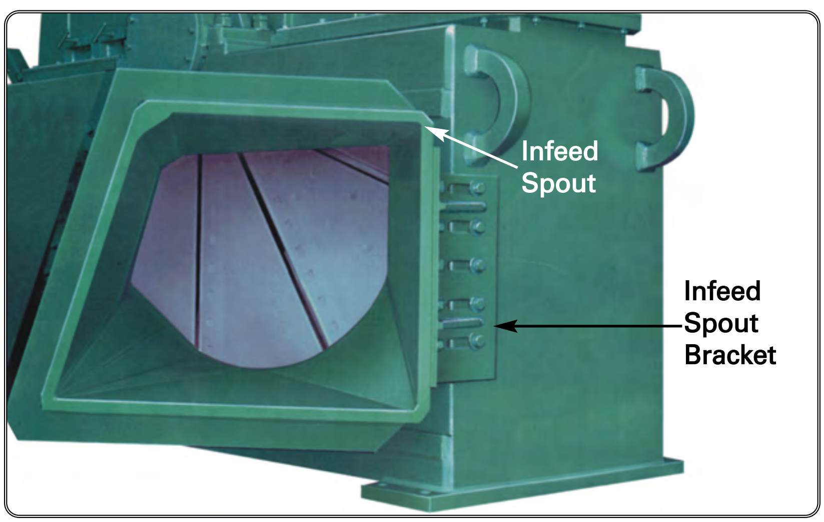
THE HORIZONTAL ANVIL IS AN OPTIONAL COMPONENT ON THE FOLLOWING MACHINES:
WTC-1858, WTC-2366, WTC-2675, & WTC-3084.

TO SET THE HORIZONTAL ANVIL TO KNIFE CLEARANCE:

The materials/tools required to complete this procedure are:

- Lock and tag
- 1 set of wrenches
- Feeler gauge
- 1 set of spout shims
- Pry Bar

1. Shutdown chipper.
2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.
3. Lockout/Tagout chipper power source.
4. Remove feed plate clamp bar and feed plate.
   See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.
5. Using a feeler gauge, check clearance between horizontal anvil and chipper knife point.
6. Compare the measurement you took in the previous step to the correct knife to horizontal knife setting for your chipper. If the measurement is within tolerance skip the remaining steps, no adjustment is necessary.
7. Remove the top and bottom infeed spout stud jam nuts.
8. Loosen the top and bottom infeed spout stud nuts.
9. **84″ - 118″ Chippers Only: [2.1 -3.0 m]** Remove infeed spout bracket bolts then the bracket.



Knife to Anvil Settings		
Chipper Size	Vertical Anvil to Knife Clearance	Horizontal Anvil to Knife Clearance
75″ [1.9 m]	0.010″- 0.015″ [0.254-0.381 mm]	0.040″- 0.050″ [1.02-1.27 mm]
84″ [2.1 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
96″ [2.4 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
112″ [2.8 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]
118″ [3.0 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]

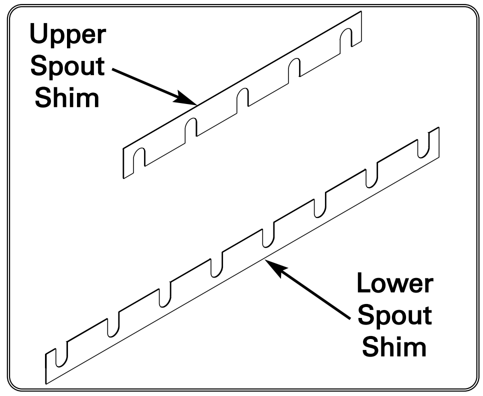
CAUTION

- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Always check the knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. **If any one knife is below the allowable tolerance damage to anvils or knives could occur.**

CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

10. Use pry bar to move infeed spout away from chipper base. Add or remove an equal amount of upper and lower spout shims until the clearance between the knives and the horizontal anvil is within the allowable tolerance.
    The spout shims come in three different widths:



16gage = 0.059″[1.52 mm] 22gage = 0.029″[0.76 mm] 28gage = 0.014″[0.38 mm]

Example:
75″[1.9 m] Chipper

A. The measurement taken in Step 5 = 0.030″[0.762 mm]

B. The knife to anvil clearance chart shows that the clearance should be **0.040-0.050″[1.02-1.27 mm]**
Compare 0.030″[0.762 mm] to **0.040-0.050″[1.02-1.27 mm]**.
0.040″ - 0.030″[**1.02 mm**-0.762 mm] = 0.010″[0.25 mm]
0.050″ - 0.030″[**1.27 mm**-0.762 mm] = 0.020″[0.508 mm]
Because 0.030″[1.27 mm] is less than **0.040-0.050″[1.02-1.27 mm]** the vertical anvil will need to move 0.010″-0.020″[0.25-0.508 mm] away from the knives.

C. Compare the distance the horizontal anvil will need to move to the width of the spout shims. The 28 gage spout shim is within the allowable range (0.010″-0.020″)[0.25-0.508 mm] that the vertical anvil needs to move.

D. Add one 28 gage upper and lower spout shim between the infeed spout and the chipper base.

11. Tighten infeed spout stud nuts.

12. Replace and tighten infeed spout stud jam nuts.

13. Recheck the horizontal anvil to knife point clearance to be sure that it is within the allowable tolerance.

14. Replace feed plate correctly align it with feed plate jack block bolts and clamp bar jacking bolts.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

15. Replace feed plate clamp bar.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

Wear Plates

The wear plates shield the front of the disc from incoming material preventing wear on the surface of the disc. They also help control chip size by maintaining the proper size chip pocket opening.

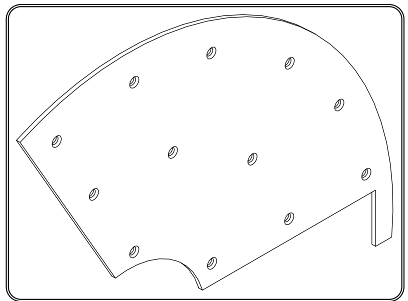


Figure 4.24-A. Standard 75"[1.9 m] Roundwood Chipper 3 Knife Wear Plate.

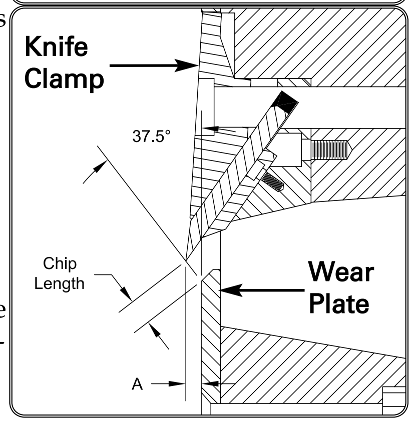
Wear Plate Conditions

As the thickness of the wear plates decrease due to wear, incoming material is allowed to feed farther and farther forward toward the chip pocket before it is struck by the knife, resulting in larger and larger chips.

NOTE

Worn wear plates can cause the production of an excess amount of over size chips.

The illustration to the right shows the cut size or "A" dimension. The chart below list what the measurement should be in order to produce the various sizes of chips.



CHIP LENGTH	DIMENSION A
5/8"[1.6 cm]	0.406"[1.031 cm]
3/4"[1.9 cm]	0.477"[1.212 cm]
7/8"[2.2 cm]	0.548"[1.392 cm]
1"[2.5 cm]	0.619"[1.572 cm]

Replacing the Wear Plates

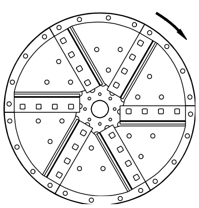
Replacing the Chipper Wear Plates

TO REPLACE THE CHIPPER WEAR PLATES:

The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- 1 new set of wear plates
- Crane

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown. To confirm disc is stopped, visually check disc shaft or drive wheel.

WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

CAUTION

- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Secure chipper disc before removing any attached components.
- Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.
- Always check the knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.

DANGER

NEVER OPERATE CHIPPER WITH MISSING HOOD BOLTS.

CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

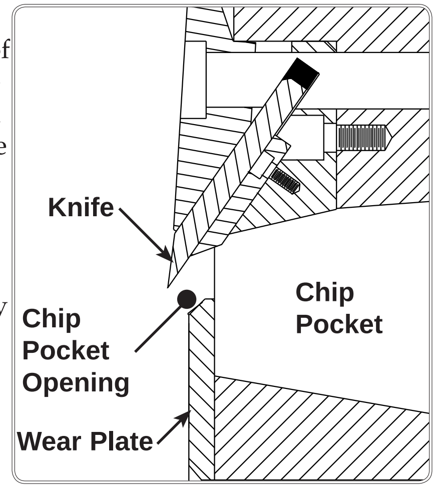
3. Lockout/Tagout chipper power source.

NOTE: FOR TOP DISCHARGE CHIPPERS IT WILL BE NECESSARY TO DETACH BLOW PIPE FROM CHIPPER HOOD AND MOVE BLOW PIPE OUT OF THE WAY BEFORE PROCEEDING.

4. Remove all bolts securing hood to base.
5. Remove hood from base.
6. Align disc so wear plate can easily be removed.
7. Secure chipper disc.
8. Remove all jam nuts from wear plate.
9. Remove all but two wear plate nuts and studs.
10. Loosen the remaining two nuts and attach crane to wear plate.
11. Remove remaining studs and remove wear plate.
12. Place new wear plate against chipper disc with countersunk holes facing outward and line up bolt holes.
13. Place wear plate bolts through the holes in the wear plate and chipper disc.
14. Replace wear plate nuts and tighten them.
15. Replace wear plate jam nuts and tighten them.
16. Repeat the previous 9 steps until all wear plates are replaced.
17. Replace hood.
18. Replace all fasteners that secure hood to base.

The size of the chip pocket opening determines the length of the chips that are produced. The size of this opening is controlled by the width of the knife and the amount the wear plate extends into the opening of the chip pocket.

The knife gauge has been factory set for the chip length you requested. You should not need to adjust this setting unless you want to change the length of the chips your chipper produces.



Adjusting the Knife Gauge for Different Chip Lengths

TO ADJUST THE KNIFE GAUGE FOR DIFFERENT CHIP LENGTHS:

The materials/tools required to complete this procedure are:

- Knife gauge
- 1 set of allen wrenches
- Knife gauge shims if increasing chip length
- Dial caliper or precision measuring instrument

1. Use the charts below to determine the new knife width for the length chips that you want to produce.

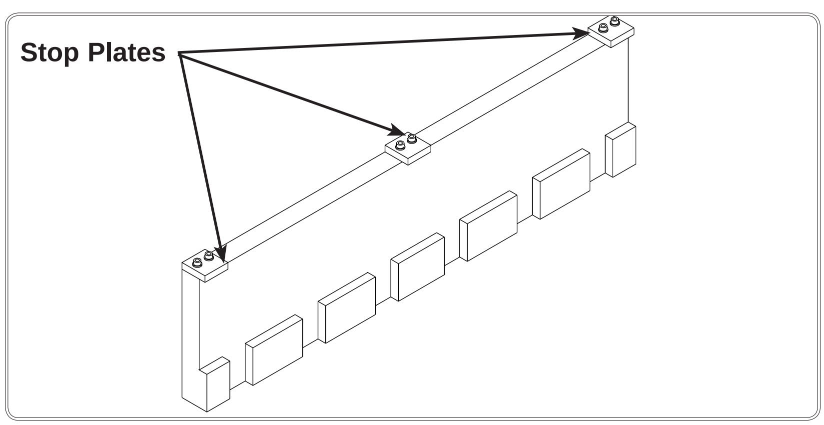
Figure 4.26-B. Knife Width Charts for the Various Chip Lengths.

Looking at the charts to the right, you can see that the width of the knife increases by 1/8" with each step up in chip size.

Knife Width for 75" - 84" Chippers with 1/2" Thick Wear Plates & Old Style 96" - 118" Chippers with 1/2" Thick Wear Plates				
Chip Size	5/8"	3/4"	7/8"	1"
Knife Width	5.135"	5.260"	5.385"	5.510"

Knife Width for 96" - 118" Chippers with 5/8" Thick Wear Plates				
Chip Size	5/8"	3/4"	7/8"	1"
Knife Width	5.353"	5.478"	5.603"	5.728"

2. Remove the two screws from one of the stop plates.



NOTE

Wear plates must be replaced or modified to change chip length. Call Precision Husky for information regarding modifying existing wear plates.

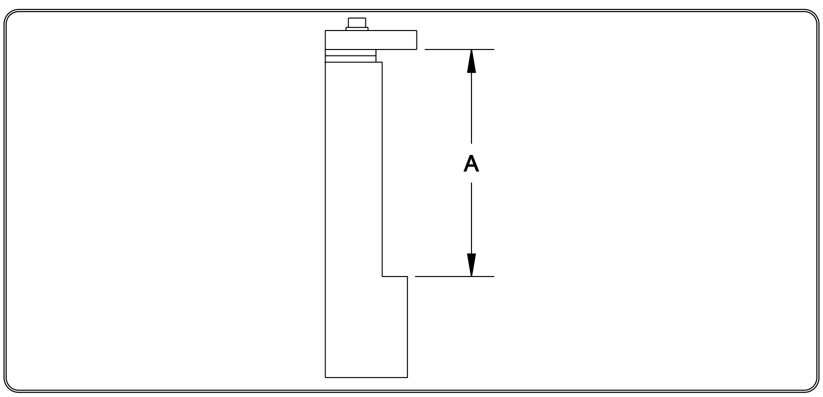
3. **If you are increasing the chip size:** Remove stop plate and add one 1/8″[3.18 mm] thick shim for each step up in chip size.

Example:
Original chip size: 5/8″[1.6 cm] 5.135″[13.043 cm] knife width
New chip size: 1″[2.5 cm] 5.510″[13.995 cm] knife width
3 steps up in chip size
three 1/8″[3.18 mm] thick shims added

If you are decreasing the chip size: Remove stop plate and remove one 1/8″[3.18 mm] thick shim for each step down in chip size.

Example:
Original chip size: 1″[2.5 cm] 5.510″[13.995 cm] knife width
New chip size: 5/8″[1.6 cm] 5.135″[13.043 cm] knife width
three steps down in chip size
three 1/8″[3.18 mm] thick shims removed

4. Replace stop plate.
5. Replace and tighten the screws.
6. Remove the screws from the other stop plate(s) and add or remove the same amount of shims as you did in Step 3.
7. Replace the stop plate(s).
8. Replace and tighten screws.
9. Use dial calipers or precision measuring instrument to measure distance “A” on your knife gauge to be sure that it matches the measurement listed in the chart. *Be sure to check distance “A” on each stop plate.*



Changing the Chip Length

NOTE

Increasing or reducing chip length will also affect the thickness of the chips that are produced. Increasing the chip length will increase chip thickness, reducing chip length will reduce chip thickness.

The knife gauge width, the clearance between the knives and the anvils, and the chip pocket opening have all been factory set to produce the length chips you specified when you ordered your chipper. If you decide to change the length of the chips that your chipper produces perform the procedure detailed below.

Before attempting to perform the following procedure, make sure that you understand the concepts in these sections: *Adjusting the Knife Gauge for Different Chip Sizes, Setting the Knife Width with the Knife Gauge, Changing the Knives, Replacing the Wear Plates, Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance, and Setting the Horizontal Anvil to Knife Clearance.*

TO CHANGE THE LENGTH OF THE CHIPS THAT YOUR CHIPPER PRODUCES:

The materials/tools required to complete this procedure are:

- Crane
- Feeler gauge
- Knife gauge
- Lock and tag
- Torque wrench
- 1 set of wrenches
- 1 set of allen wrenches
- 1 set of spout shims
- 1 spare set of knives
- Knife gauge shims if increasing chip length
- Dial calipers or precision measuring instrument
- 1 new set of wear plates or modify existing wear plates

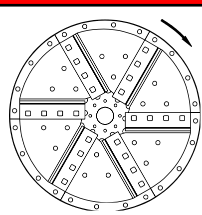
1. Set knife gauge width for new chip length.
   See the section entitled Adjusting the Knife Gauge for Different Chip Lengths.

2. Set knife width with knife gauge on spare set of sharpened knives.
   See the section entitled Setting the Knife Width with the Knife Gauge.

3. Shutdown chipper.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



4. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown. To confirm disc is stopped, visually check disc shaft or drive wheel.

WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

5. Lockout/Tagout chipper power source.

6. Remove all fasteners that secure hood to base.

7. Remove hood from base.

8. Remove feed plate clamp bar.
   See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance

9. Loosen anvil clamp stud nuts.
   If you are reducing the chip length, you can skip the next step.

10. **If lengthening the chips:**
    I. Back vertical anvil away from chipper knives with anvil clamp adjustment nuts.
    II. Loosen infeed spout stud jam nuts and nuts and move infeed spout slightly away from base.

11. Remove one knife or two half knives from a knife assembly.
    See the section entitled Changing the Knives.

12. Install a newly sharpened and gauged knife or two half knives.
    See the section entitled Changing the Knives.

13. Torque knife clamp nuts.

14. Repeat previous three steps, until all knives have been replaced.

15. Remove wear plates.
    See the section entitled Replacing the Wear Plates.

16. Install the newly purchased wear plates.
    Wear plates must be replaced or modified to change chip length. Call Precision Husky for information regarding modifying existing wear plates.

17. Remove feed plate.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

18. Set vertical anvil to knife clearance.
    See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance.

19. Torque anvil clamp stud nuts.

NOTE

Installing knives that vary in width in the chipper can unbalance the disc which can reduce the life of the bearings.

CAUTION

- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Secure chipper disc before removing any attached components.
- Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.
- Always check the knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. **If any one knife is below the allowable tolerance damage to anvils or knives could occur.**

⚠ DANGER

NEVER OPERATE CHIPPER WITH MISSING HOOD BOLTS.

⚠ CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

20. Set horizontal anvil to knife clearance.
    See the section entitled Setting the Horizontal Anvil to Knife Clearance.

21. Replace and tighten infeed spout nuts and jam nuts.

22. Replace feed plate and correctly align it with feed plate jack block bolts.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

23. Replace feed plate clamp bar.
    See the section entitled Rotating the Vertical Anvil and Setting the Knife to Anvil Clearance.

24. Replace hood.

25. Replace all fasteners that secure hood to base.

Counter Knives

The counter knife is found behind and is similar in appearance to the chipper knife. As the knife cuts through the material the counter knife breaks the chips into the desired length. They also help protect the knife holders by deflecting chips through the chip pocket away from the holders.

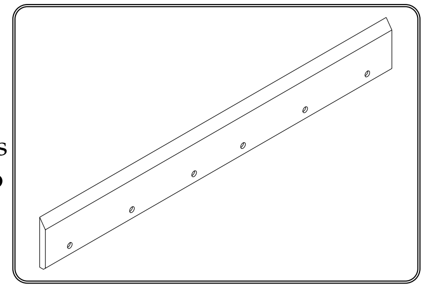


Figure 4.31-A. Standard 75”[1.9 m] Roundwood Chipper Counter Knife. To increase the life of this component Precision Husky also offers an optional hard surfaced counter knife.

Counter Knife Conditions

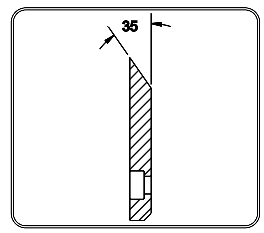
CAUTION

Using damaged or worn counter knives can cause clamping system to fail, allowing knives to break loose from disc while chipper is operating.

Worn counter knives can cause:

- Bruised chips
- Excessive wear on the knife holders
- The knife clamping system to fail
- Material to pack between the knife and the counter knife or between the counter knife and the knife holder or both.

Operating the chipper with worn counter knives is not only bad for chip quality, it can also be very dangerous. An excessively worn counter knife could allow the chipper knife to come loose from the chipper disc while it is running.



NOTE

Keeping sharp counter knives in the chipper can help minimize the production of fines and pin chips.

Counter knives should only be sharpened in the event of an accidental damage to the cutting edge. If they have to be sharpened, hold a grinding angle of **35°.**

Replacing the Counter Knives

Before attempting this procedure make sure that you have read and understand the concepts in the section: *Changing the Knives.*

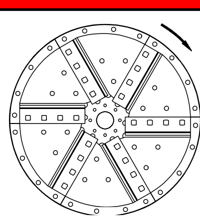
TO REPLACE THE COUNTER KNIVES:

The materials/tools required to complete this procedure are:

- Lock and tag
- 1 extra person
- Wooden wedge
- Short piece of wood
- Air impact wrench and socket set
- Feeler gauge
- Torque wrench
- 1 set of wrenches
- 1 set of allen wrenches
- Air compressor & air hose

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.

WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

CAUTION

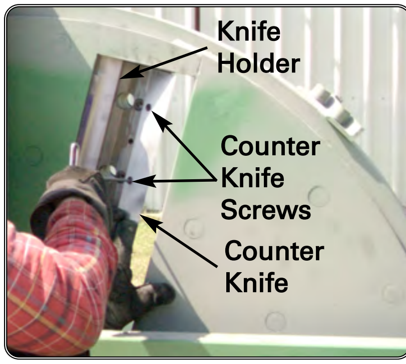
- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Secure chipper disc before removing any attached components.
- Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.

3. Lockout/Tagout chipper power source.

4. Remove one knife or both half knives from a knife assembly.
   See the section entitled Changing the Knives

5. **Full Length Knife Clamps:** Remove the knife clamp nuts and the knife clamp.
   Half Length Knife Clamps: Remove the knife clamp nuts and both half length knife clamps.
   See the section entitled Rotating the Horizontal Anvil.

6. Remove the counter knife screws.



7. **Full Length Counter Knives:** Remove the counter knife.
   Half Length Counter Knives: Remove both half length counter knives.

8. **Full Length Counter Knives:** Put the new counter knife into position & replace and torque the counter knife screws.
   Half Length Counter Knives: Put both new half length counter knives into position and replace & torque the counter knife screws.

9. **Full Length Knives:** Replace knife clamp and knife and torque knife clamp nuts.
   Half Length Knives: Replace both half knife clamps & half knives and torque knife clamp nuts.
   See the section entitled Changing the Knives

10. Repeat previous 6 steps until all counter knives have been replaced.

11. Set vertical and horizontal anvil to knife clearance.
   See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance and Setting the Horizontal Anvil to Knife Clearance.

CAUTION

- Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.
- Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

Knife Holders

The knife holders are the mounting base for the knife assemblies. The holders are firmly bolted in the chipper disc knife pocket, creating a strong foundation for the counter knives and the other components of the knife assembly.

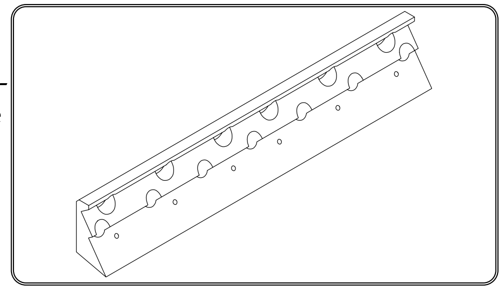


Figure 4.33-A. 75”[1.9 m] Roundwood Chipper Standard Knife Holder.

Knife Holder Conditions

NOTE

Worn counter knives can cause excessive wear on the knife holders.

The knife holders should be replaced when they begin to wear below the corner of the chip pocket, or material will begin to pack around this area, effecting chip quality. If you continue to operate the chipper after the holders have begun to wear below the the corner of the chip pocket, a rolled chip pocket will result. Rolled chip pocket is a term used to describe a chip pocket where the corner has been rounded off by exiting chips.

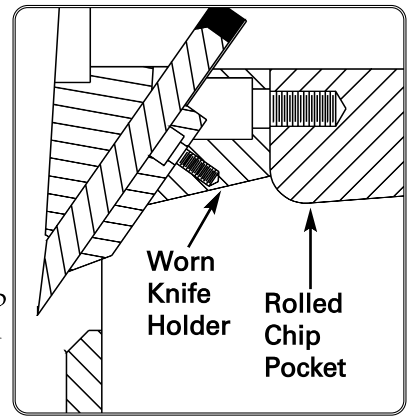


Figure 4.33-B. Rolled Chip Pocket.
A rolled chip pocket is caused by excessive knife holder wear and can only be repaired by a qualified serviceman.

Replacing the Knife Holders

Before attempting this procedure make sure that you have read and understand the concepts in the sections: *Changing the Knives and Replacing the Counter Knives.*

TO REPLACE THE KNIFE HOLDERS:

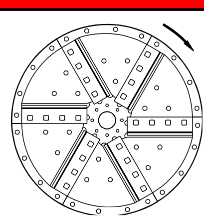
The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Wooden wedge
- Air impact wrench and socket set
- Air compressor and air hose
- 1 set of allen wrenches
- Short piece of wood
- 1 extra person
- Torque wrench
- Feeler gauge

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
Disc will continue to rotate after chipper is shutdown.
To confirm disc is stopped, visually check disc shaft or drive wheel.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



⚠ WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

⚠ CAUTION

- When rotating the chipper disc by hand always turn the disc backwards. This prevents the knife edge from causing accidental personal injury.
- Secure chipper disc before removing any attached components.
- Removing attached components from a free turning-disc will cause it to become unbalanced, and may cause the disc to rotate unexpectedly.

3. Lockout/Tagout chipper power source.

4. Remove one knife or two half length knives from a knife assembly.
   See the section entitled Changing the Knives

5. Remove the knife clamp nuts and the knife clamp or the two half length knife clamps.
   See the section entitled Replacing the Counter Knives.

6. Remove the counter knife or the two half length counter knives.
   See the section entitled Replacing the Counter Knives.

7. Remove the knife holder screws.

8. **Full Length Knife Holder:** Remove the knife holder.
   Half Length Knife Holder: Remove both half length knife holders.

9. **Full Length Knife Holder:** Line up holes in the knife holder with dowel pins in the chipper disc, and put the new knife holder into position and tighten the knife holder screws.
   Half Length Knife Holder: Line up holes in both knife holders with dowel pins in the chipper disc, and put both new half length knife holders into position and tighten the knife holder screws.

10. Replace counter knife, knife and knife clamp.

11. Repeat the previous 7 steps until all knife holders have been replaced.

12. Set vertical and horizontal anvil to knife clearance.
    See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance and Setting the Horizontal Anvil to Knife Clearance.

⚠ CAUTION

- Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.
- Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

Knife Clamps

The knife clamps are responsible for securing the chipper knives to the chipper disc. Tightening the knife clamp nuts compresses the knife between the knife clamp and the counter knife and the knife holder.

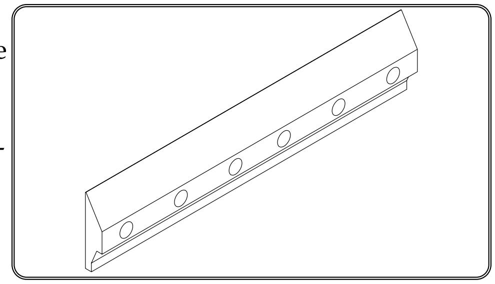


Figure 4.35-A. Standard 84”[2.1 m] Roundwood Chipper Knife Clamp.

⚠ CAUTION

Continued use of worn knife clamps could result in personal injury and/or property damage.

Knife Clamp Conditions

The knife clamps should be replaced immediately if they become worn or damaged. **Do not use worn or damaged knife clamps.**

Feed Plate

The feed plate is the removable steel plate, attached to the canted side of the infeed spout that directs incoming material toward the anvils.

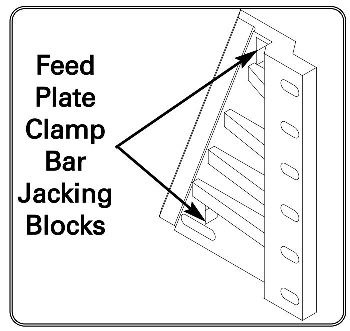


Figure 4.35-B. Standard 84”[2.1 m] Roundwood Chipper Feed Plate

Feed Plate Conditions

A worn feed plate can cause excessive wear on the vertical anvil. Chip quality is also effected, if the feed plate is unable to correctly hold the material being chipped against the vertical anvil.

Infeed Spout

The chipper infeed spout is the passage through which material is supplied to the chipper.

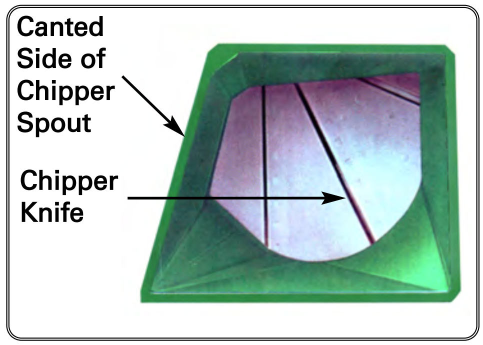
The chipper infeed spout is available in two different styles drop/gravity feed or horizontal feed.

Figures 4.36-A and 4.36-B. Infeed Spout.
The photographs to the right show the two types of available infeed spouts and their orientation.

Horizontal Infeed Spout

Drop or Gravity Feed Spout

Both infeed spout designs have a canted side. This design and the position of the knives causes a smooth slicing action. The cutting angle of the knife gives a gentle lift to the material as the knife passes the center line and begins the upward swing turning the material counterclockwise.



Bearings

The Precision Husky Roundwood Chippers use spherical roller bearings.

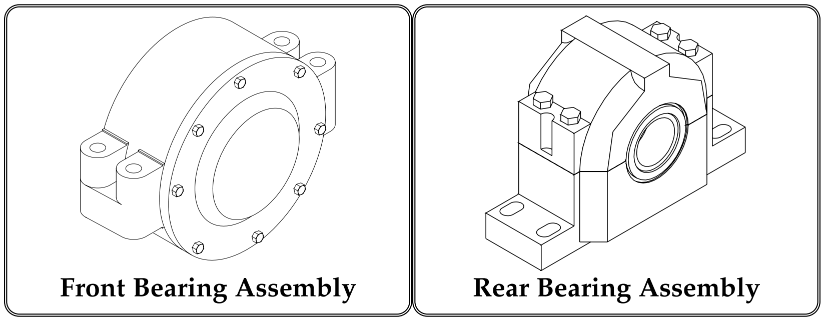


Figure 4.37-A. 96″[2.4 m] Roundwood Chipper Front and Rear Bearing Housings

Regularly scheduled maintenance is important to keep the operating level of the bearings functioning at an optimum level. Under normal operating conditions both the front and rear bearings should be relubricated every six months following this procedure.

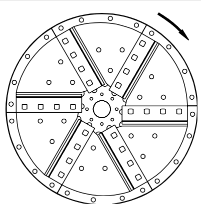
Relubricating the Front and Rear Bearings for Chipper Sizes 75″ - 96″[1.9-2.4 m]

TO RELUBRICATE THE FRONT AND REAR BEARINGS FOR CHIPPER SIZES 75″ - 96″[1.9-2.4 M]:

The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- Light Weight Oil
- Cleaning rag
- Good grade of NLGI #2 Lithium based grease

DANGER

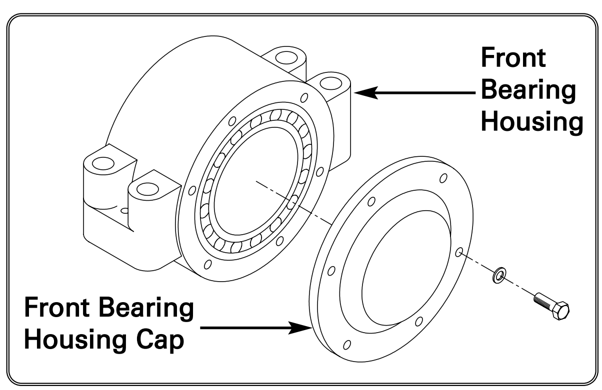
Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

1. Shutdown chipper.
2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.
3. Lockout/Tagout chipper power source.
4. Remove the front bearing housing cap screws and the front bearing housing cap.

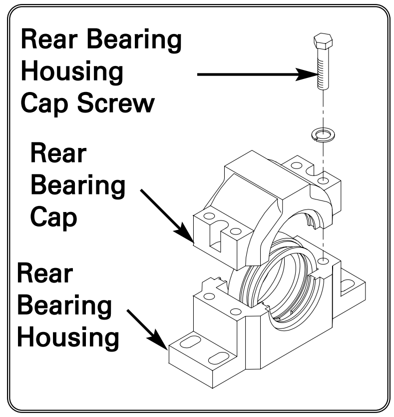


5. Remove the rear bearing housing cap screws and the rear bearing housing cap.

6. Clean out all the grease from both bearing assemblies.

7. Replace both bearing housing caps and their fasteners.

8. Remove the grease plug from the top of both the front and rear bearing housings.



9. Pour approximately 1 pint of light weight oil through the hole where you removed the grease plug in each bearing housing.

10. Replace both grease plugs.

11. Rotate the chipper disc several times.

12. Remove both bearing housing caps again and clean out all the oil and grease in the housings.

13. Pack both bearings with grease, occasionally stopping to rotate the chipper disc, until both bearings are full. Pack the empty space in the bearing housings until the housings are approximately one third full.

14. Replace both bearing caps and all fasteners.

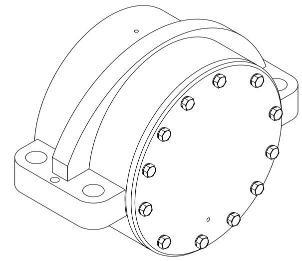
⚠ CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

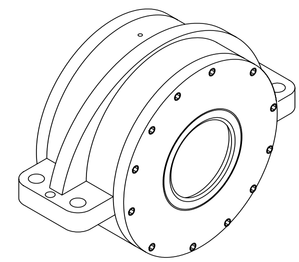
After the bearing has been lubricated, a test run should be made to check bearing temperature.

An increase in temperature immediately after start-up is normal. The temperature should begin to drop after the grease has been evenly distributed in the bearing assembly. Unusually high temperatures can indicate that there is too much grease in the housing. Excess grease can be eliminated from the front bearing housing assembly by removing the grease fitting located on the bearing housing cap or by removing the grease fitting located on the side of the bearing housing for the rear bearing assembly.

Normally bearings produce an even “purring” noise. Whistling or screeching indicates inadequate lubrication.



Front Bearing Assembly



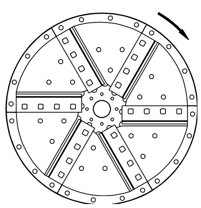
Rear Bearing Assembly

Figures 4.39-A and 4.39-B.
112″[2.8 m] Roundwood Chipper
Front and Rear Bearing Housings

Relubricating the Front and Rear Bearing for Chipper Sizes 112″ - 118″[2.8-3.0 m]

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

TO RELUBRICATE THE FRONT AND REAR BEARINGS FOR CHIPPER SIZES 112″ - 118″[2.8-3.0 M]:

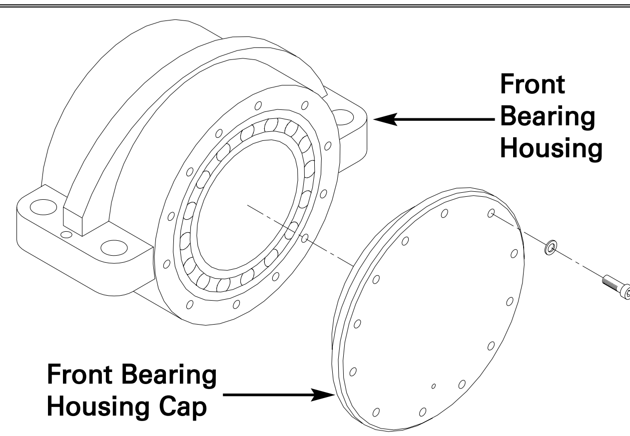
The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- 1 set of allen wrenches
- Air impact wrench and socket set
- Light Weight Oil
- Air compressor and air hose
- Cleaning rag
- Good grade of NLGI #2 Lithium based grease

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop. Disc will continue to rotate after chipper is shutdown. To confirm disc is stopped, visually check disc shaft or drive wheel.**

3. Lockout/Tagout chipper power source.

4. Remove the front bearing housing cap screws and the front bearing housing cap.

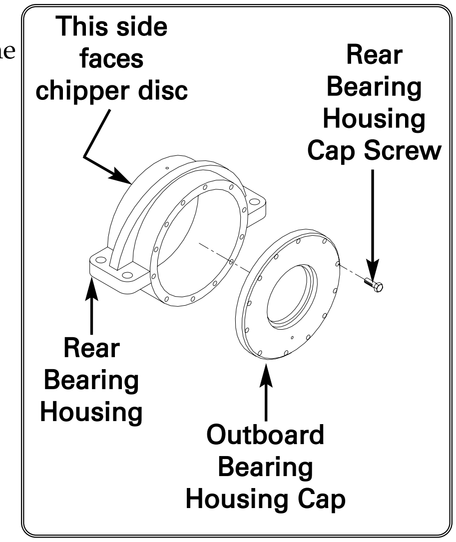


5. Remove the rear bearing housing cap screws and the outboard bearing housing cap.

6. Clean out all the grease from both bearing assemblies.

7. Replace both bearing housing caps and their fasteners.

8. Remove the grease plug from the top of both the front and rear bearing housings.



9. Pour approximately 1 pint of light weight oil through the hole where you removed the grease plug in each bearing housing.

10. Replace both grease plugs.

11. Rotate the chipper disc several times.

12. Remove both bearing housing caps again and clean out all the oil and grease in the housings.

13. Pack both bearings with grease, occasionally stopping to rotate the chipper disc, until both bearings are full. Pack the empty space in the bearing housings until the housings are approximately one third full.

14. Replace both bearing caps and all fasteners.

After the bearing has been lubricated, a test run should be made to check bearing temperature.

An increase in temperature immediately after start-up is normal. The temperature should begin to drop after the grease has been evenly distributed in the bearing assembly. Unusually high temperatures can indicate that there is too much grease in the housing. Excess grease can be eliminated from the front bearing housing assembly by removing the grease fitting located on the bearing housing cap or by removing the grease fitting located on the side of the bearing housing for the rear bearing assembly.

Normally bearings produce an even “purring” noise. Whistling or screeching indicates inadequate lubrication.

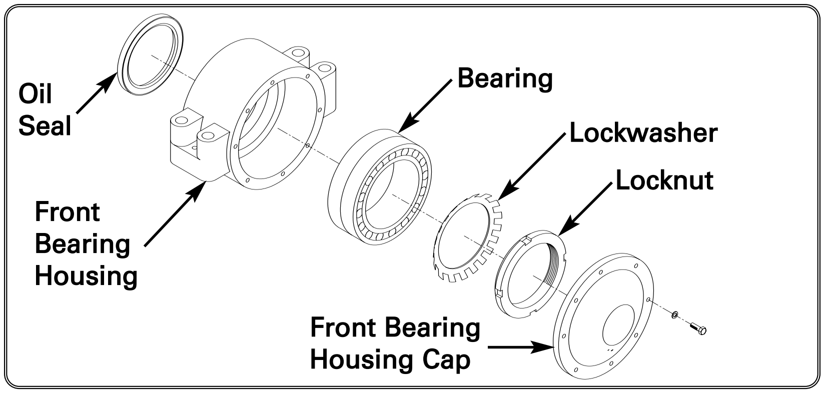


Figure 4.41-A. 84"[2.1 m] Roundwood Chipper Front Bearing Assembly.

Replacing the Front Bearing

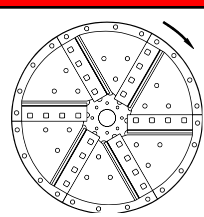
TO REPLACE THE FRONT BEARING:

The materials/tools required to complete this procedure are:

- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- Cleaning rag
- Feeler gauge
- Spanner wrench
- Hammer
- Grease gun and a good grade of NLGI #2 Lithium based grease
- Crane

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.

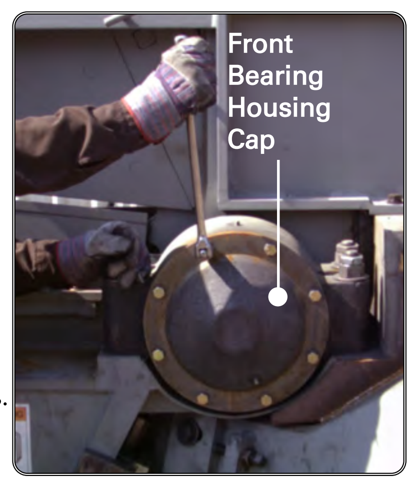
3. Lockout/Tagout chipper power source.

4. Remove hood.
   See the section entitled Replacing the Wear Plates.

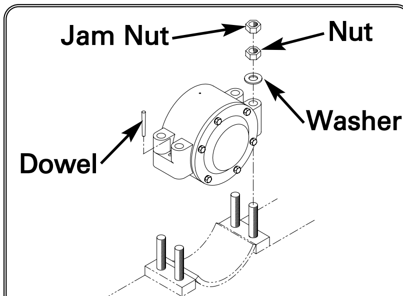
5. Remove the front bearing housing cap screws and the front bearing housing cap.

6. Clean out all the grease from around the bearing assembly.

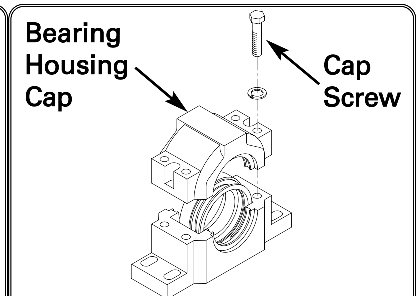
7. Use a spanner wrench to loosen the locknut 3 or 4 turns. **Do not remove locknut.**



8. **75″-96″ Chipper: [1.9-2.4 m]** Remove the front bearing housing jam nuts, nuts, dowels and washers and remove the rear bearing housing cap screws and the rear bearing housing cap.



75”[1.9 m] Chipper Front Bearing

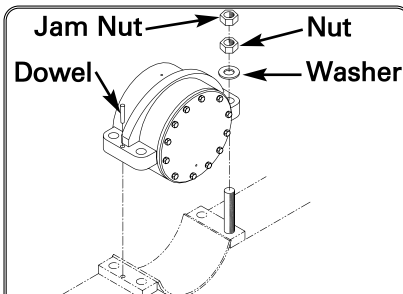


75”[1.9 m] Chipper Front Bearing

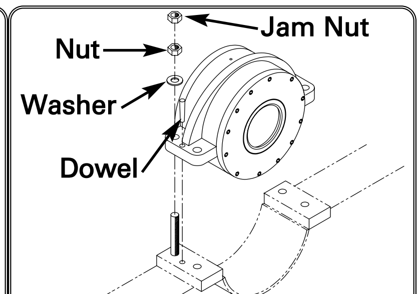
NOTE

For more detailed information on mounting the front bearing, read the instructions provided by the manufacturer that come with each bearing.

112″-118″ Chipper: [2.8-3.0 m] Remove the front and rear bearing housing jam nuts, nuts, dowels, and washers.



112”[2.8 m] Chipper Front Bearing



112”[2.8 m] Chipper Front Bearing

9. Raise the disc and shaft assembly to take the weight off the bearing housings.

CAUTION

Step 10 should not be performed with the locknut removed, in order to prevent the bearing from being forced off the end of the shaft.

10. Use a grease gun to force oil through the hole in the end of the shaft, this will push the bearing away from the front bearing housing.

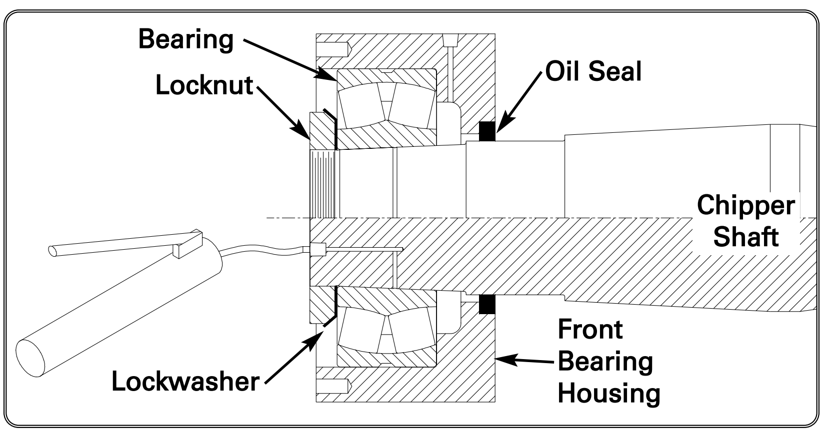


Figure 4.42-E. 96″[2.4 m] Roundwood Chipper Front Bearing Assembly. The illustration to the right, is a cross sectional view of the front bearing housing and the chipper shaft.

11. Remove the locknut, lock washer, bearing, and the bearing housing.

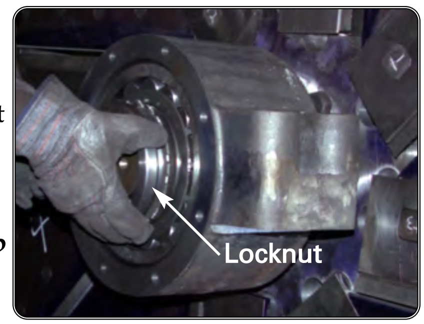
12. Clean inside of bearing housing.

13. Using a feeler gauge measure the distance between the outer ring and the unloaded *(top)* roller of the new bearing. Write down the measurement on a sheet of paper.

14. Tap new bearing into bearing housing.

15. Apply a thin film of light oil*(such as machine oil)* to the shaft to aid in bearing mounting.

16. Place bearing housing on shaft.



17. Place the locknut on the shaft with the chamfered face toward the bearing. **Do not place lockwasher on at this time, because driveup procedure may damage lock washer.**

NOTE

- A lubricant can be applied to the face of the locknut where it contacts the inner ring face of the bearing to aid in mounting the bearing.
- Do not attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing.

18. Use a spanner wrench to tighten locknut until measurement between outer ring and top roller is (**0.003″[0.076 mm]** for 75″-96″[1.9-2.4 m] Chippers) or (**0.004″[0.102 mm]** for 112″-118″[2.8-3.0 m] Chippers) smaller than the measurement you took in step 13. Rotate the bearing assembly several times then use feeler gauge to re-check clearance.

Example: 75″-96″[1.9-2.4 m] Chipper
Measurement taken in step 13 = 0.004″[0.102 mm]
Reduce by **0.003″[0.076 mm]**
0.004″[0.102 mm] - **0.003″[0.076 mm]**
Tighten locknut until measurement = 0.001″[0.025 mm]

Example: 112″-118″[2.8-3.0 m] Chipper
Measurement taken in step 13 = 0.005″[0.127 mm]
Reduce by **0.004″[0.102 mm]**
0.005″[0.127 mm] - **0.004″[0.102 mm]**
Tighten locknut until measurement = 0.001″[0.025 mm]

19. Remove the locknut and place the lockwasher and then the locknut on the shaft and re-tighten locknut. Using feeler gauge re-check the bearing clearance, if OK, find a lockwasher tang that is nearest a locknut slot. If slot is slightly past tang don’t loosen lock nut, but tighten to meet the lockwasher tang. Then bend down the lockwasher tang into the lockwasher slot.

CAUTION

- Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.
- Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

20. Pack the bearing with grease, occasionally stopping to rotate the chipper disc, until the bearing is full. Pack the empty space in the bearing housing until the housing is approximately one third full.

21. Replace the bearing cap and all fasteners.

22. Set vertical and horizontal anvil to knife clearance.
See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance and Setting the Horizontal Anvil to Knife Clearance.

After the bearing has been mounted and lubricated, a test run should be made to check bearing temperature and noise.

Normally bearings produce an even “purring” noise. Whistling or screeching indicates inadequate lubrication. An uneven rumbling or hammering is due in most cases to the presence of contaminants in the bearing or bearing damage caused during mounting.

An increase in temperature immediately after start-up is normal. The temperature should begin to drop after the grease has been evenly distributed in the bearing assembly. Unusually high temperatures can indicate that there is too much grease in the housing. Excess grease can be eliminated by removing the grease plug on the bearing housing cap.

During the test run or immediately after check the oil seals to see that that they performed correctly.

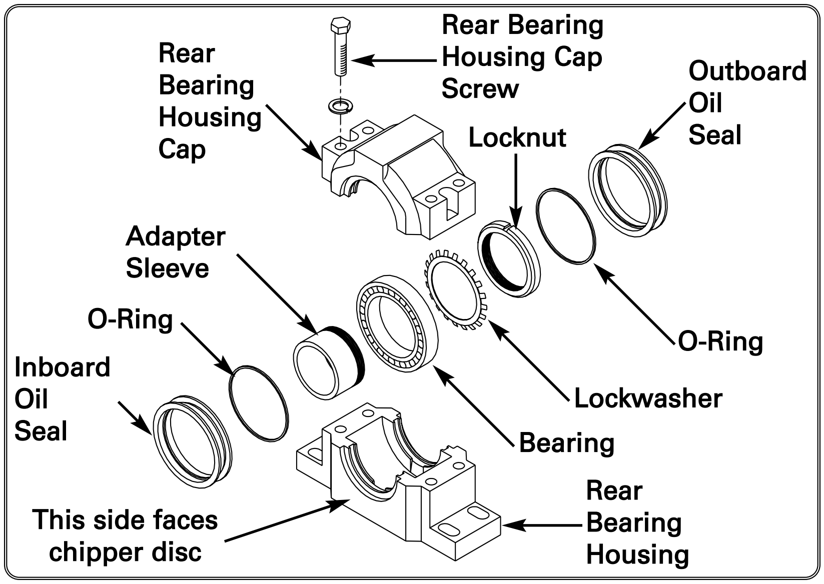


Figure 4.45-A. 96″[2.4 m] Roundwood Chipper Rear Bearing Assembly.

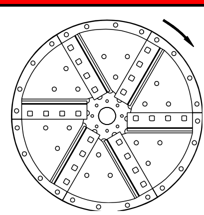
Replacing the Rear Bearing for Chipper Sizes 75″-96″[1.9-2.4 m]

TO REPLACE THE REAR BEARING:

The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Air impact wrench and socket set
- Air compressor and air hose
- Cleaning rag
- Hammer
- Spanner wrench
- Feeler gauge
- Crane
- Tubular drift or special segmental drift
- Good grade of NLGI #2 Lithium based grease

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

1. Shutdown chipper.

2. **Wait for disc to come to a complete stop.**
   Disc will continue to rotate after chipper is shutdown.
   To confirm disc is stopped, visually check disc shaft or drive wheel.

3. Lockout/Tagout chipper power source.

4. Remove hood.
   See the section entitled Replacing the Wear Plates.

5. Remove the rear bearing housing cap screws, washers, and the rear bearing housing cap.

6. Clean out all the grease from the rear bearing assembly.

NOTE

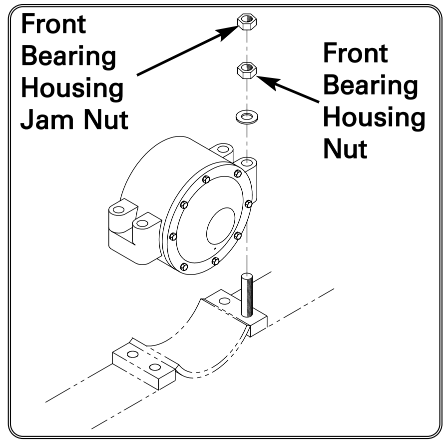
For more detailed information on mounting the rear bearing, read the instructions provided by the manufacturer that come with each bearing.

7. Remove the front bearing housing dowels, jam nuts, nuts, and washers.

8. Raise the disc and shaft assembly to take the weight off the bearing housings.

9. Remove the outboard oil seal.

10. Loosen the locknut a few turns.



11. Use hammer and tubular drift/sleeve to impact the adapter or the backside of the bearing inner ring until the adapter breaks loose from the bearing.

12. Remove locknut, lockwasher, bearing, and adapter sleeve.

13. Clean shaft, removing any oil that could be transferred onto the bore of the adapter sleeve.

14. Position adapter sleeve on the shaft, and apply a thin film of light oil*(such as machine oil)* to adapter sleeve outside diameter to aid in mounting bearing.

15. Using a feeler gauge measure the distance between the outer ring and the unloaded *(top)* roller of the new bearing. Write down the measurement on a sheet of paper.

16. Wipe bearing bore and mount on adapter sleeve, position bearing to the proper location on the shaft.

17. Place the locknut on the shaft with the chamfered face toward the bearing.
Do not place lockwasher on at this time, because drive up procedure may damage lockwasher.

NOTE

- A lubricant can be applied to the face of the locknut where it contacts the inner ring face of the bearing to aid in mounting the bearing.
- Do not attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing.

18. Use a spanner wrench to tighten locknut until measurement between outer ring & most unloaded roller is (**0.003″[0.076 mm]** for 75″-84″[1.9-2.1 m] Chippers), (**0.004″[0.102 mm]** for 96″[2.4 m] Chippers Serial #C-3013 & up), or (**0.002″[0.051 mm]** for 96″[2.4 m] Chippers Serial #C-3012 & down) **smaller** than measurement you took in step 15. Rotate the bearing assembly several times then use feeler gauge to re-check clearance.

Example: 75″-84″[1.9-2.1 m] Chipper
Measurement taken in step 15 = 0.004″[0.102 mm]
Reduce by **0.003″[0.076 mm]**
0.004″[0.102 mm] - **0.003″[0.076 mm]**
Tighten locknut until measurement = 0.001″[0.025 mm]

Example: 96″[2.4 m] Chipper Serial # **C-3013 & up**
Measurement taken in step 15 = 0.005″[0.127 mm]
Reduce by **0.004″[0.102 mm]**
0.005″[0.127 mm] - **0.004″[0.102 mm]**
Tighten locknut until measurement = 0.001″[0.025 mm]

Example: 96″[2.4 mm] Chipper Serial # **C-3012 & down**
Measurement taken in step 15 = 0.003″[0.076 mm]
Reduce by **0.002″[0.051 mm]**
0.003″[0.076 mm] - **0.002″[0.051 mm]**
Tighten locknut until measurement = 0.001″[0.025 mm]

19. Remove the locknut and place the lockwasher and then the locknut on the shaft and re-tighten locknut. Using feeler gauge re-check the bearing clearance, if OK, find a lockwasher tang that is nearest a locknut slot. If slot is slightly past tang don’t loosen lock nut, but tighten to meet the lockwasher tang. Then bend down the lockwasher tang into the lockwasher slot.
20. Replace the outboard oil seal on the shaft.
21. Clean both halves of the bearing housing and oil the bearing seats.
22. Place shaft with bearing into housing, guiding oil seals into the seal grooves, and being certain that the bearing outer rings sit squarely in the pillow block bearing seats.
23. Pack bearing with grease, occasionally stopping to rotate the chipper disc, until the bearing is full. Pack the empty space in the bearing housing until the housing is approximately one third full.
24. Place the rear bearing housing cap onto the base and tighten the screws.
25. Replace the front bearing housing fasteners and tighten.

CAUTION

- Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.
- Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

26. Set vertical and horizontal anvil to knife clearance.
    See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance and Setting the Horizontal Anvil to Knife Clearance.

After the bearing has been mounted and lubricated, a test run should be made to check bearing temperature and noise.

Normally bearings produce an even “purring” noise. Whistling or screeching indicates inadequate lubrication. An uneven rumbling or hammering is due in most cases to the presence of contaminants in the bearing or bearing damage caused during mounting.

An increase in temperature immediately after start-up is normal. The temperature should begin to drop after the grease has been evenly distributed in the bearing assembly. Unusually high temperatures can indicate that there is too much grease in the housing. Excess grease can be eliminated by removing the grease plug on the bearing housing.

During the test run or immediately after check the oil seals to see that that they performed correctly.

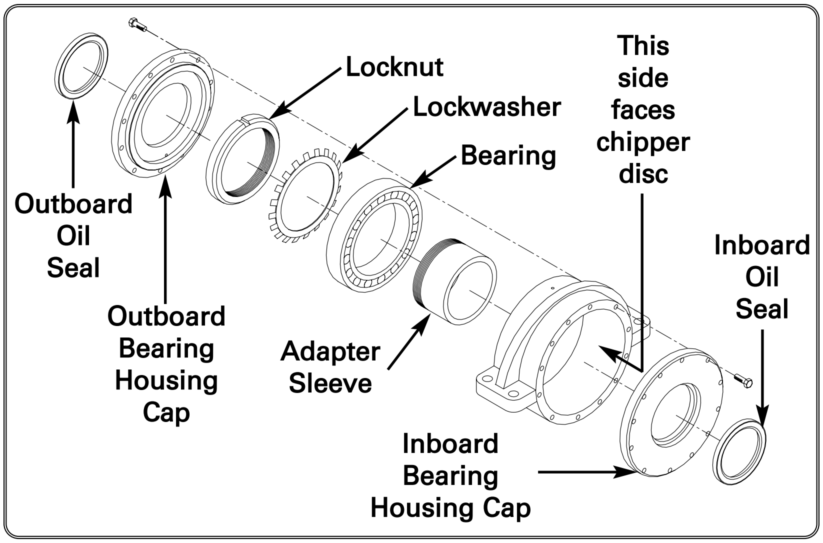


Figure 4.49-A. 112″[2.8 m] Roundwood Chipper Rear Bearing Assembly.

Replacing the Rear Bearing for Chipper Sizes 112″ - 118″[2.8-3.0 m]

To replace the rear bearing:

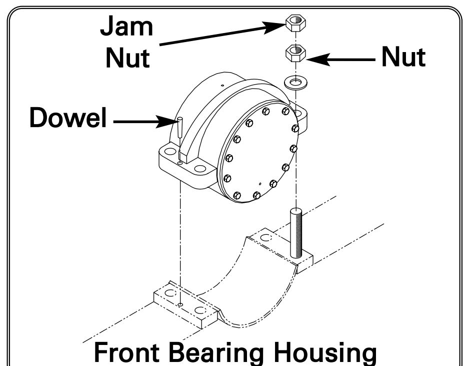
The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Cleaning rag
- Air compressor and air hose
- Air impact wrench and socket set
- Tubular drift or special segmental drift
- Good grade of NLGI #2 Lithium based grease
- Feeler gauge
- Crane
- Hammer
- Spanner wrench

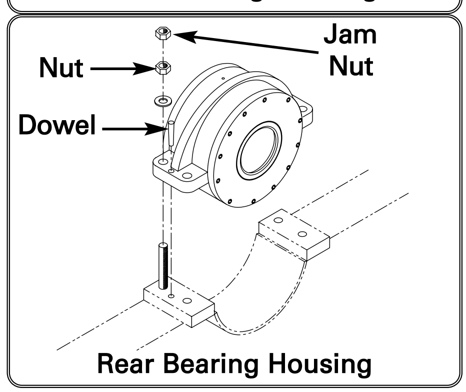
1. Shutdown chipper.

2. **Wait for disc to come to**
a **complete stop.**
Disc will continue to rotate after chipper is shutdown.
To confirm disc is stopped, visually check disc shaft or drive wheel.

3. Lockout/Tagout chipper power source.

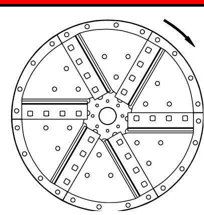
4. Remove hood.
See the section entitled Replacing the Wear Plates.





DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

NOTE

For more detailed information on mounting the rear bearing, read the instructions provided by the manufacturer that come with each bearing.

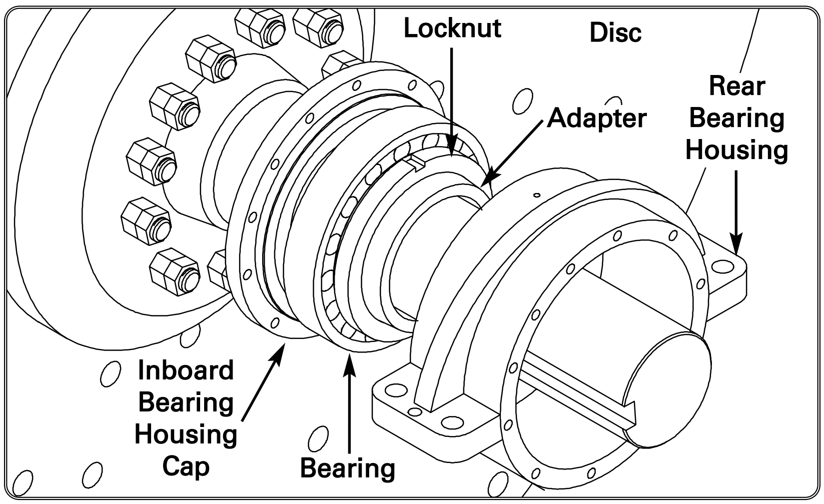
5. Remove the front and rear bearing housing jam nuts, nuts, washers and dowels.

6. Raise the disc and shaft assembly to take the weight of the disc off the bearing housings.

7. Remove the cap screws that fasten the outboard bearing housing cap to the rear bearing housing. Remove outboard bearing housing cap and oil seal.

8. Clean out all the grease from the rear bearing assembly.

9. Remove the inboard bearing housing cap cap screws and slide the bearing housing off the shaft. The bearing, lockwasher, adapter sleeve, and locknut should remain attached to the shaft.



10. Loosen the locknut a few turns.

11. Use hammer and tubular drift/sleeve to impact the adapter or the backside of the bearing inner ring until the adapter breaks loose from the bearing.

12. Remove locknut, lockwasher, bearing, and adapter sleeve.

13. Clean inside of housing.

14. Using a feeler gauge measure the distance between the outer ring and the unloaded *(top)* roller of the new bearing. Write down the measurement on a sheet of paper.

15. Tap new bearing into rear bearing housing.

16. Clean shaft, removing any oil that could be transferred onto the bore of the adapter sleeve.

17. Position adapter sleeve on the shaft, and apply a thin film of light oil*(such as machine oil)* to adapter sleeve outside diameter to aid in mounting bearing.

18. Wipe bearing bore and mount on adapter sleeve, position bearing to the proper location on the shaft.

NOTE

- A lubricant can be applied to the face of the locknut where it contacts the inner ring face of the bearing to aid in mounting the bearing.
- Do not attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing.

19. Place the locknut on the shaft with the chamfered face toward the bearing. **Do not place lockwasher on at this time, because drive up procedure may damage lockwasher.**

20. Use a spanner wrench to tighten the locknut until measurement between outer ring & most unloaded roller is **0.004”[0.102 mm]** smaller than the measurement you took in step 14.
Rotate the bearing assembly several times then use feeler gauge to re-check clearance.

Example: 112”-118”[2.8-3.0 m] Chipper
Measurement taken in step 14 = 0.005”[0.127 mm]
Reduce by **0.004”[0.102 mm]**
0.005”[0.127 mm] - **0.004”[0.102 mm]**
Tighten locknut until measurement = 0.001”[0.025 mm]

21. Remove the locknut and place the lockwasher and then the locknut on the shaft and re-tighten locknut. Using feeler gauge re-check the bearing clearance, if OK, find a lockwasher tang that is nearest a locknut slot. If slot is slightly past tang don’t loosen lock nut, but tighten to meet the lockwasher tang. Then bend down the lockwasher tang into the lockwasher slot.

22. Place the inboard bearing housing cap back on the bearing housing and tighten the cap screws.

23. Pack bearing with grease, occasionally stopping to rotate chipper disc, until bearing is full. Pack empty space in bearing housing until the housing is approximately one third full.

CAUTION

Always check knife to anvil clearances after changing or making any adjustments to knife assembly components, bearings, infeed spout, or anvils. If any one knife is below the allowable tolerance damage to anvils or knives could occur.

24. Place the outboard bearing housing cap onto the bearing housing and tighten the cap screws.

25. Replace the fasteners that attach the front and rear bearing housings to the chipper base.

26. Set vertical and horizontal anvil to knife clearance.
See the section entitled Rotating the Vertical Anvil and Setting the Anvil to Knife Clearance and Setting the Horizontal Anvil to Knife Clearance.

CAUTION

Before restarting chipper make sure all tools/materials used to complete this procedure have been removed from the chipping area.

After the bearing has been mounted and lubricated, a test run should be made to check bearing temperature and noise.

Normally bearings produce an even "purring" noise. Whistling or screeching indicates inadequate lubrication. An uneven rumbling or hammering is due in most cases to the presence of contaminants in the bearing or bearing damage caused during mounting.

An increase in temperature immediately after start-up is normal. The temperature should begin to drop after the grease has been evenly distributed in the bearing assembly. Unusually high temperatures can indicate that there is too much grease in the housing. Excess grease can be eliminated by removing the grease plug on the bearing housing.

During the test run or immediately after check the oil seals to see that that they performed correctly.

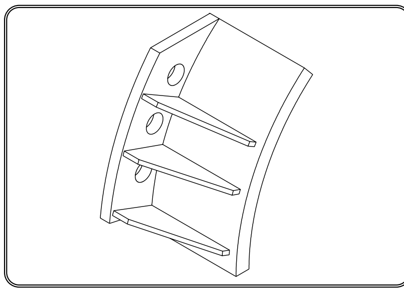
Top Discharge Chipper Components

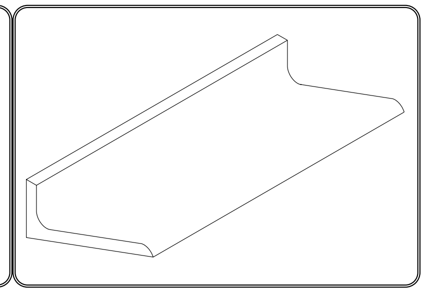
The following components are used only in top discharge chippers:

Fan Blades and Rim Blades

The fan blades and rim blades are responsible for creating the air stream that expels the chips out the discharge chute. The fan blades are mounted on the rear of the chipper disc and remove the chips as they exit the chip slot onto the lower casing band. The rim blades are attached along the outside edge of the chipper disc and remove any chips that get caught under the chipper disc.

Figures 4.53-A and 4.53-B. Standard 75"[1.9 m] Roundwood Chipper Fan Blades and Rim Blades.
The fan blades and rim blades are responsible for creating the air stream that expel the chips out the discharge chute.


Fan Blade


Rim Blade

The fan blade capscrews should be checked periodically for tightness and should be properly torqued. The fan blades can be inspected through the rear knife access door on the chipper.

The rim blades should also be checked periodically. Maintenance and inspection of the rim blades can be performed by raising the chipper hood.

⚠ WARNING

Never operate chipper without all access doors closed and secured.

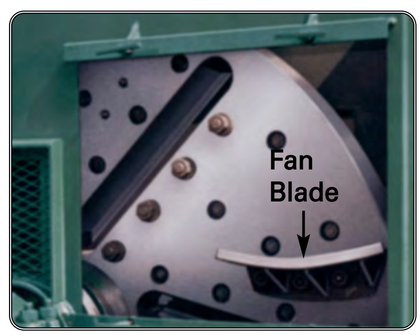
⚠ DANGER

Half of the chipper hood can be opened to gain better access to the chipper disc. Adhere to following safety rules if you need to open the hood:

- **NEVER OPEN HOOD WHILE DISC IS TURNING.**
- **ALWAYS REPLACE ALL FASTENERS THAT JOIN THE TWO SECTIONS OF HOOD TOGETHER AND THAT ATTACH HOOD TO BASE.**
- **NEVER OPERATE CHIPPER WITHOUT HOOD LOCK SECURED.**

Fan Blade and Rim Blade Conditions

Worn fan or rim blades reduce the effectiveness of the air stream in removing the chips from the base. This causes excessive production of fines or pin chips, as the acceptable chips that are unable to escape from the base are eventually broken up.



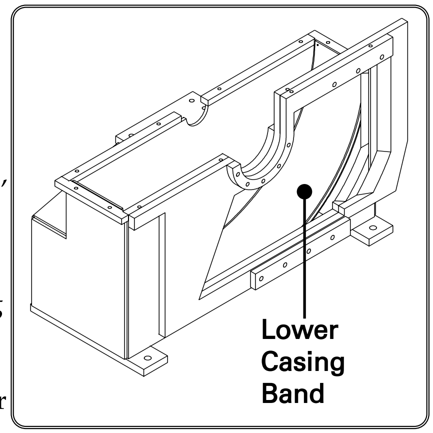
Lower Casing Band

The lower casing band is the circular steel plate that serves as the temporary holding area for the chips, before they are blown out the discharge chute by the fan blades.

Lower Casing Band Conditions

A worn lower casing band can effect chip quality in the following ways:

Holes in the lower casing band can reduce the effectiveness of the air stream in expelling the chips out the discharge chute. This results in chips being hit and broken up by the fan blades, because they are being held in the base for too long.



Rough spots on the lower casing band can break up chips as they are being blown out the discharge chute. This can also occur if their are rough spots inside the hood or blowpipe.

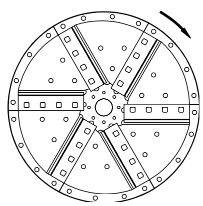
Top or End Discharge Chipper Maintenance

DANGER

Never try to clear discharge/blow pipe while chipper is operating, while disc is still turning, or before performing lockout/tagout procedures or serious injury or death can result.

DANGER

Wait for disc to come to a complete stop before servicing or inspecting the chipper.



WARNING

Lockout/Tagout power source before performing maintenance or operator adjustment.

NOTE

Conditions that can cause frequent plugging of the discharge/blow pipe:

- Producing an excessive amount of oversize chips.
- Worn fan or rim blades.
- Holes in lower casing band or hood.
- Holes in blow pipe.
- Blow pipe is too narrow.
- Holes in hood to blow pipe transition.

Oversize chips or air flow problems can cause the discharge/blow pipe from the chipper hood to the cyclone to become plugged with chips. Perform the following procedure to safely remove any obstructions from the discharge/blow pipe.

Clearing Chipper Discharge/Blow Pipe

TO CLEAR THE CHIPPER DISCHARGE/BLOW PIPE:

The materials/tools required to complete this procedure are:
- Lock and tag
- 1 set of wrenches
- Crane
- Long piece of stiff wire

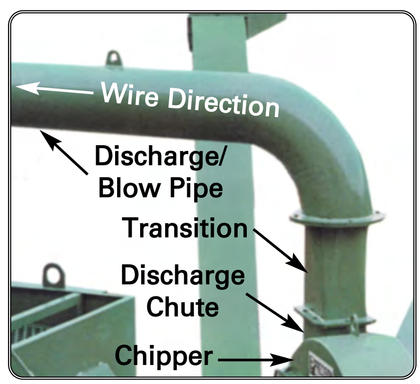
1. Shutdown chipper and all associated equipment such as: chip screen, chip blower, and chipper infeed conveyor/system.

2. **Wait for all equipment to come to a complete stop. The chipper disc will continue to rotate after it is shutdown. To confirm disc is stopped, visually check disc shaft or drive wheel.**

3. Lockout/Tagout all equipment that was shutdown.

4. Attach crane to discharge/blow pipe.

THE REMAINING INSTRUCTIONS ARE FOR A STANDARD PRECISION KWIK CHIP UNIT SETUP. INSTRUCTIONS FOR CLEARING BLOW/DISCHARGE PIPES MADE BY OTHER MANUFACTURERS MAY VARY.



5. Remove screws and nuts that attach transition to chipper hood.

6. Remove screws and nuts that attach transition to discharge/blow pipe.

7. Remove transition.

8. Run a piece of stiff wire through the end of the discharge/blow pipe **away from the chipper** (towards cyclone or screen). Repeat until discharge/blow pipe is clear.

9. Remove wire.

10. Replace transition and fasteners.

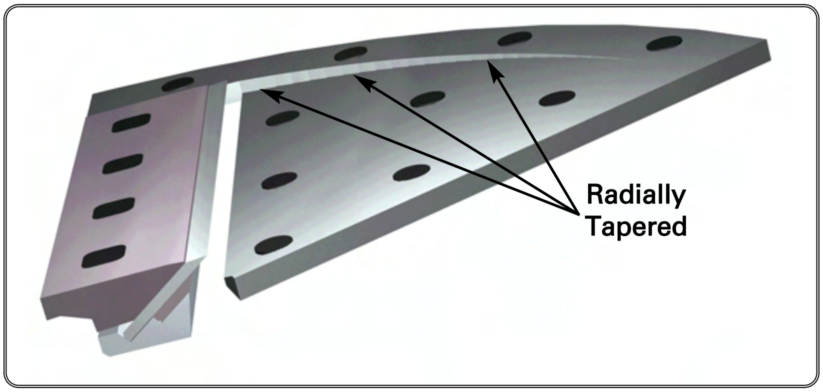
11. Detach crane from discharge/blow pipe.

Optional Equipment

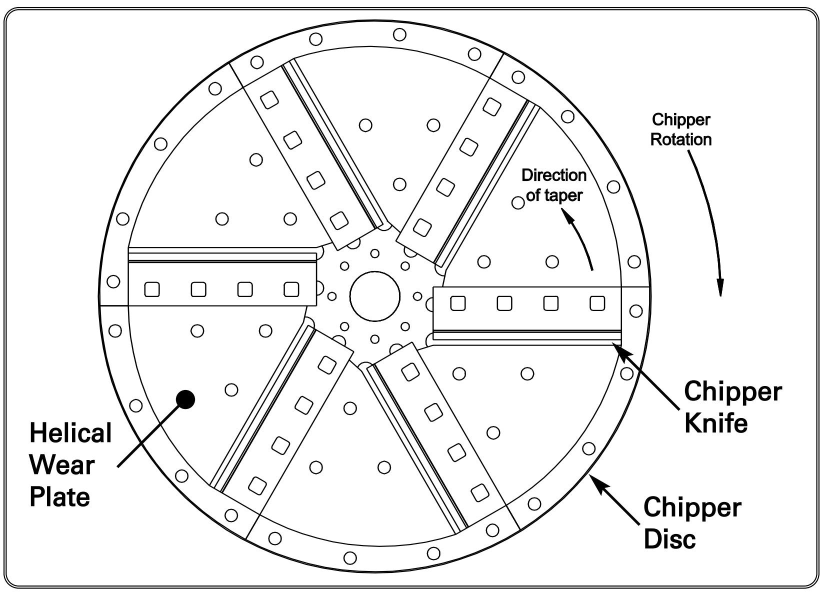
To improve the performance of your chipper you may have purchased one of the following options:

Helical Wear Plates

The optional helical wear plate design has a radially tapered face.



The thickness of the wear plate decreases radially, moving away from the chipper knife toward the next knife on the chipper disc. This allows better control of the material between cuts. The incoming material has a smooth transition from knife to knife which improves chip quality as well as chipper performance.



If the helical wear plates must be removed or replaced follow the procedure outlined in the section entitled *Replacing the Wear Plates*.

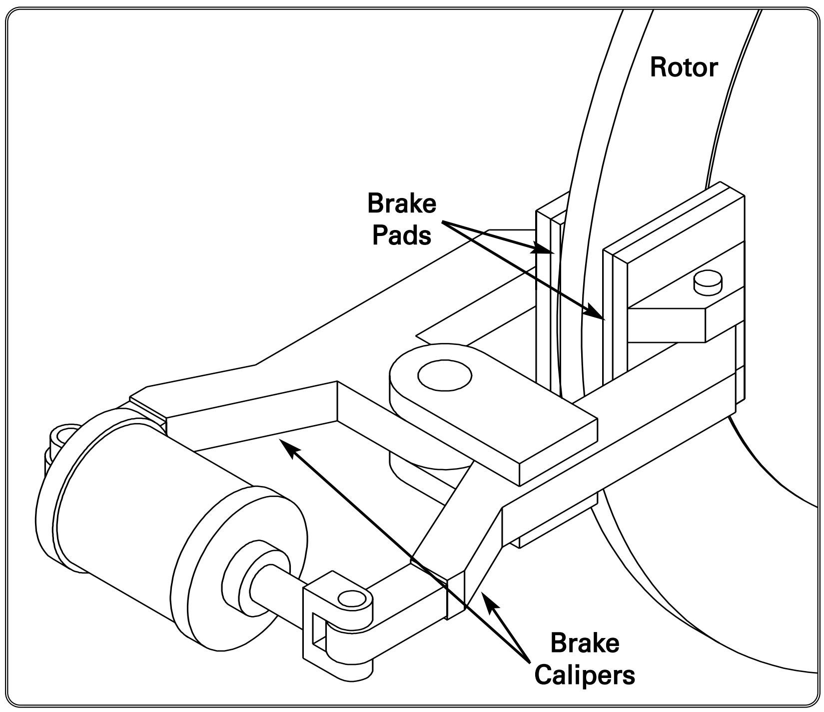
V-Bottom Rechipper Spout Assembly

The v-bottom rechipper spout assembly consists of a small infeed spout and two anvils. The rechipper spout assembly is mounted at the top of the chipper base and is used to rechip overs that have been screened out from the accepts.

The rechipper anvil to knife clearance setting should be the same as the setting you use when setting the vertical anvil.

Disc Brake

The optional disc brake is used to reduce the time it takes for the chipper disc to come to a complete stop.

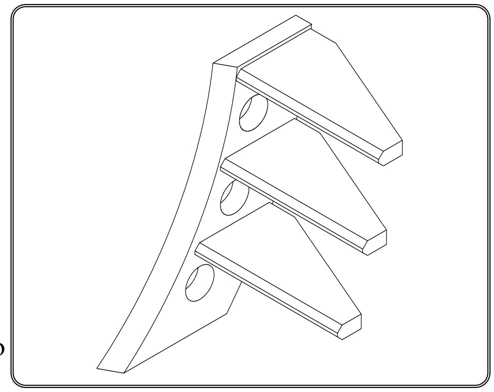


The disc brake assembly consists of a large rotor attached to the chipper shaft, brake calipers, brake pads, and an air or hydraulic cylinder. The rotor attached to the shaft is slowed by the friction of the brake pads pressed by the air or hydraulically actuated calipers against each side of the rotor.

Optional Equipment for Bottom and End Discharge Chippers

Card Breakers

A card is the term used to refer to blocks of chips in which the individual chips have not completely separated. Card breakers are the replaceable devices attached to the back of the chipper disc and the base that break up the cards into acceptable chips.



Maintenance Section Quick Reference Page

Maintenance Section Quick Reference Page

This page list all the torque ratings for all the critical fasteners and settings for the various chipper components.

Knife to Anvil Settings		
Chipper Size	Vertical Anvil to Knife Clearance	Horizontal Anvil to Knife Clearance
75″ [1.9 m]	0.010″- 0.015″ [0.254-0.381 mm]	0.040″- 0.050″ [1.02-1.27 mm]
84″ [2.1 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
96″ [2.4 m]	0.015″- 0.020″ [0.254-0.381 mm]	0.050″- 0.060″ [1.27-1.52 mm]
112″ [2.8 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]
118″ [3.0 m]	0.025″- 0.030″ [0.635-0.762 mm]	0.070″- 0.080″ [1.78-2.03 mm]

Torque Rating Chart

The following torque chart should be used if the torque rating is not specified in the manual.

Torque Chart for Bolts Capscrews and Studs (Lubricated Threads Only)

This specification does not apply to self locking nuts or capscrews. To obtain proper torque use no lock washers. Hardened flat washer recommednded.

Coarse Thread (NC) — Grade 5 — Fine Thread (NF)

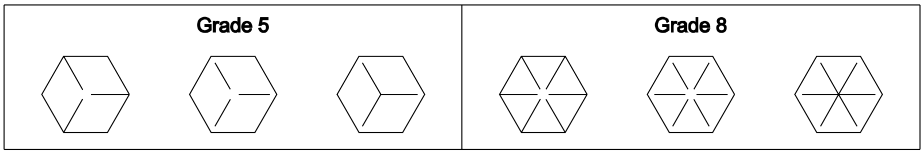
Nominal Size	Torque (ft. lb.)	Nominal Size	Torque (ft. lb.)
1/4-20	6-7	1/4-28	7-8
5/16-18	12-14	5/16-24	13-15
3/8-16	22-24	3/8-24	24-26
7/16-14	33-37	7/16-20	38-42
1/2-13	52-58	1/2-20	62-68
9/16-12	76-84	9/16-18	85-95
5/8-11	104-116	5/8-18	123-137
3/4-10	190-210	3/4-16	209-231
1-8	418-462	1-12	456-504
1 1/8-7	570-630	1 1/8-12	627-693
1 1/4-7	798-882	1 1/4-12	874-966
1 3/8-6	1045-1155	1 3/8-12	1197-1323
1 1/2-6	1387-1533	1 1/2-12	1558-1722
1 3/4-5	1872-2068	1 3/4-12	2460-2720
2 -4 1/2	2828-3126	2-12	3759-4155

These toque values are to be used unless other wise specified. Special conditions will be noted where applicable.
SAE Grade 5 Bolts (ASTM A235 and ASTM A449) are made from quenched and tempered medium carbon steel.
Grade 5 bolts are identified by 3 equally spaced radial lines embossed on the head of the bolt. (See illustration below)

Coarse Thread (NC) — Grade 8 — Fine Thread (NF)

Nominal Size	Torque (ft. lb.)	Nominal Size	Torque (ft. lb.)
1/4-20	8-9	1/4-28	9-10
5/16-18	17-19	5/16-24	19-21
3/8-16	33-36	3/8-24	34-37
7/16-14	52-57	7/16-20	53-58
1/2-13	76-84	1/2-20	86-94
9/16-12	105-115	9/16-18	124-136
5/8-11	162-178	5/8-18	171-189
3/4-10	266-294	3/4-16	304-336
7/8-9	437-483	7/8-14	475-525
1-8	646-714	1-12	703-777
1 1/8-7	912-1008	1 1/8-12	979-1081
1 1/4-7	1292-1428	1 1/4-12	1425-1575
1 1/2-6	2242-2478	1 1/2-12	2527-2793
1 3/4-5	3048-3688	1 3/4-12	4004-4424
2 -4 1/2	4610-5096	2-12	6116-6760

These toque values are to be used unless other wise specified. Special conditions will be noted where applicable.
SAE Grade 8 Bolts (ASTM A354 and Grade BD) are made from quenched and tempered medium carbon steel.
Grade 8 bolts are identified by 6 equally spaced radial lines embossed on the head of the bolt. (See illustration below)



NOTE

Small torque wrenches read in inch lbs. To convert ft. lbs. to inch lbs. multiply ft. lbs. X 12.
Example:
Torque Rating: 6 ft. lbs
6 ft. lbs. X 12
=72 inch lbs.

General Troubleshooting

Problem	Probable Cause	Correction
1. Excessive vibration.	1. Bearing is damaged. 2. Disc is out of balance.	1. Replace bearing. 2. Check that all chipper knives are approximately the same width.
2. Noisy bearing.	1. Whistling or screeching indicates inadequate lubrication. 2. An uneven rumbling or hammering indicates the presence of contaminants in the bearing or that the bearing is damaged.	1. Add more grease into the bearing housing. 2. Relubricate or replace bearing.
3. Bearing is excessively hot.	1. Too much lubricant in the bearing housing. 2. Bearing is damaged. 3. Wrong type of grease in bearing. 4. Bearing is not properly installed on shaft.	1. Remove one of the bearing housing grease plugs and release some of the excess grease. 2. Replace bearing. 3. Use a good grade of NLGI #2 Lithium based grease. 4. Re-install bearing following instructions in *Section 4.*
4. Excessive oversize chips. *75″Chipper - 560 Max RPM* *84″Chipper - 510 Max RPM* *96″Chipper - 480 Max RPM* *112″Chipper - 360 Max RPM* *118″Chipper - 327 Max RPM*	1. Knife to anvil clearance is incorrect. 2. Excessively worn disc wear plates. 3. Worn or rounded anvil. 4. Chipper disc bearing end play. 5. Chipping shortwood that is able to turn longways, in infeed spout producing overlong chips. 6. Chipper disc RPM is too low.	1. Reset knife to horizontal and vertical anvil clearance. 2. Replace wear plates. 3. Rotate or replace anvil. 4. Check clearance between top roller of bearings and outer ring sphere. 5. More careful screening of material. 6. Increase chipper disc RPM.

Problem	Probable Cause	Correction
5. Excessive fines.	1. Dull chipper knives.	1. Sharpen knives.
	2. Excessive counter knife wear.	2. Replace counter knives.
	3. Poorly debarked log.	3. Check debarking process.
	4. Poor fines screening.	4. Check screening process
	5. Knife to anvil clearance is incorrect.	5. Reset knife to horizontal and/or vertical anvil clearance.
	6. Chipper disc RPM is too high.	6. Reduce chipper disc RPM.
Top Discharge Chippers	7. Rough spots or sharp bends in blow pipe.	7. Replace or repair blow pipe.
Top Discharge Chippers	8. Rough spots or holes in lower casing band.	8. Inspect and repair lower casing band.
Top Discharge Chippers	9. Worn or damaged rim blades or fan blades.	9. Replace rim blades or fan blades.
Bottom Discharge Chippers	10. Discharge conveyor is too close to bottom of chipper base.	10. Move discharge conveyor farther away from chipper.
6. Excessive pin chips.	1. Knife to anvil clearance is incorrect.	1. Reset knife to horizontal and/or vertical anvil clearance.
	2. Worn counter knives.	2. Replace counter knives.
	3. Excessively worn disc wear plates.	3. Replace worn disc wear plates.
	4. Worn feed plate.	4. Replace feed plate.
	5. Plugged chip slot.	5. Clean out chip slots with compressed air.
	6. Chipping dry material.	6. Counter grind knives.
	7. Too much counter grind on knives.	7. Reduce angle and/or length of counter grind.
	8. Chipper disc RPM is too high.	8. Reduce chipper disc RPM.
Top Discharge Chippers	9. Rough spots or sharp bends in blow pipe.	9. Replace or repair blow pipe.
Top Discharge Chippers	10. Rough spots or holes in lower casing band.	10. Inspect and replace or repair lower casing band.
Top Discharge Chippers	11. Excessively worn rim blades or fan blades.	11. Replace rim blades or fan blades.
Bottom Discharge Chippers	12. Discharge conveyor is too close to bottom of chipper base.	12. Move discharge conveyor farther away from chipper.

Problem	Probable Cause	Correction
7. Chipper not feeding properly.	1. Dull chipper knives. 2. Incorrectly sharpened knives. 3. Wood is dry or dirty. 4. Wood is frozen. 5. Chipper disc RPM is too low.	1. Sharpen knives. 2. Resharpen knives following instructions in Section 4. 3. Counter grind knives. 4. Counter grind knives. 5. Increase chipper disc RPM.
8. Top discharge chipper not discharging chips properly.	1. Worn or damaged rim blades or fan blades. 2. Holes in chipper hood. 3. Holes in lower casing band.	1. Replace worn fan or rim blades. 2. Repair or replace chipper hood. 3. Repair or replace lower casing band.
9. Knives require sharpening too frequently.	1. Tramp metal or excessive dirt or grit in material being fed to chipper. 2. Knife to anvil clearance is incorrect. 3. Wood is extremely hard. 4. Wire or feather edge not removed after sharpening knives.	1. Check material being fed to chipper. Install metal detector to remove tramp metal from material. 2. Reset knife to horizontal and/or vertical anvil clearance. 3. Counter grind knives. 4. After sharpening, use a hone to remove wire or feather edge.
10. Frequent plugging of blow pipe. *(Top or end discharge chippers)*	1. Fan or rim blades are worn, reducing air flow. 2. Holes in the lower casing band, reducing air flow. 3. Holes in blow/discharge pipe are reducing the air flow. 4. Holes in hood are reducing air flow. 5. Improperly designed blow/discharge pipe.	1. Replace fan or rim blades. 2. Replace or repair lower casing band. 3. Replace or repair blow/discharge pipe. 4. Replace or repair hood. 5. Blow/discharge pipe needs to be large enough to prevent plugging and any bends in the pipe need to be large enough to prevent material packing.

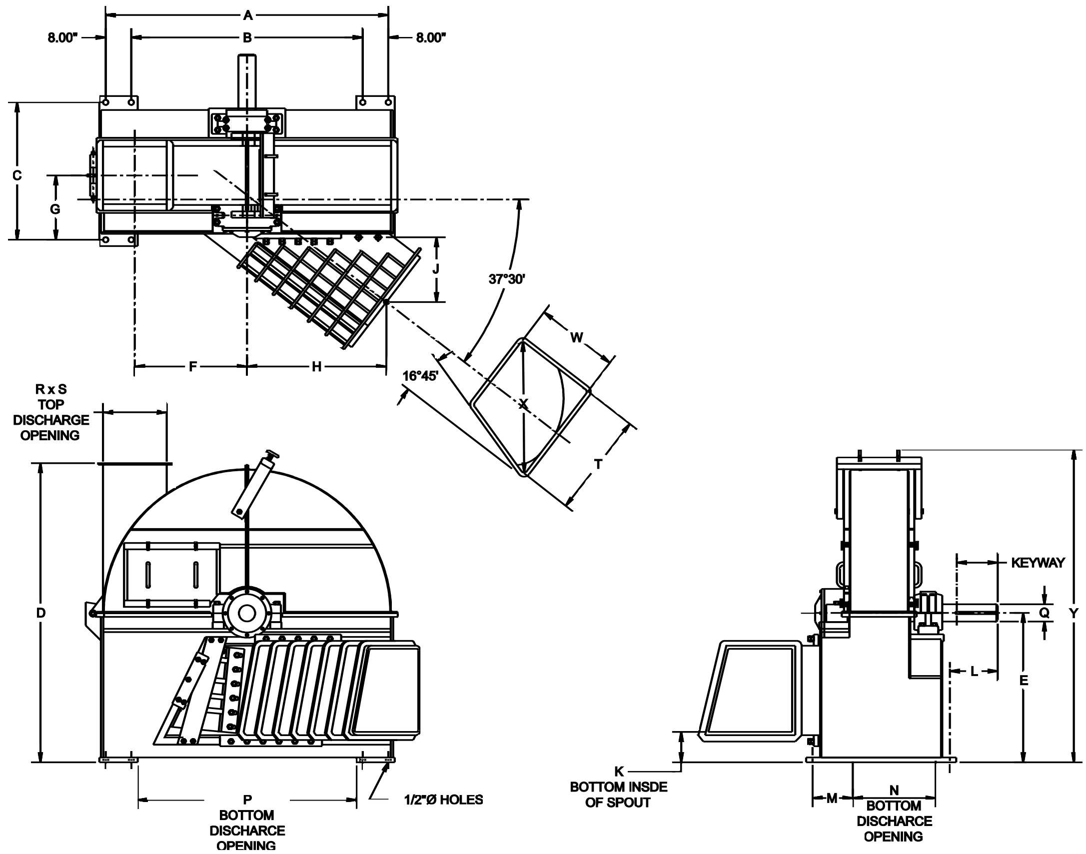
Notes

NOTE

See *Section C - Engine & Service Manuals* for more troubleshooting information.

PRECISION HUSKY

ROUNDWOOD CHIPPER SPECIFICATIONS



Chipper Size	75"	84"	96"	112"	118"
A	75 1/4"	88 1/2"	100 1/2"	117"	120"
B	75 1/4"	72 1/2"	84 1/2"	101"	104"
C	39"	43"	43"	49"	49"
D	82 5/8"	93 3/4"	108 1/4"	123"	131 3/4"
E	43 1/8"	46 11/16"	55 1/2"	63"	67"
F	31 3/8"	34 3/8"	40 3/8"	N/A	N/A
G	22 3/8"	24 1/2"	24 1/2"	N/A	N/A
H	34"	43 5/8"	45 1/4"	51 1/2"	51 1/2"
J	12"	19 1/2"	21"	23"	23"
K	10 1/4"	9 1/2"	12 3/4"	13"	13 1/4"
L	13 1/8"	15"	17"	21 11/16"	21 11/16"
M	10 1/4"	11 7/8"	12"	15 1/2"	15 1/2"
N	25 1/4"	27 1/4"	27 1/2"	29 1/2"	29 1/2"
P	63 1/4"	68 1/2"	80 1/2"	97"	100"
Q	5 3/16"	5 7/16"	5 15/16"	8"	8"
R	9 3/4"	11"	11"	N/A	N/A
S	16"	20"	20"	N/A	N/A
T	27"	33"	35 1/4"	42"	45"
W	22"	26"	27"	32"	36"
X	35"	40"	44"	53"	57 1/2"
Y	85"	97 3/4"	111"	125"	138"
KEYWAY	1 1/4" X 5/8" X 13"	1 1/4" X 5/8" X 12"	1 1/2" X 3/4" X 15 1/2"	1 3/4" X 7/8" X 15 1/2"	1 3/4" X 7/8" X 15 1/2"

General

75” Chipper

Maximum Operating RPM:	560	
Number of Knives:	3 to 8	
Approximate Weight (Less Motor):	15,300 lbs.	17,600 lbs.
Thickness of Disc:	6”	8”
Production Rate*:	125 Tons/Hour	
Approximate Disc Weight	7,200 lbs.	9,500 lbs.
Disc WK^2 lbs. Ft^2	34,850	48,868
Disc Width at Rim	5-3/4”	7-3/4”

84” Chipper

Maximum Operating RPM:	510	
Number of Knives:	3 to 8	
Approximate Weight (Less Motor):	20,200 lbs.	23,350 lbs.
Thickness of Disc:	6”	8”
Production Rate*:	175 Tons/Hour	
Approximate Disc Weight	9,085 lbs.	12,167 lbs.
Disc WK^2 lbs. Ft^2	55,070	74,470
Disc Width at Rim	5-3/4”	7-3/4”

96” Chipper

Maximum Operating RPM:	450	
Number of Knives:	4 to 10	
Approximate Weight (Less Motor):	26,000 lbs	30,000 lbs.
Thickness of Disc:	6”	8”
Production Rate*:	250 Tons/Hour	
Approximate Disc Weight	11,650 lbs.	15,895 lbs.
Disc WK^2 lbs. Ft^2	93,000	126,683
Disc Width at Rim	5-3/4”	7-3/4”

112” Chipper

Maximum Operating RPM:	360	
Number of Knives:	6 to 12	
Approximate Weight (Less Motor):	44,800 lbs	47,600 lbs.
Thickness of Disc:	7”	8”
Production Rate*:	300 Tons/Hour	
Approximate Disc Weight	18,840 lbs.	21,630 lbs.
Disc WK^2 lbs. Ft^2	203,838	234,125
Disc Width at Rim	6-3/4”	7-3/4”

118” Chipper

Maximum Operating RPM:	327	
Number of Knives:	6 to 12	
Approximate Weight (Less Motor):	45,650 lbs.	48,750 lbs.
Thickness of Disc:	7”	8”
Production Rate*:	350 Tons/Hour	
Approximate Disc Weight	20,900 lbs.	24,795 lbs.
Disc WK^2 lbs. Ft^2	251,636	309,652
Disc Width at Rim	6-3/4”	7-3/4”

Average Production Rate based on maximum number of knives and a 3/4” chip setting.

Options

Drop/Gravity Feed

Disc Brake *(With Direct Coupled Motor Only)*

Top or Bottom Discharge

End or Back Discharge

V-Bottom Rechipper Spouts

Hard Surfaced or Carbide Counter Knives

Right Hand

Chipper with a Diesel Engine on a Common Base

Chipper with an Electric Motor on a Common Base

Dissipator for Back Discharge Chippers

AR Plate Wear Package

Helical Wear Plates

Carbide Anvils

Belt Driven

Wear Liners

Direct Driven

Left Hand

Hydraulic Hood Opener

Horizontal Feed

T1 Wear Package

		Standard	Optional
Chipper Disc Thickness	75″ Chipper	5 7/8″	7 3/4″
Chipper Disc Thickness	84″ Chipper	5 7/8″	7 3/4″
Chipper Disc Thickness	96″ Chipper	5 7/8″	7 3/4″
Chipper Disc Thickness	112″ Chipper	6 7/8″	7 3/4″
Chipper Disc Thickness	118″ Chipper	6 7/8″	7 3/4″

Appendix B

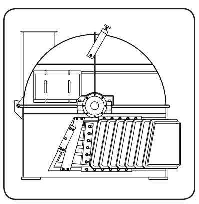
Parts & Assembly

This section of the manual contains parts information for the Standard Precision Husky Roundwood Chipper.

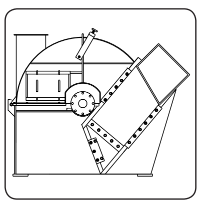
Before calling and ordering parts be sure you know the chipper model number, the complete serial number, the feed and discharge directions, if it is a right hand or a left hand, and any special options that you may have purchased with your chipper.

Example:

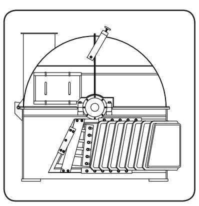
75” Roundwood Chipper	Top Discharge
C-9999	Right Hand
Horizontal Feed	Helical Wear Plates



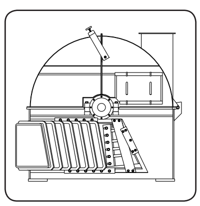
Horizontal Feed



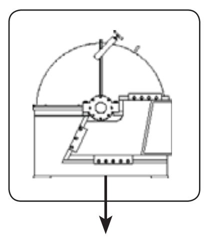
Drop Feed



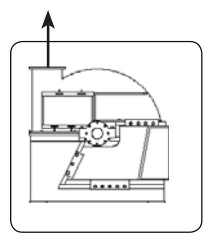
Right Hand



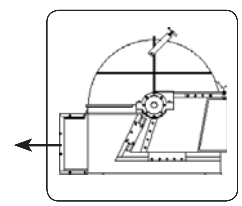
Left Hand



Bottom Discharge



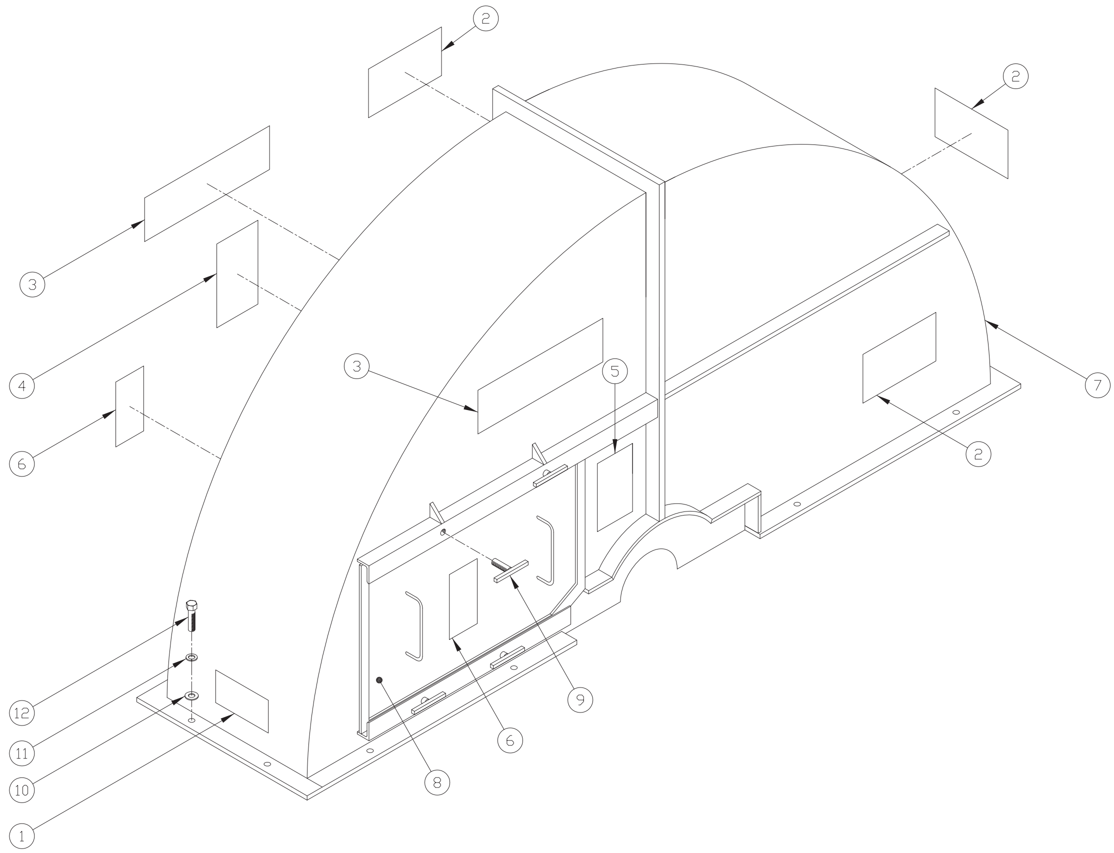
Top Discharge



End or Rear Discharge

850 Markeeta Spur Road
Moody, Alabama 35004
Phone: (205) 640-5181
Sales Fax: (205) 640-1147
Parts Fax: (205) 640-3210
Email: sales@msn.com

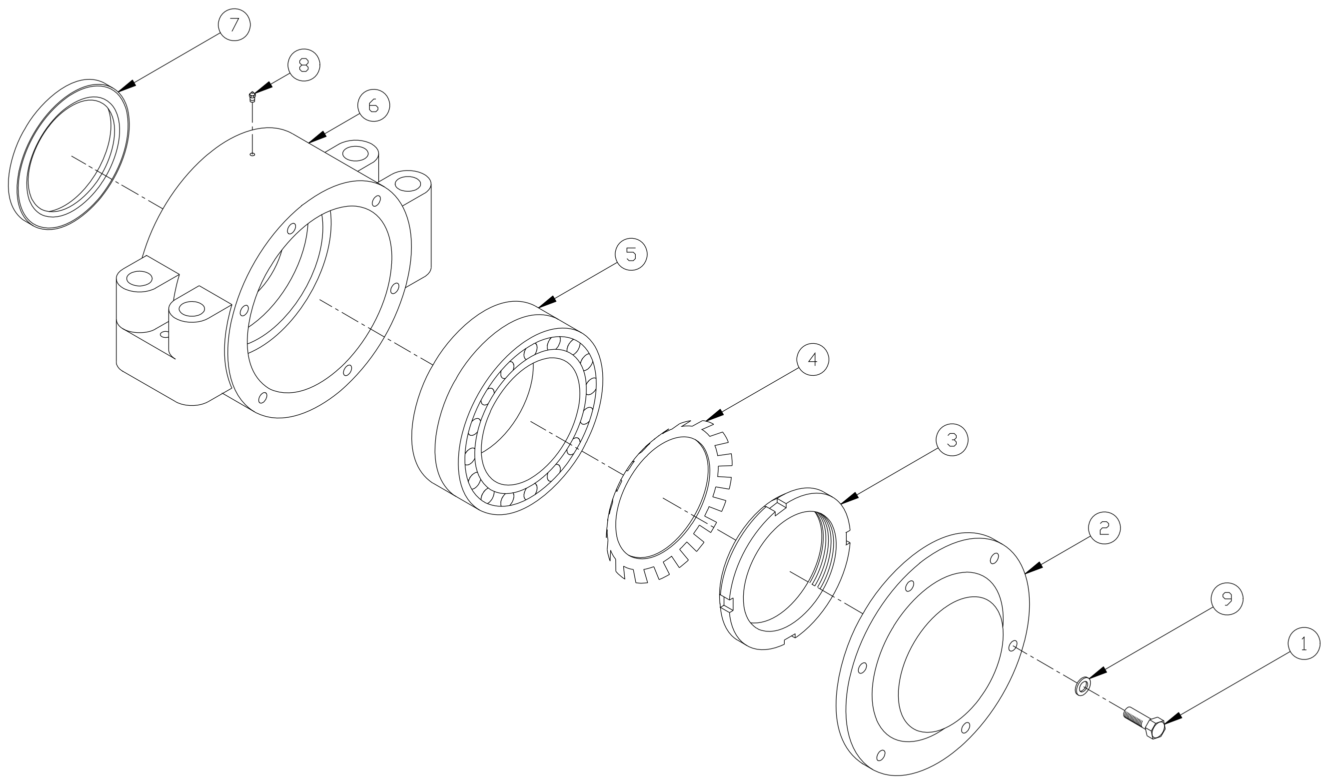
75” CHIPPER



HOOD

Ref. No.	Part No.	Description	No. Used
1	97-4262	Decal, Lockout/Tagout	1
2	97-4263	Decal, Do Not Open Hood	3
3	97-4271	Decal, Prec. Husky Logo	2
4	97-4259	Decal, Caution List	1
5	242-150-678	Decal, Read & Understand	1
6	97-4261	Decal, Access Doors	2
7	99-9778	Hood, Bottom Discharge	1

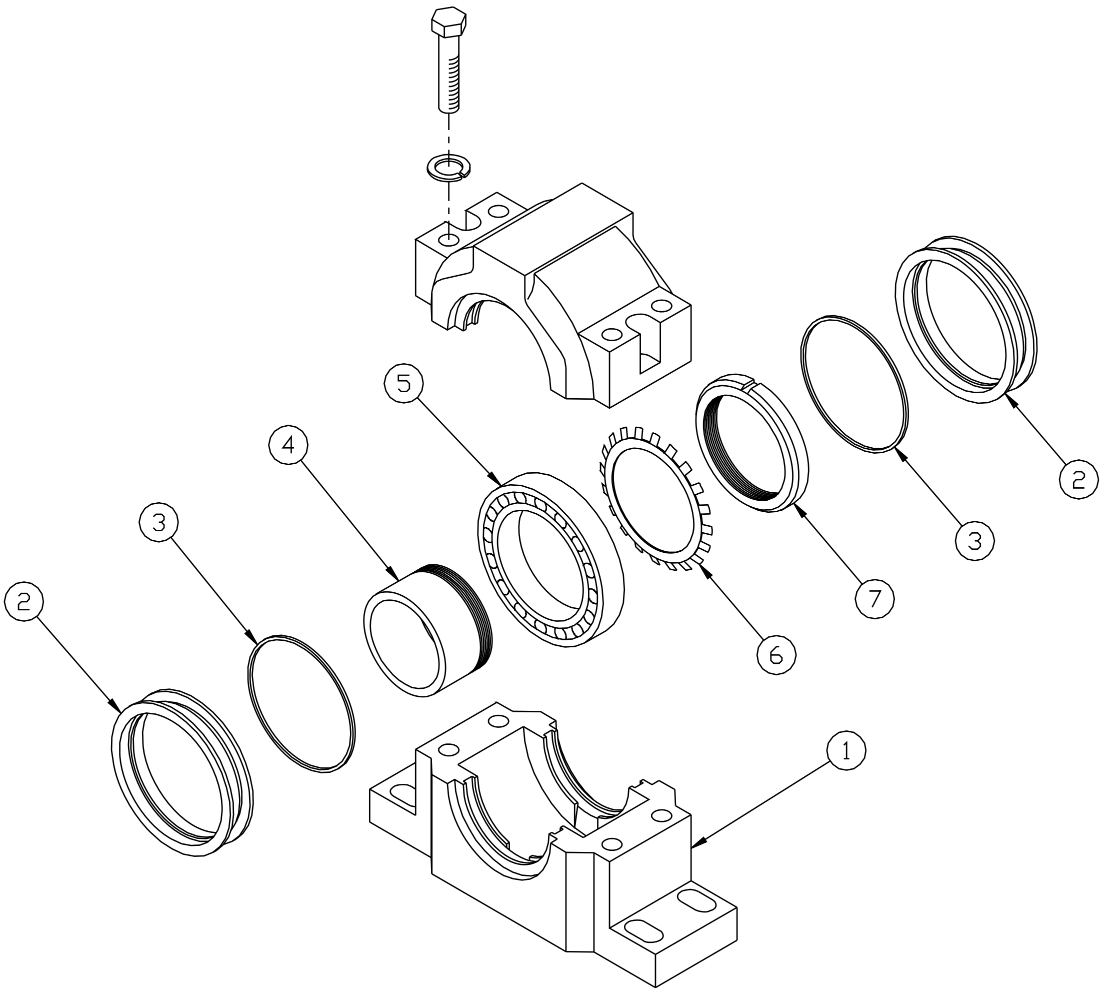
Ref. No.	Part No.	Description	No. Used
8	Call	Front Knife Access Door	1
	Call	Rear Knife Access Door	1
9	Call	Access Door T-Handle Bolt	8
10	944 000 766	Flatwasher, 5/8”	12
11	944 000 738	Lockwasher, 5/8”	12
12	944 000 133	HHCS, 5/8-11 X 2 1/4”	12



FRONT BEARING ASSEMBLY

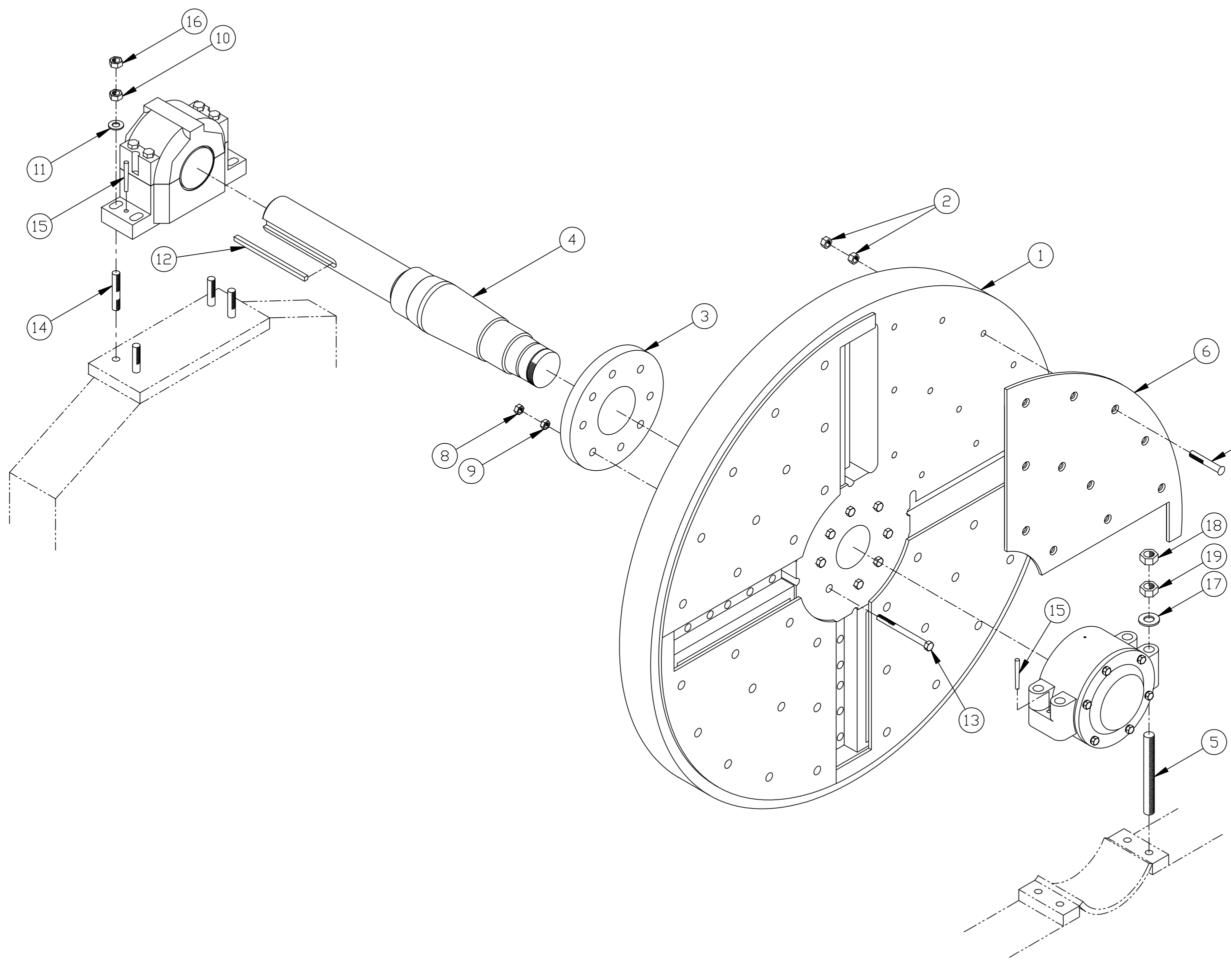
Ref. No.	Part No.	Description	No. Used
1	Call	HHCS, 5/8-11 x 2 1/4”	6
2	237 750 225	Bearing Housing Cap	1
3	901 000 508	Locknut	1
4	901 000 474	Lockwasher	1
5	901 000 330	Bearing	1

Ref. No.	Part No.	Description	No. Used
6	237 75 018	Bearing Housing	1
7	901 000 580	Seal	1
8	Call	Pipe Plug, 1/8”	1
9	944 000 738	Lockwasher, 5/8”	6
	*237 750 211	Front Bearing Housing with Cap	



REAR BEARING ASSEMBLY

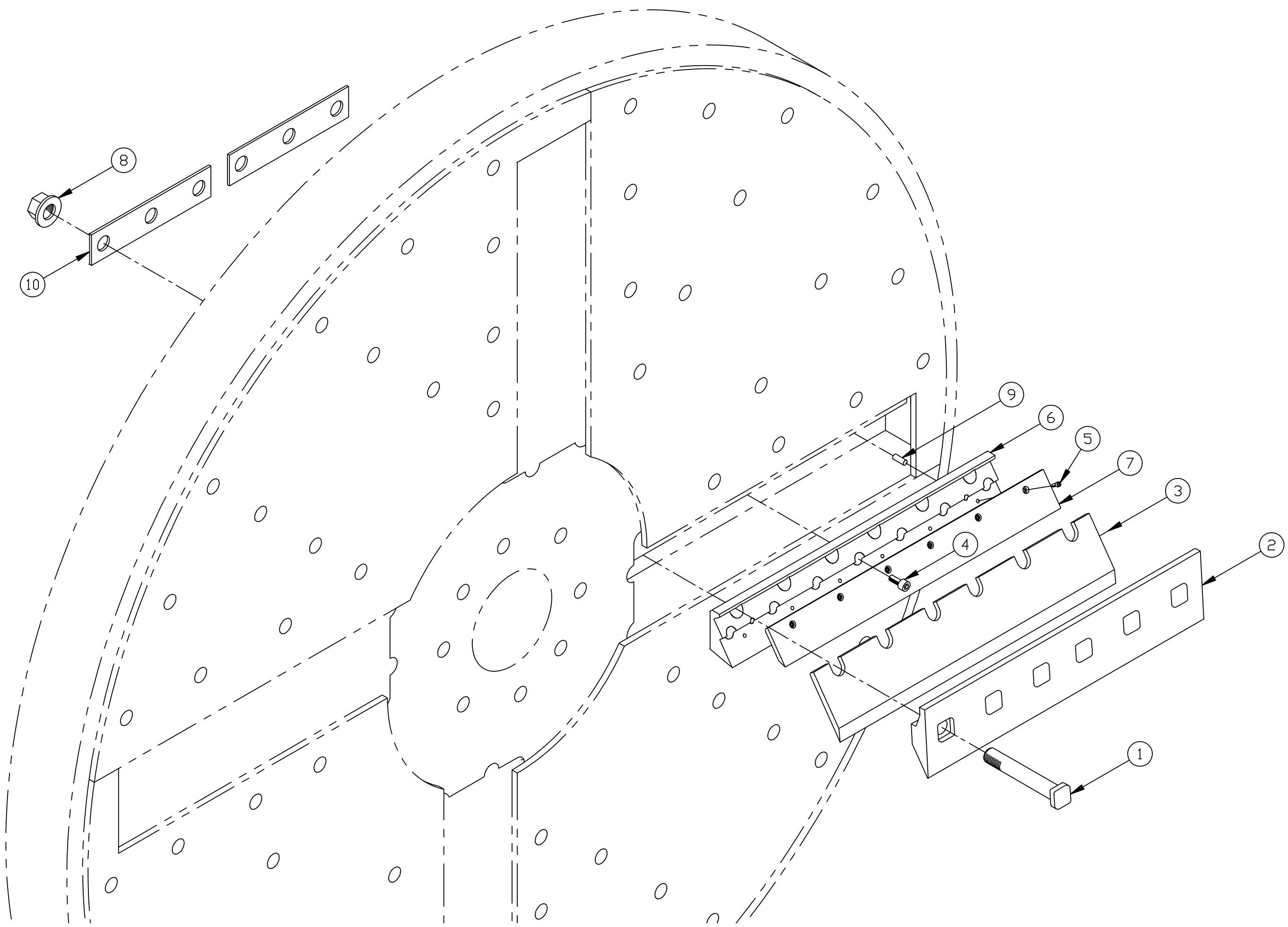
Ref. No.	Part No.	Description	No. Used
1	901 000 400	Bearing Housing	1
2	901 000 710	Seal	2
3	Call	O-Ring	2
4	901 000 445	Adapter	1
5	901 000 345	Bearing	1
6	901 000 478	Lockwasher	1
7	901 000 510	Locknut	1



DISC, SHAFT, & BEARING ASSEMBLY

Ref. No.	Part No.	Description	No. Used
1	Call	Disc	1
2	944 000 692	Hex Nut, 3/4-6	96
3	237 750 257	Draw Ring	1
4	99-9782	Shaft	1
5	944 000 042	Threaded Rod, 1-8 X 9”	4
6	237750106-77-3	4Knife Standard Wear Plate	4
7	944 000 565	Flat Head Bolt 3/4-10 X 6 1/8”	48
8	944 000 711	Heavy Hex Jam Nut, 1-8	8
9	944 000 706	Heavy Hex Nut, 1-8	8

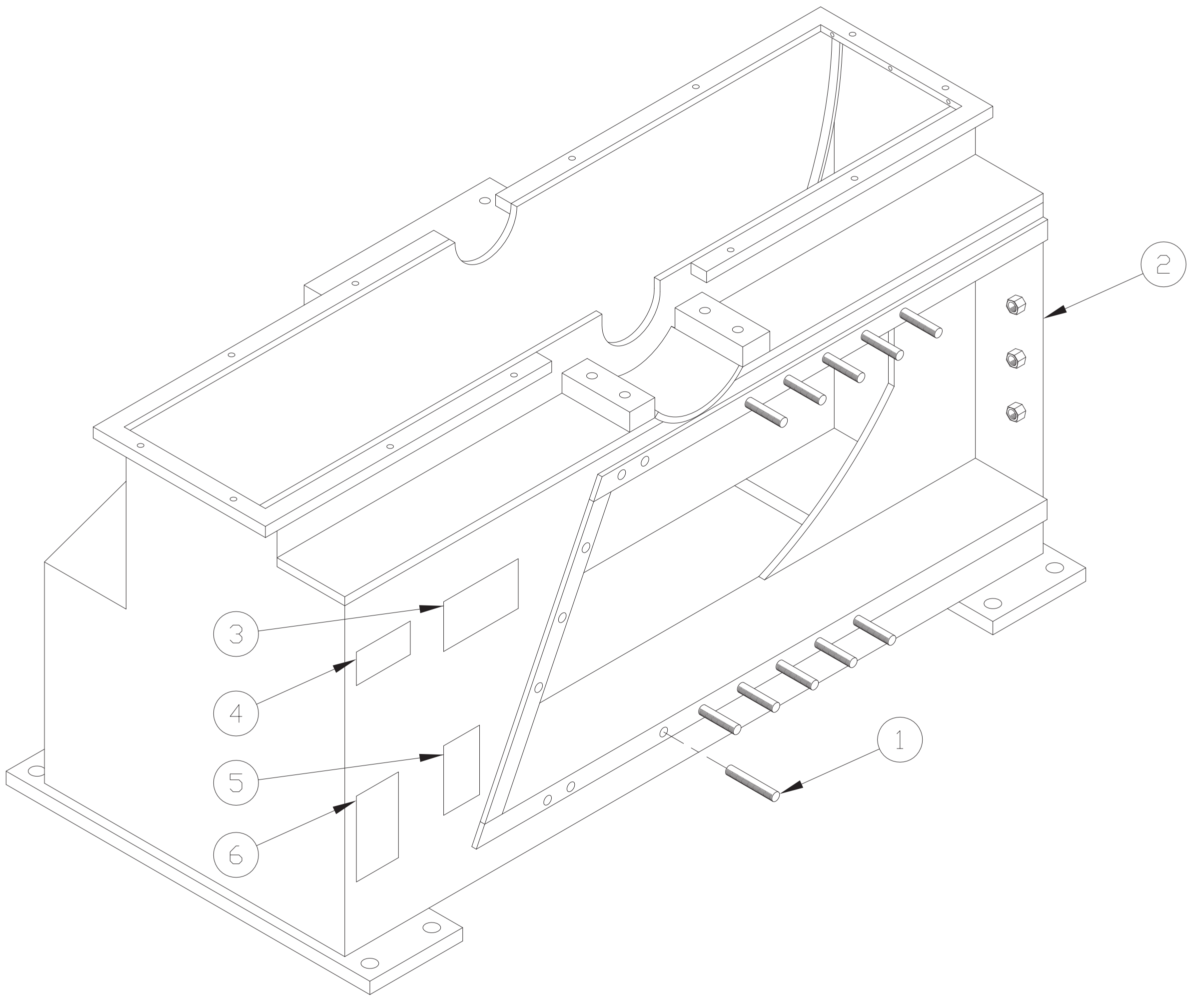
Ref. No.	Part No.	Description	No. Used
10	944 000 711	Heavy Hex Jam Nut, 1-8	4
11	944 000 772	Flatwasher, 1”	4
12	Call	Shaft Key	1
13	944 000 280	HHCS, 1-8 X 14”	8
14	944 000 025	Dbl. End Stud, 1-8 X 6”	4
15	Call	Dowel Pin	4
16	944 000 706	Heavy Hex Nut, 1-8	4
17	944 000 772	Flatwasher, 1”	4
18	944 000 711	Heavy Hex Jam Nut, 1-8	4
19	944 000 706	Heavy Hex Nut, 1-8	4



KNIFE ASSEMBLY

Ref. No.	Part No.	Description	No. Used
1	944 000 297	Sq. Head Bolt, 1-8 X 7 1/2”	24
2	237 840 178	Knife Clamp - Half Length	8
3	235 840 015	Knife - Half Length	8
4	944 000 425	SHCS, 1/2-13 X 1 1/4”	24
5	944 000 406	SHCS, 1/4-20 X 1/2”	24

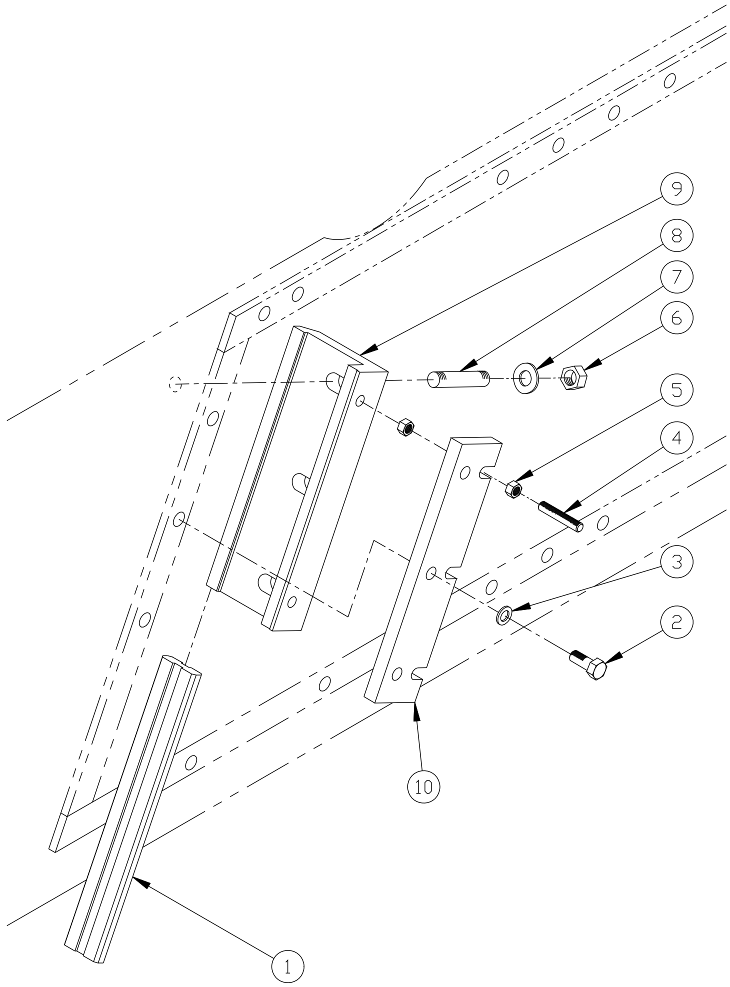
Ref. No.	Part No.	Description	No. Used
6	237 840 125	Knife Holder - Full Length	4
7	237 840 001	Counter Knife - Half Length	8
8	944 000 710	Northwestern Nut, 1-8	24
9	944 000 646	Spring Pin, 3/8” X 1”	8
10	Call	Disc Washer Clamp	1



Base Assembly

Ref. No.	Part No.	Description	No. Used
1	944 000 025	Dbl. End Stud, 1-8 X 6”	11
2	237 750 001	Base, Bottom Discharge	1
3	97-4263	Decal, Do Not Open Hood	1

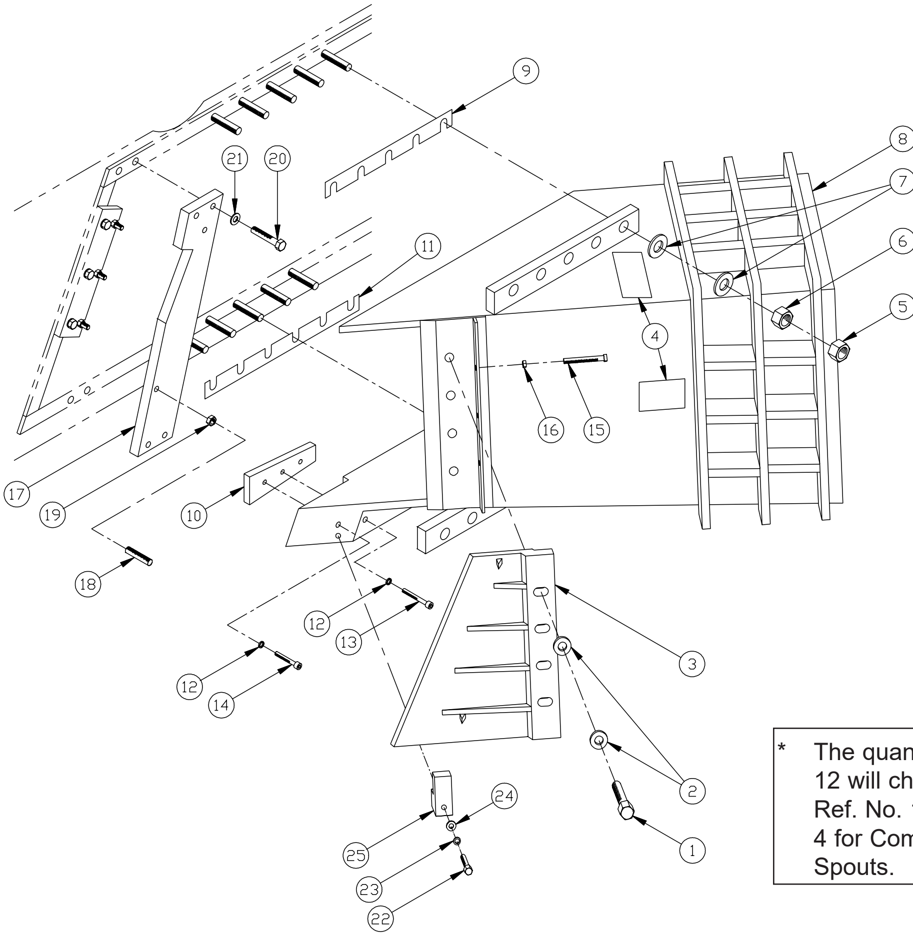
Ref. No.	Part No.	Description	No. Used
4	97-4262	Decal, Lockout/Tagout	1
5	242 150-678	Decal, Read & Understand	1
6	97-4259	Decal, Caution List	1



VERTICAL ANVIL & KEEPER PLATE ASSEMBLY

Ref. No.	Part No.	Description	No. Used
1	235 000 023	Standard Vertical Anvil	1
2	944 000 169	HHCS, 3/4-10 X 2 1/2”	3
3	944 000 740	Lockwasher, 3/4”	3
4	Call	All Thread, 5/8-11 X 5”	2
5	944 000 690	Heavy Hex Nut, 5/8-11	4

Ref. No.	Part No.	Description	No. Used
6	944 000 708	Hex Nut, 1-12	3
7	944 000 772	Flatwasher, 1”	3
8	944 000 019	Dbl. End Stud, 1-8 X 5 1/2”	3
9	237 750 155	Vertical Anvil Clamp	1
10	237 750 0197	Keeper Plate	1

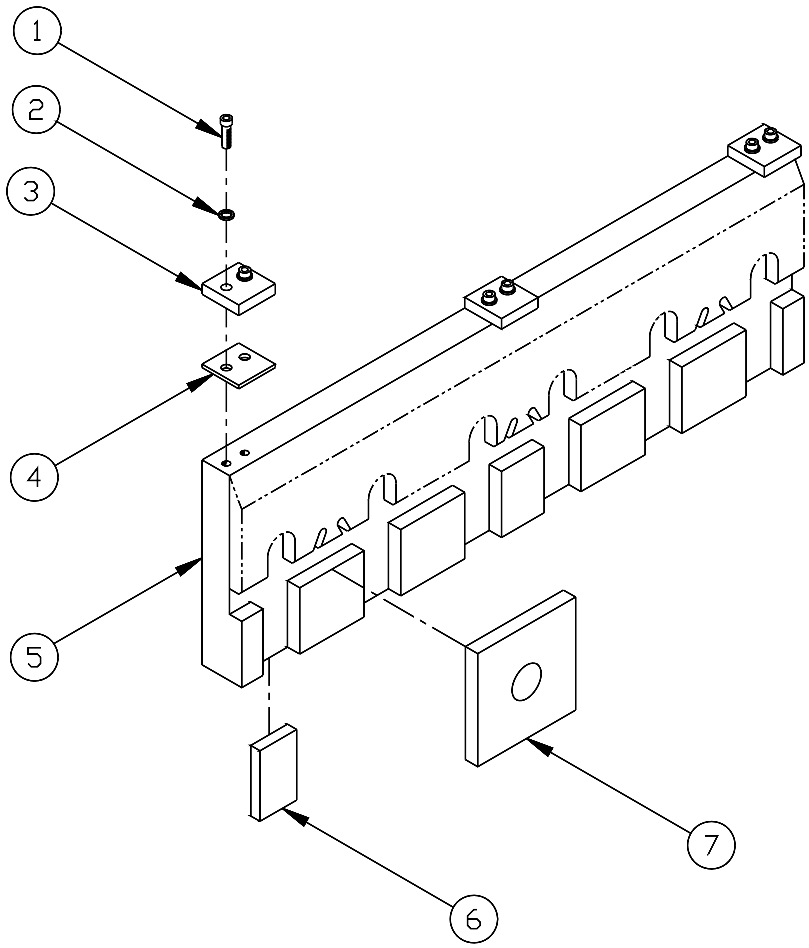


* The quantities for Ref. No. 12 will change to 5 and Ref. No. 13 will change to 4 for Combination Infeed Spouts.

Infeed Spout Assembly

Ref. No.	Part No.	Description	No. Used
1	944 000 234	HHCS, 1-8 X 2 1/2”	4
2	944 000 772	Flatwasher, 1”	12
3	237 000 071	Feed Plate, Right Hand	1
4	97-4264	Decal, Infeed Spout	2
5	944 000 711	Heavy Hex Jam Nut, 1-8	11
6	944 000 706	Heavy Hex Nut, 1-8	11
7	944 000 772	Flatwasher, 1”	22
8	230-751-326-rh-mod	Standard Horizontal Infeed Spout, Right Hand	1
9	235 750 047	Upper Spout Shim	varies
10	230 750 372	Tapered Har. Horizontal Anvil	1
	235 750 027	Standard Horizontal Anvil	1
	235 750 029	Combination Infeed Spout Horizontal Anvil	1

Ref. No.	Part No.	Description	No. Used
11	235 750 046	Lower Spout Shims	varies
*12	944 000 738	Lockwasher, 5/8”	3
*13	944 000 450	SHCS, 5/8-11 X 2 3/4”	2
14	944 000 444	SHCS, 5/8-11 X 1 1/4”	1
15	944 000 392	Sq. Head Setscrew, 3/4-10 X 6”	3
16	944 000 693	Hex Jam Nut, 3/4	3
17	237 000 080	Feed Plate Clamp Bar	1
18	Call	All Thread, 1-8	2
19	944 000 704	Hex Nut, 1-8	2
20	944 000 238	HHCS 1-8 X 3 1/2”	4
21	944 000 772	Flatwasher, 1”	4
22	944 000 170	HHCS, 3/4-10 X 2 3/4”	1
23	944 000 740	Lockwasher, 3/4”	1
24	944 000 768	Flatwasher, 3/4”	1
25	Call	Feed Plate Clamp	1



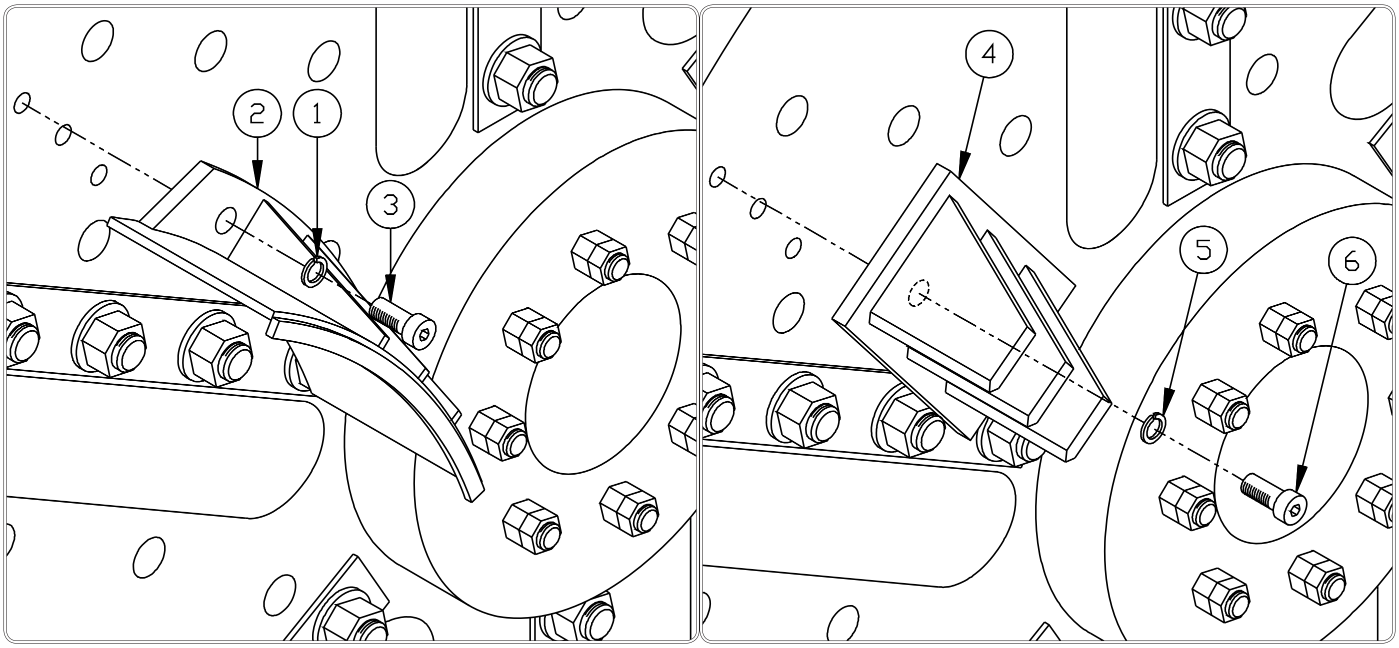
BABBITT KNIFE GAUGE ASSEMBLY

Ref. No.	Part No.	Description	No. Used
1	944 000 409	SHCS, 1/4-20 X 1 1/4”	6
2	944 000 730	Lockwasher, 1/4”	6
3	944 000 099	Stop Plate	3
4	Call	1/8” Shim	varies

Ref. No.	Part No.	Description	No. Used
5	237 840 197	Babbitt Gauge Assembly	1
6	Call	Babbitt Retainer Bars	6
7	237 000 100	Babbitt Pour Block	4
8	237 000 103	1 lb. of Babbitt Metal	

FAN BLADE ASSEMBLY

DISC CARD BREAKER ASSEMBLY



REAR VIEW OF THE CHIPPER DISC

FAN BLADE ASSEMBLY / DISC CARD BREAKER ASSEMBLY

Ref. No.	Part No.	Description	No. Used
1	944 000 744	Lockwasher, 1”	3
2	237 750 134	Standard Fan Blade, R.H.	varies
	237 750 134L	Standard Fan Blade L.H.	varies
3	944 000 475	SHCS, 1-8 X 2”	3

Ref. No.	Part No.	Description	No. Used
4	237 750 131	Standard Disc Card Breaker	varies
5	944 000 744	Lockwasher, 1”	3
6	944 000 475	SHCS, 1-8 X 2”	3

Customer information packet
ECR93004TR-4

300HP, 1785RPM, 3PH, 60HZ, 449T, A44144M, TEFC
Class - None
Division - Not Applicable

7/18/2023 9:44:37 AM

Specifications

Enclosure	TEFC
Frame	449T
Frame Material	Iron
Frequency	60.00 Hz
Motor Letter Type	Three Phase
Output @ Frequency	300.000 HP @ 60 HZ
Phase	3
Synchronous Speed @ Frequency	1800 RPM @ 60 HZ
Voltage @ Frequency	460.0 V @ 60 HZ
XP Class and Group	None
XP Division	Not Applicable
Agency Approvals	CSA EEV
Ambient Temperature	40 °C
Auxillary Box	No Auxillary Box
Base Indicator	Rigid
Bearing Grease Type	Mobil SHC 220 (Athens Only)
Constant Torque Speed Range	30-60
Current @ Voltage	336.000 A @ 460.0 V
Design Code	A
Drip Cover	No Drip Cover
Duty Rating	CONT
Efficiency @ 100% Load	96.2 %
Feedback Device	NO FEEDBACK
Heater Indicator	No Heater
High Voltage Full Load Amps	336.0 a
Insulation Class	F
Inverter Code	Inverter Ready
KVA Code	H
Lifting Lugs	No Lifting Lugs
Max Speed	3600 rpm
Motor Lead Quantity/Wire Size	12 @ 1 AWG
Motor Standards	NEMA

Part detail

Revision	G
Type	AC
Mech. spec.	
Base	
Status	PRD/A
Elec. spec.	A44WG5110
Layout	617427-091
Eff. date	04-08-2021
CD Diagram	416820-036
Poles	04
Leads	3#1 (04 per group)
Proprietary	False
Created date	02-05-2015

Motor Type	A44144M
Mounting Arrangement	F1
Number of Poles	4
Overall Length	53.24 IN
Power Factor	87
Product Family	Crusher / Chipper
Pulley End Bearing Type	Roller
Pulley Face Code	Standard
Service Factor	1.15
Shaft Ground Indicator	No Shaft Grounding
Shaft Rotation	Reversible
Shaft Slinger Indicator	Shaft Slinger
Speed	1785 rpm
Speed Code	Single Speed
Starting Method	Direct on line
Thermal Device - Bearing	None
Thermal Device - Winding	None

Nameplate

000613007PV											
CAT NO	ECR93004TR-4			SPEC NO.	P44G1819						
HP	300	AMPS	336	VOLTS	460			DESIGN	A		
RPM	1785	RPM MAX	3600	HZ	60	AMB	40	SF	1.15		
D.E. BRG.DATA	NU222			O.D.E. BRG.DATA	6318	PH	3	DUTY	CONT	INSUL.CLASS	F
FRAME	449T	I.P.	55	TYPE	P	ENCL	TEFC	CODE	H		
POWER FACTOR	87	3/4 LOAD EFF.	96.1	NEMA NOM EFFICIENCY	96.2						
CHP HZ	60-90	CT HZ	30-60	VT HZ	6-60						
SER.NO.		MOTOR WEIGHT									

NP2496L	
MOBIL SHC -220 GREASE	

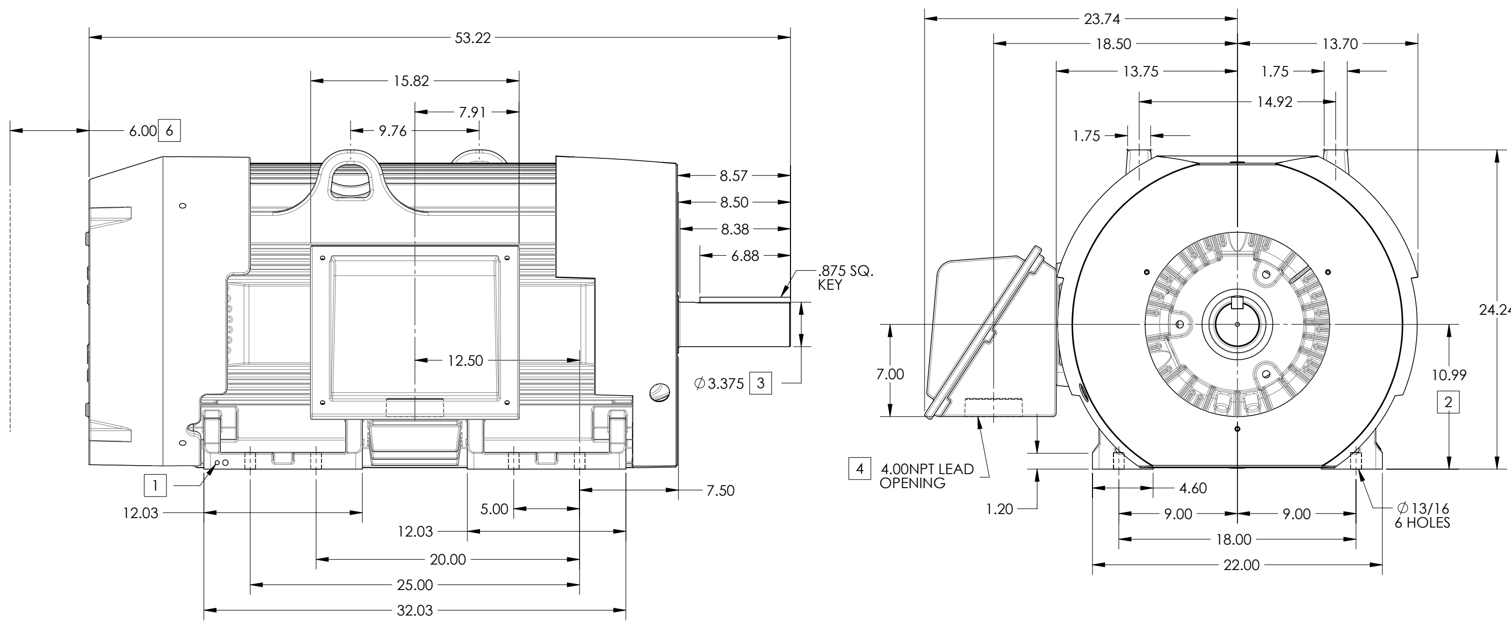
617427-091

DUTY MASTER ALTERNATING CURRENT MOTORS

SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED | FRAME 449T ABOVE NEMA RATINGS | COOLING: FAN COOLED

MOUNTING: FOOT | INCLUDES 447T FRAME MOUNTING HOLES



1. GROUND HOLES QTY 1 1/2-13 TAP; QTY 1 3/8-16 TAP
2. VARIES +.01,-.05
3. VARIES +.000,-.001
4. ON STANDARD MOTORS THIS IS CONDUIT SIZE. ON XT AND CORROSION PROOF MOTOR THIS IS PIPE TAP.
5. MOTOR WEIGHTS MAY VARY BY 15% DEPENDING ON RATING.
6. OBSTRUCTION MUST NO ENCROACH ON AIR INLET

CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F-2.
IF MOUNTING CLEARANCE DETAILS ARE REQUIRED, CONSULT FACTORY.
MAXIMUM PERMISSIBLE SHAFT RUNOUT WHEN MEASURED AT END OF STANDARD SHAFT EXTENSION IS .003" T.I.R. TO 5 INCH DIA.

5 WEIGHT (LBS): 3080

DRIVE END AIR DEFLECTOR IS ONLY INCLUDED WHEN NECESSARY.

DIMENSIONS ARE IN INCHES

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

SHEET NUMBER 1 OF 2

617427-091

REV. DESC: ADD C DIMENSION			BALDOR
REV: B	VERSION: 02	REVISED: 02:45:42 09/29/2015	TDR: 000000942902
MODEL NO. 617427-091			
BY: USBRCHA2		C	G449/447T SIDE MOUNT C-BOX,TEFC

617427-091

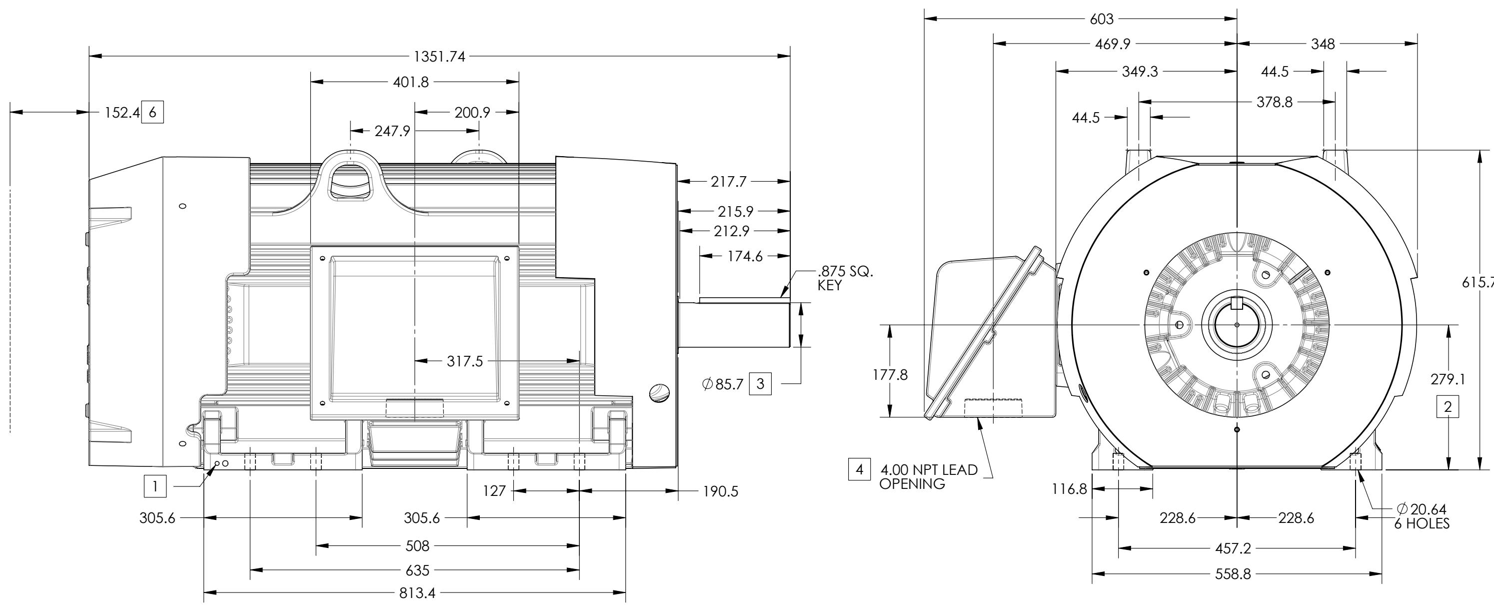
617427-091

DUTY MASTER ALTERNATING CURRENT MOTORS

SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED | FRAME 449T ABOVE NEMA RATINGS | COOLING: FAN COOLED

MOUNTING: FOOT | INCLUDES 447T FRAME MOUNTING HOLES



1. GROUND HOLES QTY 1 1/2-13 TAP; QTY 1 3/8-16 TAP
2. VARIES +.00,-1.524
3. VARIES +.000,-.0254
4. ON STANDARD MOTORS THIS IS CONDUIT SIZE. ON XT AND CORROSION PROOF MOTOR THIS IS PIPE TAP.
5. MOTOR WEIGHTS MAY VARY BY 15% DEPENDING ON RATING.
6. OBSTRUCTION MUST NO ENCROACH ON AIR INLET

CONDUIT BOX LOCATED ON OPPOSITE SIDE WHEN F-2.
IF MOUNTING CLEARANCE DETAILS ARE REQUIRED, CONSULT FACTORY.
MAXIMUM PERMISSIBLE SHAFT RUNOUT WHEN MEASURED AT END OF STANDARD SHAFT EXTENSION IS .0762 T.I.R. TO 127 MM DIA.

5 MASS (KGS): 1395

DRIVE END AIR DEFLECTOR IS ONLY INCLUDED WHEN NECESSARY.

DIMENSIONS ARE IN MILLIMETERS, SEE SHEET 1 FOR DIMENSIONS IN INCHES

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

SHEET NUMBER 2 OF 2

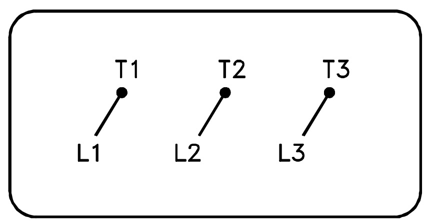
617427-091

REV. DESC: ADD C DIMENSION			BALDOR
REV: B	VERSION: 02	REVISED: 02:45:42 09/29/2015	TDR: 000000942902
MODEL NO. 617427-091			G449/447T SIDE MOUNT C-BOX,TEFC
BY: USBRCHA2		C	

617427-091

416820–036

A–C MOTOR
CONNECTION DIAGRAM
STANDARD 3 LEAD CONNECTED



(N.P. 1575–BA)

REV. DESC: LOADED TO BUS, C/R 335225			BALDOR
REV. LTR: –	VERSION: 00	TDR: 000000538207	
FILE: \MGA\00000\682		REVISED: 11:54:06 04/30/2010	CONN DIAG – STANDARD 3 LEAD
MTL: –		BY: RAGRA	SH 1 of 1

416820–036

SKF

640-810 May 1989
Supersedes April 1981

Read All Instructions Carefully Before Assembling

Mounting Procedure for SKF Split-Housing Pillow Blocks

Assembly Instructions for SKF Spherical Roller Bearings (Adapter Mounting)

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

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

Step #1. Check Shaft Tolerance

Shaft Tolerance Limits for Adapter Mountings (Values in inches)

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

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

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

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

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

Step #6. (Fig. 5) Locknut
Apply the locknut with the chamfered face toward the bearing. Use a lubricant on the threads and face of the locknut where it contacts the inner ring face of the bearing to make easier mounting for larger sizes. LARGER SIZE BEARINGS WILL REQUIRE A HEAVY DUTY SPANNER WRENCH AND SLEDGE HAMMER TO OBTAIN THE REQUIRED REDUCTION IN RADIAL INTERNAL CLEARANCE. **Do not** attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing. In larger bearing sizes it will be impossible to tighten the locknut far enough with a drift. If lower half of housing is in position, support the shaft such that the bearing outer ring is free to rotate. This will prevent internal damage to the bearing during tightening of the locknut. Remeasure internal radial clearance at this time. Tighten locknut and measure radial internal clearance with feeler blades between the most vertical unloaded roller and the outer ring sphere or at the 6:00 position if the bearing is hanging free on the shaft, until the radial internal clearance is less than the measurement in Step 3 by the amount shown in the following tabulation:

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

EXAMPLE: Determine the amount to reduce the radial internal clearance for a 3⁷⁄₁₆″ diameter shaft mounting.

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

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

C. Final mounted radial internal clearance will range from:

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

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

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

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

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

NOTE: ***There must be only one "held" bearing per shaft. Other bearing or bearings must be "free" to permit shaft expansion.*** *If the pillow block is to have one closed end, an end plug is supplied which fits snugly into the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: ***There must be only one "held" bearing per shaft. Other bearing or bearings must be "free" to permit shaft expansion.*** *If the pillow block is to have one closed end, an end plug is supplied which fits snugly into the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: ***There must be only one "held" bearing per shaft. Other bearing or bearings must be "free" to permit shaft expansion.*** *If the pillow block is to have one closed end, an end plug is supplied which fits snugly into the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

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

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

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

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

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

Lubrication Notes

GENERAL

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

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

Ball Bearings: Use NLGI(2) grade 2 or 3 channeling grease as shown below.

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

GREASE CLASSIFICATION

Class	Type of Base[1,9]	Oil Viscosity Centistokes (Approx.) (Saybolt Second Approx.)		NLGI(2) Grade of Grease	
		@38°C (100°F)	@99°C (210°F)	Ball Bearings	Roller Bearings
A	Lithium, Clay or Synthetic	43-108 (200-500)	6.7-8.8 (48-55)	2	0
B	Lithium, Clay or Synthetic	86-130 (400-600)	9.6-12.4 (58-68)	2 or 3	1
C	Lithium, Clay or Synthetic	173-216 (800-1000)	14.2-16.0 (75-82)	2 or 3	1
D	Lithium, Clay or Synthetic	173-216 (800-1000)	14.2-16.0 (75-82)		2

TYPE OF GREASE & RELUBE CYCLE RECOMMENDED

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

1 Calcium Complex Greases Not Recommended

2 National Lubricating Grease Institute Consistency Code

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

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

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

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

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

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

9 Never mix greases with unlike bases.

10 Remove old grease at least once a year.

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

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

Ball Bearings: 13 Centistokes (70 Saybolt Sec.)

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

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

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

Static Oil Lubrication

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

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

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

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

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

For further assistance consult SKF Applications Engineering.

Reference to Centistokes in this publication is equivalent to the use of mm²/s.

80M MGA 4/2000 Printed in U.S.A.

SKF Split Pillow Block Assembly Procedure

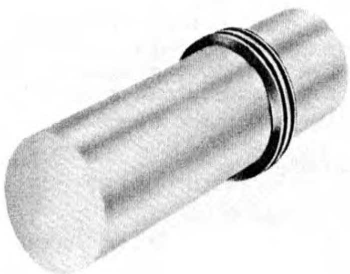


Fig. 1. Inner Triple Seal

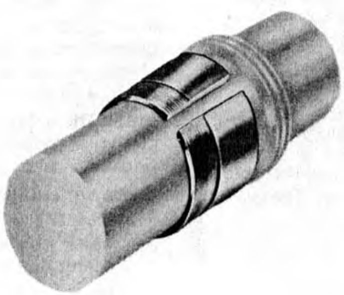


Fig. 2. Adapter Sleeve

Fig. 3. Unmounted Clearance

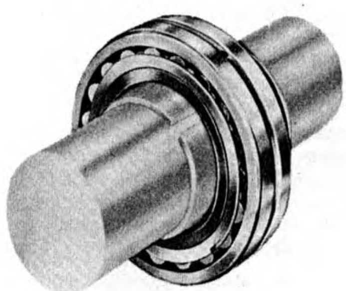


Fig. 4. Bearing

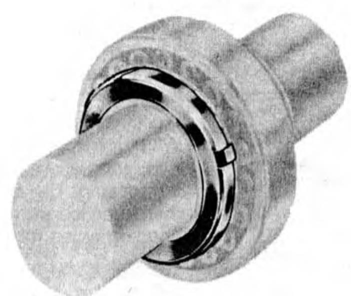


Fig. 5. Locknut

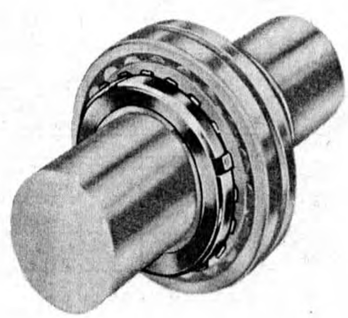


Fig. 6. Locknut & Lockwasher

Fig. 7. Inner Triple Seal — Cylindrical Bore

Fig. 8. Press Small Bearing on Shaft

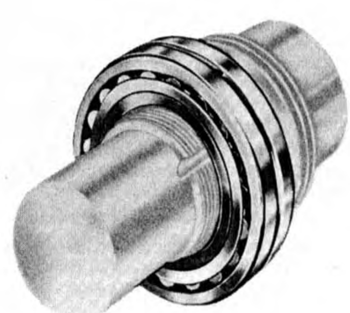


Fig. 9. Bearing with Cylindrical Bore

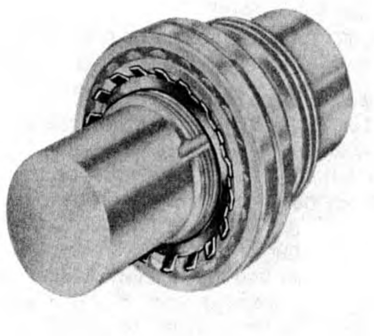


Fig. 10. Lockwasher

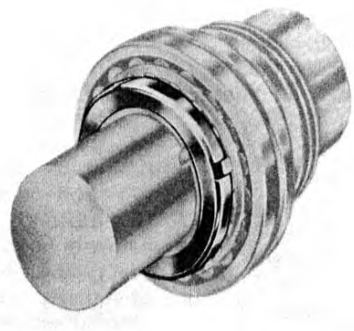


Fig. 11 Locknut on Shaft

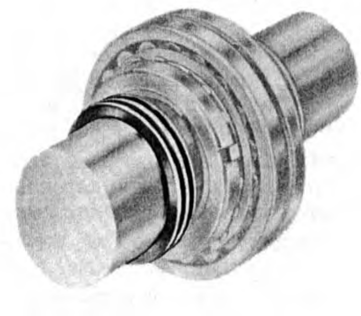


Fig. 12. Outer Triple Seal

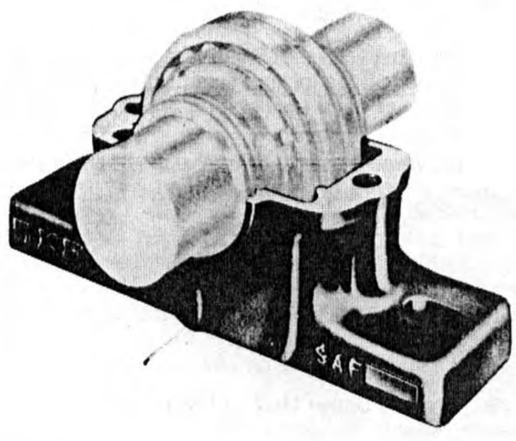


Fig. 13. Lower Half of Housing

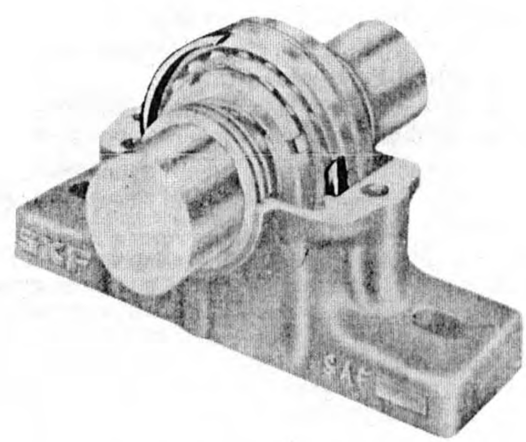


Fig. 14. Stabilizing Ring
(Only for Held Bearing)

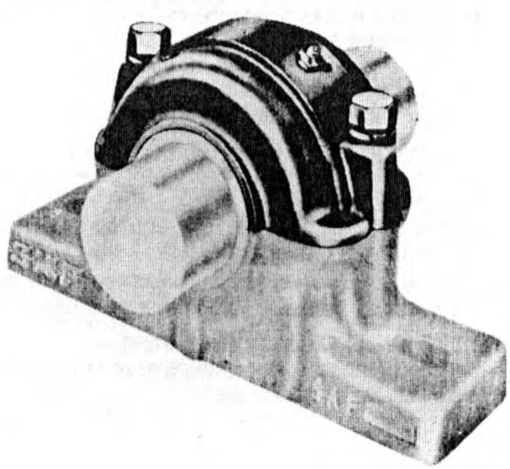


Fig. 15. Upper Half of Housing (CAP)

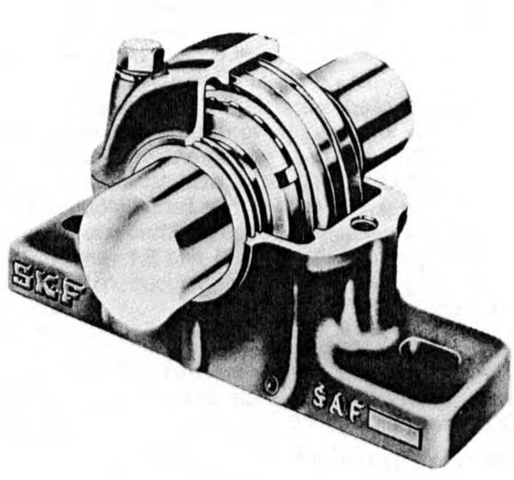
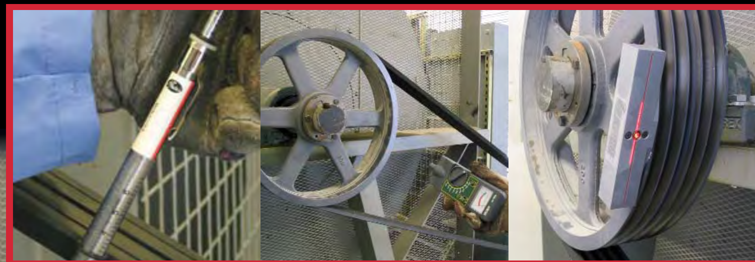


Fig. 16. Cutaway Illustration

BELT DRIVE
PREVENTIVE MAINTENANCE
& SAFETY MANUAL



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The Driving Force in Power Transmission®

Gates®

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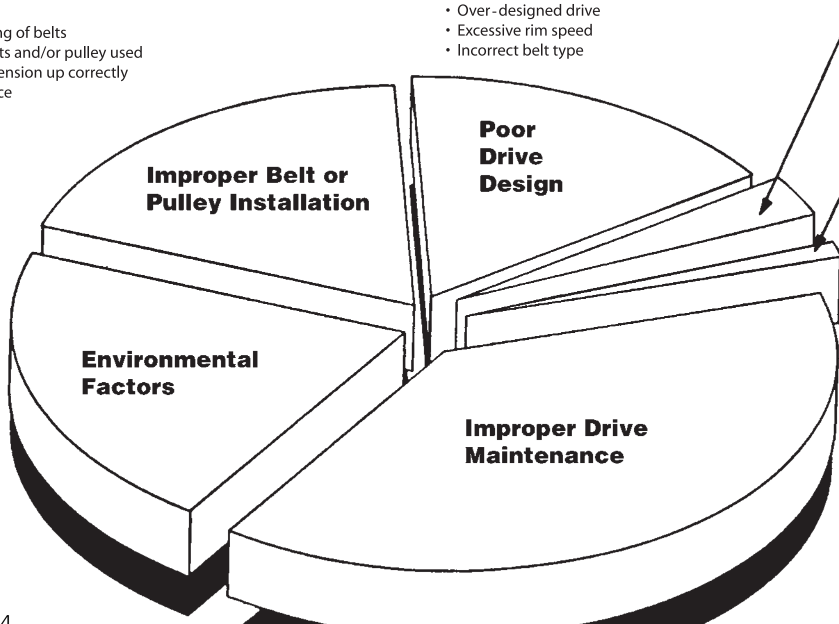
Sources of Drive Problems

- Rolling or prying on belts
- Misalignment
- Incorrect tension
- Improper handling of belts
- Mis-matched belts and/or pulley used
- Idler not taking tension up correctly
- Guard interference

- Sub-minimal diameters
- Under-designed drive
- Over-designed drive
- Excessive rim speed
- Incorrect belt type

Improper Belt Storage or Handling
- Temperature
- High Humidity
- Storing for too long
- Too near ozone generating equipment
- Exposed to sunlight

Defective Drive Components
- Check for worn pulleys or sheaves
- Check for cracked or weakened bracketry
- Check for weak mounting brackets
- Check for worn belts
- Check for nonfunctioning idlers
- Check for damaged guards



- Dust
- Debris
- Water/humidity
- Oil/grease
- Heat/cold
- Rust

- No retensioning
- Not replacing worn sheave
- Not cleaning guards
- Not checking for weak bracketry & drive components
- Not checking alignment

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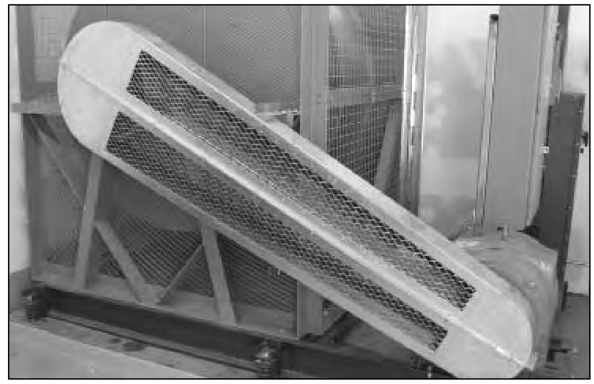
FOREWORD

Why have a preventive maintenance program?

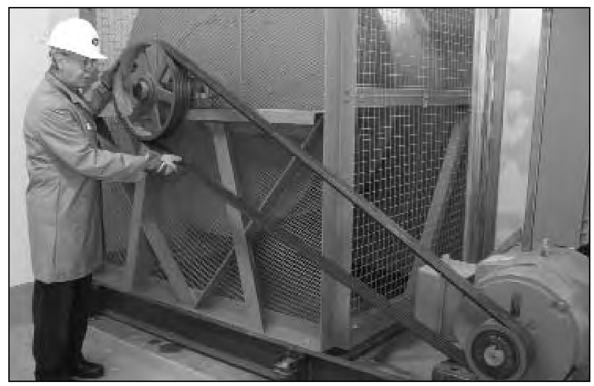
When compared to the constant lubrication problems associated with chain drives, or the mechanical problems and high costs associated with gear drives, belts are the most cost-effective, reliable means of power transmission.

However, optimum belt drive performance requires proper maintenance. The potential for long service life is built into every Gates belt. When coupled with a regularly scheduled maintenance program, belt drives will run relatively trouble-free for a long time.



Belt drive should have adequate guard

Power should be shut off and controls locked before inspecting



Carefully inspect all belts

*** Note** *- If belt looks bad, it probably is*

Important to your business

An effective preventive maintenance program saves time and money. Inspecting and replacing belts and faulty drive components before they fail will reduce costly downtime and production delays.

What is a good belt maintenance program?

A comprehensive, effective program of preventive maintenance consists of several elements:

- Maintaining a safe working environment.
- Regularly scheduled belt drive inspections.
- Proper belt installation procedures.
- Belt drive performance evaluations.
- Belt product knowledge.
- Belt storage and handling.
- Troubleshooting.

Maintaining A Safe Working Environment

It is common sense to establish a safe working environment in and around belt drives. The following precautions will make belt drive inspection and maintenance easier and safer.

Power should be shut off and controls locked before inspecting

Wear Proper Clothing

Never wear loose or bulky clothes, such as neckties, exposed shirttails, loose sleeves or loose lab coats around belt drives. Wear gloves while inspecting sheaves or sprockets to avoid being cut by nicks, burrs or sharply worn pulley edges. Wear safety glasses to avoid eye injuries. Don't be foolish! Wear proper clothing.
This technician is not wearing safety glasses, and his bulky lab coat and neck tie are hazards near moving components.

No loose or bulky clothing

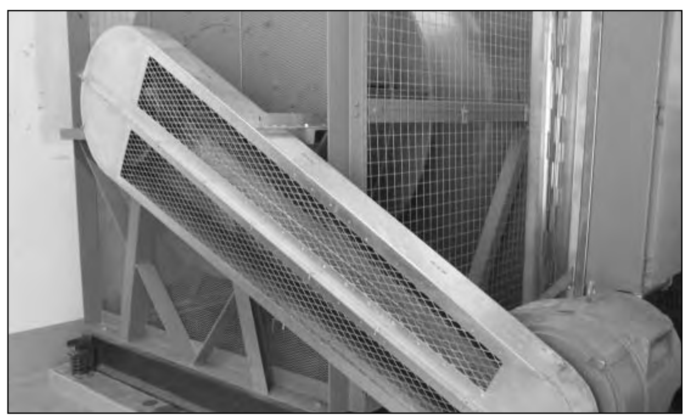
Maintain Safe Access to Drives

Always maintain a safe access to the belt drives. Keep area around drives free of clutter, debris and other obstructions. Floors should be clean and free of oil and debris to insure good footing and balance while working on machinery.

Don't clutter area around belt drive

Drive Guards

Always keep drives properly guarded. Every belt drive must be guarded when in operation. Guard must be designed and installed according to OSHA standards.



A properly guarded belt drive

A Properly Guarded Belt Drive

A properly designed guard has the following features:

- Completely encloses drive.
- Grills or vents for good ventilation.
- Accessible inspection door or panels.
- Can easily be removed and replaced if damaged.
- Where necessary, should protect the drive from weather, debris and damage.

Follow these precautions to make your preventive maintenance easier.

DRIVE SHUTDOWN & THOROUGH INSPECTION

Simple Drive Inspection

Begin preventive maintenance with a periodic drive inspection as a normal part of your maintenance rounds. Look and listen for any unusual vibration or sound while observing the guarded drive in operation. A well designed and maintained drive will operate smoothly and quietly.

Inspect guard for looseness or damage. Keep it free of debris or dust and grime buildup on either the inside or the outside of the guard. Any accumulation of material on the guard acts as insulation, and could cause drives to run hotter.

The effect of temperature on belt life is important. For example, an internal temperature increase of 18°F (or approximately 36°F rise in ambient drive temperature) may cut belt life in half.

Also look for oil or grease dripping from guard. This may indicate over-lubricated bearings. If this material gets on rubber belts, they may swell and become distorted, leading to early belt failure.

It's a good idea to check motor mounts for proper tightness. Check take-up slots or rails to see that they are clean and lightly lubricated.

How Often To Inspect

The following factors influence how often to inspect a drive.

- Critical nature of equipment
- Drive operating cycle
- Accessibility of equipment
- Drive operating speed
- Environmental factors
- Temperature extremes in environment

Experience with specific equipment is the best guide to how often to inspect belt drives. Drives operating at high speeds, heavy loads, frequent stop/start conditions and at temperature extremes or operating on critical equipment require frequent inspection.

When To Perform Preventive Maintenance

To help establish a preventive maintenance schedule, keep the following in mind.

Critical Drives

A quick visual and noise inspection may be needed every one to two weeks.

Normal Drives

With most drives, a quick visual and noise inspection can be performed once a month.

Complete Inspection

A drive shutdown for a thorough inspection of belts, sheaves or sprockets and other drive components may be required every three to six months.

Remember, a well-designed industrial belt drive is capable of operating for several years when properly maintained and used under normal conditions.

Follow the Preventive Maintenance Procedure on the following page when performing detailed maintenance during equipment shutdowns.

DRIVE SHUTDOWN & THOROUGH INSPECTION

Preventive Maintenance Check List

By following these steps, belt drives can be maintained efficiently and safely.

1. Always turn off the power to the drive. Lock the control box and tag it with a warning sign "Down For Maintenance. Do Not Turn Power On."
Make sure the power is turned off for the correct drive.

2. Test to make sure correct circuit has been turned off.

3. Place all machine components in a safe (neutral) position. Make sure that moving components are locked down or are in a safe position. Make sure that fans cannot unexpectedly freewheel.

4. Remove guard and inspect for damage. Check for signs of wear or rubbing against drive components. Clean and realign guard to prevent rubbing if necessary.

5. Inspect belt for wear or damage. Replace as needed.

6. Inspect sheaves or sprockets for wear and misalignment. Replace if worn.

Turn off power, lock controls and tag

7. Inspect other drive components such as bearings, shafts, motor mounts and take-up rails.

8. Inspect static conductive grounding system (if used) and replace components as needed.

9. Check belt tension and adjust as needed.

10. Recheck sheave or sprocket alignment.

11. Reinstall belt guard.

12. Turn power back on and restart drive. Look and listen for anything unusual.

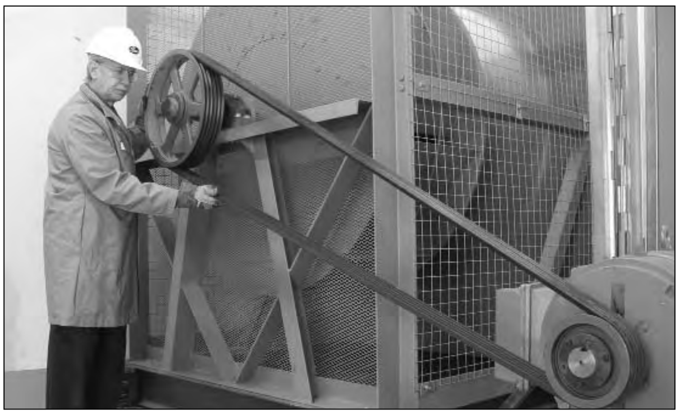
Preventive Maintenance Procedure

Once the power is off, locked and tagged, and the machine components are in safe positions, remove the guard and begin the inspection.

How to Inspect a Belt

Observing signs of unusual belt wear or damage will help troubleshoot possible drive problems.

Mark or note a point on the belt, or on one of the belts in a multiple V-belt drive. Wearing gloves, work around the belt(s), checking for cracks, frayed spots, cuts, or unusual wear patterns.



Begin by inspecting the belt

Check the belt for exposure to excessive heat. Excessive heat can come from a hot environment or from belt slip that generates heat. The maximum environmental temperature for a properly maintained V-belt is 140˚F. The maximum environmental temperature for a properly maintained synchronous belt is 185˚F.

Rubber belts that are running hot, or running in a hot environment will harden and develop cracks from the bottom of the belt upwards.

Refer to the PROBLEM/SOLUTION SUMMARY TABLE for other symptoms.

Belts should be replaced if there are obvious signs of cracking, fraying, unusual wear or loss of teeth.

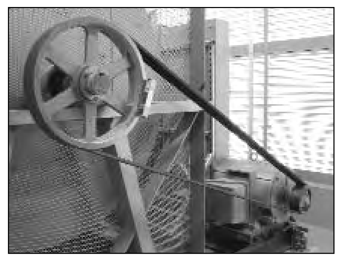
How to Check Alignment

While the drive is shut down, it is a good idea to check the sheaves or sprockets for proper alignment.

To check alignment, use a straight edge, string, or Gates EZ Align™ laser alignment tool.

Using a straight edge to check alignment

Using a string to check alignment



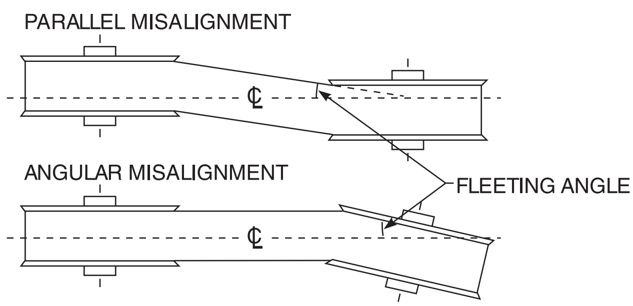
Using EZ Align™ laser alignment tool on both ends

Using EZ Align™ laser alignment tool, showing reflected laser on emitter

Using EZ Align™ laser alignment tool showing laser line on target

If using a straight edge (or string), line the straight edge along the outside face of both sheaves or sprockets as shown in the photo. If the drive is properly aligned, the straight edge or string will contact each sheave or sprocket evenly. The straight edge or string (pulled tight) should touch the two outer edges of each sheave or pulley for a total of four points of contact. Misalignment of sprockets and shafts will show up as a gap between the outside face of the sheave or sprocket and the straight edge. Check for tilting or shaft misalignment by using a bubble level. For proper alignment, the bubble should be in the same position as measured on each shaft.

If using the Gates EZ Align™ laser alignment tool, follow the detailed instructions included with the tool. The EZ Align laser alignment tool makes it very quick and easy to check alignment of shafts, sheaves and sprockets.



There are three possible causes and solutions of sheave or sprocket misalignment:

1. Angular Misalignment: The motor shafts and driven machine shafts are not parallel.
   a. Correct alignment by adjusting the motor shaft into alignment with the driveN shaft.
2. Parallel Misalignment: Sheaves or sprockets are not properly located on the shafts.
   a. Loosen and reposition one or both sheaves or sprockets until properly aligned.
3. Sheaves or sprockets are tilted on the shaft due to incorrect bushing installation.

   a. Rotate drive by hand and look for excessive wobble. If wobble is observed, remove and reinstall sheave or sprocket. Follow the bushing installation procedures explained in the INSTALLATION section. Further check alignment by using one of the previously mentioned methods.

Misalignment on V-belt drives should be less than 1/2˚ or 1/10" per foot of center distance. Misalignment for synchronous, Polyflex®, or Micro-V® belts should be less than 1/4˚ or 1/16" per foot of center distance.

When a synchronous belt drive has been aligned (following the procedure discussed above in the "How to Check Alignment" section), do not continue to adjust alignment in an attempt to make the synchronous belt ride in the center of the sprocket's face width. Synchronous belts, while neutral tracking, will tend to ride in contact with a flange on one side of the sprockets. Synchronous belts on drives that are properly aligned will lightly contact the flanges. Synchronous belts on misaligned drives will ride hard against the flanges and generate additional noise. Attempting to adjust a synchronous belt drive's alignment to force the belt to ride in the center of the sprocket's face width will typically result in misalignment.

Guard Inspection

Check the guard for wear or possible damage. Don't overlook wear on the inside of the guard. Check for any areas that may be contacting the belt. Clean the guard to prevent it from becoming blocked and closed to ventilation. Clean off any grease or oil that may have spilled onto the guard from over-lubricated bearings.

Check Other Drive Components

It is always a good idea to examine bearings for proper lubrication. Check the motor base bolts and adjustment screws to make sure they are not loose. If loose, tighten to the recommended torque value. Make sure that adjustment screws are free of debris, dirt, or rust.

Check Belt Tension

Following the drive component inspection, the final step is to check belt tension. Rotate the drive two or three revolutions by hand and check the belt tension. If necessary, retension the belt and make a final alignment check.

If V-belts are undertensioned, they can slip. Slippage generates heat and will result in cracking and belt failure.

If synchronous belts are undertensioned, they can jump teeth or ratchet. Ratcheting will damage the belt and result in premature belt failure.

If belts are overtensioned, belt and bearing life can be reduced.

The proper way to check belt tension is to use a tension tester. Gates has a variety of tension testers, ranging from the simple spring scale type tester to the sophisticated Sonic Tension Meter.

Measuring Belt Tension

The spring scale type tester measures how much force is required to deflect the belt a specified distance at the center of its span. This is the force deflection method of tensioning belts.

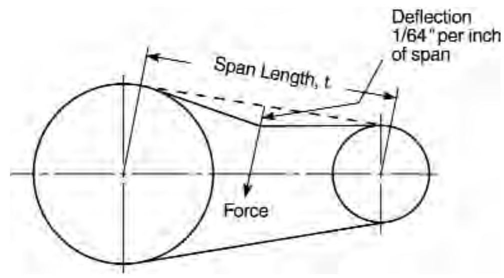
The Sonic Tension Meter measures the vibration of the belt span and instantly converts the vibration frequency into belt static tension. This is the span vibration method of tensioning belts.

For more information, refer to the Troubleshooting Tools section.

Force Deflection Tension Method

The force deflection tension method does not directly measure belt span tension or static tension. The deflection force is a calculated value that is based on the amount of static tension required in the belt. Static tension is the tension force that is actually in the belt, while deflection force is simply a measurement to check how much static tension is in the belt. The tension testers used for the force deflection tension method are available in one, two, or five barrel configurations. The one barrel tension tester can measure up to 30 lb. of force; the two barrel tension tester can measure up to 66 lb. of force; and the five barrel tension tester can measure up to 165 lb. of force. Add the force readings off each barrel to determine the total force being measured.

1. Measure span length (t). Span length is the distance from where the belt exits one pulley to where it enters the next pulley.



2. Position the lower of the two O-Rings using either of these methods:
   a. On the scale reading "Deflection Inches", set the O-Ring to show a deflection equal to 1/64" per inch of span length (t).
   b. On the scale reading "Inches of Span Length", set O-Ring to show a deflection equal to the inches of measured span length (t).
3. At the center of the span (t), apply force using the appropriately sized Gates tension testers. Apply the force perpendicular to the span. If the belt is a wide synchronous belt or a PowerBand belt, place a piece of steel or angle iron across the belt width and deflect the entire width of the belt evenly. Deflect the belt until the bottom edge of the lower O-Ring is at the correct deflection distance. If multiple individual V-belts are used on the drive, the deflection distance can be measured against an adjacent belt. For drives with only one belt, use a straightedge or string pulled tight across the sheaves, sprockets, or top of the belt to establish a reference line. When the belt is deflected to measure tension, measure the deflection distance by measuring from the belt to the straight edge or string reference line.

4. Find the amount of deflection force on the upper scale of the tension tester. The sliding rubber O-Ring slides up the scale as the tool compresses and stays up for a reading of the deflection force. Read at the bottom edge of the ring. Remember to slide the O-Ring down before using again.

5. Installation tension forces should ideally be calculated for each specific drive. The tension calculations are included in all Gates drive design manuals. Additionally, the Gates drive design and selection computer program, Design Flex® II can be used to quickly calculate the proper installation tensions. Design Flex® II is available for download at www.gates.com.

   If installation tension values for a specific V-belt drive are not available, the tables shown can be used to determine generic tension values based on the V-belt cross section. As synchronous belt drives are more sensitive to proper belt tensioning, there are no similar quick reference tension tables for them.

Compare the deflection force with the range of forces recommended. If less than the minimum recommended deflection force, the belts are too loose and should be tightened. If more than the maximum recommended deflection force, the belts are too tight and should be loosened.

Recommended Deflection Force Per Belt For Super HC® V-Belts, Super HC PowerBand® Belts, Super HC Molded Notch V-Belts or Super HC Molded Notch PowerBand Belts

V-Belt Cross Section	Small Sheave Diameter Range (In.)	Small Sheave RPM Range	Speed Ratio Range	Recommended Deflection Force (Lbs.)	
				Minimum	Maximum
3V	2.65 - 2.80	1200-3600	2.00 to 4.00	3.0	4.3
	3.00 - 3.15	1200-3600		3.3	4.8
	3.35 - 3.65	1200-3600		3.7	5.4
	4.12 - 5.00	900-3600		4.4	6.4
	5.30 - 6.90	900-3600		4.8	7.1
3VX	2.20	1200-3600	2.00 to 4.00	2.8	4.1
	2.35 - 2.50	1200-3600		3.2	4.7
	2.65 - 2.80	1200-3600		3.5	5.1
	3.00 - 3.15	1200-3600		3.8	5.5
	3.35 - 3.65	1200-3600		4.1	6.0
	4.12 - 5.00	900-3600		4.8	7.1
	5.30 - 6.90	900-3600		5.8	8.6
5VX	4.40 - 4.65	1200-3600	2.00 to 4.00	9.0	13.0
	4.90 - 5.50	1200-3600		10.0	15.0
	5.90 - 6.70	1200-3600		11.0	17.0
	7.10 - 8.00	600-1800		13.0	19.0
	8.50 - 10.90	600-1800		14.0	20.0
	11.80 - 16.00	400-1200		15.0	23.0
5V	7.10 - 8.00	600-1800	2.00 to 4.00	11.0	16.0
	8.50 - 10.90	600-1800		13.0	18.0
	11.80 - 16.00	400-1200		14.0	21.0
8V	12.50 - 17.00	600-1200	2.00 to 4.00	28.0	41.0
	18.00 - 24.00	400- 900		32.0	48.0

Recommended Deflection Force Per Belt For Hi-Power II™ V-Belts, Hi Power II PowerBand Belts or Tri-Power® Molded Notch V-Belts

V-Belt Cross Section	Small Sheave Diameter Range (In.)	Small Sheave RPM Range	Speed Ratio Range	Recommended Deflection Force (Lbs.)			
				Hi-Power II		Tri-Power Molded Notch	
				Minimum	Maximum	Minimum	Maximum
A AX	3.0	1750 to 3600	2.00 to 4.00	2.7	3.8	3.8	5.4
	3.2			2.9	4.2	3.9	5.6
	3.4 - 3.6			3.3	4.8	4.1	5.9
	3.8 - 4.2			3.8	5.5	4.3	6.3
	4.6 - 7.0			4.9	7.1	4.9	7.1
B BX	4.6	1160 to 1800	2.00 to 4.00	5.1	7.4	7.1	10.0
	5.0 - 5.2			5.8	8.5	7.3	11.0
	5.4 - 5.6			6.2	9.1	7.4	11.0
	6.0 - 6.8			7.1	10.0	7.7	11.0
	7.4 - 9.4			8.1	12.0	7.9	12.0
C CX	7.0	870 to 1800	2.00 to 4.00	9.1	13.0	12.0	18.0
	7.5			9.7	14.0	12.0	18.0
	8.0 - 8.5			11.0	16.0	13.0	18.0
	9.0 - 10.5			12.0	18.0	13.0	19.0
	11.0 - 16.0			14.0	21.0	13.0	19.0
D	12.0 - 13.0	690 to 1200	2.00 to 4.00	19.0	27.0		
	13.5 - 15.5			21.0	30.0		
	16.0 - 22.0			24.0	36.0		

Span Vibration Method

The Gates Sonic Tension Meter can be used with all Gates belts. The Sonic Tension Meter measures the vibration in the belt span, and converts that measurement into a reading of the actual static tension in the belt. To use the Sonic Tension Meter, you will need to enter the belt unit weight, belt width for synchronous belts or number of ribs or strands for V-belts, and the span length. To measure the span vibration, press the "Measure" key on the meter, tap the belt span to vibrate the belt, and hold the microphone approximately 3/8" to 1/2" away from the back of the belt. The Sonic Tension Meter will display the static tension, and can also display the vibration frequency.

Since the span vibration method is intended to be a very accurate method of measuring actual tension in a belt, it is important that the proper recommended tension is calculated for the specific belt drive. Procedures for calculating belt tension are included in each of the appropriate Gates drive design manuals. To determine the belt tension recommended for specific drive applications, refer to the appropriate belt drive design manual or download the Gates belt drive selection program, DesignFlex® II, at www.gates.com. Alternatively, Gates Power Transmission Product Application engineers can be contacted at (303) 744-5800.

The adjusted belt weights for use with the Gates Sonic Tension Meter are shown in the following table.

Belt Product Family	Belt Cross Section	Belt Type	Adjusted Belt Weight (grams/meter)
Super HC® V-belts	3VX	Single	61
	5VX	Single	158
	3V	Single	72
	5V	Single	200
	8V	Single	510
	3VX	PowerBand®	70
	5VX	PowerBand®	185
	3V	PowerBand®	96
	5V	PowerBand®	241
	8V	PowerBand®	579
Predator® Belts	3VP	PowerBand®	89
	5VP	PowerBand®	217
	8VP	PowerBand®	528
	BP	PowerBand®	212
	CP	PowerBand®	332
Tri-Power® V-belts	AX	Single	85
	BX	Single	144
	CX	Single	232
Hi Power® II V-belts	A	Single	96
	B	Single	168
	C	Single	276
	D	Single	554
	E	Single	799
	A	PowerBand®	151
	B	PowerBand®	200
	C	PowerBand®	342
	D	PowerBand®	663
Hi Power® II Dubl V-belts	AA	Single	125
	BB	Single	194
	CC	Single	354
	DD	Single	750
Power Cable® Belts	A	Single	108
	B	Single	172
	C	Single	302
Micro-V® Belts	H	Single	5
	J	Single	7
	K	Single	18
	L	Single	29
	M	Single	109

Belt Product Family	Belt Cross Section	Belt Type	Adjusted Belt Weight (grams/meter)
Metric Power™ V-belts	10X-Notched	Single	44
	13X-Notched	Single	86
	17X-Notched	Single	139
For belt lengths over 3000mm	13X	Single	100
For belt lengths over 3000mm	17X	Single	171
	XPZ	Single	51
	XPA	Single	87
	XPB	Single	156
	XPC	Single	249
For belt lengths over 3000mm	SPZ	Single	72
For belt lengths over 3000mm	SPA	Single	115
For belt lengths over 3000mm	SPB	Single	186
For belt lengths over 3000mm	SPC	Single	337
Truflex® Belts	2L	Single	22
	3L	Single	44
	4L	Single	77
	5L	Single	125
PoweRated® Belts	3L	Single	52
	4L	Single	83
	5L	Single	138
Polyflex® Belts	3M	Single	4
	5M	Single	10
	7M	Single	24
	11M	Single	49
	3M	JB®	5
	5M	JB®	11
	7M	JB®	30
	11M	JB®	64

Belt Product Family	Belt Cross Section	Belt Type	Adjusted Belt Weight (grams/meter)
PowerGrip® Timing Belts	MXL	Synchronous	1.3
	XL	Synchronous	2.4
	L	Synchronous	3.2
	H	Synchronous	3.9
	XH	Synchronous	11.3
	XXH	Synchronous	14.9
PowerGrip® Timing Twin Power® Belts	XL	Synchronous	1.9
	L	Synchronous	3.2
	H	Synchronous	4.6
PowerGrip® HTD® Belts	3M	Synchronous	2.4
	5M	Synchronous	3.9
	8M	Synchronous	6.2
	14M	Synchronous	9.9
	20M	Synchronous	12.8
PowerGrip® HTD® Twin Power® Belts	3M	Synchronous	2.7
	5M	Synchronous	4.6
	8M	Synchronous	7.2
	14M	Synchronous	12.3
PowerGrip® GT® Belts	8M	Synchronous	5.8
	14M	Synchronous	9.7
PowerGrip® GT® 2 Belts	2M	Synchronous	1.4
	3M	Synchronous	2.8
	5M	Synchronous	4.1
	8M	Synchronous	5.5
	14M	Synchronous	9.6
	20M	Synchronous	12.8
PowerGrip® GT® 2 Twin Power® Belts	8M	Synchronous	6.93
	14M	Synchronous	11.44
Poly Chain® GT® 2 Belts and Poly Chain® GT® Belts	5M	Synchronous	3
	8M	Synchronous	4.7
	14M	Synchronous	7.9

How to Install Belts

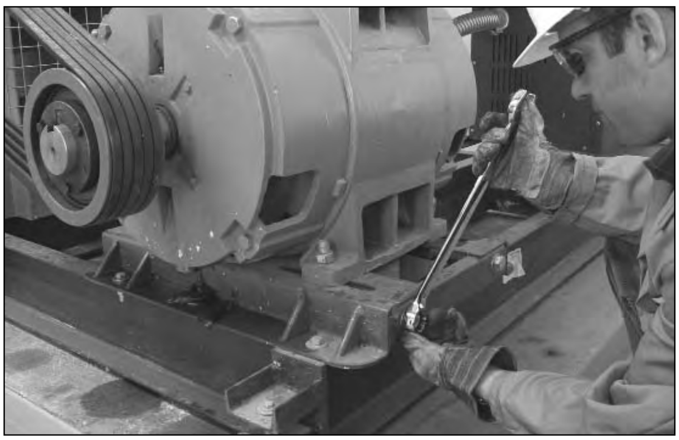
When a belt is being installed, the same basic steps must be followed, regardless of whether the belt is a V-belt or a synchronous belt.

Preparation

1. Confirm that the power is off, locked, and tagged. Never work on a belt drive until this important step is completed. Wear proper safety equipment (hardhat, gloves, safety glasses, steel toe shoes).
2. Remove belt guard and place away from drive so that it does not interfere with working on the drive.

Removal

3. Loosen motor mounting bolts or adjusting screws.



4. Move the motor in until the belt is slack and can be removed easily without prying. Never pry off a belt, as the sheave or sprocket can be damaged. Prying off belts also adds the risk of injury.

5. Remove old belt

Inspection

6. Inspect the old belt for any unusual wear. Excessive or unusual wear may indicate problems with the drive design or past maintenance procedures. Refer to the Problem/Solution Summary Table in the Belt Performance and Troubleshooting section for guidelines in matching belt appearance to possible problem causes.
7. Inspect the sheaves or sprockets for unusual or excessive wear. Belt life will be reduced if the sheaves or sprockets are worn. Wear gloves for protection from nicks or sharp surfaces.

   <u>For V-belt sheaves:</u> Inspect grooves for wear and nicks. Use Gates sheave gauges to determine if the grooves are worn. Place the proper sheave gauge into the sheave groove and check for wear. If more than 1/32" of wear can be seen between the gauge and groove side wall, the sheaves are worn and should be replaced. A light source such as a flashlight may be used to backlight the gauge.

   Do not be misled by "shiny" grooves. Grooves that are "shiny" are often polished because of heavy wear.

   Inspect the sheave grooves for rust or pitting. If rusted or pitted surfaces are found, the sheave should be replaced.

   <u>For Synchronous sprockets:</u> Inspect sprocket grooves for unusual or excessive wear. Check for excessive wear by both visually inspecting the grooves and by running your finger along the sprocket grooves. If you can feel or see noticeable wear, the sprockets are worn and should be replaced.

Do not be misled by "shiny" grooves. Grooves that are "shiny" are often polished because of heavy wear.

Inspect the sprocket grooves for rust or pitting. If rusted or pitted surfaces are found, the sprocket should be replaced.

Check the sprocket flanges and make sure that they are not loose or bent. Bent flanges can interfere with the belt and cause premature belt wear and failure.

8. If necessary, clean sheave and sprocket grooves by wiping the surface with a rag slightly dampened with a light, non-volatile solvent. Do not sand or scrape the grooves to remove debris.

Installation

9. If necessary, install new sheaves or sprockets. Refer to page 14 for detailed instructions for installing QD or Taper-Lock® bushings.
10. Check the sheave or sprocket alignment. In order to achieve optimum belt life, it is important that the drive's sheaves or sprockets be aligned properly. Use a straightedge or Gates EZ Align® laser alignment tool. Adjust the sheave or sprocket position as necessary.
11. Install the new belt or set of belts.

    Replace all belts on multiple V-belt drives. Never replace a single belt or a portion of a multiple belt drive. Always use belts from the same manufacturer on a multiple belt drive. If a new belt is used with old belts, the load will not be shared evenly between the belts on a multiple V-belt drive. Mixing new and old belts very possibly could lead to premature belt failure and uneven sheave wear.

    When installing the belt, make sure that there is clearance to slip the belt over the sheave or sprocket. Do not pry or use force to install the belt. Do not roll the belt onto the drive.
12. Adjust the motor base adjustment screws to take up the center distance on the belt drive until the belts are tight.
13. Check belt tension, using a tension gauge or Sonic Tension Meter. Adjust the belt drive's center distance until the correct tension is measured.

    On multiple belt drives, some belts may appear to hang unevenly when installed. It is normal for belts within RMA length and matching tolerances to have noticeable differences in the distance the belt span sags. This is called the "catenary effect".

    Catenary effect is a curve made by a cord of uniform weight suspended between two points.

    Follow the recommended run-in and retensioning procedure to minimize the visible difference in belt sag.
14. Rotate the belt drive by hand for a few revolutions. Re-check the belt tension and adjust as necessary.
15. Re-check the drive alignment and adjust as necessary.

Completion

16. Secure motor mounting bolts to the correct torque.
17. Re-check the belt tension and adjust as necessary. Tightening the motor mounting bolts may have changed the belt tension.
18. Replace the belt guard.
19. Start the drive, looking and listening for any unusual noise or vibration. If possible, shut down the drive and check the bearings and motor for unusual heat. If the motor or bearings are hot, the belt tension may be too high, or bearings may not be properly lubricated. Temperatures can be checked with an infrared pyrometer.

V-belt Run-In Procedure

20. A run-in procedure is recommended for all V-belt drives so that the optimum belt life can be achieved. A run-in consists of starting the drive and letting it run under full load for up to 24 hours. If a 24 hour run-in is not possible, let the belt drive run overnight, to the next shift, or at least a few hours. After the belts have run-in, stop the belt drive and check the belt tension. Running the belts under full load for an extended period of time will seat the V-belts into the sheave grooves.
    V-belt tension will drop after the initial run-in and seating process. This is normal. Adjust the belt tension as necessary.

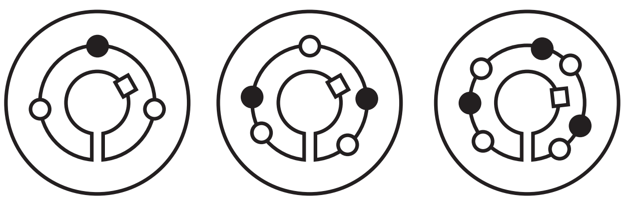
    Since tension in V-belts will drop after the initial run-in and seating process, failure to check and retension the belt will result in low belt tension and belt slippage. This slippage will result in premature belt failure.

How to Install Taper-Lock® and QD® Bushed Sheaves and Sprockets

It is important that new or replacement sheaves or sprockets be properly installed. Most sheaves or sprockets are attached to a shaft with a tapered bushing that fits a mating tapered bore in the sheave or sprocket. Bushings come in several different bore size diameters. This allows for a reduction in the parts inventory required in your plant because one bushing size with multiple bore sizes can be used with a number of different sizes of sheaves or sprockets.

There are two styles of bushings: Taper-Lock® and QD®. Installation and removal instructions for each style are noted below.

Taper-Lock® Type Sprocket Installation and Removal



1008 to 3020　　3525 to 6050　　7060

To Install TAPER-LOCK® Type Bushings

1. Clean the shaft, bore of bushing, outside of bushing and the sprocket hub bore of all oil, paint and dirt. File away any burrs.

   Note: The use of lubricants can cause sprocket breakage. DO NOT USE LUBRICANTS IN THIS INSTALLATION.
2. Insert the bushing into the sprocket hub. Match the hole pattern, not threaded holes (each complete hole will be threaded on one side only).
3. "LIGHTLY" oil the bolts and thread them into those half-threaded holes indicated by "O" on the diagram above.

   Note: Do not lubricate the bushing taper, hub taper, bushing bore, or the shaft. Doing so could result in sprocket breakage.
4. With the key in the shaft keyway, position the assembly onto the shaft allowing for small axial movement of the sprocket which will occur during the tightening process.

   Note: When mounting sprockets on a vertical shaft, precautions must be taken to positively prevent the sprocket and/or bushing from falling during installation.
5. Alternately torque the bolts until the sprocket and bushing tapers are completely seated together (at approximately half of the recommended torque; see table below).

   Note: Do not use worn hex key wrenches. Doing so may result in a loose assembly or may damage bolts.
6. Check the alignment and sprocket runout (wobble), and correct as necessary.
7. Continue alternate tightening of the bolts to the recommended torque values specified in the table below.

Taper-Lock® Bushings

Bushing	Bolts		Torque Wrench	
Style	Qty.	Size	lb-ft	lb-in
1008	2	1/4-20 x 1/2	4.6	55
1108	2	1/4-20 x 1/2	4.6	55
1210	2	3/8-16 x 5/8	14.6	175
1610	2	3/8-16 x 5/8	14.6	175
2012	2	7/16-14 x 7/8	23.3	280
2517	2	1/2-13 x 1	35.8	430
3020	2	5/8-11 x 1 1/4	66.7	800
3525	3	1/2-13 x 1 1/2	83.3	1000
4030	3	5/8-11 x 1 3/4	141.7	1700
4535	3	3/4-10 x 2	204.2	2450
5040	3	7/8-9 x 2 1/4	258.3	3100
6050	3	1 1/4-7 x 3 1/2	651.7	7820
7060	4	1 1/4-7 x 3 1/2	651.7	7820

Caution: Excessive bolt torque can cause sprocket and/or bushing breakage.

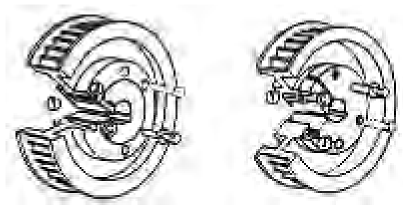
Note: To insure proper bushing/sprocket performance, full bushing contact on the shaft is recommended.

8. To increase the bushing gripping force, firmly tap the face of the bushing using a drift or sleeve (Do not hit the bushing directly with the hammer).
9. Re-torque the bushing bolts after Step 8.
10. Recheck all bolt torque values after the initial drive run-in, and periodically thereafter. Repeat steps 5 through 9 if loose.

To Remove TAPER-LOCK® Type Bushings

1. Loosen and remove all mounting bolts.
2. Insert bolts into all jack screw holes indicated by "●" (see figure above).
3. Loosen the bushing by alternately tightening the bolts in small but equal increments until the tapered sprocket and bushing surfaces disengage.

QD® Type Sprocket Installation and Removal



Position One Position Two

To Install QD® Type Bushings

1. Clean the shaft, bore of bushing, outside of bushing and the sprocket hub bore of all oil, paint and dirt. File away any burrs.

   Note: The use of lubricants can cause sprocket breakage. DO NOT USE LUBRICANTS IN THIS INSTALLATION.

2. For "Position One" or "Position Two" (whichever applies), line up the unthreaded bushing holes "C" with the threaded sprocket hub holes "T". Lightly oil the bolts and thread them (with lock washers) into the sprocket hub engaging only 2 or 3 threads. Bolt heads should be mounted outside to allow for disassembly. When mounting sprockets on 'M' through 'W' bushing sizes, position the threaded jack screw hole (J) as far from the bushing saw slot as possible to reduce the possibility of bushing breakage during disassembly.

   Note: Do not lubricate the bushing taper, hub taper, bushing bore, or the shaft. Doing so could result in sprocket breakage.

3. With the key in the shaft keyway, position the assembly onto the shaft allowing for small axial movement of the sprocket which will occur during the tightening process. When installing large or heavy parts in "Position One" (see figure above), it may be easier to mount the key and bushing onto the shaft first, then place the sprocket on the bushing and align the holes.

   Note: When mounting sprockets on a vertical shaft, precautions must be taken to positively prevent the sprocket and/or bushing from falling during installation.

4. Alternately tighten the bolts until the sprocket and bushing tapers are completely seated together (at approximately half the recommended torque).

5. Check the alignment and sprocket runout (wobble), and correct as necessary.

6. Continue alternate tightening of the bolts to the recommended torque values specified in the table below.

   Note: Excessive bolt torque can cause sprocket and/or bushing breakage. When properly mounted, there must be a gap between bushing flange and sprocket after the bolts are tightened.

Bushing Style	Bolts		Torque Wrench	
	Qty.	Size	lb-ft	lb-in
H	2	1/4 x 3/4	7.9	95
JA	3	10-24 x 1	4.5	54
SH & SDS	3	1/4-20 x 1 3/8	9.0	108
SD	3	1/4-20 x 1 7/8	9.0	108
SK	3	5/16-18 x 2	15.0	180
SF	3	3/8-16 x 2	30.0	360
E	3	1/2-13 x 2 3/4	60.0	720
F	3	9/16-12 x 3 5/8	75.0	900
J	3	5/8-11 x 4 1/2	135.0	1620
M	4	3/4-10 x 6 3/4	225.0	2700
N	4	7/8-9 x 8	300.0	3600
W	4	1 1/8-7 x 11 1/2	600.0	7200
S	5	1 1/4-7 x 15 1/2	750.0	9000
P	4	1-8 x 9 1/2	450.0	5400

QD® Bushings

Caution: Excessive bolt torque can cause sprocket and/or bushing breakage.

Note: To insure proper bushing/sprocket performance, full bushing contact on the shaft is recommended.

7. Tighten the set screw, when available, to hold the key securely during operation.

To Remove QD® Type Bushings

1. Loosen and remove all mounting bolts.
2. Insert bolts into all threaded jack screw holes.
3. Loosen the bushing by first tightening the bolt furthest from the bushing saw slot, then alternately tighten remaining bolts. Keep tightening the bolts in small but equal increments until the tapered sprocket and bushing surfaces disengage.

   Note: Excessive or unequal pressure on the bolts can break the bushing flange, making removal nearly impossible without destroying the sprocket.

Storage Recommendations

Proper preventive maintenance should not be limited to the actual belt drive operating on equipment, but should also include following proper storage procedures. In order to retain their serviceability and dimensions, proper storage procedures must be followed for all belt types. Quite often premature belt failures can be traced to improper belt storage procedures that damaged the belt before it was installed on the drive. By following a few common sense steps, these types of belt failures can be avoided.

General Guidelines

Recommended

Belts should be stored in a cool and dry environment with no direct sunlight. Ideally, less than 85° F and 70% relative humidity.

Store on shelves or in boxes or containers. If the belt is packaged in a box, like Poly Chain® GT®2, store the belt in its individual box.

V-belts may be stored by hanging on a wall rack if they are hung on a saddle or diameter at least as large as the minimum diameter sheave recommended for the belt cross section.

When the belts are stored, they must not be bent to diameters smaller than the minimum recommended sheave or sprocket diameter for that cross section. (see Technical Information section) Belts should not be stored with back bends that are less than 1.3 times the minimum recommended sheave or sprocket diameter for that cross section.

If stored in containers, make sure that the belt is not distorted when in the container. Limit the contents in a container so that the belts at the bottom of the container are not damaged by the weight of the rest of the belts in the container.

Not Recommended

Belts should not be stored near windows, which may expose the belts to direct sunlight or moisture.

Belts should not be stored near heaters, radiators, or in the direct airflow of heating devices.

Belts should not be stored near any devices that generate ozone. Ozone generating devices include transformers and electric motors.

Belts should not be stored where they are exposed to solvents or chemicals in the atmosphere.

Do not store belts on the floor unless they are in a protective container. Floor locations are exposed to traffic that may damage the belts.

Do not crimp belts during handling or while stored.

Belts are crimped by bending them to a diameter smaller than the minimum recommended diameter sheave or sprocket for that cross section. Do not use ties or tape to pull belt spans tightly together near the "end" of the belt. This will crimp the belt and cause premature belt failure. Do not hang on a small diameter pin that suspends all of the belt weight and bends the belt to a diameter smaller than the minimum recommended sheave or sprocket diameter. Improper storage will damage the tensile cord and the belt will fail prematurely. Handle belts carefully when removing from storage and going to the application. Do not inadvertently crimp or damage the belts by careless handling.

Storage Methods

V-belts

V-belts can be coiled in loops for storage purposes. Each coil results in a number of loops. One coil results in three loops, two coils results in five loops, etc. The maximum number of coils that can be used depends on the belt length. If coiling a belt for storage, consult the table on the next page and follow the limits shown.

Belt Cross Section	Belt Length (in)	Belt Length (mm)	Number of Coils	Number of Loops
3L, 4L, 5L, A, AX, AA, B, BX, 3V, 3VX, 9R, 13R, 13C, 13CX, 13D, 16R, 16C, 16CX, 9N	Under 60	Under 1500	0	1
	60 up to 120	1500 up to 3000	1	3
	120 up to 180	3000 up to 4600	2	5
	180 and over	4600 and over	3	7
BB, C, CX, 5V, 5VX, 16D, 22C, 22CX, 15N	Under 75	Under 1900	0	1
	75 up to 144	1900 up to 3700	1	3
	144 up to 240	3700 up to 6000	2	5
	240 and over	6000 and over	3	7
CC, D, 22D, 32C	Under 120	Under 3000	0	1
	120 up to 240	3000 up to 6100	1	3
	240 up to 330	6100 up to 8400	2	5
	330 up to 420	8400 up to 10,600	3	7
	420 and over	10,600 and over	4	9
8V, 25N	Under 180	Under 4600	0	1
	80 up to 270	4600 up to 6900	1	3
	270 up to 390	6900 up to 9900	2	5
	390 up to 480	9900 up to 12,200	3	7
	Over 480	12,200 and over	4	9

PowerBand® V-belts, Synchronous Belts, Micro-V® Belts

Poly Chain® GT®2 is shipped in individual boxes. Poly Chain® GT®2 should be stored in the box in which it was shipped.

These belts may be stored by hanging on a wall rack if they are hung on a saddle or diameter at least as large as the minimum diameter sheave or sprocket recommended for the belt cross section, and the belts are not distorted.

PowerBand® V-belts, Synchronous belts, and Micro-V® belts up to 120 inches (3000 mm) may be stored in a nested configuration. Nests are formed by laying a belt on its side on a flat surface and placing as many belts inside the first belt as possible without undue force. When nests are formed, do not bend the belts to a diameter that is smaller than the minimum recommended sheave or sprocket diameter. Nests may be stacked without damaging the belts if they are tight and stacked with each nest rotated 180˚ from the nest below.

PowerBand® V-belts and Micro-V® belts over 120 inches (3000 mm) may be rolled up and tied for shipment. These individual rolls may be stacked for easy storage. When the belts are rolled, they must not be bent to a diameter that is smaller than the minimum diameter recommended for the cross section.

Variable Speed Belts

Variable speed belts have a thicker cross section and are more sensitive to distortion than other V-belts. Do not hang variable speed belts from pins, racks, or saddles. Store variable speed belts on their edge on shelves. Variable speed belts that are in sleeves may be stacked, taking care to avoid distorting the belts at the bottom of the stack.

Storage Effects

Belts may be stored up to six years if properly stored at temperatures less than 85˚F and relative humidity less than 70%.

If the storage temperature is higher than 85˚ F, the storage limit for normal service performance is reduced by one half for each 15˚F increase in temperature. Belts should never be stored at temperatures above 115˚F.

At relative humidity levels above 70%, fungus or mildew may form on stored belts. This has minimal affect on belt performance, but should be avoided.

When equipment is stored for prolonged periods of time (over six months), the belt tension should be relaxed so that the belt does not take a set, and the storage environment should meet the 85˚F and 70% or less relative humidity condition. If this is not possible, belts should be removed and stored separately in a proper environment.

BELT IDENTIFICATION

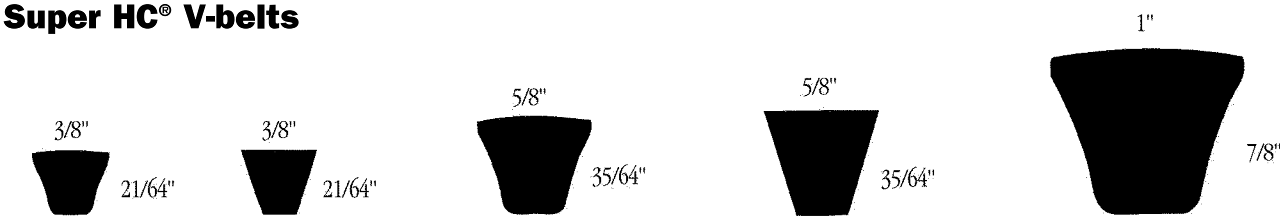
When preventive maintenance inspections indicate that belts need replacing, it is important to install the correct belts.

Consequently, it is important to identify the various types and sizes of belts available, and then quickly be able to specify the correct replacement.

The information on the following pages will help identify the belt types used in industry. Gates makes a belt to fit nearly any application.

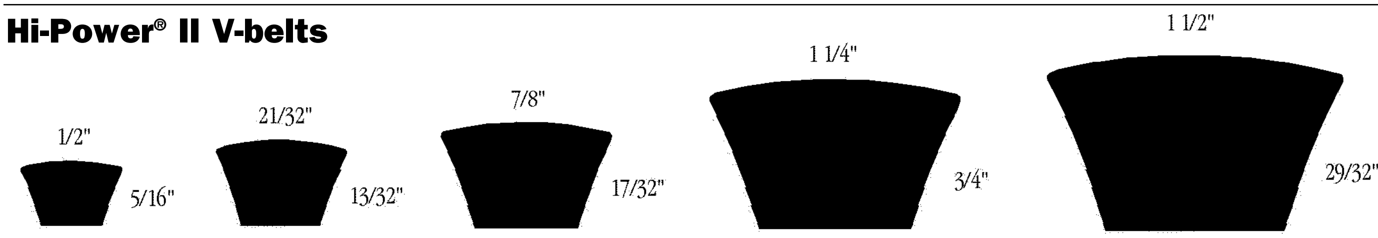
V-belts

Super HC® V-belts



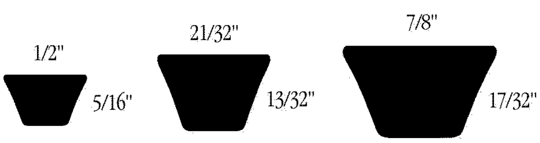
3V **3VX** **5V** **5VX** **8V**

Hi-Power® II V-belts



A **B** **C** **D** **E**

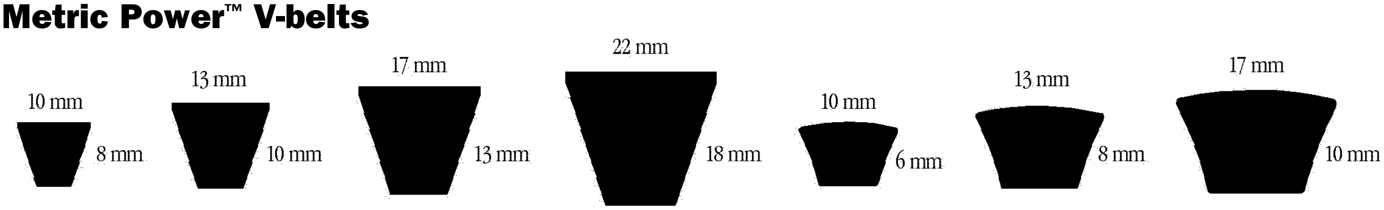
Tri-Power® V-belts



AX **BX** **CX**

PowerBand® – Hi-Power® II and Super HC®

Metric Power™ V-belts



SPZ/XPZ **SPA/XPA** **SPB/XPB** **SPC/XPC** **10X** **13X** **17X**

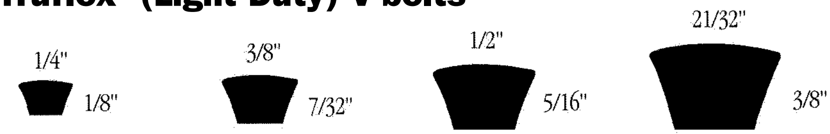
BELT IDENTIFICATION

Multi-Speed Belts
Top Width-Sheave Angle

Example: Belt No. 2326V310 designates:

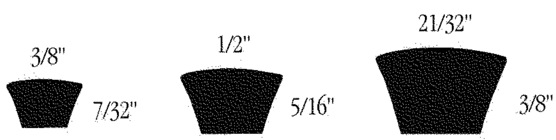
23	26	V	310
Top Width in 16ths of an Inch: 23/16" = 1-7/16"	Sheave Angle in Degrees (26)	Multi-Speed	Pitch Circumference to the Nearest 10th Inch: 31.0"

Truflex® (Light Duty) V-belts



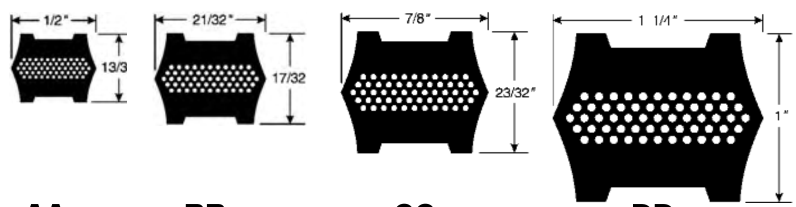
2L **3L** **4L** **5L**

PoweRated® V-belts



3L **4L** **5L**

Dubl V-belts



AA **BB** **CC** **DD**

Micro-V® Belts

J Section

L Section

M Section

Standard Polyflex® Belts

3M **5M** **7M** **11M**

Polyflex® JB® Belts

3M **5M** **7M** **11M**

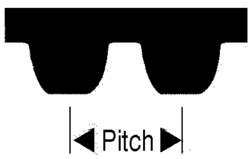
Synchronous Belts

All synchronous belts are identified in a similar manner, in either English or metric units. Belts are measured by:

1. **Pitch:** Distance in inches or millimeters between two adjacent tooth centers as measured on the belt pitch line.
2. **Pitch Length:** Total length (circumference) in inches or millimeters as measured along the pitch line. It is equal to the pitch multiplied by the number of teeth in the belt.
3. **Width:** Denoted in inches or millimeters.

Poly Chain® GT®2 Belts

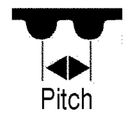
8M
8mm Pitch



14M
14mm Pitch

PowerGrip® HTD® Belts

3M
3mm Pitch



5M
5mm Pitch

PowerGrip® GT®2 Belts

2M
2mm Pitch

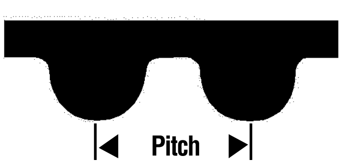
3M
3mm Pitch

5M
5mm Pitch

8M
8mm Pitch

14M
14mm Pitch

20M
20mm Pitch



PowerGrip® Timing Belts

MXL
.080" Pitch

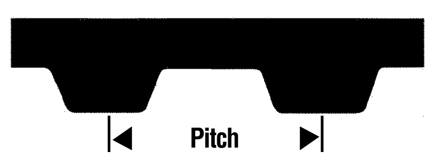
XL
.200" Pitch

L
.375" Pitch

H
.500" Pitch

XH
.875" Pitch

XXH
1.250" Pitch



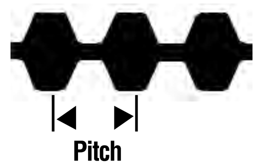
BELT IDENTIFICATION

Twin Power® Timing Belts

XL
.200" Pitch

L
.375" Pitch

H
.500" Pitch

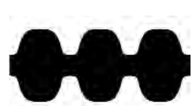


Twin Power® PowerGrip® GT®2 Belts

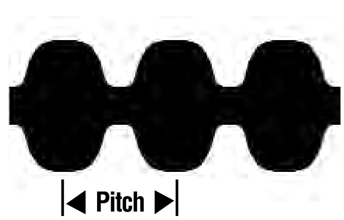
3M
3mm Pitch

5M
5mm Pitch

8M
8mm Pitch



14M
14mm Pitch



BELT IDENTIFICATION

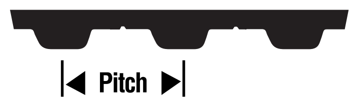
Synchro-Power® Polyurethane Belts

MXL
.080" Pitch

XL
.200" Pitch

L
.375" Pitch

H
.500" Pitch

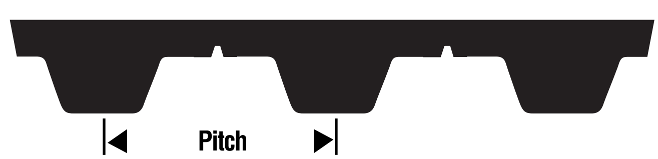


T2.5
2.5mm Pitch

T5
5mm Pitch

T10
10mm Pitch

T20
20mm Pitch



Synchro-Power® Polyurethane Belts

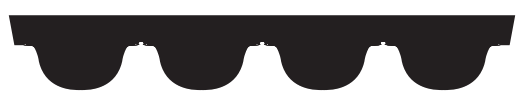
AT5
5mm Pitch

AT10
10mm Pitch

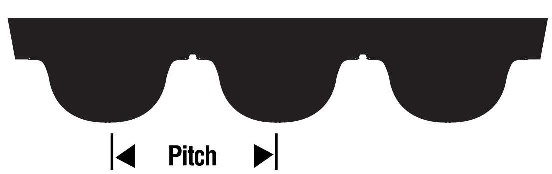
AT20
20mm Pitch

5M HTD
5mm Pitch

8M HTD
8mm Pitch



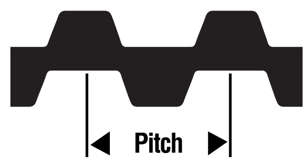
14M HTD
14mm Pitch



Synchro-Power® Polyurethane Belts

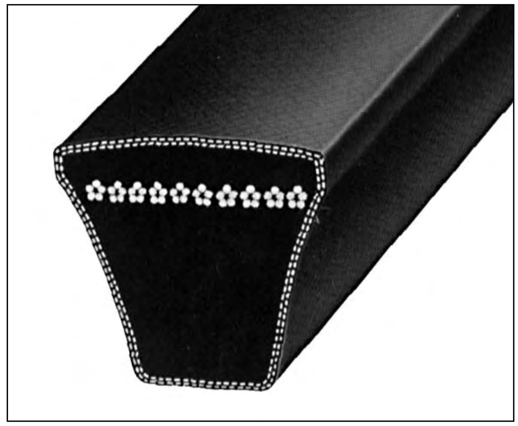
DT5
5mm Pitch

DT10
10mm Pitch



Narrow Section V-Belts

These high capacity belts are used to substantially reduce drive costs and decrease space requirements. This V-belt handles the complete range of drive horsepower recommended with three narrow cross sections instead of the five regular cross sections needed for classical heavy-duty belts. Specified by 3V, 5V or 8V cross sections. Specify Gates Super HC® V-Belts.



Classical Section V-Belts

These are the original belts used in heavy duty applications. They are specified by cross section and standard length. The size is designated as A, B, C, D or E. The easiest way to select a replacement is by finding the belt number on the worn belt. If not legible, measure the belts outside circumference with a flexible tape, preferably while it is still on the drive.

Then, order the Gates **Hi-Power® II** V-belt which has the next shorter standard length. For example: For an "A" section belt with a 28.0" O.C., order an A26 replacement belt.

Banded and Bandless Belts

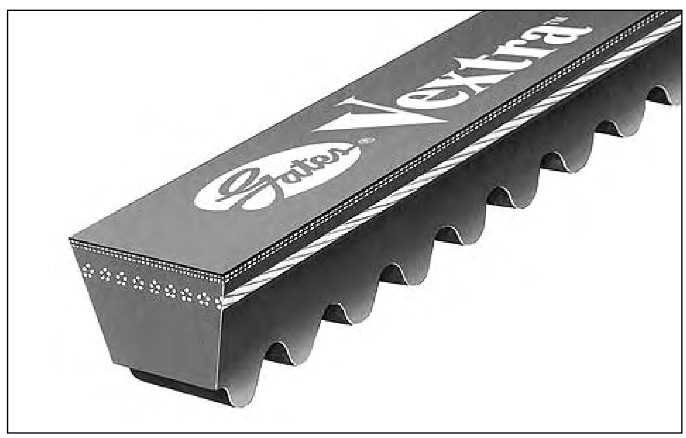
Banded belts, also called wrapped or covered belts, have a fabric cover. Un-notched and generally with concave sidewalls, banded belts have rounded bottom corners and arched tops.

Bandless belts have no fabric cover They have straight, cut-edge sidewalls and special molded notches.
The notches reduce bending stress which allows belts to run on smaller diameter sheaves than comparable non-notched banded belts.

Gates offers these two types in both the classical and narrow sections. In the classical section, Gates **Tri-Power**® molded notch is available in AX, BX and CX cross sections. Its length is specified by the same standard belt number as other classical section belts.

Gates also offers **Super HC® Molded Notch** V-belts in 3VX and 5VX sizes.

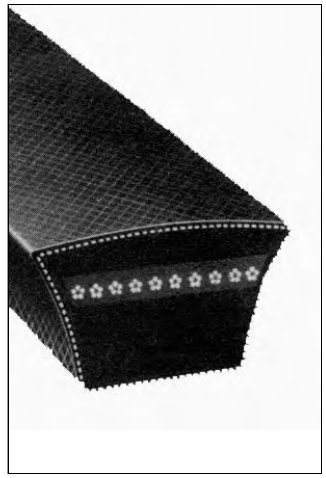
In both cases, an "X" is used in the belt number to designate a molded notch construction. For example: An AX26 is a bandless, molded notch classical section belt. A 5VX1400 is a narrow section, bandless, molded notch belt with a 140" O.C.

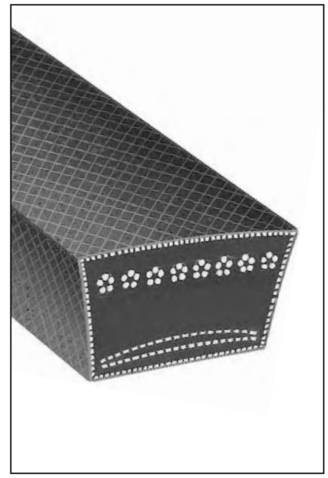


Note: The revolutionary Gates Vextra® construction is used in the notched belts.

Light Duty Belts

These are used on light duty fractional horsepower drives and are designed for use with backside idlers. **Gates Truflex®** and **PoweRated®** V-belts are offered in this category and are specified by cross section and outside circumference. **Truflex®** is recommended for the lower lighter duty range. **PoweRated®**, a special belt designed for clutching, heavier shock-load and backside idler drives, is recognized by its green color. Reinforced with an aramid fiber tensile (pound for pound stronger than steel). **PoweRated®** can interchange with **Truflex®**, but **Truflex®** cannot interchange with **PoweRated®**.





Synchronous Belts

These belts are also known as timing or positive drive belts and are used where driveN shaft speeds must be synchronized to the rotation of the driveR shafts. They can also be used to eliminate noise and maintenance problems caused by chain drives.

Synchronous belts, such as **Gates Poly Chain® GT®2**, can be used in high horsepower drives, drives where space is severely limited and where there is limited take up.

Synchronous drives are extremely efficient... as much as 98% with properly maintained **Poly Chain® GT®2** or **PowerGrip® GT®2** systems. By contrast, chain drives are in the 91-98% efficiency range, while V-belts average in the 93-98% range.

Distinctive tooth profiles (shapes) identify synchronous belts. Various sizes and constructions are available to meet a wide range of applications. The three important dimensions of a synchronous belt are pitch, width and pitch length. Tooth profiles must also be identified.

Belt Pitch - Distance in inches or millimeters between two adjacent tooth centers as measured on the belt's pitch line.

Belt Pitch Length - Circumference in inches or millimeters as measured along the pitch line.

Width - Top width in inches or millimeters.

Tooth Profile - See the Belt Identification section for the easiest way to identify tooth profile.

Synchronous belts run on sprockets, which are specified by the following:

Pitch - Distance between groove centers, measured on the sprocket pitch circle. The pitch circle coincides with the pitch line of the mating belt.

Number of Sprocket Grooves

Width - Face width.

Note: The sprocket's pitch diameter is always greater than its outside diameter.

Note: PowerGrip® GT®2 belts must be used with PowerGrip® GT®2 sprockets for new designs.

Note: 8 and 14 mm pitch PowerGrip® GT®2 belts can be used as replacement belts at the next smaller width for the following: HTD, RPP®, RPP Plus®, HTB, HPT, HT100, HT150, HT200, ETH, HPR, HPPD, EHT or HTT.

Example: 14mm-170mm width – substitute a PowerGrip® GT®2-14mm-115 without any performance loss. Refer to page 32 for crossover information.

Polyflex® JB® Belts

Polyflex® is a unique belt with a distinctive 60° belt angle and ribbed top specifically designed for long life in small diameter sheave drives. **Polyflex® JB®** is ideal for compact drives, drives with high speed ratios, and drives requiring especially smooth operation.

The "JB" refers to the belt's configuration: two, three or five belts joined together to provide extra stability and improved performance. This joined belt style should be used instead of matched single belts whenever possible.

Polyflex® JB® belts are ideal for these applications:

- Milling, grinding or drilling machines
- Lathes
- Machine spindle drives
- Centrifuges
- Blowers
- High speed compressors

Polyflex® JB® belts are specified by Top Width and Effective Length

Multi-Speed Belts

(Variable Speed Drives)

Multi-Speed belts have a distinct shape. Multi-Speed belt top widths are usually greater than their thicknesses. This permits a greater range of speed ratios than standard belts. Usually cogged or notched on the underside, **Multi-Speed** belts are specified for equipment which require changes in driveN speed during operation.

Multi-Speed belts are specified by **Top Width**, **Outside Circumference**, and the required **Groove Angle**. The groove angle can be measured from the drive pulleys.

Micro-V® or V-Ribbed Belts

Gates Micro-V® belts outperform other V-ribbed belts because the tips of the "V" are truncated (shorter). This shorter profile gives the new **Micro-V belts** increased flexibility, reduced heat buildup and allows them to operate at extra high speeds on smaller diameter sheaves.

Additional advantages of the truncated tips are: (1) the belt does not bottom in the sheave, therefore providing a higher degree of wedging and (2) the belt can better tolerate debris in the sheave groove. They are extremely smooth running and highly resistant to oil, heat and other adverse conditions.

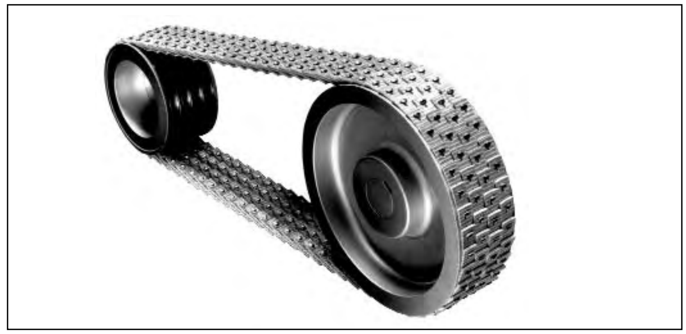
Three cross sections are available for industrial applications: J, L and M.

Spliced Belting

Used on drives with little or no take-up, or as an emergency belt replacement.

Belting is sold on reels in standard V-belt cross sections. Ends are spliced with fasteners that require special assembly tools. Always use the correct fasteners with the correct belt type and cross section.

Nu-T-Link*, a high performance, spliced belt, is also available for use as emergency belting, and for drives where conditions are detrimental to rubber belts.



*Nu-T-Link® is a Registered Trademark of Fenner-Manheim.

PowerBand® Belts

PowerBand belts were developed by Gates for drives subjected to pulsating loads, shock loads or extreme vibrations where single belts could flip over on the pulleys. A high-strength tie band permanently joins two or more belts to provide lateral rigidity. This keeps the belts running in a straight line in the pulley grooves. PowerBand® construction is offered with **Gates Hi-Power® II**, **Super HC®** and **Super HC® Molded Notch Belts**.

The Gates Predator® V-belt is a multi layered **PowerBand®** construction that adds strength, durability, shear and tear resistance and lateral rigidity to handle the toughest shock-loaded applications. It is available in **Super HC®** and **Hi- Power® II** profiles.

Predator® V-belts primary features:

- Aramid tensile cords for extraordinary strength, durability and virtually zero stretch.
- Chloroprene rubber compounds for superb oil and heat resistance.
- Specially-treated extra tough cover withstands slip and shear forces at peak loads without generating excessive heat. It also fends off penetration by foreign materials.
- Gates curves that compensate for effects that occur when belts bend around a sheave for uniform loading and maximum life.
- Matched by request to maximize power absorption and belt life.

BELT STYLES

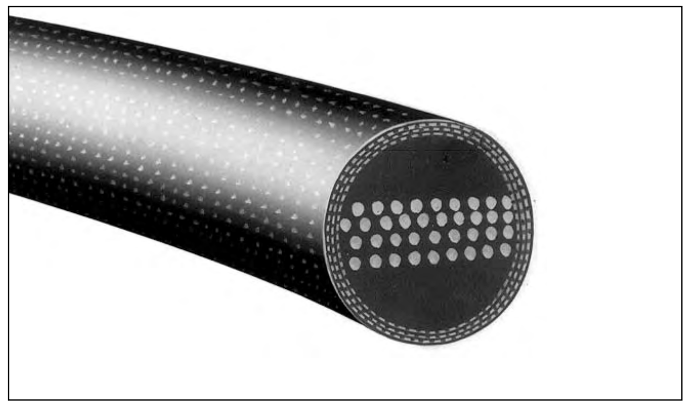
Dubl-V Belts

A special version of Gates Hi-Power® II for serpentine drives where power is transmitted by both the top and bottom of the belt. Dubl-V belts are specified by A, B, or C cross sections, and by Effective Length.

Round Endless Belts

Recommended for replacing leather belting on serpentine or quarter-turn drives. They are specified by **Diameter** and **Inside Length**.

If your current drive has leather or round endless belting, you should consider a new drive design. V-belt drives offer many advantages in performance, even on serpentine or quarter-turn drives.



PowerBack™ Belts

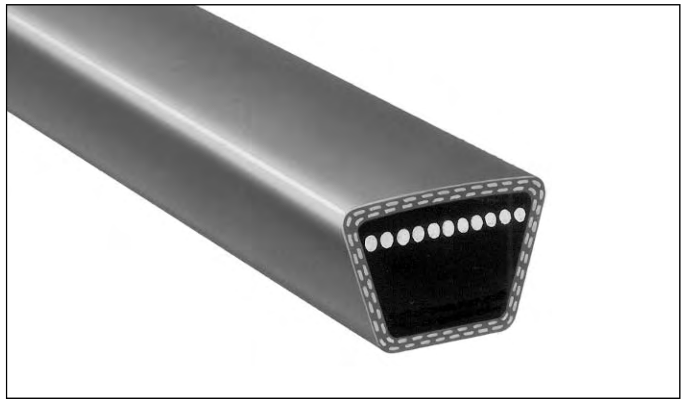
PowerBack™ belts are "B" section V-belts with a flat back surface. The flat back surface makes PowerBack™ belts ideal for driving roll-to-roll conveyor applications.

Power Curve® Belts

Power Curve® belts are "B" section V-belts offering increased flexibility for demanding power turn conveyor applications. The belts "bend" around corners and drive the rollers in most conveyor applications.

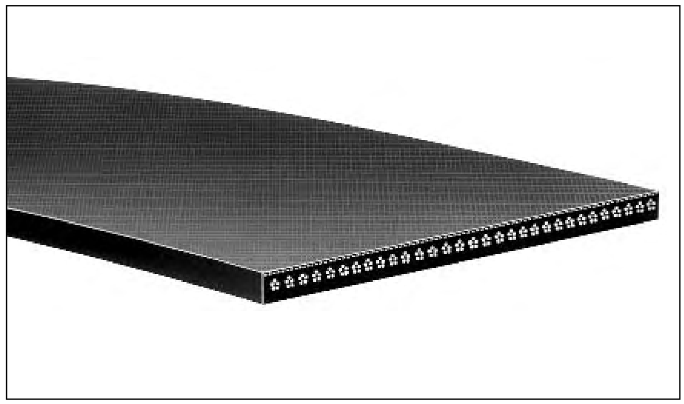
Power Cable® Belts

Recommended for the toughest shock load applications, especially on drives that can't be shut down for retensioning after initial belt run-in. Reinforced with an aramid fiber tensile (pound for pound stronger than steel), Power Cable® belts last longer and cost less than steel cable belts.



Flat Belts

Gates Speed- Flex® Belts, are designed for high speed applications such as drill presses, lathes, grinders and other woodworking equipment. Gates Powercord® Belts are designed for general purpose, lower speed applications. Flat belts are specified by belt **Width** and required **Inside Diameter**.



Static Conductive Belts

Static discharge can pose a hazard on belt drives that operate in potentially explosive environments. Static discharge can also interfere with radios, electronic instruments, or controls used in a facility. While uncommon, static discharge can also cause bearing pitting if the discharge occurs through the bearing. Static conductivity is a required belt characteristic in these cases in order to prevent static discharge.

The **Rubber Manufacturer's Association** (RMA) has published **Bulletin IP 3-3** for static conductivity. Static conductivity testing involves using an ohmmeter to pass an electrical current with a nominal open circuit 500 volt potential through a belt. The test should be performed with the belt off of the belt drive. The belt's resistance is measured by placing electrodes 8.5 inches apart on the clean driving surface of the belt. A resistance reading of six (6) megohms or more constitutes a test failure. Belts that measure a resistance of 6 megohms or more are considered to be non-conductive. Belts that measure a resistance of less than 6 megohms are considered to be static conductive. A static conductive belt with a resistance of 6 megohms or less has sufficient conductivity to prevent measurable static voltage buildup, thus preventing a static discharge.

V-belts are generally manufactured to be static conductive in accordance with the RMA IP 3-3 bulletin, but it is important to confirm with the belt manufacturer that a specific belt product or product line is static conductive.

Gates Hi-Power® II, Tri-Power®, Super HC®, Super HC® Molded Notch, Metric Power™, Micro-V®, and Truflex® V-belts are all static conductive when new as defined by RMA Bulletin IP 3-3. Belts that have been in operation can be checked for static conductivity by using an ohmmeter and following the inspection recommendations given in the RMA IP 3-3 bulletin.

PowerGrip®Timing, PowerGrip® GT®2, Poly Chain® GT®, Poly Chain® GT®2, Polyflex®, Polyflex® JB®, Power Cable®, PoweRated®, and Predator™ belts do not meet the static conductivity requirements specified in RMA Bulletin IP 3-3 and are not considered to be static conductive.

PowerGrip® GT®2 and PowerGrip® Timing belts can be manufactured in a static conductive construction on a made-to-order basis.

When a belt is used in a hazardous environment, additional protection must be employed to assure that there are no accidental static spark discharges. The portion of the belt that contacts the sheave or sprocket must be

BELT STYLES

conductive to ensure that static charge is conducted into the drive hardware. V-belts must have a static conductive sidewall in contact with a conductive sheave groove. Synchronous belts must have a static conductive tooth surface in contact with conductive sprocket grooves.

Unusual or excessive debris or contaminant on the belt contact surface or sheave or sprocket grooves should be cleaned and removed. Banded V-belts (V-belts with a fabric bandply on the driving surface) should be inspected for bandply wear. If the fabric bandply on the belt sidewall has worn away, the belts should be replaced immediately. Bandless V-belts do not have to be replaced if wear is evident on the belt sidewall. If there is any question about the belt's physical condition and its static conductivity characteristics, replace the belt.

Any belt drive system, whether it uses a synchronous belt or V-belt, that operates in a potentially hazardous environment must be properly grounded. A continuous conductive path to ground is necessary to bleed off the static charge. This path includes a static conductive belt, a conductive sheave or sprocket, a conductive bushing, a conductive shaft, conductive bearings, and the ground. As an additional measure of protection, a static-conductive brush or similar device should be employed to bleed off any residual static buildup that might remain around the belt.

BELT DRIVE PERFORMANCE

To provide proper maintenance, you must understand the nature of the belt drives in your plant. You know the expected belt service life on each drive, and you are aware of the capabilities and limitations of this equipment.

On occasion, however, it is necessary to give some thought to belt service life, especially when belt service life is below the expected performance level and the situation must be improved.

Upgrade Drive Performance

A belt drive can sometimes be upgraded to improve performance. The first step is to see if simple improvements can be made at minimal costs. This involves checking the drive design for adequate capacity using the appropriate drive design manual or Gates Design Flex® II drive design software.

If further improvement is needed, the next step is to upgrade the drive to a higher performance belt system.

Here are examples of minor changes that could improve performance.

- Increase sheave or sprocket diameters
- Increase the number of belts, or use wider belt
- Add vibration dampening to system
- Improve guard ventilation to reduce operating temperature
- Use at least the correct, minimum recommended pulley diameters on inside and backside idlers
- Use premium belts rather than general purpose types
- Replace sheaves or sprockets when they are worn
- Keep sheaves or sprockets properly aligned
- Place idler on span with lowest tension
- Re-tension newly installed belts after a 4 to 24 hour run-in period
- Review proper belt installation and maintenance procedures

Gates Corporation is the recognized industry leader in product innovation and belt drive technology. New products and applications are continually made available to Gates customers. Here are examples of advanced Gates belt innovations.

Advanced Gates Belt Drive Products & Solutions

- Poly Chain® GT®2 positive drive (synchronous) belts
- PowerGrip® GT®2
- Polyflex® JB® belts
- Power Cable® belts
- PoweRated® light-duty V-belts
- Nu-T-Link®* spliced belting
- Super HC® Molded Notch V-belts
- Predator® Powerband belts
- Vextra® technology
- Power Curve™ V-belts
- PowerBack™ V-belts
- Stainless steel sprockets & bushings (stock)
- Polyflex® Sheaves (stock)
- Gates DesignFlex® II Software
- Gates DesignView® Software

*Registered Trademark of Fenner-Manheim.

Your local Gates distributor or representative can work with you to upgrade your existing drives and reduce your maintenance and down time costs.

Or, you may have a problem or excessive maintenance costs with a non-belt drive, such as gear or chain. Again, your local Gates distributor or representative can offer you excellent advice as to whether or not a belt drive could solve the problem and reduce your maintenance costs.

In most cases, synchonous belt drives that are using non-Gates curvilinear belts can be changed to a Gates PowerGrip® GT®2 belt to reduce width. Use the table below to identify product types that can be converted, and what widths are recommended.

PowerGrip® GT®2 – 8 & 14mm belts can be used to replace other non-Gates curvilinear belts in the next smallest width.

Company	Product Trade Name	Profile	Nomenclature	Belt-Pitch
Bando	Synchro-Link® – HT	H†	1600-8M-20-H	8 & 14MM
Dodge	HT100	GT	1600-8M-20	8 & 14MM
Gates	HTD®	HTD	1600-8M-20	8 & 14MM
Jason	HTB®	H†	1600-8M-20	8 & 14MM
Browning	HPT®	RPP	1600-14M-20	8* & 14MM
Goodyear	HPPD™	RPP	1600-14M-20	8* & 14MM
Dayco/Carlisle	RPP®/RPP Plus®	RPP	1600-14M-20	8* & 14MM
Dodge	HT150	GT	1600-14M-20	8 & 14MM
T.B. Wood's	RPP®/RPP Plus®	RPP	1600-14M-20	8* & 14MM

Competitors Width	PowerGrip GT2 – Width
8MM – Pitch	**8MM – Pitch**
20	20
30	20
50	30
85	50

Competitors Width	PowerGrip GT2 – Width
14MM – Pitch	**14MM – Pitch**
40	40
55	40
85	55
115	85

* Replacement only on sprockets with fewer than 50 grooves

† See Rubber Manufacturer's Association Bulletin IP-27 (1997) for H type tooth profile specification information

For example, a competitor's belt in 14mm pitch, 85mm wide, can be replaced with a narrower 55mm Gates PowerGrip® GT®2 belt.

Reference www.gates.com for electronic interchange information.

V-belt, synchronous belt, roller chain, and gear drives will all generate noise while transmitting power. Each type of system has its own characteristic sound. V-belt drives tend to be the quietest belt drives, and synchronous belt drives are much quieter than roller chain drives. When noise is an issue, there are several design and maintenance tips that should be followed to achieve the quietest possible belt drive.

Noise: Decibel and Frequency

Noise is an unwanted or unpleasant sound that can be described with two criteria – frequency and decibel (dBA) levels. Frequency is measured in Hertz.
The human ear is capable of distinguishing frequencies typically from 20 to 20,000 Hertz. The human ear generally does not perceive frequencies higher than 20,000 Hertz.

The noise level or intensity of noise is measured in terms of decibels (dBA). The decibel has become the basic unit of measure since it is an objective measurement that approximately corresponds to the subjective measurement made by the human ear. Since sound is composed of several distinct and measurable parts and the human ear doesn't differentiate between these parts, measuring scales that approximate the human ear's reaction have been adopted. Three scales – A, B, and C are used to duplicate the ear's response over the scale's ranges. The A scale is most commonly used in industry because of its adoption as the standard in OSHA regulations.

Noise described in decibels (dBA) is generally perceived as the loudness or intensity of the noise.

While the human ear can distinguish frequencies from 20 to 20,000 Hertz, the ear is most sensitive in the range of normal speech – 500 to 2000 Hertz. As a consequence, this range is the most common concern for noise control. Frequency is most closely related to what the ear hears as pitch. High frequency sounds are perceived as whining or piercing, while low frequency sounds are perceived as rumbling.

The combination of decibel and frequency describes the overall level of loudness to the human ear. One without the other does not adequately describe the loudness potential of the noise. For example, an 85 dBA noise at 3000 Hertz is going to be perceived as much louder than an 85 dBA noise at 500 Hertz.

For comparison, some typical noise levels and their sources are listed below.

Normal Speech	60 dBA
Busy Office	80 dBA
Textile Weaving Plant	90 dBA
Canning Plant	100 dBA
Heavy City Traffic	100 dBA
Punch Press	110 dBA
Air Raid Siren	130 dBA
Jet Engine	160 dBA

Reducing Noise

Following proper installation and maintenance procedures, as well as some simple design alternatives can reduce belt drive noise.

<u>Belt Drive Tension and Alignment</u>

Properly tensioning and aligning a belt drive will allow the belt drive to perform at its quietest level.

Improperly tensioned V-belt drives can slip and squeal. Improper tension in synchronous belt drives can affect how the belt fits in the sprocket grooves. Proper tension minimizes tooth to groove interference, and thereby reduces belt noise. Check to make sure that the drive is properly tensioned by using Gates tension measurement gauges.

Misaligned V-belt drives will be noisier than properly aligned drives since interference is created at the belt's entry point into the sheave. Misaligned synchronous belt drives tend to be much noisier than properly aligned drives due to the even greater amount of interference that is created between the belt teeth and the sprocket grooves. Misaligned synchronous belt drives may cause belt tracking that forces the edge of the belt to ride hard against a sprocket flange. Misalignment causing belt contact with a flange will generate noise that is easily detected. Follow the guidelines discussed in the installation section of this manual for checking and correcting alignment.

Noise Barriers and Absorbers

Sometimes, even properly aligned and tensioned belt drives may be too noisy for a work environment. When this occurs, steps can be taken to modify the drive guard to reduce the noise level.

Noise barriers are used to block and reflect noise. Noise barriers do not absorb or deaden the noise; they block the noise and generally reflect most of the noise back towards its point of origin. Good noise barriers are dense, and should not vibrate. A sheet metal belt guard is a noise barrier. The more complete the enclosure is, the more effective it is as a noise barrier. Noise barrier belt guards can be as sophisticated as a completely enclosed case, or as simple as sheet metal covering the front of the guard to prevent direct sound transmission.

Noise absorbers are used to reduce noise reflections and to dissipate noise energy. Noise absorbers should be used in combination with a noise barrier. Noise absorbers are commonly referred to as acoustic insulation. Acoustic insulation (the noise absorber) is used inside of belt guards (the noise barrier) where necessary. A large variety of acoustic insulation manufacturers are available to provide different products for the appropriate situation.

A combination of noise barrier (solid belt guard) and noise absorber (acoustic insulation) will provide the largest reduction in belt drive noise. While the noise reduction cannot be predicted, field experience has shown that noise levels have been reduced by 10 to 20 dBA when using complete belt guards with acoustic insulation.

Poly Chain® GT®2 belt drives are excellent replacements for roller chain drives. Poly Chain® GT®2 belt drives offer significant maintenance savings and performance advantages over roller chain drives on applications that operate in corrosive environments. Synchronous belt drives also provide energy savings compared to V-belt drives. Some of these applications may also operate in corrosive environments.

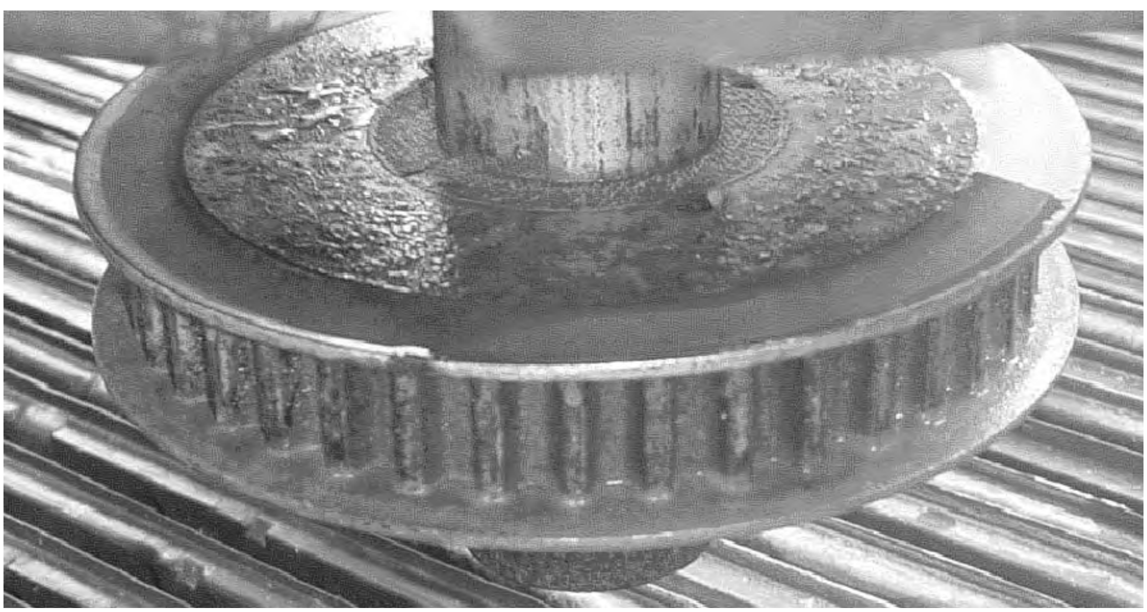
Corrosive Environments

Many applications in the food and beverage industry are located in areas that require periodic wash down. Unless a drive is completely shielded and protected from wash down, rust and corrosion will be rapidly apparent in these types of environments.

Applications that are located in environments that have high humidity or moisture content will also develop sprocket and bushing corrosion. Examples of these types of environments are pulp processing applications and cooling tower applications that pass moist air over the belt drive.

Effects of Corrosion

Corrosion will attack the sprocket grooves, building up rust deposits. The corrosion will increase over time, building up in the sprocket grooves and non-driving surfaces (flanges, sprocket faces, bushing face).

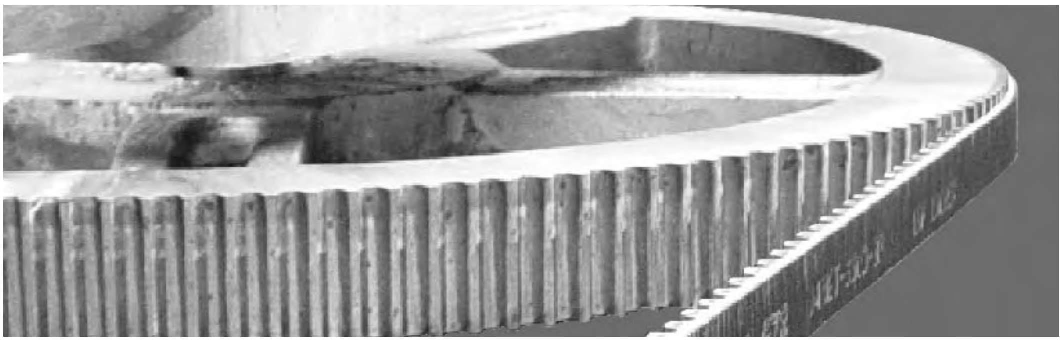


Sprockets with corrosion in the grooves will rapidly wear the belt's teeth. Sprockets with corroded grooves will wear through the abrasion resistant tooth fabric, resulting in tooth shear and premature belt failure.

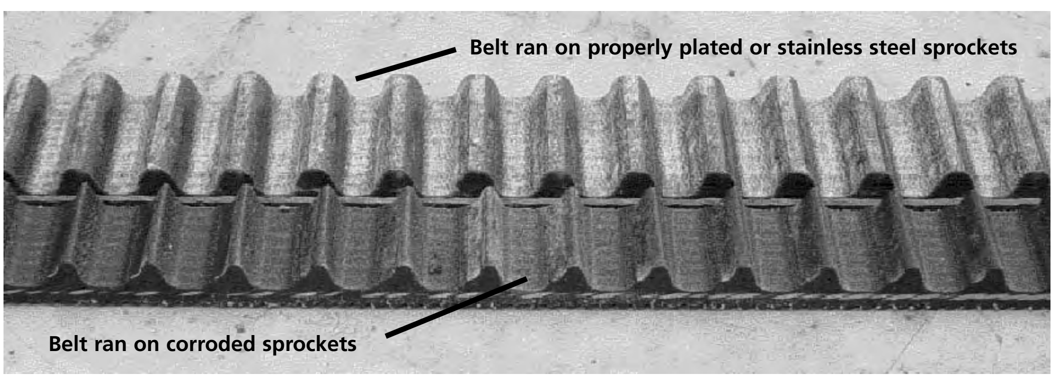
Preventing Corrosion

Sprocket corrosion can be prevented by using Gates stainless steel Poly Chain® GT®2 sprockets and bushings. Sprockets can also be electroless nickel plated. Both solutions will eliminate corrosion as a cause of failure on belt drives located in these damaging environments.

The sprocket shown below has been electroless nickel plated. Compare the grooves to the unprotected corroded sprocket shown on page 35.



The photo below illustrates the difference in wear between belts running on properly plated sprockets and those running on corroded sprockets. The wear on the belt running on corroded sprockets is severe and will result in a greatly shortened belt life.



When troubleshooting a drive problem, the goal is to identify the cause(s), then take appropriate corrective action. The following stops should be followed to help with this process.

1. Describe the drive problem as accurately as possible. Use Step 1 as a guide. Use this step as a guide in the troubleshooting process.
2. Go through the list of "Drive Symptoms". Check those symptoms that are observed and record them, as well as observations of anything unusual about the drive.
3. Go through the "Problem/Solution Summary Table". List the probable cause(s) and corrective action. Also, review the list of observations.
4. After identifying probable causes and corrective action, review and implement.

What to Do When All Else Fails

If the problem still exists after all troubleshooting efforts have been exhausted, contact the local Gates distributor. If the local distributor cannot solve the problem, a qualified Gates representative can be contacted.

Gates Power Transmission Product Application engineers are also available at (303) 744-5800 to answer additional drive design and troubleshooting questions.

Step 1

Describe the problem

- *What is wrong?*
- *When did it happen?*
- *How often does it happen?*
- *What is the drive application?*
- *Have the machine operations or output changed?*
- *What kind of belt(s) are being used?*
- *What are the expectations for belt performance in this application?*

Step 2

Identify symptoms and record observations of anything unusual.

V-belt Drive Symptoms
Check List
(Check those that are observed)

- **Premature Belt Failure**
  - ☐ Broken belt(s)
  - ☐ Belt(s) fail to carry load (slip). No visible reason
  - ☐ Edge cord failure
  - ☐ Belt delamination or undercord separation

- **Severe or Abnormal Belt Wear**
  - ☐ Wear on belt top surface
  - ☐ Wear on top corners of belt
  - ☐ Wear on belt sidewall
  - ☐ Wear on belt bottom corners
  - ☐ Wear on bottom surface of belt
  - ☐ Undercord cracking
  - ☐ Burn or hardening on bottom or sidewall
  - ☐ Belt surface flaking, sticky or swollen
  - ☐ Belt stretch
  - ☐ Extensive hardening of belt exterior

V-belt Drive Symptoms Checklist–cont.

- **Problems with PowerBand® Belts**
  - ☐ Tie-band separation
  - ☐ Top of tie-band frayed, worn or damaged
  - ☐ Band comes off drive
  - ☐ One or more ribs run outside of pulley

- **V-belt Turns Over or Jumps off Sheave**
  - ☐ Single belt
  - ☐ One or more belts in a set
  - ☐ Joined or banded belts

- **Problems with Belt Take-Up**
  - ☐ Single belt
  - ☐ Multiple belts stretch unequally
  - ☐ All belts stretch equally
  - ☐ Belts do not match

- **V-belt Noise**
  - ☐ Squeal or "chirp"
  - ☐ Slapping noise
  - ☐ Rubbing sound
  - ☐ Grinding
  - ☐ Unusually loud drive

- **Unusual Vibration**
  - ☐ Belts flopping
  - ☐ Excessive vibration in drive system

- **Problem With Sheaves**
  - ☐ Broken or damaged
  - ☐ Severe, rapid groove wear

- **Problems With Drive Components**
  - ☐ Bent or broken shafts
  - ☐ Hot bearings

Synchronous Drive Symptoms Checklist

- **Belt Problems**
  - ☐ Unusual noise
  - ☐ Tension loss
  - ☐ Excessive belt edge wear
  - ☐ Tensile break
  - ☐ Cracking
  - ☐ Premature tooth wear
  - ☐ Tooth shear
  - ☐ Belt ratcheting
  - ☐ Land area worn

- **Sprocket Problems**
  - ☐ Flange failure
  - ☐ Unusual wear
  - ☐ Rusted or corroded

- **Performance Problems**
  - ☐ Incorrect driveN speeds
  - ☐ Belt tracking problems
  - ☐ Excessive temperature: bearings, housings, shafts, etc.
  - ☐ Shafts out of sync
  - ☐ Vibration

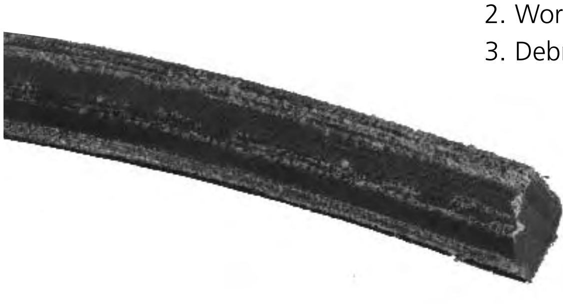
V-belt Drive Symptoms

Premature Belt Failure

Symptoms	Probable Cause	Corrective Action
Broken belt(s) 	1. Under-designed drive 2. Belt rolled or pried onto sheave 3. Object falling into drive 4. Severe shock load	1. Redesign, using Gates manual. 2. Use drive take-up when installing. 3. Provide adequate guard or drive protection. 4. Redesign to accommodate shock load.
Belts fail to carry load, no visible reason	1. Underdesigned drive 2. Damaged tensile member 3. Worn sheave grooves 4. Center distance movement	1. Redesign, using Gates manual. 2. Follow correct installation procedure. 3. Check for groove wear; replace as needed. 4. Check drive for center distance movement during operation.
Edge cord failure	1. Pulley misalignment 2. Damaged tensile member	1. Check alignment and correct. 2. Follow correct installation procedure.
Belt de-lamination or undercord separation	1. Too small sheaves 2. Use of too small backside idler	1. Check drive design, replace with larger sheaves. 2. Increase backside idler to acceptable diameter.

PROBLEM/SOLUTION SUMMARY TABLE

Severe or Abnormal V-belt Wear

Symptoms	Probable Cause	Corrective Action
Wear on top surface of belt	1. Rubbing against guard 2. Idler malfunction	1. Replace or repair guard. 2. Replace idler.
Wear on top corner of belt 	1. Belt-to-sheave fit incorrect (belt too small for groove)	1. Use correct belt-to-sheave combination.
Wear on belt sidewalls	1. Belt slip 2. Misalignment 3. Worn sheaves 4. Incorrect belt	1. Retention until slipping stops. 2. Realign sheaves. 3. Replace sheaves. 4. Replace with correct belt size.
Wear on bottom corner of belt	1. Belt-to-sheave fit incorrect 2. Worn sheaves	1. Use correct belt-to-sheave combination. 2. Replace sheaves.
Wear on bottom surface of belt 	1. Belt bottoming on sheave groove 2. Worn sheaves 3. Debris in sheaves	1. Use correct belt/sheave match. 2. Replace sheaves. 3. Clean sheaves.
Undercord cracking	1. Sheave diameter too small 2. Belt slip 3. Backside idler too small 4. Improper storage	1. Use larger diameter sheaves. 2. Retention. 3. Use larger diameter backside idler. 4. Don't coil belt too tightly, kink or bend. Avoid heat and direct sunlight.

Severe or Abnormal V-belt Wear–cont.

Symptoms	Probable Cause	Corrective Action
Undercord or sidewall burn or hardening 	1. Belt slipping 2. Worn sheaves 3. Underdesigned drive 4. Shaft movement	1. Retension until slipping stops. 2. Replace sheaves. 3. Refer to Gates drive manual. 4. Check for center distance changes.
Belt surface hard or stiff	1. Hot drive environment	1. Improve ventilation to drive.
Belt surface flaking, sticky or swollen 	1. Oil or chemical contamination	1. Do not use belt dressing. Eliminate sources of oil, grease or chemical contamination.

Problems With PowerBand® Belts

Symptoms	Probable Cause	Corrective Action
Tie band separation 	1. Worn sheaves 2. Improper groove spacing	1. Replace sheaves. 2. Use standard groove sheaves.
Top of tie band frayed or worn 	1. Interference with guard 2. Backside idler malfunction or damaged	1. Check guard. 2. Replace or repair backside idler
PowerBand® belt comes off drive repeatedly	1. Debris in sheaves 2. Misalignment	1. Clean grooves. Use single belts to prevent debris from being trapped in grooves. 2. Realign drive.

Problems With PowerBand® Belts–cont.

Symptoms	Probable Cause	Corrective Action
One or more "ribs" runs out of pulley	1. Misalignment	1. Realign drive.
	2. Undertensioned	2. Retension.

V-belts Turn Over or Come Off Drive

Symptoms	Probable Cause	Corrective Action
Involves single or multiple belts	1. Shock loading or vibration	1. Check drive design. Use Gates PowerBand® belts or Power Cable® belts.
	2. Foreign material in grooves	2. Shield grooves and drive.
	3. Misaligned sheaves	3. Realign the sheaves.
	4. Worn sheave grooves	4. Replace sheaves.
	5. Damaged tensile member	5. Use correct installation and belt storage procedure.
	6. Incorrectly placed flat idler	6. Carefully align flat idler on slack side of drive as close as possible to driveR sheaves.
	7. Mismatched belt set	7. Replace with Gates matched belts. <u>Do not mix old and new belts.</u>
	8. Poor drive design	8. Check for center distance stability and vibration dampening.

Problems with V-belt Take-Up

Symptoms	Probable Cause	Corrective Action
Multiple belts stretch unequally	1. Misaligned drive	1. Realign and retension drive.
	2. Debris in sheaves	2. Clean sheaves.
	3. Broken tensile member or cord damaged	3. Replace all belts, install properly.
	4. Mismatched belt set	4. Install Gates matched belt set.
Single belt, or where all belts stretch evenly	1. Insufficient take-up allowance	1. Check take-up. Use allowance specified in Gates design manuals.
	2. Grossly overloaded or under designed drive	2. Redesign drive.
	3. Broken tensile members	3. Replace belt, install properly.
Belts do not match	1. Not all belts are from the same manufacturer	1. Use Gates belts

PROBLEM/SOLUTION SUMMARY TABLE

V-belt Noise

Symptoms	Probable Cause	Corrective Action
Belt squeals or chirps	1. Belt slip 2. Contamination	1. Retension. 2. Clean belts and sheaves.
Slapping Sound	1. Loose belts 2. Mismatched set 3. Misalignment	1. Retension. 2. Install matched belt set. 3. Realign pulleys so all belts share load equally.
Rubbing sound	1. Guard interference	1. Repair, replace or redesign guard.
Grinding sound	1. Damaged bearings	1. Replace, align & lubricate.
Unusually loud drive	1. Incorrect belt 2. Incorrect Tension 3. Worn sheaves 4. Debris in sheaves	1. Use correct belt size. Use correct belt tooth profile for sprockets on synchronous drive. 2. Check tension and adjust 3. Replace sheaves 4. Clean sheaves, improve shielding, remove rust, paint, or remove dirt from grooves.

Unusual Vibration

Symptoms	Probable Cause	Corrective Action
Belts flopping	1. Loose belts (under tensioned) 2. Mismatched belts 3. Pulley misalignment	1. Retension. 2. Install Gates matched belts. 3. Align pulley
Unusual or excessive vibration	1. Incorrect belt 2. Poor machine or equipment design 3. Pulley out of round 4. Loose drive components	1. Use correct belt cross section in pulley. Use correct tooth profile and pitch in sprocket. 2. Check structure and brackets for adequate strength. 3. Replace with non-defective pulley. 4. Check machine components and guards, motor mounts, motor pads, bushings, brackets and framework for stability, adequate design strength, proper maintenance and proper installation.

Problems With Sheaves

Symptoms	Probable Cause	Corrective Action
Broken or damaged sheave	1. Incorrect sheave installation 2. Foreign objects falling into drive 3. Excessive rim speeds 4. Incorrect belt installation	1. Do not tighten bushing bolts beyond recommended torque values. 2. Use adequate drive guard. 3. Keep pulley rim speeds below maximum recommended value. 4. Do not pry belts onto pulleys.
Severe Groove Wear	1. Excessive belt tension 2. Sand, debris or contamination 3. Wrong belt	1. Retension, check drive design. 2. Clean and shield drive as well as possible. 3. Make sure belt and sheave combination is correct.

Problem With Other Drive Components

Symptoms	Probable Cause	Corrective Action
Bent or broken shaft	1. Extreme belt overtension	1. Retension
	2. Overdesigned drive*	2. Check drive design, may need to use smaller or fewer belts.
	3. Accidental damage	3. Redesign drive guard.
	4. Machine design error	4. Check machine design.
	5. Accidental damage to guard or poor guard design	5. Repair, redesign for durability.
	6. Pulley mounted too far away from outboard bearing	6. Move pulley closer to bearing.
Hot Bearings	1. Worn grooves - belts bottoming and won't transmit power until overtensioned*	1. Replace sheaves. Tension drive properly.
	2. Improper tension	2. Retension.
	3. Motor manufacturer's sheave diameter recommendation not followed	3. Redesign using drive design manual.
	4. Bearing underdesigned	4. Check bearing design.
	5. Bearing not properly maintained	5. Align and lubricate bearing.
	6. Sheaves too far out on shaft	6. Place sheaves as close as possible to bearings. Remove obstructions
	7. Belt Slippage	7. Retension.

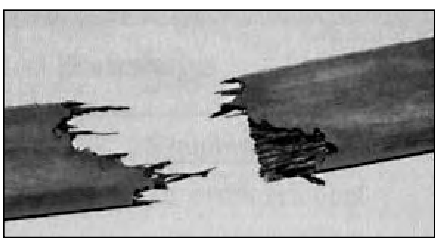
* Using too many belts, or belts that are too large, can severely stress motor or driveN shafts. This can happen when load requirements are reduced on a drive, but the belts are not redesigned accordingly. This can also happen when a drive is greatly overdesigned. Forces created from belt tensioning are too great for the shafts.

Synchronous Drive Symptoms

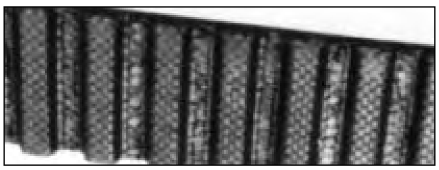
Synchronous Belt Problems

Symptoms	Probable Cause	Corrective Action
Unusual noise	1. Misaligned drive	1. Correct alignment.
	2. Too low or high tension	2. Adjust to recommended value
	3. Backside idler	3. Use inside idler.
	4. Worn sprocket	4. Replace.
	5. Bent guide flange	5. Replace.
	6. Belt speed too high	6. Redesign drive.
	7. Incorrect belt profile for sprocket (i.e. HTD®, GT®, etc.)	7. Use proper belt/sprocket combination.
	8. Subminimal diameter	8. Redesign drive using larger diameters.
	9. Excessive load	9. Redesign drive for increased capacity.

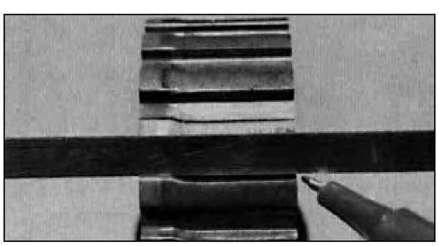
Synchronous Belt Problems–cont.

Symptoms	Probable Cause	Corrective Action
Tension Loss	1. Weak support structure 2. Excessive sprocket wear 3. Fixed (non-adjustable) centers 4. Excessive debris 5. Excessive load 6. Subminimal diameter 7. Belt, sprocket or shafts running too hot 8. Unusual belt degradation	1. Reinforce structure. 2. Use alternate sprocket material. 3. Use inside idler for belt adjustment. 4. Remove debris, check guard. 5. Redesign drive for increased capacity. 6. Redesign drive using larger diameters. 7. Check for conductive heat transfer from prime mover. 8. Reduce ambient drive temperature to 185°F maximum.
Excessive Belt Edge Wear	1. Damage due to handling 2. Flange damage 3. Belt too wide 4. Belt tension too low 5. Rough flange surface finish 6. Improper tracking 7. Belt hitting drive guard or bracketry 8. Misalignment	1. Follow proper handling instructions. 2. Repair flange or replace sprocket. 3. Use proper width sprocket. 4. Adjust tension to recommended value. 5. Replace or repair flange (to eliminate abrasive surface). 6. Correct alignment. 7. Remove obstruction or use inside idler. 8. Realign drive
Tensile Break 	1. Excessive shock load 2. Subminimal diameter 3. Improper belt handling and storage prior to installation (crimping) 4. Debris or foreign object in drive 5. Extreme sprocket run-out	1. Redesign drive for increased capacity. 2. Redesign drive using larger diameters. 3. Follow proper storage and handling procedures. 4. Remove objects and check guard. 5. Replace sprocket.
Belt Cracking	1. Subminimal diameter 2. Backside idler 3. Extreme low temperature at start-up. 4. Extended exposure to harsh chemicals 5. Cocked bushing/sprocket assembly	1. Redesign drive using larger diameter. 2. Use inside idler or increase diameter of backside idler. 3. Pre-heat drive environment. 4. Protect drive. 5. Install bushing per instructions.
Premature Tooth Wear 	1. Too low or high belt tension 2. Belt running partly off unflanged sprocket 3. Misaligned drive 4. Incorrect belt profile for sprocket (i.e. HTD, GT®, etc) 5. Worn sprocket 6. Rough sprocket teeth	1. Adjust to recommended value. 2. Correct alignment. 3. Correct alignment. 4. Use proper belt/sprocket combination. 5. Replace. 6. Replace sprocket.

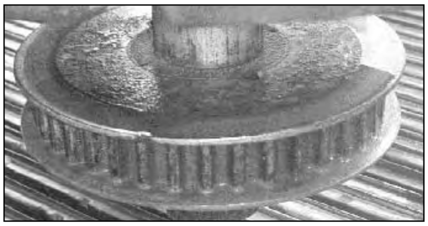
Synchronous Belt Problems–cont.

Symptoms	Probable Cause	Corrective Action
Premature Tooth Wear–cont.	7. Damaged sprocket	7. Replace.
	8. Sprocket not to dimensional specification	8. Replace.
	9. Belt hitting drive bracketry or other structure	9. Remove obstruction or use idler
	10. Excessive load	10. Redesign drive for increased capacity
	11. Insufficient hardness of sprocket material	11. Use a more wear-resistant sprocket
	12. Excessive debris	12. Remove debris, check guard.
	13. Cocked bushing/sprocket assembly	13. Install bushing per instructions.
Tooth Shear 	1. Excessive shock loads	1. Redesign drive for increased capacity.
	2. Less than 6 teeth-in-mesh	2. Redesign drive.
	3. Extreme sprocket run-out	3. Replace sprocket.
	4. Worn sprocket	4. Replace.
	5. Backside idler	5. Use inside idler
	6. Incorrect belt profile for the sprocket (i.e. HTD®, GT®, etc.)	6. Use proper belt/sprocket combination.
	7. Misaligned drive	7. Realign.
	8. Belt undertensioned	8. Adjust tension to recommended value.
Belt Ratcheting	1. Drive is undertensioned	1. Adjust tension to recommended value.
	2. Excessive shock loads	2. Redesign drive for increased capacity.
	3. Drive framework not rigid	3. Reinforce system.
Land Area Worn	1. Excessive tension	1. Adjust tension to recommended value.
	2. Excessive sprocket wear	2. Check sprocket condition. Replace if necessary.

Synchronous Sprocket Problems

Symptoms	Probable Cause	Corrective Action
Flange Failure	1. Belt forcing flange off	1. Correct alignment or properly secure flange to sprocket.
Unusual Sprocket Wear 	1. Sprocket has too little wear resistance (i.e. plastic, aluminum, soft metals)	1. Use alternate sprocket material.
	2. Misaligned drive	2. Correct alignment.
	3. Excessive debris	3. Remove debris, check guard.
	4. Excessive load	4. Redesign drive for increased capacity.
	5. Belt tension too low or high	5. Adjust tension to recommended value.
	6. Incorrect belt profile (i.e. HTD®, GT®, etc.)	6. Use proper belt/sprocket combination.

Synchronous Sprocket Problems–cont.

Symptoms	Probable Cause	Corrective Action
Rust and Corrosion 	1. Rust caused by high moisture conditions in the production area, or by the use of water-based cleaning solutions.	1. Replace cast iron sprockets and bushings with stainless steel components. 2. Replace cast iron sprockets with nickel plated sprockets.

Performance Problems

Symptoms	Probable Cause	Corrective Action
Incorrect driveN speed	1. Design error	1. Use correct driveR/driveN sprocket size for desired speed ratio.
Belt Tracking	1. Belt running partly off unflanged sprocket 2. Centers exceed 8 times small sprocket diameter 3. Excessive belt edge wear	1. Correct alignment. 2. Correct parallel alignment to set belt to track on both sprockets. Flange both sprockets. 3. Correct alignment.
Excessive Temperature (Belt, Bearing, Housing, Shafts, etc.)	1. Misaligned drive 2. Too low or high belt tension 3. Incorrect belt profile (i.e. HTD®, GT®, etc.)	1. Correct alignment. 2. Adjust tension to recommended value. 3. Use proper belt/sprocket combination.
Shafts Out of Sync	1. Design error 2. Incorrect belt	1. Use correct sprocket sizes. 2. Use correct belt with correct tooth profile for grooves.
Vibration	1. Incorrect belt profile for the sprocket (i.e. HTD®, GT®, etc.) 2. Too low or high belt tension 3. Bushing or key loose	1. Use proper belt/sprocket combination. 2. Adjust tension to recommended value. 3. Check and reinstall per instructions.

TROUBLESHOOTING TOOLS

The tools available to help troubleshoot drive problems range from the surprisingly simple to complicated. Following is a list of tools that can be used to effectively diagnose a problem. While Gates does not sell all of the items discussed in this section, the items are readily available from industrial instrumentation outlets throughout the United States.

Eyes, Ears & Nose

When troubleshooting a belt drive problem, stand back and observe the drive while it is in operation and at rest. Is there a warm rubber smell? Is there anything unusual about the way the belt travels around the drive? Is the drive frame flexing under load? Are there chirping, squealing or grinding noises? Is there an accumulation of dust or debris beneath the drive which might interfere with the belts?

Squirt Bottle With Soapy Water

When a belt drive is excessively noisy, the belt is often incorrectly blamed. It is easy to eliminate the belt as the problem by spraying it with soapy water while it is running. If the noise goes away, or decreases, then the belt is part of the problem. If the same noise is still present, the problem is likely due to other drive components.

String

Variation in drive center distance, often caused by weak supporting structure, can cause problems from vibration to short belt life. To determine if center distance variation exists, turn off the drive and tightly tie a piece of string from the driveR to the driveN shaft. Start up the drive and note if the string stretches almost to the point of breaking, or goes slack. If either is the case, the problem could be center distance variation.

It is particularly important to observe the string right at drive start up when the loads are highest. String can also be used to check pulley alignment.

Belt & Sheave Groove Gauges

If a belt-to-sheave groove mismatch is suspected, English and metric belt and sheave groove gauges can be used to check dimensions. These also are handy for identifying a belt cross section for replacements and for checking sheave grooves for wear.

These gauges are available from the local Gates distributor.

English Gauge: Product No. 7401-0014
Metric Gauge: Product No. 7401-0013

Long Straight Edge

While V-belts can be somewhat forgiving of misalignment, this condition can still affect V-belt performance. Even slight misalignment can cause major problems on a synchronous drive. Use a long straight edge, made of wood, metal or any rigid material, to quickly check drive alignment. Simply lay the straight edge across the pulley faces and note the points of contact (or lack of contact).

Design Flex® II and Design View® Software

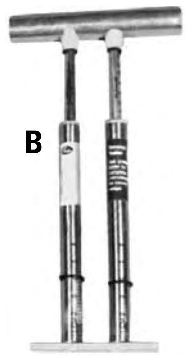
Gates design suite of engineering programs include interactive support software and a user friendly interface for rapid data retrieval and smooth design work.

Both programs are available at www.gates.com.

NOTE: In some cases redesign of the drive is necessary. Gates Design Flex® II drive design software provides a quick, accurate and flexible method of correctly redesigning problem drives.

TROUBLESHOOTING TOOLS

A

B

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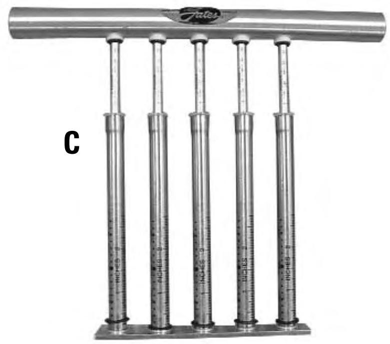
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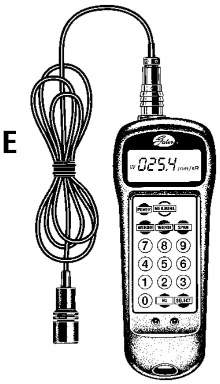
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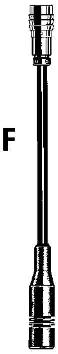
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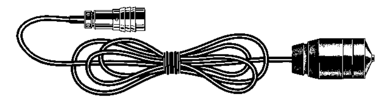


Belt Tension Testers

Improper belt tension, either too high or too low, can cause belt drive problems. An "experienced" thumb may be okay for ordinary drives, but for critical drives,
Gates recommends using a tension gauge. Proper tension and installation can extend belt life and reduce costly downtime.

Several types of tension gauges are available.

A. Tension Tester
(Product No. 7401-0076)
Maximum deflection force: 30 lbs. For use with all small V-belt and Synchronous drives, including PowerBand® and Poly Chain® GT®2 belt drives.

B. Double Barrel Tension Tester
(Product No. 7401-0075)
Maximum deflection force: 66 lbs. For use with all multiple V-belt and large Synchronous drives, including PowerBand® and Poly Chain® GT® 2 belt drives.

C. 5-Barrel Tension Tester
(Product No. 7401-0079)
Maximum deflection force: 165 lbs. for use with multiple V-belt and large Synchronous drives.

D. Krikit Gauge
(Product No. 7401-0071)
For use with Automotive V-belts

E. Sonic Tension Meter Model 505C
(Product No. 7420-0201)*

For extremely accurate belt tension measuring, the Gates Sonic Tension Meter is an electronic device that measures the natural frequency of a free stationary belt span and instantly computes the static belt tension based upon the belt span length, belt width and belt type.

Features:

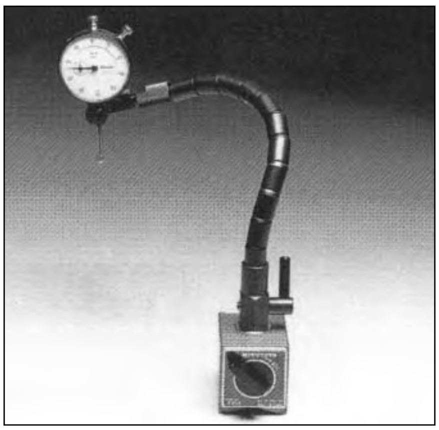
- Can be used for synchronous and V-belts.
- Uses sound waves instead of force/deflection.
- Results are repeatable with any operator.
- Portable, lightweight and easy to use.
- Fast. Calculates tension in seconds.
- Can be used in almost any environment.
- Model 505C runs on two AAA batteries.

* Available until stock is depleted.
New model available January, 2005.
Sonic Tension Meter
Model 507C
(Product No. 7420-0507)

Accessories:
F. Flexible Sensor
(Product No. 7420-0204)
G. Optional Inductive Sensor
(Product No. 7420-0212)

Dial Indicator

Improperly mounted sheaves or out-of-round pulleys are sometimes the root of vibration or more severe problems. This device can be used to measure side-to-side sheave wobble or diameter variation by holding it up to the sheave sidewall or top of the belt inside the pulley groove, respectively. IMPORTANT: Always turn off the machine before using the dial indicator. Rotate the drive by hand to make your measurements.

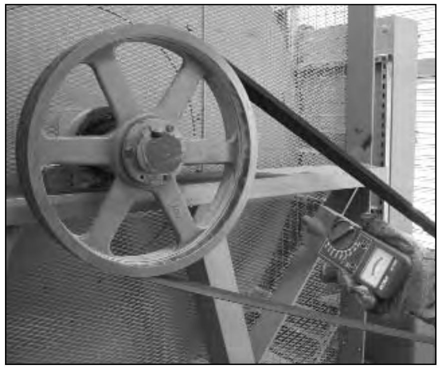


Infrared Pyrometer

The pyrometer accurately measures external belt temperatures and environmental temperatures.

Noise Meter

Use a noise meter to measure environmental and belt drive noise.



Strobe Tachometer

It is not always possible to see what is happening to a drive while it is in operation. This instrument visually stops the action to get a better idea of the dynamic forces affecting the drive. The strobe tachometer is best used after initial diagnosis of the problem because it helps pinpoint the cause. It will help identify such things as single or dual mode belt span vibration and frame flexure.

EZ Align™ Laser Alignment Tool (Product No. 7420-1000)

- Compact design
- Laser projects a line
- Mirror reflects laser line, making it easy to align shafts
- Laser line is very easy to read on targets
- Includes a hard foam filled plastic carrying case

Table No. 1

Belt Section, Sheave Diameters and Standard Groove Angles*

Belt Section	Sheave Datum Diameter (D.D.) (In.)	Standard Groove Angle (± 0.20°)
A, AX	Up to 5.4	34
A, AX	Over 5.4	38
B, BX	Up to 7.0	34
B, BX	Over 7.0	38
C, CX	Up to 7.99	34
C, CX	8.0 to 12.0	36
C, CX	Over 12.0	38
D	Up to 12.99	34
D	13.0 to 17.0	36
D	Over 17.0	38
E	Up to 24.0	36
E	Over 24.0	38
Belt Section	**Sheave Outside Diameter (O.D.) (In.)**	**Standard Groove Angle (± 0.20°)**
3V, 3VX	Up to 3.49	36
3V, 3VX	3.50 to 6.00	38
3V, 3VX	6.0 to 12.00	40
3V, 3VX	Over 12.00	42
5V, 5VX	Up to 9.99	38
5V, 5VX	10.00 to 16.0	40
5V, 5VX	Over 16.00	42
8V	Up to 15.99	38
8V	16.00 to 22.4	40
8V	Over 22.4	42

*For these data on Micro-V® and Polyflex® JB™ belts, refer to Micro-V Drive Design Manual 15408 and Polyflex JB Drive Design Manual 18595.

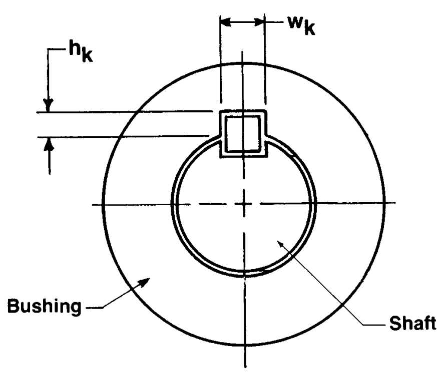
Table No. 2

Maximum Allowable Outside Diameters For Cast Iron Pulleys

Maximum Shaft Speed (RPM)	Maximum Allowable Pulley Diameter (In.)
600	41.4
870	28.5
1,160	21.4
1,400	17.7
1,600	15.5
1,750	14.2
2,000	12.4
2,400	10.3
2,800	8.8
3,000	8.3
3,450	7.2
4,000	6.2
4,500	5.5
5,000	5.0
7,500	3.31
10,000	2.48

Table No. 3

Standard Shaft and Bushing Keyseat Dimensions



Shaft Diameter (Inches)	Width w_k (inches)*	Depth h_k +0.015-0.000 (Inches)
Up Through 7/16 (0.44)	3/32 (0.094)	3/64 (0.047)
Over 7/16 (0.44) To and Incl. 9/16 (0.56)	1/8 (0.125)	1/16 (0.062)
Over 9/16 (0.56) To and Incl. 7/8 (0.88)	3/16 (0.188)	3/32 (0.094)
Over 7/8 (0.88) To and Incl. 1 1/4 (1.25)	1/4 (0.250)	1/8 (0.125)
Over 1 1/4 (1.25) To and Incl. 1 3/8 (1.38)	5/16 (0.312)	5/32 (0.156)
Over 1 3/8 (1.38) To and Incl. 1 3/4 (1.75)	3/8 (0.375)	3/16 (0.188)
Over 1 3/4 (1.75) To and Incl. 2 1/4 (2.25)	1/2 (0.500)	1/4 (0.250)
Over 2 1/4 (2.25) To and Incl. 2 3/4 (2.75)	5/8 (0.625)	5/16 (0.312)
Over 2 3/4 (2.75) To and Incl. 3 1/4 (3.25)	3/4 (0.750)	3/8 (0.375)
Over 3 1/4 (3.25) To and Incl. 3 3/4 (3.75)	7/8 (0.875)	7/16 (0.438)
Over 3 3/4 (3.75) To and Incl. 4 1/2 (4.50)	1 (1.000)	1/2 (0.500)
Over 4 1/2 (4.50) To and Incl. 5 1/2 (5.50)	1 1/4 (1.250)	5/8 (0.625)
Over 5 1/2 (5.50) To and Incl. 6 1/2 (6.50)	1 1/2 (1.500)	3/4 (0.750)
Over 6 1/2 (6.50) To and Incl. 7 1/2 (7.50)	1 3/4 (1.750)	3/4 (0.750)
Over 7 1/2 (7.50) To and Incl. 9 (9.00)	2 (2.000)	3/4 (0.750)
Over 9 (9.00) To and Incl. 11 (11.00)	2 1/2 (2.500)	7/8 (0.875)
Over 11 (11.00) To and Incl. 13 (13.00)	3 (3.000)	1 (1.000)

*Tolerance on Width, w_k for widths up through 1/2'' (0.500) .... +0.002-0.000
For widths over 1/2'' (0.500) through 1'' (1.000) .... +0.003-0.000
For widths over 1'' (1.000) .... +0.400-0.000

Electric Motor Frames and Minimum Sheave and Sprocket Diameters

The National Electric Manufacturers Association (NEMA) publishes recommendations for the minimum diameter of sheaves to be used on General Purpose electric motors. Purpose of the recommendations is to prevent the use of too small sheaves, which can result in shaft or bearing damage because belt pull goes up as sheave diameter goes down.

The NEMA Standard MG-1-14.42, November 1978 shows minimum recommended sheave diameters as a function of frame number. The table below lists the NEMA frame assignments and minimum diameter recommendations according to the 1964 rerating program.

Table No. 4

		Horsepower at Synchronous Speed (rpm)				Synchronous Belts
Motor Frame Code	Shaft Dia. (in)	3600 (3450)	1800 (1750)	1200 (1160)	900 (870)	Min. Pitch Dia. (in)
143T	0.875	1-1/2	1	3/4	1/2	2.0
145T	0.875	2 — 3	1-1/2 — 2	1	3/4	2.2
182T	1.125	3	3	1-1/2	1	2.2
182T	1.125	5	—	—	—	2.4
184T	1.125	—	—	2	1-1/2	2.2
184T	1.125	5	—	—	—	2.2
184T	1.125	7-1/2	5	—	—	2.7
213T	1.375	7-1/2—10	7-1/2	3	2	2.7
215T	1.375	10	—	5	3	2.7
215T	1.375	15	10	—	—	3.4
254T	1.625	15	—	7-1/2	5	3.4
254T	1.625	20	15	—	—	4.0
256T	1.625	20-25	—	10	7-1/2	4.0
256T	1.625	—	20	—	—	4.0
284T	1.875	—	—	15	10	4.0
284T	1.875	—	25	—	—	4.0
286T	1.875	—	30	20	15	4.7
324T	2.125	—	40	25	20	5.4
236T	2.125	—	50	30	25	6.1
364T	2.375	—	—	40	30	6.1
364T	2.375	—	60	—	—	6.7
365T	2.375	—	—	50	40	7.4
365T	2.375	—	75	—	—	7.7
404T	2.875	—	—	60	—	7.2
404T	2.875	—	—	—	50	7.6
404T	2.875	—	100	—	—	7.7
405T	2.875	—	—	75	60	9.0
405T	2.875	—	100	—	—	7.7
405T	2.875	—	125	—	—	9.5
444T	3.375	—	—	100	—	9.0
444T	3.375	—	—	—	75	8.6
444T	3.375	—	125	—	—	9.5
444T	3.375	—	150	—	—	9.5
445T	3.375	—	—	125	—	10.8
445T	3.375	—	—	—	100	10.8
445T	3.375	—	150	—	—	10.8
445T	3.375	—	200	—	—	11.9

For other than the General Purpose AC motors (for example, DC motors, Definite Purpose motors, motors with special bearings or motors that are larger than those covered by the NEMA standard), consult the motor manufacturer for minimum sheave diameter recommendations. It is helpful to the manufacturer to include details of the application with your inquiry.

Minimum Recommended Sprocket Outside Diameters for General Purpose Electric Motors

Data in the white area are from NEMA Standard MG-1-14-42, June 1972. Figures in black area are from MG-1-43, January 1968. The gray area is a composite of electric motor manufacturer data. They are generally conservative and specific motors and bearings may permit the use of a smaller motor sprocket. Consult the motor manufacturer.

NOTE: For a given horsepower and speed, the total belt pull is related to the motor sprocket size. As the size **decreases**, the total belt pull **increases**. Therefore, to limit the resultant load on motor and shaft bearings, NEMA lists minimum sprocket sizes for the various motors. The sprocket on the motor (DriveR sprocket) should be at least this large.

NEMA Minumum Spocket Diameters

Table No. 5

Motor Horsepower	Motor RPM (60 Cycle and 50 Cycle Electric Motors) 575 / 485*	690 / 575*	870 / 725*	1160 / 950*	1750 / 1425*	3450 / 2850*	Motor Horsepower
1/2	-	-	2.0	-	-	-	1/2
3/4	-	-	2.2	2.0	-	-	3/4
1	2.7	2.3	2.2	2.2	2.0	-	1
1-1/2	2.7	2.7	2.2	2.2	2.2	2.0	1-1/2
2	3.4	2.7	2.7	2.2	2.2	2.2	2
3	4.1	3.4	2.7	2.7	2.2	2.2	3
5	4.1	4.1	3.4	2.7	2.7	2.2	5
7-1/2	4.7	4.1	4.0	3.4	2.7	2.7	7-1/2
10	5.4	4.7	4.0	4.0	3.4	2.7	10
15	6.1	5.4	4.7	4.0	4.0	3.4	15
20	7.4	6.1	5.4	4.7	4.0	4.0	20
25	8.1	7.4	6.1	5.4	4.0	4.0	25
30	9.0	8.1	6.1	6.1	4.7	-	30
40	9.0	9.0	7.4	6.1	5.4	-	40
50	9.9	9.0	7.6	7.4	6.1	-	50
60	10.8	9.9	9.0	7.2	6.7	-	60
75	12.6	11.7	8.6	9.0	7.7	-	75
100	16.2	13.5	10.8	9.0	7.7	-	100
125	18.0	16.2	13.5	10.8	9.5#	-	125
150	19.8	18.0	16.2	11.7	9.5	-	150
200	19.8	19.8	19.8	-	11.9	-	200
250	19.8	19.8	-	-	-	-	250
300	24.3	24.3	-	-	-	-	300

*These RPM are for 50 cycle electric motors. # Use 8.6 for Frame Number 444 T only.

NEMA Minumum V-belt Sheave Diameters

Table No. 6

Minimum Recommended Sheave Outside Diameters for General Purpose Electric Motors
Super HC® V-belts, Super HC PowerBand® Belts, Polyflex® JB® Belts.

Motor Horse-power	Motor RPM (60 cycle and 50 cycle Electric Motors) 575 / 485*	690 / 575*	870 / 725*	1160 / 950*	1750 / 1425*	3450 / 2850	Motor Horse-power
1/2	—	—	2.2	—	—	—	1/2
3/4	—	—	2.4	2.2	—	—	3/4
1	3.0	2.5	2.4	2.4	2.2	—	1
1 1/2	3.0	3.0	2.4	2.4	2.4	2.2	1 1/2
2	3.8	3.0	3.0	2.4	2.4	2.4	2
3	4.5	3.8	3.0	3.0	2.4	2.4	3
5	4.5	4.5	3.8	3.0	3.0	2.4	5
7 1/2	5.2	4.5	4.4	3.8	3.0	3.0	7 1/2
10	6.0	5.2	4.4	4.4	3.8	3.0	10
15	6.8	6.0	5.2	4.4	4.4	3.8	15
20	8.2	6.8	6.0	5.2	4.4	4.4	20
25	9.0	8.2	6.8	6.0	4.4	4.4	25
30	10.0	9.0	6.8	6.8	5.2	—	30
40	10.0	10.0	8.2	6.8	6.0	—	40
50	11.0	10.0	8.4	8.2	6.8	—	50
60	12.0	11.0	10.0	8.0	7.4	—	60
75	14.0	13.0	9.5	10.0	8.6	—	75
100	18.0	15.0	12.0	10.0	8.6	—	100
125	20.0	18.0	15.0	12.0	10.5#	—	125
150	22.0	20.0	18.0	13.0	10.5	—	150
200	22.0	22.0	22.0	—	13.2	—	200
250	22.0	22.0	—	—	—	—	250
300	27.0	27.0	—	—	—	—	300

*These RPM are for 50 cycle electric motors. # 9.5 for Frame Number 444T.

Data in the white area of Table No. 6 are from NEMA Standard MG-1-14.42, November 1978. Data in the gray area are from MG-1-14.43, January 1968. Data in the ?? area are a composite of electic motor manufacturers data. They are generally conservative, and specific motors and bearings may permit the use of a smaller motor sheave. Consult the motor manufacturer. See Page ??.

Table No. 7

Minimum Recommended Sheave Datum Diameters for General Purpose Electric Motors
Hi-Power® II V-belts, Hi-Power II PowerBand Belts or Tri-Power® Molded Notch V-belts.

Motor Horse-power	Motor RPM (60 cycle and 50 cycle Electric Motors) 575 / 485*	690 / 575*	870 / 725*	1160 / 950*	1750 / 1425*	3450 / 2850	Motor Horse-power
1/2	2.5	2.5	2.2	—	—	—	1/2
3/4	3.0	2.5	2.4	2.2	—	—	3/4
1	3.0	2.5	2.4	2.4	2.2	—	1
1 1/2	3.0	3.0	2.4	2.4	2.4	2.2	1 1/2
2	3.8	3.0	3.0	2.4	2.4	2.4	2
3	4.5	3.8	3.0	3.0	2.4	2.4	3
5	4.5	4.5	3.8	3.0	3.0	2.6	5
7 1/2	5.2	4.5	4.4	3.8	3.0	3.0	7 1/2
10	6.0	5.2	4.6	4.4	3.8	3.0	10
15	6.8	6.0	5.4	4.6	4.4	3.8	15
20	8.2	6.8	6.0	5.4	4.6	4.4	20
25	9.0	8.2	6.8	6.0	5.0	4.4	25
30	10.0	9.0	6.8	6.8	5.2	—	30
40	10.0	10.0	8.2	6.8	6.0	—	40
50	11.0	10.0	9.0	8.2	6.8	—	50
60	12.0	11.0	10.0	9.0	7.4	—	60
75	14.0	13.0	10.5	10.0	9.0	—	75
100	18.0	15.0	12.5	11.0	10.0	—	100
125	20.0	18.0	15.0	12.5	11.5†	—	125
150	22.0	20.0	18.0	13.0	—	—	150
200	22.0	22.0	22.0	—	—	—	200
250	22.0	22.0	—	—	—	—	250
300	27.0	27.0	—	—	—	—	300

*These RPM are for 50 cycle electric motors. † 11.0 for Frame Number 444T.

Data in the white area of Table No. 7 are from NEMA Standard MG-1-14.42, November 1978. Data in the gray area are from MG-1-14.43, January 1968. Data in the ?? area are a composite of electic motor manufacturers data. They are generally conservative, and specific motors and bearings may permit the use of a smaller motor sheave. Consult the motor manufacturer. See Page ??.

Minimum Recommended Sheave Diameter By Belt Cross Section

Table No. 8

Belt Cross Section	Min Recommended Datum Diameter (Standard Groove) (in)
Classical V-belts	
AX	2.20
A	3.00
BX	4.00
B	5.40
CX	6.80
C	9.00
D	13.00
E	21.00
Belt Cross Section	**Min Recommended Outside Diameter (Standard Groove) (in)**
Narrow V-belts	
3VX	2.20
3V	2.65
5VX	4.40
5V	7.10
8V	12.50
Light Duty V-belts	
2L	0.8
3L	1.5
4L	2.5
5L	3.5
Micro-V® Belts	
J	0.8
L	3.00
M	7.00
Polyflex® JB® Belts	
3M	0.67
5M	1.04
7M	1.67
11M	2.64

Minimum Recommended Sprocket Sizes

Table No. 9

Belt Pitch	Min Recommended Sprocket Size (No. of Teeth)
PowerGrip® Timing	
MXL	12
XL	12
L	12
H	14
XH	18
XXH	18
PowerGrip® HTD®	
3M	12
5M	14
PowerGrip® GT®2	
2M	12
3M	16
5M	18
8M	22
14M	28
20M	34
Poly Chain® GT®2	
8M	22
14M	28
Synchro-Power® Polyurethane	
MXL	10
XL	10
L	10
H	14
T2.5	12
T5	10
T10	16
T20	15
AT5	12
AT10	18
AT20	18
5mm HTD	10
8mm HTD	16
14mm HTD	28

Minimum Recommended Idler Diameters

Table No. 10

Belt Cross Section	Min. O.D. Grooved Inside Idler (in)	Min. O.D. Flat Inside Idler (in)	Min. O.D. Flat Backside Idler (in)
A, AA, AX	2.75	2.25	4.25
B, BB, BX	4.00	3.75	6.00
C, CC, CS	6.75	5.75	8.50
D	9.00	7.50	13.50
3V, 3VX	2.65		4.25
5V, 5VX	7.10		10.00
8V	12.50		17.50
Belt Cross Section	**Minimum Grooved Inside (grooves)**	**Min. O.D. Flat Inside Idler (in)**	**Min. O.D. Flat Backside Idler (in)**
MXL PowerGrip Timing	12	1.00	0.50
XL PowerGrip Timing	12	2.50	1.00
L PowerGrip Timing	10	4.75	1.60
H PowerGrip Timing	14	6.38	2.88
XH PowerGrip Timing	18	11.00	6.38
XXH PowerGrip Timing	18	15.75	9.25
3M PowerGrip HTD	12	1.50	0.75
5M PowerGrip HTD	14	2.50	1.25
2M PowerGrip GT2	12	1.00	0.50
3M PowerGrip GT2	12	1.50	0.75
5M PowerGrip GT2	14	2.50	1.25
8M PowerGrip GT2	22	4.00	2.80
14M PowerGrip GT2	28	7.00	6.50
20M PowerGrip GT2	34	10.00	11.00
5M Poly Chain GT	16	2.50	1.88
8M Poly Chain GT2	25	4.00	3.00
14M Poly Chain GT2	28	7.00	6.50

Minimum Center Distance Allowances for Belt Installation and Takeup

Table No. 11

V-Belt Number	Minimum Center Distance Allowance for Installation (Inches)						Minimum Center Distance Allowance for Initial Tensioning and Subsequent Takeup (Inches)
	3V/3VX		5V/5VX		8V		All Cross Sections
	Super HC® V-Belt	Super HC PowerBand® Belt*	Super HC V-Belt	Super HC PowerBand Belt*	Super HC V-Belt	Super HC PowerBand Belt*	All Types
Up to and Incl. 475	0.5	1.2					1.0
Over 475 to and Incl. 710	0.8	1.4	1.0	2.1			1.2
Over 710 to and Incl. 1060	0.8	1.4	1.0	2.1	1.5	3.4	1.5
Over 1060 to and Incl. 1250	0.8	1.4	1.0	2.1	1.5	3.4	1.8
Over 1250 to and Incl. 1700	0.8	1.4	1.0	2.1	1.5	3.4	2.2
Over 1700 to and Incl. 2000			1.0	2.1	1.8	3.6	2.5
Over 2000 to and Incl. 2360			1.2	2.4	1.8	3.6	3.0
Over 2360 to and Incl. 2650			1.2	2.4	1.8	3.6	3.2
Over 2650 to and Incl. 3000			1.2	2.4	1.8	3.6	3.5
Over 3000 to and Incl. 3550			1.2	2.4	2.0	4.0	4.0
Over 3550 to and Incl. 3750					2.0	4.0	4.5
Over 3750 to and Incl. 5000					2.0	4.0	5.5
Over 5000 to and Incl. 6000					2.0	4.0	6.0

*Also use these figures for individual Super HC V-Belts in deep groove sheaves.

Minimum Center Distance Allowances for Belt Installation and Takeup

Table No. 12

V-Belt Number	Minimum Center Distance Allowance For Installation (Inches)										Minimum Center Distance Allowance For Initial Tensioning and Subsequent Takeup (Inches)
	A		B		C		D		E		All Cross Sections
	Hi-Power II and Tri-Power* Molded Notch V-Belts	Hi-Power II PowerBand Belt*	Hi-Power II and Tri-Power Molded Notch V-Belts	Hi-Power II PowerBand Belt*	Hi-Power II and Tri-Power Molded Notch V-Belts	Hi-Power II PowerBand Belt*	Hi-Power II and Tri-Power Molded Notch V-Belts	Hi-Power II PowerBand Belt*	Hi-Power II V-Belts	Hi-Power II PowerBand Belt*	All Types
Up To and Incl. 35	0.75	1.20	1.00	1.50							1.00
Over 35 To and Incl. 55	0.75	1.20	1.00	1.50	1.50	2.00					1.50
Over 55 To and Incl. 85	0.75	1.30	1.25	1.60	1.50	2.00					2.00
Over 85 To and Incl. 112	1.00	1.30	1.25	1.60	1.50	2.00					2.50
Over 112 To and Incl. 144	1.00	1.50	1.25	1.80	1.50	2.10	2.00	2.90			3.00
Over 144 To and Incl. 180			1.25	1.80	2.00	2.20	2.00	3.00	2.50	3.40	3.50
Over 180 To and Incl. 210			1.50	1.90	2.00	2.30	2.00	3.20	2.50	3.50	4.00
Over 210 To and Incl. 240			1.50	2.00	2.00	2.50	2.50	3.20	2.50	3.60	4.50
Over 240 To and Incl. 300			1.50	2.20	2.00	2.50	2.50	3.50	3.00	3.90	5.00
Over 300 To and Incl. 390					2.00	2.70	2.50	3.60	3.00	4.00	6.00
Over 390					2.50	2.90	3.00	4.10	3.50	4.40	1.5% of belt length

*Also use these figures for individual Hi-Power II and Tri-Power Molded Notch V-Belts in deep groove sheaves.

Table No. 13

Micro-V® Belts

V-Belt Number	Minimum Center Distance Allowance for Installation (Inches)			Minimum Center Distance Allowance For Initial Tensioning and Subsequent Takeup (Inches)
Standard Effective Length (In.)	J	L	M	All Cross Sections
Up through 20.0	0.4	—	—	0.3
20.1 through 40.0	0.5	—	—	0.5
40.1 through 60.0	0.6	0.9	—	0.7
60.1 through 80.0	0.7	1.0	—	0.9
80.1 through 100.0	0.8	1.2	1.5	1.1
100.1 through 120.0	—	1.2	1.6	1.3
120.1 through 160.0	—	1.4	1.7	1.7
160.1 through 200.0	—	—	1.8	2.2
200.1 through 240.0	—	—	1.9	2.6
240.1 through 300.0	—	—	2.2	3.3
300.1 through 360.0	—	—	2.5	3.9
60.1 through 370.0	—	—	2.7	4.6

Polyflex® JB® Belts

	3M	5M	7M	11M	
180-300	.18	0.4	—	—	0.2
307-750	.28	0.6	0.6	1.0	0.6
750-1090	—	0.9	0.9	1.2	1.1
1120-1500	—	1.1	1.1	1.4	1.4
1550-1900	—	—	1.1	1.5	1.4
1950-2300	—	—	1.5	1.9	1.8

Poly Chain® GT®2 Installation & Tensioning Allowances

Center Distance Allowance For Installation and Tensioning

Table No. 14

Belt Length	Standard Installation Allowance (Flanged Sprockets Removed For Installation)	Tensioning Allowance (Any Drive)
40″ and under (1000mm and under)	0.07″ 1.8mm	0.03″ 0.8mm
Over 40″ to 70″ (Over 1000mm to 1780mm)	0.11″ 2.8mm	0.03″ 0.8mm
Over 70″ to 100″ (Over 1780mm to 2540mm)	0.13″ 3.3mm	0.04″ 1.0mm
Over 100″ to 130″ (Over 2540mm to 3300mm)	0.16″ 4.1mm	0.04″ 1.0mm
Over 130″ to 180″ (Over 3300mm to 4600mm)	0.21″ 5.3mm	0.05″ 1.3mm

Additional Center Distance Allowance For Installation Over Flanged Sprocket*

(Add to Installation Allowance in Above Table)

Table No. 15

Belt Pitch	One Sprocket Flanged	Both Sprockets Flanged
8mm 8mm	0.86″ 21.8mm	1.31″ 33.3mm
14mm 14mm	1.23″ 31.2mm	1.97″ 50.0mm

* For drives that require installation of the belt over one sprocket at a time, use the value for both sprockets flanged, even if only one sprocket is flanged.

Table No. 16

Power Grip GT2® Center Distance Allowance For Installation and Tensioning

Length Belt (mm) (in)	Standard Installation Allowance (Flanged Sprockets Removed For Installation) (mm) (in)	Tensioning Allowance (All Drives) (mm) (in)
Up to 125 / **5**	0.5 / **0.02**	0.5 / **0.02**
Over 125 / **5** to 250 / **10**	0.8 / **0.03**	0.8 / **0.03**
Over 250 / **10** to 500 / **20**	1.0 / **0.04**	0.8 / **0.03**
Over 500 / **20** to 1000 / **40**	1.8 / **0.07**	0.8 / **0.03**
Over 1000 / **40** to 1780 / **70**	2.8 / **0.10**	0.8 / **0.04**
Over 1780 / **70** to 2540 / **100**	3.3 / **0.13**	1.0 / **0.04**
Over 2540 / **100** to 3300 / **130**	4.1 / **0.16**	1.3 / **0.05**
Over 3300 / **130** to 4600 / **180**	4.8 / **0.19**	1.3 / **0.05**
Over 4600 / **180** to 6900 / **270**	5.6 / **0.22**	1.3 / **0.05**

Table No. 17

Additional Center Distance allowance For Installation Over Flanged Sprockets*

(Add to Installation Allowance in Above Table)

Pitch	One Sprocket Flanged (mm) (in)	Both Sprockets Flanged (mm) (in)
5mm	13.5 / **0.53**	19.1 / **0.75**
8mm	21.8 / **0.86**	33.3 / **1.31**
14mm	31.2 / **1.23**	50.0 / **1.97**
20mm	47.0 / **1.85**	77.5 / **3.05**

* For drives that require installation of the belt over one sprocket at a time, use the value for "Both Sprockets Flanged"

Table No. 18

Power Grip® Timing Belts Center Distance Allowance for Installation and Tensioning

Belt Length (In.)	Standard Installation Allowance (Flanged Pulleys Removed For Installation)	Tensioning Allowance (Any Drive)
3.6 to 5.0	.02″	.02″
Over 5.0 to 10.0	.03″	.03″
Over 10.0 to 20.0	.04″	.03″
Over 20.0 to 40.0	.05″	.04″
Over 40.0 to 60.0	.07″	.05″
Over 60.0 to 180.0	.12″	.08″

Table No. 19

Additional Center Distance Allowance for Installation Over Flanged Pulleys*

(Add to Installation Allowance in Above Table)

Belt Pitch	Small Pulley Flanged	Both Pulleys Flanged
0.080″ (MXL)	.33″	.49″
0.200″ (XL)	.46″	.71″
0.375″ (L)	.64″	.85″
0.500″ (H)	.64″	.96″
0.875″ (XH)	1.14″	1.92″
1.250″ (XXH)	1.53″	2.65″

*For drives that require installation of the belt over one pulley at a time, use the value for both pulleys flanged — even if only one pulley is flanged.

Table No. 20

Estimating Belt Length from Drive Dimensions

(2 Pulleys)

$$\text{Belt Length} = 2C + 1.57\,(D + d) + \frac{(D - d)^2}{4C}$$

Where: C = Shaft Center Distance

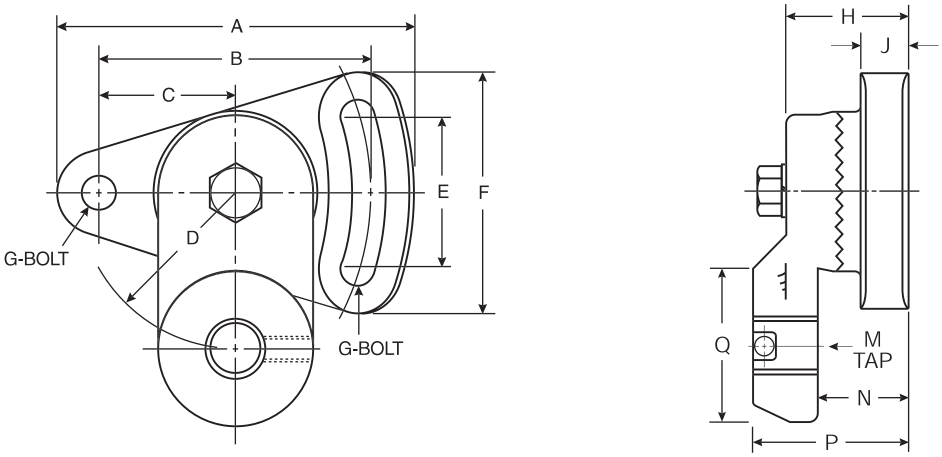
a.) For Super HC®: Belt Length = Belt Outside Diameter
D = O.D. of Larger Pulley
d = O.D. of Smaller Pulley

b.) For Hi-Power® II and Tri-Power® Molded Notch: Belt Length = Datum Length
D = Datum Diameter of Larger Pulley
d = Datum Diameter of Smaller Pulley

c.) For Synchronous Belts: Belt Length = Pitch Length
D = Pitch Diameter of Larger Sprocket
d = Pitch Diameter of Smaller Sprocket

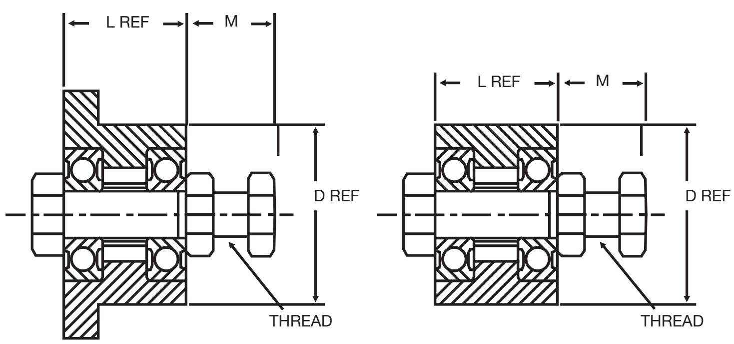
Belt Drive Tensioners

(Double Adjustable)



Idler Bracket Specifications

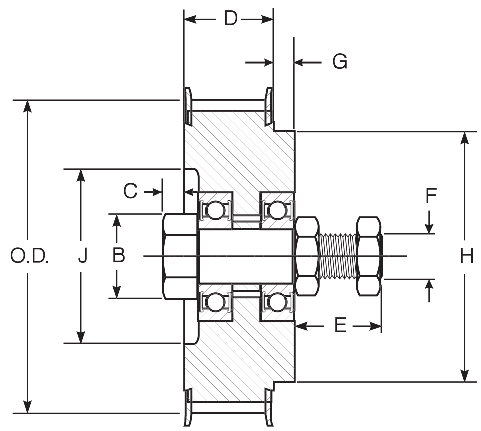
Part No.	Tensioner Part No.	Use With	A (in)	B (in)	C (in)	D (in)	E (in)	F (in)	G (in)	H (in)	J (in)	M (Threads)	N (in)	P (in)	Q (in)	Weight (lb)
05-IDL-BRAK	7720-1005	1610-IDL-BUSH	4.62	3.50	1.75	2.00	2.06	3.06	0.38	1.63	0.62	5/8-18	1.16	2.01	2.00	2.80
10-IDL-BRAK	7720-1010	8mm Pitch Idler Sprockets 2012-IDL-BUSH 2517-IDL-BUSH 20-IDL-BUSH (SK)	4.63	3.50	1.75	2.00	2.06	3.06	0.38	1.50	0.56	3/4-16	1.00	1.88	1.75	3.4
20-IDL-BRAK	7720-1020	14mm Pitch Idler Sprockets 30-IDL-BUSH (SF) 40-IDL-BUSH (E)	6.94	5.25	2.63	5.00	3.00	4.56	0.63	2.38	1.00	1-14	1.63	2.94	2.75	11.2



Idler Bushings (Internal Shaft Included)

Product No.	Part No.	Use with Bracket	D (in)	L (in)	M (in)	Threads	Weight (lb)
7720-1610	1610-IDL-BUSH	05-IDL-BRAK	2.25	1.00	1.38	5/8-18	1.30
7720-2012	2012-IDL-BUSH	10-IDL-BRAK	2.75	1.25	1.56	3/4-16	2.30
7720-2517	2517-IDL-BUSH	10-IDL-BRAK	3.38	1.75	1.56	3/4-16	3.90
7720-1120	20-IDL-BUSH (SK)	10-IDL-BRAK	2.81	1.94	1.44	3/4-16	4.10
7720-1130	30-IDL-BUSH (SF)	20-IDL-BRAK	3.13	2.08	2.13	1-14	6.40
7720-1140	40-IDL-BUSH (E)	20-IDL-BRAK	3.83	2.75	2.19	1-14	8.60

Idler Sprockets



Poly Chain® GT®2 Idler Dimensions

Part No.	Product No.	Use With	Size Designation	Belt Width (mm)	No. of Teeth	O.D. (in)	B Ref. (in)	C (in)	D (in)	E Ref. (in)	F (Threads) (in)	G Ref. (in)	H (in)	J (in)	Weight (lb)
12-IDL-SPRK	7720-1500	8mm Pitch Poly Chain GT2	8MX-32S-12	12	32	3.145	1.25	0.50	0.85	1.56	3/4-16	0.94	2.75	-	1.0
21-IDL-SPRK	7720-1510		8MX-32S-21	21	32	3.145	1.25	0.50	1.24	1.56	3/4-16	0.56	2.75	-	1.1
36-IDL-SPRK	7720-1520		8MX-36S-36	36	36	3.546	1.91	0.75	1.86	1.63	3/4-16	-	-	-	2.0
62-IDL-SPRK	7720-1530		8MX-36S-62	62	36	3.546	1.91	0.75	2.91	1.69	3/4-16	0.69	3.13	-	2.1
20-IDL-SPRK	7720-1600	14mm Pitch Poly Chain GT2	14MX-30S-20	20	30	5.153	2.55	1.00	1.36	2.25	1-14	1.00	4.38	-	9.0
37-IDL-SPRK	7720-1610		14MX-30S-37	37	30	5.153	2.55	1.00	2.06	2.25	1-14	0.25	4.38	-	12.0
68-IDL-SPRK	7720-1620		14MX-34S-68	68	34	5.855	3.38	0.56	3.33	2.25	1-14	1.00	4.88	4.34	15.6
90-IDL-SPRK	7720-1640		14MX-34S-90	90	34	5.855	3.38	0.31	4.20	2.25	1-14	1.00	4.88	4.34	16.7
125-IDL-SPRK	7720-1630		14MX-35S-125	125	35	6.031	3.38	0.19	5.61	2.25	1-14	1.09	4.88	4.34	23.1

PowerGrip® GT® 2 Idler Dimensions

Part No.	Product No.	Use With	Size Designation	Belt Width (mm)	No. of Teeth	O.D. (in)	B Ref. (in)	C (in)	D (in)	E Ref. (in)	F (Threads) (in)	G Ref. (in)	H (in)	J (in)	Weight (lb)
20-SPK2-IDL	7720-1740	8mm Pitch PowerGrip GT2	32S-8MGT-20	20	32	3.154	1.25	0.50	1.24	1.56	3/4-16	0.56	2.75	-	1.1
30-SPK2-IDL	7720-1750		36S-8MGT-30	30	36	3.555	1.91	0.75	1.86	1.63	3/4-16	0.56	2.75	-	2.0
40-SPK2-IDL	7720-1850	14mm Pitch PowerGrip GT2	30S-14MGT-40	40	30	5.153	2.55	1.00	2.06	2.25	1-14	0.25	4.38	-	12.0
55-SPK2-IDL	7720-1860		34S-14MGT-55	55	34	5.855	3.38	0.56	3.33	2.25	1-14	1.00	4.38	4.34	15.6

Additional Gates Publications to Guide You in Design, Selection and Usage of Gates Belts and Pulleys

Gates produces many other publications — each designed to do a specific job.

Some provide you with the necessary information to design new belt drives — others provide you with product descriptions and specifications to guide in the selection of types and sizes of belts and pulleys — some contain application listings showing manufacturers' makes and models with the corresponding Gates Replacement Belt Numbers.

In all cases, the publications listed have one thing in common — they will help you specify the most economical and proper Gates belt or pulleys best for your application.

Description	Form Number
V-belt Technical Manuals	
Heavy-Duty V-belt Drive Design Manual	14995-A
Synchronous Drive Manuals	
Poly Chain® GT® 2 Belt Drive Design Manual	17595
PowerGrip® GT® 2 Belt Drive Design Manual	17195
Light Power & Precision Drive Catalog	17183
Replacement Guides	
Belt Replacement Guide for Variable Speed Drives	12684
Belt/Sprocket Interchange Guide	12998-B
Industrial Drive Products & Preventive Maintenance Pocket Guide	19998-C
Product Brochures	
Poly Chain® GT®2 Belt Drive Systems	17605
Gates Powered Solutions	17598
Polyflex® JB® Polyurethane V-belts	18563
Conveyor Systems	16425
Sonic Tension Meter	17898
V80® Belt Length Matching	12458-A

DRIVE SURVEY WORKSHEET

High Speed Drive Survey and Energy Savings Worksheet

CUSTOMER INFORMATION

Distributor ______________________________

Customer ______________________________

DRIVE INFORMATION

I.D. of Drive (location, number, etc.) ______________________________

Description of DriveN Equipment ______________________________

Manufacturer of DriveN Equipment ______________________________

Horsepower Rating of Motor __________ DriveN HP Load (Peak) __________ (Normal) __________

Motor Frame Size __________ Motor Shaft Dia. __________ DriveN Shaft Dia. __________

Speed:

DriveR RPM __________ __________ RPM Measured with Contact or Strobe Tachometer ☐ Yes ☐ No

DriveN RPM __________ __________ RPM Measured with Contact or Strobe Tachometer ☐ Yes ☐ No

Speed Ratio __________ Speed Up __________ or Speed Down __________

Center Distance: Minimum __________ Nominal __________ Maximum __________

Existing Drive Components: DriveR __________ DriveN __________

Belts __________ Belt Manufacturer __________

Ambient Conditions:

Temperature __________ Moisture __________ Oil, etc. __________

Abrasives __________ Shock Load __________

Static Conductivity Required? ☐ Yes ☐ No

Maximum Sprocket Diameter (OD) and Width Limitations (for guard clearance):

DriveR: Max. OD __________ Max. Width __________ DriveN: Max. OD __________ Max. Width __________

Guard Description ______________________________

Motor Mount:

Double Screw Base? ☐ Yes ☐ No Motor Mounted on Sheet Metal? ☐ Yes ☐ No

Adequate Structure? ☐ Yes ☐ No Floating/Pivot Motor Base? ☐ Yes ☐ No

Start Up Load:

%Motor Rating at Start Up __________ AC Inverter? ☐ Yes ☐ No Soft Start? ☐ Yes ☐ No

Duty Cycle:

Number of Starts/Stops __________ times per __________ (hour, day, week, etc.)

ENERGY SAVINGS INFORMATION

Energy Cost per KW-Hour ______________________________

Hours of Operation: ______ Hours per Day ______ Days per Week ______ Weeks per Year

Low Speed Drive Design Information Sheet

For Drive Selections with Shaft Speeds Less Than 500 rpm

Distributor: ____________________

Customer: ____________________

Drive Identification (location, number, etc.) ____________________

DriveR Information:

Motor Nameplate Data

Rated Horsepower = ________ Rated RPM = ________ Efficiency = ________

Rated Voltage = ________ Rated Amps = ________ Rated Torque = ________

Actual Motor Load = ________

Motor Type: AC ☐ DC ☐ Gear Motor ☐

Output Speed: Constant ☐ Variable ☐

Reducer Information:

Reducer Type (worm, right angle helical, cycloidal, etc):

Reducer Efficiency = ________ Output RPM = ________ Reducer Ratio = ________

Rated **Input** HP/Torque = ________ Rated **Output** HP/Torque = ________

Existing Drive Information:

Drive Type: Chain ☐ V-Belt ☐ Synchronous Belt ☐

If chain, type; 2/#60. #80, etc. ________ Lubed ☐ Unlubed ☐

Current Drive Service Life = ________

DriveR Sprocket/Sheave = ________ (teeth/OD) DriveR Shaft Diameter =

DriveN Sprocket/Sheave = ________ (teeth/OD) DriveN Shaft Diameter =

Center Distance = ________ + ________ - ________

Type of Center Distance Adjustment: ________

Idler used: Yes ☐ No ☐ Inside ☐ Backside ☐

DriveN Information:

Type of Equipment: ________ Actual Horsepower Required = ________

DriveN RPM = ________

Hours/Day = ________ Days/Week = ________ Weeks/Year = ________

Special Requirements:

Space Limitations:

Maximum DriveR Dia. = ________ Maximim DriveN Dia = ________

Maximum DriveR Width = ________ Maximum DriveN Width = ________

Environmental Conditions:

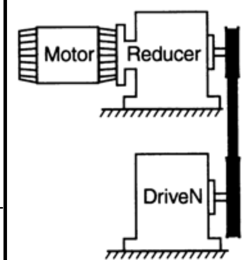
Temperature Range = ________ Belt Conductivity Required ☐

Oil Mist ☐ Oil Splash ☐ Moisture ☐ Abrasives ☐

Drive Layout

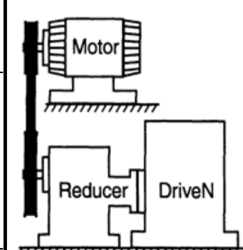
(check one)

☐ **Motor Reducer Belt Drive Driven**



Belt Drive on Reducer Output Shaft

☐ **Motor Belt Drive Reducer Driven**



Belt Drive on Reducer Input Shaft

Gates Design IQ Data Worksheet

Account: ______________________ Contact: ______________________
Address: ______________________ Title: ______________________
______________________ Phone: ____________ Fax: ____________
______________________ E-mail: ______________________

Application Summary

General Description: ______________________
Product Type: ______________________ Production Volume: ______________________
Prototype Schedule: ______________________ Production Time Schedule: ______________________

Design Parameters

DriveR:

Motor Type & Description: ______________ (Servo, Stepper, DC, AC, etc.) Reversing: _____ (Y/N)
Nominal Motor Torque / Power Output: ______________________ rpm: __________
Max / Peak Motor Torque/Power Output: ______________________ rpm: __________
Motor Stall Torque (If applicable): ______________ Driver Rotation: ________ (CW / CCW / Rev)

DriveN's / Idlers: (Specify appropriate units for each field; in, mm / hp, kw / lb-ft, lb-in, N-m, etc.)

Description	X	Y	Pulley Diameter	Pitch		Sprocket Grooves	Inside/ Outside	rpm	Load (driven)		Units	Conditions #	Conditions % Time	Shaft Diameter
Driver														

Note: For complex drive layouts use additional pages as needed

Drive Sketch

Idler Details

Slot Movement:

Min Position X	Min Position Y	Max Position X	Max Position Y

Spring: ☐

Pivoting Movement:

Pivot Point X	Pivot Point Y	Movement Angle Min Deg	Movement Angle Max Deg

Spring: ☐
Pivot Arm Radius: ______________ (in/mm): __________

Special Requirements

Product Design Life: __________ Belt Life: __________ Hours/Day: ________ Hours/Year: ________
Pulley Materials: Prototype ______________ Production ______________
Belt Construction Considerations:
Temperature: ________ Moisture: ______ Oil: ______ Static Dissipation: ________ Abrasives: ________
Special Requirements: ______________________

Page _____ Of _____

NOTES

ALTRA INDUSTRIAL MOTION

Installation & Maintenance of V-Belt Drives

TB Wood's
Incorporated

An Altra Industrial Motion Company

Quality Products and the Support to Back Them Up – Wood's

V-Belt sheaves of close grain, high-tensile cast iron are machined to provide safe, vibration-free operation at speeds up to 6500 FPM. Made to order sheaves of ductile iron material can be provided for speeds up to 10,000 FPM. V-Belt drives are only the beginning of what Wood's can do.

Wood's offers a complete line of high capacity synchronous drives. The RPP-Plus system offers a higher horsepower capacity drive at the cost of the competitions standard rated product. Wood's also offers the aramid fiber QT Powerchain drive in 8M and 14M pitch. The QT drive is capable of high horsepower capacity in a smaller package. Both QT and RPP sprockets offer metric/inch drilling for applications which require a totally metric drive system.

Wood's has many different ways of offering variable speed for customer applications. The most basic way is through the use of one of our many belted variable speed systems. Wood's also offers many different options in the line of electronic inverters and electronic speed controls. One of the most unique ways of varying speed, however, is our HSV/HSVA hydro-static systems. The HSV system is ideal for harsh, dirty, or explosive proof environments.

Wood's Elastomeric coupling line offers something for every application. Wood's Jaw couplings offer a full compliment of spider materials and bore option. Our Sure-Flex line offers the 4-way flexing action, and many different flange and sleeve options to meet your needs. The Dura-Flex coupling is designed and patented with improvements over other similar type coupling that provide for the maximum possible service life.

Wood's line of Steel couplings offers both gear and disc coupling options. Wood's Form-Flex disc couplings offer zero-backlash and eliminate the need for lubrication. Our gear couplings are available in all the standard, spacer, and special options common to the industry. In both disc and gear lines we welcome the challenge of the "special" coupling.

TB Wood's

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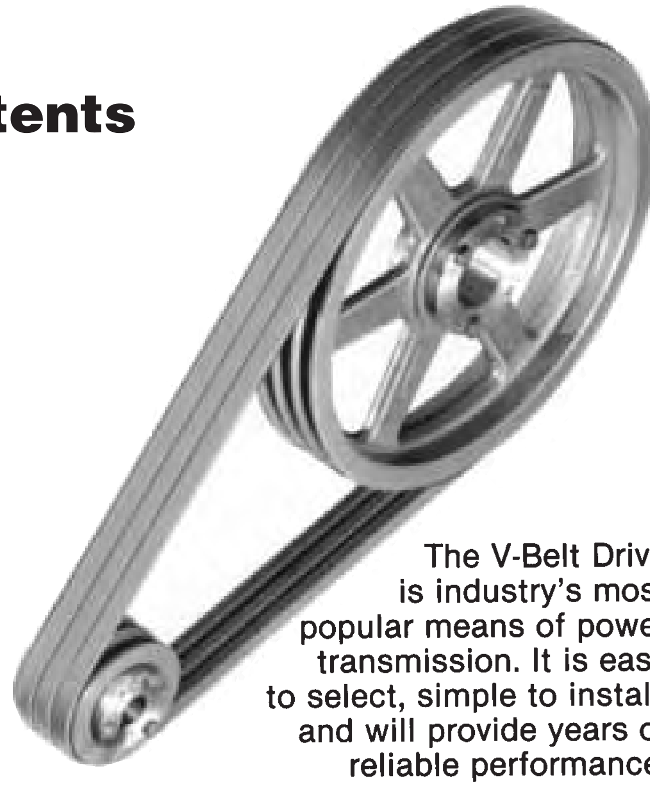


The V-Belt Drive is industry's most popular means of power transmission. It is easy to select, simple to install, and will provide years of reliable performance.

Even when misapplied, improperly installed or completely ignored, the V-Belt Drive will usually deliver some kind of performance. However, with proper installation and maintenance, many years of operating efficiency can be added to the life span of the V-Belt Drive.

It is hoped that the information contained herein will help you receive the greatest possible value from your V-belts and sheaves, will help you receive a full measure of performance from industry's dominant drive.

TB Wood's

V-Drive Inspection and Maintenance Procedures

Well designed and properly installed V-belt drives are without question the most reliable, trouble-free means of power transmission available. In general, except for an occasional retensioning, they will run year in and year out without maintenance.

However, some do require periodic inspection and maintenance, both while the drive is running and while it is stationary.

Inspection while running

A noisy V-belt drive is like a person with a fever. Both need attention.

V-drive noise can be caused by the slapping of belts against the drive guard or other obstruction. Check for an improperly installed guard, loose belts or excessive vibration. Squealing of belts as a drive is started or while it is running is usually caused by a poorly tensioned drive and/or by a build-up of foreign material in the sheave grooves. But it can also be caused by oil or grease between the belt and the sheave groove.

If necessary, remove the belt guard and watch the drive while it is running under load. **(Caution: Observe only; stand clear of the running drive!)** Much can be learned by watching the action of the slack side of the drive. Each variation in the driven load causes a corresponding change in the tension of the slack side of the belt. During across-the-line starts or suddenly applied loads while running, the sag on the slack side of the drive will increase. If the sag under these conditions is excessive, tension should be increased.

Any vibration in a system will cause the slack side of the belts to dance up and down. Excessive vibration will also induce a vibration in the tight side of the drive. The cause of the vibration should be determined and corrected.

If a set of belts is perfectly matched, all belts will have the same amount of sag. However, perfection is a rare thing and there will usually exist some difference in sag from belt to belt. It is more important to look at the tight side of a drive to be sure that all of the belts are running tight. If one or more belts are running loose, the drive needs to be retensioned, or the belts replaced with a matched set.

The above conditions could also be caused by uneven wear of the grooves in the sheave. These should be checked with sheave groove gages.

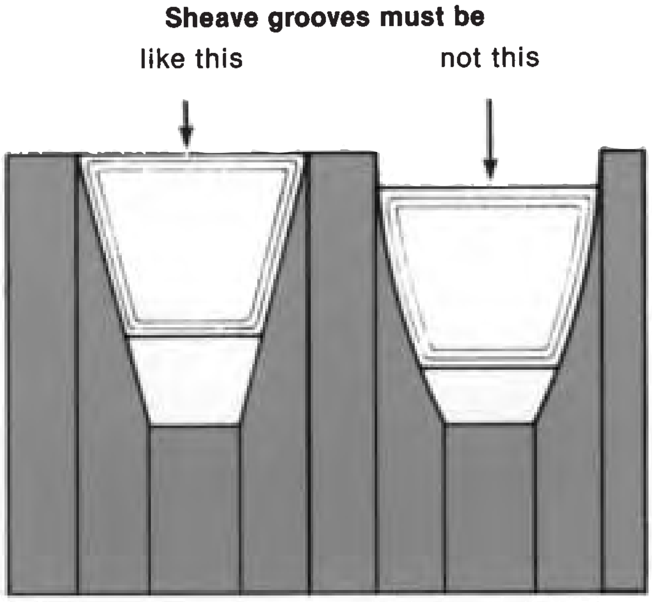
Inspect sheaves often

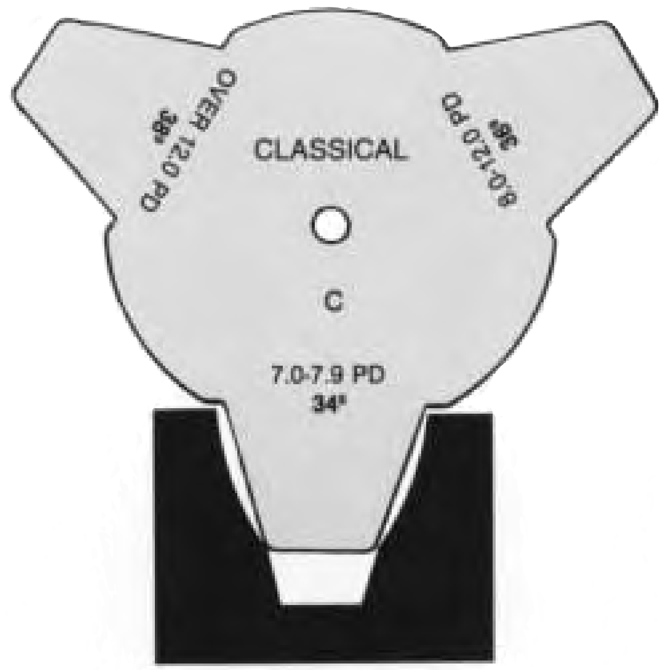
Keep all sheave grooves smooth and uniform. Burrs and rough spots along the sheave rim can damage belts. Dust, oil and other foreign matter can lead to pitting and rust and should be avoided as much as possible. If sheave sidewalls are permitted to "dish out," as shown in the picture on page 2, the bottom "shoulder" ruins belts quickly by chewing off their bottom corners. Also, the belt's wedging action is reduced and it loses its gripping power.

A shiny groove bottom indicates that either the sheave, the belt or both are badly worn and the belt is bottoming in the groove.

Badly worn grooves cause one or more belts to ride lower than the rest of the belts, and the effect is the same as with mismatched belts. This is called "differential driving." The belts riding high in the grooves travel faster than the belts riding low. In a drive under proper tension, a sure sign of differential driving is when one or several belts on the tight side are slack.

Check alignment of drive. Sheaves that are not aligned properly cause excessive belt and sheave wear. When the shafts are not parallel, belts on one side are drawn tighter and pull more than their share of the load. These overloaded belts wear out faster, reducing the service life of the entire set. If the misalignment is between the sheaves themselves, belts will enter and leave the grooves at an angle, causing excessive cover and sheave wear and premature failure. See page 10 for complete information on drive alignment.



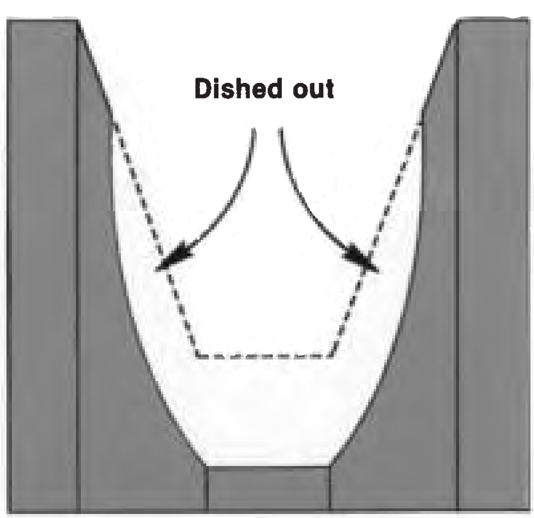


Groove gage.

Belt and sheave gages

Belt and sheave groove gage sets are available from your Wood's distributor.

You can use them to determine the proper belt section by trying the old belt in the various gages until a proper fit is obtained. The cross section of the Classical or Narrow belt can be read from the gage.



To check sheave grooves for wear, simply select the proper gage and template for the sheave diameter; then insert the gage in the groove until the rim of the gage butts against the outside diameter of the sheave flange. Worn grooves will show up as illustrated below. If more than 1/32 inch of wear can be seen, poor V-belt life may be expected.

Check belt fit

Classical V-belts should ride in standard sheave grooves so that the top surface of the belt is just above the highest point of the sheave. In A-B combination grooves, an A section belt will ride slightly low in the groove, while a B belt will be in the normal position. In special deep groove sheaves, belts will ride below the top of the sheave.

Narrow belts are purposely designed so that the top of the belt will ride above the O.D. of the sheave. The tensile cords are located in the belt so that they ride almost at the O.D. of the sheave. This simplifies sheave identification and drive calculations.

No matter which V-belt section the sheave is grooved for, the belts should never be allowed to bottom in the groove. This will cause the belt to lose its wedging action, to slip and/or burn. Sheaves worn to the point where they allow a belt to bottom should be replaced immediately.

Keep belts clean

Dirt and grease reduce belt life. Belts should be wiped with a dry cloth occasionally to remove any build-up of foreign material. If the belts have been splattered with grease and/or oil, clean them with methyl chloroform or soap and water. Inflammable cleaners such as gasoline are to be avoided as a matter of safety.

Although all Wood's V-belts are of oil resistant construction, an occasional cleaning will help to prolong their life.

Under no circumstances is the use of belt dressing recommended on a V-belt. The remedial effect is only temporary. It is much better to keep the belts and grooves of the drive clean.

Use belt guards

Belt guards protect personnel and the drive itself. They should be definitely used in abrasive atmospheres to protect the drive from sand, metal chips and other foreign matter. But they should be ventilated to avoid excessive heat.

Check them periodically for damage and for loose or missing mounting bolts. These could cause the belts to come in contact with the guard and cause failure.

Guards alone will generally protect belts from abrasion. But where abrasive materials are common — in rock processing machinery, grinders, foundries, etc. — drives should be inspected frequently for excessive belt and groove wear.

Check for hot bearings

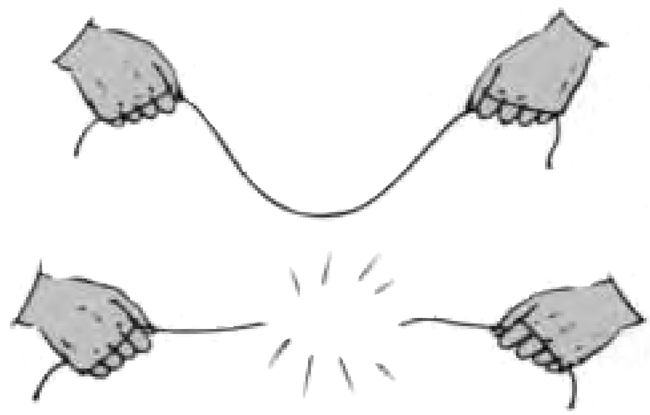
When the drive has been stopped for inspection, check the bearings to make sure they are not running hot. If they are, it could be due to improper lubrication or improper drive tension. Hot bearings can be caused by belts that are either too tight or too loose. Check the tension carefully using the instructions furnished.

If the belts are slipping on your drive, retension the drive. Never use belt dressing to correct slipping belts.

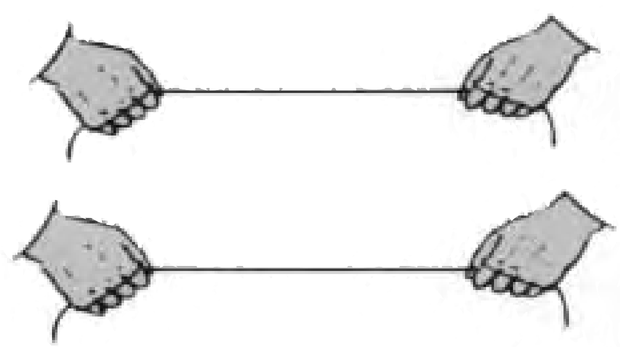
Maintain proper belt tension

Maintaining correct tension is the most important rule of V-belt care. It will give the belts 50% to 100% longer life.

Belts that are too loose will slip, causing excessive belt and sheave wear. V-belts that sag too much are snapped tight suddenly when the motor starts or when peak loads occur. That snapping action can actually break the belts, because the added stress is more than the belt was designed to take. This can be clearly demonstrated with a piece of string, as illustrated.



Loosely-held string snaps easily,
Taut string can stand strong pull.



Belt Selection

Selecting the correct belts

All the work and experience that goes into designing a V-belt drive is wasted if the specified belts are not used or the number of belts is changed. Over-belting is wasteful. Under-belting is even more expensive in the long run, because overloaded belts wear out faster.

V-belts are identified for size according to industry standards. A combination of letters and numbers indicates the width across the top of the belt (often referred to as "cross section") and the belt length. Classical belts come in five widths: A, B, C, D, and E; while Narrow belts are made in three widths: 3V, 5V, and 8V. In addition, there are the Light Duty 2L, 3L, 4L, and 5L belts. If you are not sure which to use, measure the top width of the old belts carefully, or use Wood's gages described previously.

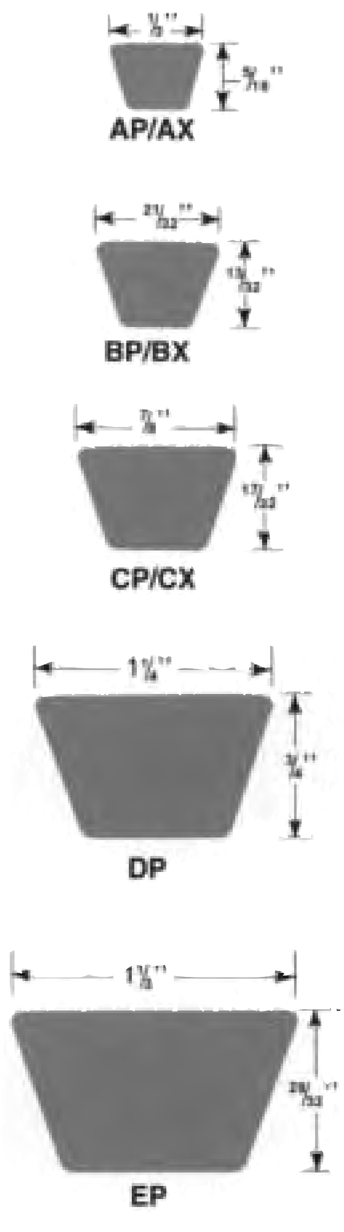
Be careful in measuring V-belts. The top widths of the B and 5V belts are very close; however, the 5V is considerably thicker, and the groove angles of the sheaves are different. Do not attempt to use these belts interchangeably. The 4L and 5L Light Duty belts are also very close in size to the A and B belts. But again, groove angles may be different. Light Duty belts should not be used on heavy-duty drives.

The belt number C270 indicates a belt with a nominal 7/8" top width and a nominal length of 270". Its pitch length is 270.9". These should be ordered as: CP270 Classical belts. (The "P" is for Wood's Premium construction.)

The number 5VX1250 indicates a narrow belt with a nominal 5/8" top width and an effective outside length of 125". These belts should be ordered as follows: 5VX1250 Narrow belts. (The "X" identifies cogged construction belts.)

The number 4L550 indicates a Light Duty fractional horsepower belt having a nominal top width of 1/2" and a nominal outside length of 55". Light Duty belts are available for general purpose applications; specify 4L550 Light Duty. It is designed to have little or no stretch and will require few take-ups during its life.

Classical Belts



Narrow Belts

To assure maximum V-belt life, follow the minimum recommended pitch and sheave diameters for belts established by Mechanical Power Transmission Association and Rubber Manufacturers Association standards.

Classical Belt Section	Minimum* Pitch Diameter
A	3.0"
AX	2.2"
B	5.4"
BX	4.0"
C	9.0"
CX	6.8"
D	13.0"

**Not applicable to Light Duty Belts*

Narrow Belt Section	Minimum Sheave Diameter
3V	2.65"
3VX	2.2"
5V	7.1"
5VX	4.4"
8V	12.5"

All belts "ORS"

At one time it was necessary to order special belts for various types of environments. All Wood's belts are of "ORS" construction, meaning they are heat resistant, oil resistant and static conducting.

By heat resistant, we mean these belts will operate well in ambient temperatures up to 140°F. They may be operated at higher temperatures, but there would be a reduction in service life. In general, short belts develop higher internal temperatures than long belts. They are usually subjected to more flexures per minute and are frequently found on totally-enclosed drives where there is little or no air circulation.

Oil resistance is a matter of degree. It varies with the amount of contact with oil, whether it is continuous or intermittent immersion, exposure to an atmospheric mist or an occasional spattering. A great many chemicals, particularly petroleum derivatives, can cause deterioration. All Narrow, Classical and Light Duty belts will withstand nominal exposure to oil and grease, but they are not 100% oilproof.

For maximum performance from belts in oily atmospheres, they should be guarded as much as practical against excessive amounts of oil and should be periodically cleaned with methyl chloroform. Oil and grease on belts and sheaves will tend to lubricate the drive and reduce the traction of the belt, even though they may not actually harm the belts themselves. However, since the friction factor is reduced, belts must be operated at abnormal tensions, and their life is shortened.

Belt failure caused by oil is obvious and easy to detect. The most apparent sign is the build-up of a black, soft substance that can be wiped off when the belt is rubbed. Another sign is a softening and swelling of the belt to the point where it no longer fits the sheave groove properly.

Like oil resistance, resistance to ozone is a matter of degree. Narrow, Classical and Light Duty belts are resistant to normal amounts of ozone in the atmosphere. However, high concentrations such as found around arc welding equipment can cause rubber to harden and crack. It is because of ozone that belts should never be stored in direct sunlight.

Belts intended for operation in potentially dangerous atmospheres are constructed with a relatively low electrical resistance characteristic and referred to as "static conducting." All Narrow, Classical and Light Duty belts meet the following requirements.

In the standard method of measuring a belt's electrical resistivity, two ⅝"-diameter flat contacts are placed 8½" apart on centers, moistened with water and pressed against the belt with a force of 12½ lbs. The resistance "conductivity" between the contacts is measured with an ohmmeter operating at a potential of 500 volts and having an accuracy range from 0 to 10 megohms. Experience has demonstrated that the dissipation provided by belts having a resistance of 6 megohms or less "when new and measured as above" is satisfactory for operation in hazardous atmospheres.

Explosive atmospheres

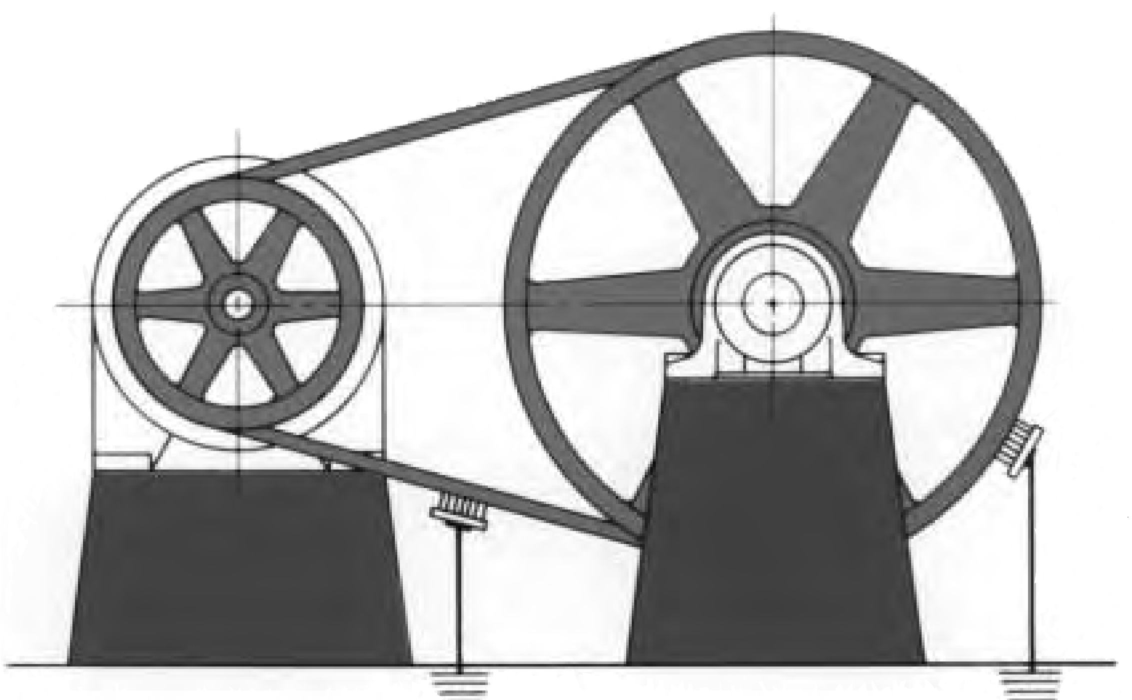
Belts on drives in hazardous atmospheres should be kept reasonably free of encrusted accumulations of non-conducting materials. In addition, all elements of the drive must be interconnected and grounded to earth as illustrated here.

Although we know of no explosion caused by static generated by a V-belt drive, we cannot accept responsibility beyond that of furnishing belts within the above described limits.

Store belts properly

V-belts should be stored in a cool, dry place out of direct sunlight. They should be kept away from ozone-producing equipment such as arc welders and high voltage apparatus. Temperature should be below 85°F, relative humidity below 70%. If belts are stored in piles, the piles should be kept small to avoid excessive weight which could distort the bottom belts. When belts are stored in boxes, the box size should be limited. Ideally, belts should be hung on saddle type pegs. With proper storage, belt quality will not change significantly within eight years.

Assuming good storage practices, a decrease in service life of approximately 10% per year of storage beyond eight years can be expected. From a norm of eight years storage life at 85˚, it is estimated that the storage limit should be reduced by half for each 15˚ increase in temperature. A significant increase in humidity may cause a fungus to form on belts, but any effect on the performance of the belt would be very slight.



Proper V-drive installation in explosive atmospheres

Safety Tips

No matter where rotating machines are located or by what means they are driven, there is always a chance of personal injury unless they are installed and operated under safe conditions. It is with this thought uppermost in our minds that this manual is written.

Guard all drives properly

All regulating agencies such as OSHA, State Departments of Labor and Industry, insurance firms and other safety authorities either recommend or insist on drive guards. We, also, strongly recommend that every V-belt drive be completely guarded. Do not be lulled into a sense of security by a temporary or makeshift guard.

Of course, provision can and should be made for proper ventilation and inspection by the use of grills, inspection doors and removable panels. But the guard should have no gap where workers can reach inside and become caught in the drive. Besides being a safety asset, a good guard helps make maintenance easier by protecting the drive from weather and foreign objects.

Check safe speed limits

Safe speed limits for sheaves manufactured by TB Wood's Incorporated have been established by a rigorous burst testing program. The limit for cast iron sheaves has been established at 6500 fpm; the maximum speed in rpm corresponding to 6500 fpm is either cast or stamped on each sheave.

Before installing the drive, this safe speed limit should be checked against the speed of the shaft on which it is being installed. Operating sheaves above recommended speeds could result in serious damage to equipment and/or serious personal injury.

Safe speed is cast into the arm of Wood's sheaves.

Burst testing. Results of centrifugal force are clearly shown in these broken "D"-groove sheaves. The pattern of breakage is typical. The rim breaks away from the arms, arms break from hub and the hub shatters through its bolt holes. With the force in several hundred thousand pounds, it all happens in a split second.

TB Wood's

Drive Installation

Sure-Grip® Sheave and Bushing Installation Instructions

Wood's Sure-Grip bushings are the most widely used, tapered, QD-type and have exceptional holding power that eliminates wobble. Standard and reverse mounting features provide greater adaptability. Sure-Grip bushings can be used interchangeably in many of Wood's products as well as those of other maufacturers.

To Install:

IMPORTANT:
DO NOT USE LUBRICANTS IN THIS INSTALLATION

Before beginning, make sure the correct size and quantity of parts are available for the installation. The bushing has been manufactured to accept a setscrew over the key and its use is optional. It is packaged with the hardware on sizes SH to M and loosely installed in the bushing on sizes N to S.

1. Inspect the tapered bore of the sheave and the tapered surface of the bushing. Any paint, dirt, oil, or grease MUST be removed.

2. Select the type of mounting (See Fig. 1 or 2) that best suits your application.

3. **STANDARD MOUNTING:** Install shaft key. (Note: If key was furnished with bushing, you must use that key.) Install bushing on clean shaft, flange end first. If bushing will not freely slide on the shaft, insert a screwdriver or similar object into the flange sawcut to act as a wedge to open the bushing's bore. **Caution: Excessive wedging will split the bushing.** If using the setscrew, tighten it just enough to prevent the bushing from sliding on the shaft. **Caution: Do not over tighten setscrew!** Slide sheave into position on bushing aligning the drilled holes in the sheave with the tapped holes in the bushing flange. (Note: Install M thru S bushings so that the two tapped holes in the sheave are located as far away as possible from the bushing's sawcut.) Loosely thread the capscrews with lockwashers into the assembly. **DO NOT USE LUBRICANT ON THE CAPSCREWS!**

4. **REVERSE MOUNTING:** With large end of the taper out, slide sheave onto shaft as far as possible. Install shaft key. (See shaft key note in #3 above.) Install bushing onto shaft so tapered end will mate with sheave. (See wedging note in #3 above.)If using the setscrew, tighten it enough to prevent the bushing from sliding on the shaft. **Caution: Do not over tighten setscrew!** Pull the sheave up on the bushing, aligning the drilled holes in the bushing flange with the tapped holes in the sheave. Loosely thread the capscrews with lockwashers into the assembly. **DO NOT USE LUBRICANT ON THE CAPSCREWS!**

5. Using a torque wrench, tighten all capscrews evenly and progressively in rotation to the torque value in Table. There must be a gap between the bushing flange and sheave hub when installation is complete. **DO NOT OVER TORQUE! DO NOT ATTEMPT TO CLOSE GAP BETWEEN BUSHING FLANGE AND SHEAVE HUB!**

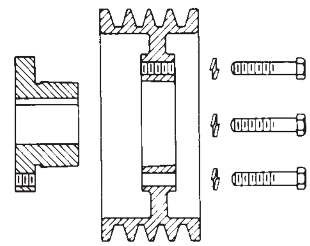


FIG. 1 **Standard Mounting**

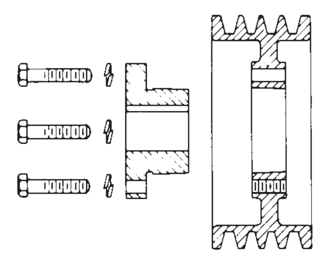


FIG. 2 **Reverse Mounting**

To Remove:

1. Relieve drive tension by shortening the center distance between driver and driven sheaves.
2. Lift off belts.
3. Loosen and remove cap screws. If the bushings have keyway setscrews, loosen them.
4. As shown below, insert cap screws (three in JA through J bushings, two in QT and M thru W bushings and four in S bushing) in tapped removal holes and progressively tighten each one until mating part is loose on bushing. (Exception: If mating part is installed with cap screw heads next to motor, with insufficient room to insert screws in tapped holes, loosen cap screws and use wedge between bushing flange and mating part.)
5. Remove mating part from bushing, and if necessary, bushing from shaft.

Sure-Grip Bushing Screw Tightening Information

Tapered Bushing	Size & Thread of Cap Screw	Ft.-Lbs. To Apply With Torque Wrench
QT	1/4—20	9
JA	No. 10—24	5
SH-SDS-SD	1/4—20	9
SK	5/16—18	15
SF	3/8—16	30
E	1/2—13	60
F	9/16—12	110
J	5/8—11	135
M	3/4—10	225
N	7/8—9	300
P	1 —8	450
W	1 1/8—7	600
S	1 1/4—7	750

CAUTION: The tightening force on the screws is multiplied many times by the wedging action of the tapered surface. If extreme tightening force is applied, or if a lubricant is used, bursting pressures will be created in the hub of the mating part.

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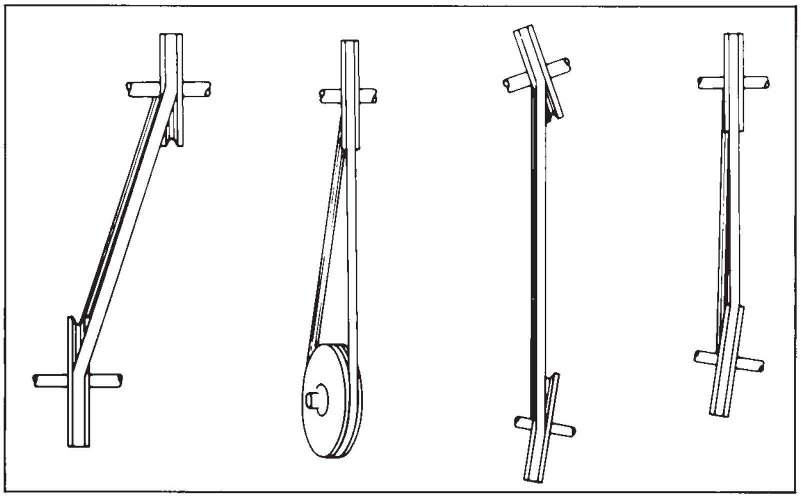
Check alignment

Although alignment is not as critical in V-belt drives as in others, proper alignment is essential to long belt and sheave life.

First, make sure that drive shafts are parallel. The most common causes of misalignment are non-parallel shafts and improperly located sheaves.

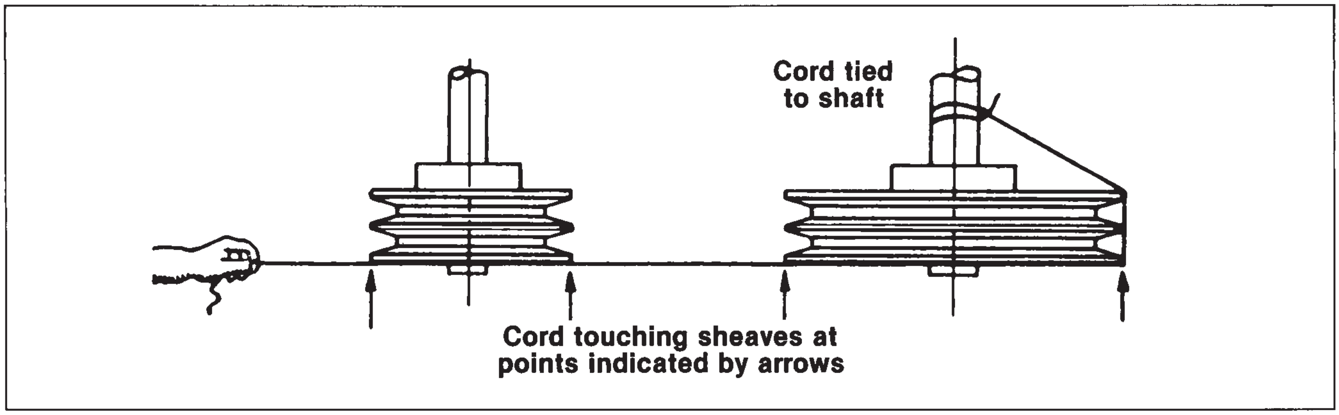
Where shafts are not parallel, belts on one side are drawn tighter and pull more than their share of the load. As a result, these belts wear out faster, requiring the entire set to be replaced before it has given maximum service. If misalignment is in the sheave, belts will enter and leave the grooves at an angle, causing excessive belt cover and sheave wear.



Shaft alignment can be checked by measuring the distance between the shafts at three or more locations. If the distances are equal, then the shafts will be parallel.

To check the location of the sheaves on the shafts, a straightedge or a piece of string can be used. If the sheaves are properly lined up, the string will touch them at the points indicated by the arrows in the accompanying sketch. Rotating each sheave a half revolution will determine whether the sheave is wobbly or the drive shaft is bent. Correct any misalignment.

With sheaves aligned, tighten cap screws evenly and progressively. Apply the recommended torque to cap screws as listed in table on page 9. NOTE: There should be 1/8" to 1/4" gap between the mating part hub and the bushing flange. If gap is closed, the shaft is seriously undersize.



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Install belts

Shorten the center distance between the driven and driver sheave so the belts can be put on without the use of force.

While the belts are still loose on the drive, rotate the drive until all the slack is on one side. Then increase the center distance until the belts are snug. The drive is now ready for tensioning.

NOTE: Never "roll" or "pry" the belts into the sheave grooves. This can damage the belt cords and lead to belt turnover, short life or actual breakage. Moreover, it is both difficult and unsafe to install belts this way.

Keep takeup rails, motor base or other means of center distance adjustment free of dirt, rust and grit. Lubricate adjusting screws and slide rails from time to time.

No!

When belts are forced into the sheave with a screwdriver or other wedge, the outer fabric is often ruptured and cords broken.

Yes!

It is well worth the time to move the driver unit forward so V-belts can be slipped easily into the sheave groove without damage.

Center Distance Allowance for Installation and Take-Up (Inches)

Narrow Belts

Belt Length	For Installation (Subtract)						For take-up (Add)
	3VX & 3V	3V Banded	5VX & 5V	5V Banded	8VX & 8V	8V Banded	All Cross Sections
250 thru 475	0.5	1.2	–	–	–	–	1.0
500 thru 710	0.8	1.4	1.0	2.1	–	–	1.2
750 thru 1060	0.8	1.4	1.0	2.1	1.5	3.4	1.5
1120 thru 1250	0.8	1.4	1.0	2.1	1.5	3.4	1.8
1320 thru 1700	0.8	1.4	1.0	2.1	1.5	3.4	2.2
1800 thru 2000	–	–	1.0	2.1	1.8	3.6	2.5
2120 thru 2360	–	–	1.2	2.4	1.8	3.6	3.0
2500 thru 2650	–	–	1.2	2.4	1.8	3.6	3.2
2800 thru 3000	–	–	1.2	2.4	1.8	3.6	3.5
3150 thru 3550	–	–	1.2	2.4	2.0	4.0	4.0
3750	–	–	–	–	2.0	4.0	4.5
4000 thru 5000	–	–	–	–	2.0	4.0	5.5

Classical Belts

Belt Length Designation	For Installation (Subtract)							For take-up (Add)
	AX & AP	BX & BP	BX & BP Banded	CX & CP	CX & CP Banded	DX & DP	DX & DP Banded	All Cross Sections
21 thru 35	0.8	1.0	1.5	–	–	–	–	1.0
36 thru 55	0.8	1.0	1.5	1.5	2.0	–	–	1.5
56 thru 85	0.8	1.2	1.6	1.5	2.0	–	–	2.0
86 thru 112	1.0	1.2	1.6	1.5	2.0	–	–	2.5
116 thru 144	1.0	1.3	1.8	1.5	2.1	2.0	2.9	3.0
148 thru 180	–	1.3	1.8	2.0	2.2	2.0	3.0	3.5
191 thru 210	–	1.5	1.9	2.0	2.3	2.0	3.2	4.0
225 thru 240	–	1.5	2.0	2.0	2.5	2.5	3.2	4.5
255 thru 300	–	1.5	2.2	2.0	2.5	2.5	3.5	5.0
315 thru 390	–	–	–	2.0	2.7	2.5	3.6	6.0
420 and Over	–	–	–	2.5	2.9	3.0	4.1	1.5% of belt length.

All dimensions in inches.

TB Wood's

Tensioning V-Belt Drives

Without exception, the most important factor in the successful operation of a V-belt drive is proper belt-tensioning. To achieve the long, trouble-free service associated with V-belt drives, belt tension must be sufficient to overcome slipping under maximum peak load. This could be either at start or during the work cycle. The amount of peak load will vary depending upon the character of the driven machine or drive system. To increase total tension, merely increase the center distance. Before attempting to tension any drive it is imperative that the sheaves be properly installed and aligned. If a V-belt slips it is too loose. Add to the tension by increasing the center distance. Never apply belt dressing as this will damage the belt and cause early failure.

General method

The general method for tensioning V-belts should satisfy most drive requirements.

Step 1: Reduce the center distance so that the belts may be placed over the sheaves and in the grooves without forcing them over the sides of the grooves. Arrange the belts so that both the top and bottom spans have about the same sag. Apply tension to the belts by increasing the center distance until the belts are snug. See figure 1.

Step 2: Operate the drive a few minutes to seat the belts in the sheave grooves. Observe the operation of the drive under its highest load condition (usually starting). A slight bowing of the slack side of the drive indicates proper tension. If the slack side remains taut during the peak load, the drive is too tight. Excessive bowing or slippage indicates insufficient tension. If the belts squeal as the motor comes on or at some subsequent peak load, they are not tight enough to deliver the torque demanded by the drive machine. The drive should be stopped and the belts tightened.

Step 3: Check the tension on a new drive frequently during the first day by observing the slack side span. After a few days' operation the belts will seat themselves in the sheave grooves and it may become necessary to readjust so that the drive again shows a slight bow in the slack side.

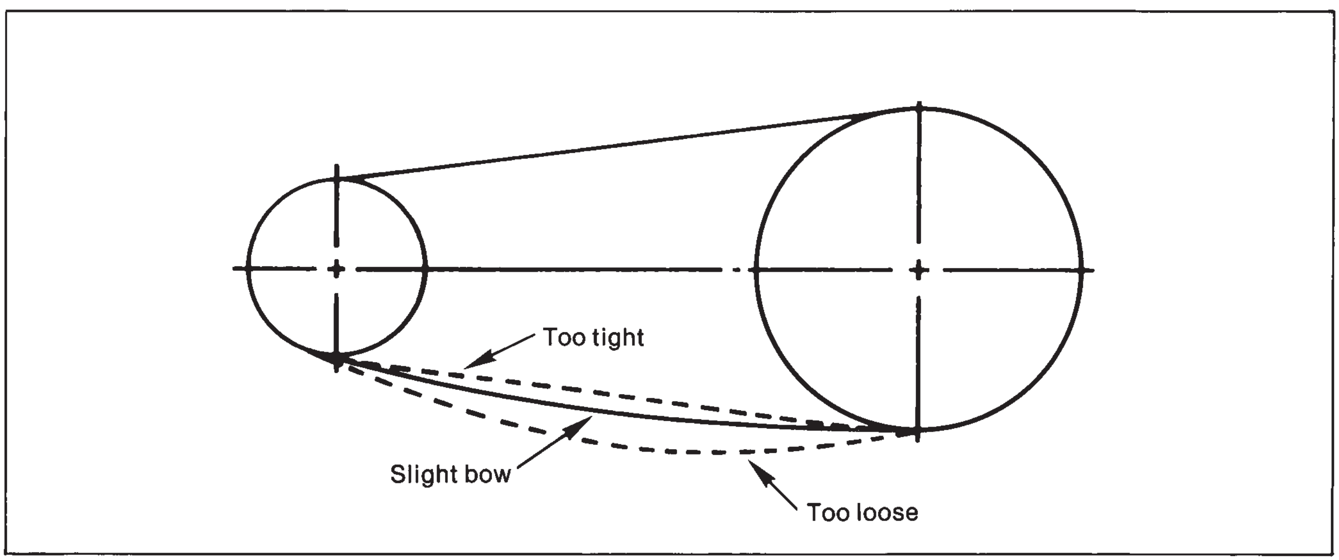


Figure 1

Force deflection method

This method should be used only for tensioning drives on which the grade of belt, rated belt capacity, service factor, design horsepower, etc. are known.

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

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

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

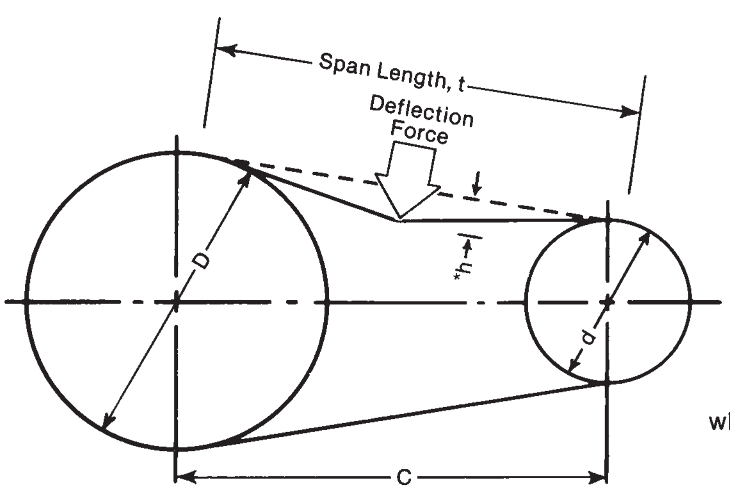
Step 4: Using a spring scale, apply a perpendicular force to any ONE of the belts at the mid point of the span as shown in figure 2. Compare this deflection force with the values found in Step 3.

a. If the deflection force is below the minimum, the belts are too loose and the tension should be increased by increasing the center distance.

b. If the deflection force is higher than the maximum, the belts are too tight and the tension should be decreased.

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

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



*Deflection height
h = 1/64" per inch of span

$$t = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2}$$

$$h = \frac{t}{64}$$

where t = Span length, inches
C = Center distance, inches
D = Larger sheave diameter, inches
d = Smaller sheave diameter, inches

Figure 2

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Table 1
Recommended Minimum Force Per Belt

Belt Section	Small Sheave: Speed Range	Small Sheave: Dia.	Drive Ratio: 1.0	Drive Ratio: 1.5	Drive Ratio: 2.0	Drive Ratio: 4.0 & over
3V	1200-3600	2.65	2.0	2.4	2.6	3.0
	1200-3600	3.65	2.8	3.6	3.8	4.2
	1200-3600	4.75	3.8	4.2	4.4	4.8
	1200-3600	5.60	4.2	4.6	4.8	5.4
	1200-3600	6.90	4.6	5.0	5.2	5.6
5V	900-1800	7.1	8.5	9.5	10	11
	900-1800	9.0	10	11	12	13
	900-1800	14.0	12	13	14	15
	700-1200	21.2	14	15	16	17
8V	900-1800	12.5	18	21	23	25
	900-1800	14.0	21	23	24	28
	700-1500	17.0	24	26	28	30
	700-1200	21.2	28	30	32	34
	400-1000	24.8	31	32	34	36
3VX	1200-3600	2.20	2.2	2.5	2.7	3.0
	1200-3600	2.50	2.6	2.9	3.1	3.6
	1200-3600	3.00	3.1	3.5	3.7	4.2
	1200-3600	4.12	3.9	4.3	4.5	5.1
	1200-3600	5.30	4.6	4.9	5.1	5.7
	1200-3600	6.9	5.0	5.4	5.6	6.2
5VX	1200-3600	4.4	6.5	7.6	8.0	9.0
	1200-3600	5.2	8.0	9.0	9.5	10
	1200-3600	6.3	9.5	10	11	12
	1200-3600	7.1	10	11	12	13
	900-1800	9.0	12	13	14	15
	900-1800	14.0	14	15	16	17
AP	1800-3600	3.0	2.0	2.3	2.4	2.6
	1800-3600	4.0	2.6	2.8	3.0	3.3
	1800-3600	5.0	3.0	3.3	3.4	3.7
	1800-3600	7.0	3.5	3.7	3.8	4.3
BP	1200-1800	4.6	3.7	4.3	4.5	5.0
	1200-1800	5.0	4.1	4.6	4.8	5.6
	1200-1800	6.0	4.8	5.3	5.5	6.3
	1200-1800	8.0	5.7	6.2	6.4	7.2
CP	900-1800	7.0	6.5	7.0	8.0	9.0
	900-1800	9.0	8.0	9.0	10	11
	900-1800	12.0	10	11	12	13
	700-1500	16.0	12	13	13	14
DP	900-1500	12.0	13	15	16	17
	900-1500	15.0	16	18	19	21
	700-1200	18.0	19	21	22	24
	700-1200	22.0	22	23	24	26
AX	1800-3600	3.0	2.5	2.8	3.0	3.3
	1800-3600	4.0	3.3	3.6	3.8	4.2
	1800-3600	5.0	3.7	4.1	4.3	4.6
	1800-3600	7.0	4.3	4.6	4.8	5.3
BX	1200-1800	4.6	5.2	5.8	6.0	6.9
	1200-1800	5.0	5.4	6.0	6.3	7.1
	1200-1800	6.0	6.0	6.4	6.7	7.7
	1200-1800	8.0	6.6	7.1	7.5	8.2
CX	900-1800	7.0	10	11	12	13
	900-1800	9.0	11	12	13	14
	900-1800	12.0	12	13	13	14
	700-1500	16.0	13	14	14	15
DX	900-1500	12.0	16	18	19	20
	900-1500	15.0	19	21	22	24
	700-1200	18.0	22	24	25	27
	700-1200	22.0	25	27	28	30

MAXIMUM Deflection Force = Minimum times 1.5

INITIAL Deflection Force = Minimum times 2.0

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

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

For Narrow Band, Classical Band and Classical Cog Band belts multiply the minimum deflection force from table 1 by the number of belts in the band. Where larger values make use of the Force Deflection Method impractical, use the Elongation Method to tension V-bands.

Table 2
K Factors and Arc of Contact

$\frac{D-d}{C}$	Arc Contact Degree	Factor: Ac	Factor: K
0.000	180	1.000	24.750
0.025	179	0.997	24.883
0.050	177	0.994	25.019
0.075	176	0.990	25.158
0.100	174	0.987	25.300
0.125	173	0.983	25.444
0.150	171	0.980	25.591
0.175	170	0.977	25.742
0.200	169	0.973	25.896
0.225	167	0.969	26.053
0.250	166	0.966	26.213
0.275	164	0.962	26.377
0.300	163	0.958	26.545
0.325	161	0.954	26.717
0.350	160	0.951	26.892
0.375	158	0.947	27.072
0.400	157	0.943	27.257
0.425	155	0.939	27.445
0.450	154	0.935	27.639
0.475	153	0.930	27.837
0.500	151	0.926	28.040
0.525	150	0.922	28.249
0.550	148	0.917	28.463
0.575	147	0.913	28.684
0.600	145	0.908	28.910
0.625	144	0.904	29.142
0.650	142	0.899	29.381
0.675	141	0.894	29.627
0.700	139	0.889	29.881
0.725	137	0.884	30.142

$\frac{D-d}{C}$	Arc Contact Degree	Factor: Ac	Factor: K
0.750	136	0.879	30.411
0.775	134	0.874	30.688
0.800	133	0.869	30.975
0.825	131	0.864	31.270
0.850	130	0.858	31.576
0.875	128	0.852	31.892
0.900	127	0.847	32.219
0.925	125	0.841	32.558
0.950	123	0.835	32.909
0.975	122	0.829	33.273
1.000	120	0.823	33.652
1.025	118	0.816	34.045
1.050	117	0.810	34.454
1.075	115	0.803	34.879
1.100	113	0.796	35.323
1.125	112	0.789	35.786
1.150	110	0.782	36.270
1.175	108	0.774	36.777
1.200	106	0.767	37.307
1.225	104	0.759	37.864
1.250	103	0.751	38.448
1.275	101	0.742	39.064
1.300	99	0.734	39.713
1.325	97	0.725	40.398
1.350	95	0.716	41.123
1.375	93	0.706	41.892
1.400	91	0.697	42.709
1.425	89	0.687	43.580

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Force deflection engineering formulas

For a more precise method, or where a V-drive combination is not within specified limits, table 1, use the following engineering formulas to determine force deflection values.

Step 1: Determine Span Length (t) and Deflection Height (h). Reference figure 2.

Step 2: Calculate the Static Strand Tension (Ts).

$$Ts = \frac{K \times DHP}{N \times S} + \frac{MS^2}{2}$$

Step 3: Calculate the recommended Deflection Forces (P) for drives using multiple belts or more than one V-band.

$$P_{Minimum} = \frac{Ts + Y}{16}$$

$$P_{Maximum} = \frac{1.5(Ts) + Y}{16}$$

$$P_{Initial} = 1.33 \text{ times } P_{Maximum}$$

Explanation of Symbols

A_c = Arc of contact - smaller sheave, degrees
C = Center distance, inches
D = Larger sheave pitch diameter, inches
d = Smaller sheave pitch diameter, inches
DHP = Design horsepower based upon the recommended application service factor
h = Deflection height, inches (Refer. figure 2)
K = Value from table 2 depending on $\frac{D-d}{C}$ or $K = 16.5 \frac{2.5 - A_c}{A_c}$
L = Belt length, inches
M = Centrifugal constant table 3
N = Number of belts or V-band ribs
P = Deflection force, pounds
S = Belt speed, FPM/1000
t = Span length, inches (Refer. figure 2)
Y = Belt constant table 3

Note: For drives using only one belt or one V-band, and at least one shaft free to rotate use the following to determine the recommended Deflection Forces (P).

$$P_{Minimum} = \frac{Ts + Y\left(\frac{t}{L}\right)}{16} \qquad P_{Maximum} = \frac{1.5(Ts) + Y\left(\frac{t}{L}\right)}{16} \qquad P_{Initial} = 1.33 \text{ times } P_{Maximum}$$

Table 3
Belt Constants M and Y

Factors	Narrow			Narrow Cog		Classical					Classical Cog			
	3V	4V	8V	3VX	5VX	AP	BP	CP	DP	EP	AX	BX	CX	DX
M Single Belts	.46	1.23	3.28	.39	1.08	.66	1.08	1.98	3.74	5.85	.61	1.00	1.78	3.97
M V-Band	.51	1.32	3.80	—	—	—	1.40	2.33	4.29	6.26	—	1.28	2.10	4.56
Y	4.0	12.00	22.00	7.0	20.0	6.0	9.0	16.0	30.00	45.00	7.0	10.00	28.00	82.00

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Belt elongation method

This method is recommended for V-band drives where larger deflecting forces make the use of previously described methods impractical.

Elongation is related to the tension causing it; thus, tape measured V-band lengths, both slack and tight, can be used to obtain proper V-band tension.

Step 1: Decrease the center distance until the V-band(s) can be easily slipped into the sheave grooves. Forcing the belts on can damage the load-carrying cords and cause premature belt failure.

Step 2: With the V-band(s) still on the drive at NO tension, measure the outside circumference (slack O.C.) of the bands. Note: If retensioning a used drive, decrease the center distance until there is no tension on the band(s), then measure the outside circumference (slack O.C.) of the band(s).

Step 3: Determine the required Static Tension (Ts) per individual rib strand using the following formula.

$$Ts = \frac{K \times DHP}{N \times S} + \frac{MS^2}{2}$$

Step 4: Find a range of recommended tensions.

Lower Tension = Ts
Upper Tension = 1.5 times Ts

Step 5: Calculate minimum and maximum elongated band lengths for use in tensioning the drive.

a. From table 4, find length multipliers corresponding to the lower and upper Ts values in Step 4 above.
b. Multiply the slack O.C. found in Step 2 by the length multipliers to find the minimum and maximum elongated band lengths.

Step 6: Increase the drive center distance until a tape measurement of the band(s) O.C. is between the two values calculated for elongated band length Step 5b.

Step 7: Retension as required. New V-bands may lose tension rapidly during the run-in period and will probably require retensioning. V-bands that have been on a drive for some time may also require retensioning due to tension decay from normal use and wear.

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Table 4 Belt length multipliers for tensioning banded belts

Ts Per Strand (lbs.)	NARROW BAND					CLASSICAL BAND					CLASSICAL COG BAND		
	CROSS SECTION												
	3V	5V		8V		BP		CP		DP	BX All Sizes	CX All Sizes	DX All Sizes
		5V1700 & under	5V1800 & over	8V1700 & under	8V1800 & over	BP144 & under	Over BP144	CP144 & under	Over CP144				
10	1.00186	1.00056	1.00001	1.00013	1.00010	1.00113	1.00141	1.00029	1.00052	1.00013	1.00082	1.00027	1.00013
12	1.00220	1.00068	1.00097	1.00016	1.00012	1.00135	1.00168	1.00035	1.00062	1.00016	1.00098	1.00032	1.00016
14	1.00254	1.00079	1.00113	1.00019	1.00014	1.00157	1.00194	1.00041	1.00072	1.00019	1.00114	1.00038	1.00019
16	1.00288	1.00090	1.00129	1.00021	1.00016	1.00178	1.00220	1.00046	1.00082	1.00021	1.00129	1.00043	1.00021
18	1.00320	1.00101	1.00144	1.00024	1.00018	1.00199	1.00246	1.00052	1.00092	1.00024	1.00145	1.00048	1.00024
20	1.00352	1.00112	1.00159	1.00027	1.00020	1.00220	1.00271	1.00058	1.00102	1.00027	1.00160	1.00054	1.00027
24	1.00414	1.00133	1.00190	1.00032	1.00024	1.00261	1.00320	1.00069	1.00122	1.00033	1.00191	1.00065	1.00032
28	1.00472	1.00155	1.00219	1.00037	1.00029	1.00301	1.00368	1.00081	1.00141	1.00038	1.00220	1.00075	1.00038
32	1.00520	1.00176	1.00249	1.00043	1.00033	1.00339	1.00414	1.00092	1.00161	1.00044	1.00250	1.00086	1.00043
36	1.00556	1.00197	1.00277	1.00048	1.00037	1.00377	1.00458	1.00104	1.00180	1.00050	1.00278	1.00097	1.00049
40	1.00588	1.00217	1.00305	1.00054	1.00042	1.00413	1.00500	1.00115	1.00199	1.00056	1.00306	1.00107	1.00054
45	1.00625	1.00243	1.00340	1.00060	1.00047	1.00458	1.00529	1.00129	1.00222	1.00063	1.00341	1.00121	1.00061
50	1.00659	1.00268	1.00374	1.00067	1.00053	1.00500	1.00553	1.00144	1.00246	1.00071	1.00374	1.00134	1.00068
55	1.00691	1.00293	1.00406	1.00074	1.00058	1.00528	1.00574	1.00158	1.00268	1.00078	1.00407	1.00147	1.00075
60	1.00722	1.00317	1.00438	1.00081	1.00064	1.00553	1.00591	1.00172	1.00291	1.00086	1.00439	1.00161	1.00081
65	1.00754	1.00341	1.00470	1.00088	1.00070	1.00576	1.00606	1.00186	1.00313	1.00094	1.00470	1.00174	1.00088
70	1.00787	1.00365	1.00500	1.00095	1.00076	1.00596	1.00620	1.00200	1.00335	1.00102	1.00500	1.00187	1.00095
75	1.00822	1.00389	1.00523	1.00101	1.00082	1.00614	1.00632	1.00214	1.00357	1.00110	1.00522	1.00200	1.00102
80	1.00861	1.00412	1.00545	1.00108	1.00088	1.00631	1.00644	1.00228	1.00378	1.00118	1.00543	1.00213	1.00109
85	1.00903	1.00434	1.00566	1.00115	1.00094	1.00646	1.00656	1.00242	1.00399	1.00127	1.00563	1.00227	1.00116
90	1.00949	1.00456	1.00586	1.00122	1.00100	1.00659	1.00668	1.00256	1.00420	1.00135	1.00581	1.00240	1.00123
95	1.01000	1.00478	1.00606	1.00129	1.00106	1.00672	1.00682	1.00270	1.00441	1.00144	1.00599	1.00253	1.00130
100	1.01056	1.00500	1.00625	1.00136	1.00113	1.00684	1.00697	1.00284	1.00461	1.00152	1.00616	1.00266	1.00137
120	1.01333	1.00561	1.00696	1.00164	1.00139	1.00727	1.00780	1.00339	1.00528	1.00188	1.00679	1.00319	1.00166
140	1.01692	1.00617	1.00765	1.00192	1.00166	1.00771	1.00912	1.00393	1.00579	1.00226	1.00736	1.00371	1.00195
160	1.02081	1.00672	1.00836	1.00220	1.00194	1.00827	1.01104	1.00447	1.00627	1.00265	1.00793	1.00423	1.00224
180	1.02385	1.00728	1.00913	1.00249	1.00223	1.00902	1.01357	1.00500	1.00675	1.00306	1.00854	1.00474	1.00253
200	1.02655	1.00707	1.01000	1.00277	1.00254	1.01000	1.01718	1.00534	1.00724	1.00349	1.00922	1.00525	1.00283
240	1.03118	1.00921	1.01213	1.00335	1.00319	1.01279	1.02268	1.00607	1.00832	1.00440	1.01090	1.00625	1.00343
280	1.03579	1.01088	1.01524	1.00395	1.00389	1.01663	1.02737	1.00692	1.00963	1.00542	1.01313	1.00724	1.00405
320	1.04070	1.01292	1.01834	1.00454	1.00461	1.02088	1.03275	1.00797	1.01124	1.00656	1.01590	1.00824	1.00468
360	1.04671	1.01562	1.02162	1.00515	1.00543	1.02423	1.03853	1.00926	1.01317	1.00771	1.01925	1.00924	1.00532
400	1.05308	1.01826	1.02526	1.00575	1.00631	1.02708	1.04393	1.01081	1.01580	1.00886	1.02229	1.01026	1.00598
450		1.02179	1.03056	1.00652	1.00744	1.03072	1.05000	1.01311	1.01877	1.01028	1.02625	1.01156	1.00683
500		1.02558	1.03643	1.00732	1.00859	1.03425		1.01610	1.02186	1.01164	1.03000	1.01292	1.00768
550		1.02927	1.04200	1.00813	1.00976	1.03781		1.01888	1.02500	1.01293	1.03354	1.01435	1.00856
600		1.03286	1.04642	1.00896	1.01094	1.04158		1.02169	1.02813	1.01413	1.03685	1.01557	1.00946
650		1.03632	1.05000	1.00982	1.01213	1.04567		1.02449	1.03123	1.01524	1.04000	1.01729	1.01037
700		1.03967		1.01071	1.01331	1.05000		1.02718	1.03426	1.01625	1.04333	1.01919	1.01130
750		1.04310		1.01163	1.01449			1.03000	1.03719	1.01718	1.04667	1.02126	1.01224
800		1.04655		1.01257	1.01571			1.03282	1.04000	1.01802	1.05000	1.02372	1.01320
850		1.05000		1.01354	1.01689			1.03563	1.04268	1.01833		1.02607	1.01418
900				1.01454	1.01887			1.03838	1.04524	1.01936		1.02840	1.01518
950				1.01561	1.01927			1.04101	1.04768	1.02044		1.03068	1.01619
1000				1.01667	1.02049			1.04345	1.05000	1.02156		1.03209	1.01717

TB Wood's

Trouble Shooting V-Belts

How to spot V-belt trouble

Trouble	Cause	To correct
Belt slip (sidewalls glazed)	Not enough tension.	Replace belts; apply proper tension.
Drive squeals	Shock load.	Apply proper tension.
	Not enough arc of contact.	Increase center distance.
	Heavy starting load.	Increase tension.
Belt turned over.	Broken cord caused by prying on sheave.	Replace set of belts correctly.
	Overloaded drive.	Redesign drive.
	Impulse loads.	Apply proper tension.
	Misalignment of sheave and shaft.	Realign drive.
	Worn sheave grooves.	Replace sheaves.
	Flat idler sheave.	Align idler. Re-position on slack side of drive close to drive sheave.
	Excessive belt vibration.	Check drive design. Check equipment for solid mounting. Consider use of banded belts.
Mismatched belts.	New belts installed with old belts.	Replace belts in matched set only.
	Sheave grooves worn unevenly; improper groove angle. Give appearance of mismatched belts.	Replace sheaves.
	Sheave shafts not parallel. Give appearance of mismatched belts.	Align drive.
Belt breaks.	Shock loads.	Apply proper tension; Recheck drive.
	Heavy starting loads.	Apply proper tension; Recheck drive. Use compensator starting.
	Belt pried over sheaves.	Replace set of belts correctly.
	Foreign objects in drive.	Provide drive shroud.
Belt wears rapidly.	Sheave grooves worn.	Replace sheaves.
	Sheave diameter too small.	Redesign drive.
	Mismatched belts.	Replace with matched belts.
	Drive overloaded.	Redesign drive.
	Belt slips.	Increase tension.
	Sheaves misaligned.	Align sheaves.
	Oil or heat condition.	Eliminate oil. Ventilate drive.

TB Wood's

How to diagnose V-belt failure

V-Belt Troubleshooting Checklist

BELT CONDITION

Oil Deterioration

CAUSE

Oil-softened rubber.

PREVENTION

Splash guards will protect drives against oil. Although Classical belts are oil resisting, excessive oil can cause some deterioration.

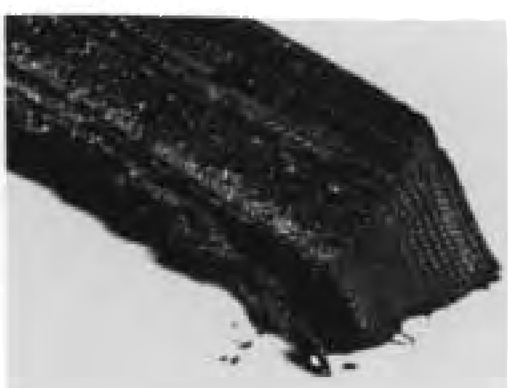
Cover Fabric Rupture

CAUSE

Cover fabric ruptured when belt was pried over sheave during installation.

PREVENTION

Proper installation of belts by moving motor so belts do not have to be pried into the grooves.



Slip Burn

CAUSE

Belt too loose. Belt didn't move, friction against sheave burned rubber. When belt finally grabbed, it snapped.

PREVENTION

Maintain proper tension on the drive.

How to diagnose V-belt failure

V-Belt Troubleshooting Checklist

BELT CONDITION

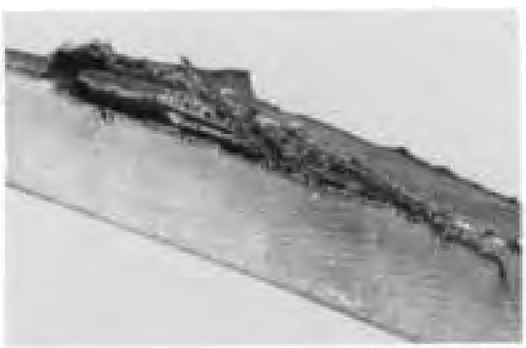
Base Cracking

CAUSE

Severe back-bend idlers. Improper storage. Excessive ambient operating temperature.

PREVENTION

Check storage conditions. If back-bend idler cannot be avoided, install idler of larger diameter. Avoid ambient temperature over 140°.



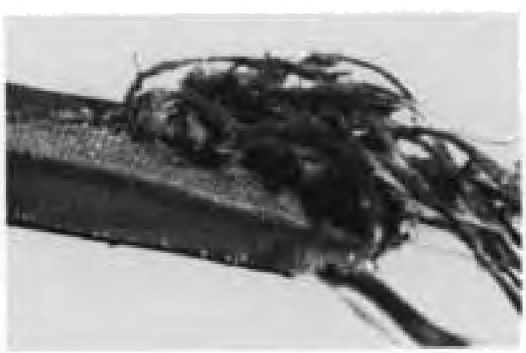
Ply Separation

CAUSE

Split along pitch line indicating belt ran over too small a sheave.

PREVENTION

Redesign drive using sheaves of proper size.



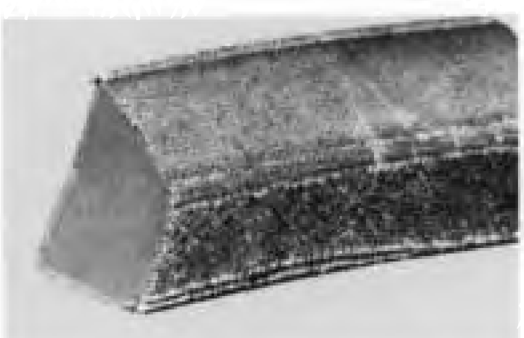
Ruptured

CAUSE

Ruptured cords in the plies.

PREVENTION

Check for rocks or tools falling into sheave grooves. Check tension. Belts loose enough to twist in groove can rupture cords.



Worn Belt Sides

CAUSE

Misalignment. Grit or dirt. Normal wear.

PREVENTION

Align sheaves. Replace belts as required.

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How to diagnose V-belt failure

V-Belt Troubleshooting Checklist

BELT CONDITION

Snub Break

CAUSE

Cover wear indicates slip. Clean break reveals sudden snap.

PREVENTION

Maintain proper tension on the drive.

Distorted Belt

CAUSE

Breakdown of adhesion or broken cords.

PREVENTION

Do not pry belts on drives. Check sheaves for recommended diameters.

Abrasion

CAUSE

Foreign material and rust in sheaves wore away sidewalls, letting belt drop to bottom of groove.

PREVENTION

Dust guards help protect against abrasion. Tension must be maintained in dusty atmospheres.

SURE-GRIP® SHEAVE FEATURES

Wood's sheaves are constructed of fine grain, high tensile cast iron, and have been carefully engineered to assure maximum performance over a long life span. Behind each sheave is one of the most extensive engineering design and testing programs in the industry.

DESIGN INTEGRITY

TB Wood's Incorporated has been a leading supplier of cast iron pulleys, v-belt sheaves, synchronous belt sprockets and Sure-Grip mounting bushings since the inception of these products. We are committed to the continual improvement of our standard products and special or MTO products through design, materials and quality enhancements. For example, new product designs are typically computer generated and then verified using finite element analysis before CAD drawings are made. This enables Wood's to quickly and accurately quote on any special needs, and to relay the tool paths for new designs quickly from engineering to the shop floor.

FOUNDRY PROCESSES

TB Wood's Incorporated has a modern state-of-the-art foundry in Chambersburg, PA where cast iron and ductile iron castings are produced. This captive foundry operation not only gives Wood's the control needed to obtain standard high quality castings as they are required, but also enables them to produce any special requirements in a minimal amount of time.

MACHINING

TB Wood's Incorporated has numerous machining facilities throughout North America. Each is equipped with modern CNC equipment and capable of doing high precision machining. Statistical process controls are in place in each location, and each has been ISO-9000 certified.

SPECIFICATIONS

TB Wood's products are manufactured to conform to or exceed recognized industry standard specifications. The following is a listing of some of these specs.

ANSI/RMA	IP-20	Classical V-Belt Sheaves
ANSI/RMA	IP-22	Narrow V-Belt Sheaves
ANSI/RMA	IP-24	Synchronous Sprockets
MPTA	QD-1	QD Bushing Guideline
MPTA	SPB	Pulley Balance
MPTA	SAS	V-Belt Sheave Arm Stress
MPTA	SF	Pulley Surface Finish

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Glossary

Accepts - Any chip deemed acceptable in size by the pulp mill or other market to which it is sold.

Figure D.1-A. Accepts

Babbitt Metal- Term that is applied to a whole class of silver-white bearing metals. An alloy of tin, copper, and antimony with traces of other metals added in some cases and lead substituted for tin in others. *Used for setting the width of the chipper knives.*

B.D.T.- Bone-dry ton.

B.D.U.- Bone-dry unit.

Bed Knife - *See Horizontal and Vertical Anvil.*

Belly Band - *See Lower Casing Band.*

Bruised Chips - Chips that have one end has been visibly compacted and distorted.

Beneficiation - Process used to upgrade chips, making them more acceptable for pulp and paper manufacture. Upgrading is accomplished by separating the acceptable chips from the unacceptable.

Blow/Discharge Pipe - Pipe attached to top and end discharge chippers, that chips are expelled through.

Bolt - Any short log such as a pulpwood log or pulpwood stick. Any short stick, generally between 2 and 8 feet long. Also referred to as a block.

Bone-dry ton - Wood pulp or residue that weighs 2,000 pounds at zero percent moisture content. Also known as an ovendry ton.

Bone-dry unit - Wood residue that weighs 2,400 pounds at zero percent moisture content.

Branchwood - Wood portions of a tree excluding the stems and roots.

Bruised Chips - Chips that have one end has been visibly compacted and distorted.

Canted - Angular deviation from a vertical or horizontal plane or surface; an inclination or a slope.

Cards - Blocks of chips in which the individual chips have not completely separated.

Cellulose Fibers - The basic raw material used in the manufacture of paper.

Chemical pulping - Process in which wood fibers are separated by removing the lignin and certain other wood components through the use of chemicals.

Chipper Base - The metal housing that covers the lower half of the chipper disc.

Chipping - Breaking or cutting wood into small pieces of controlled fiber length.

Chip Pocket - Hole in the chipper disc through which the chips pass after they are produced.

Figure D.1-B. Precision Husky High Volume Chip Screen

Chip Screen - A machine used to separate acceptable chips (*"Accepts"*) from the fine chips (*"Fines"*) and oversized chips (*"Overs"*).

Cord - Any timber product delivered to a receiving facility in short-length form, 8 feet, or less, and intended for use as a raw material in the manufacture of pulp and paper products; a cord is approximately 5,200 pounds for pine, 5,400 pounds for soft hardwood, 5,600 pounds for mixed hardwood, and 5,800 pounds for hard hardwood.

Counter Knife - As the knife cuts through the material, the counter knife breaks the chips into the desired length. Found behind, and similar in appearance to, the chipper knife.

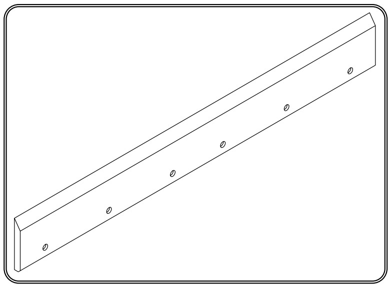


Figure D.2-A. 75″ Chipper Counter Knife

Debarker - Machine used to remove the bark from roundwood prior to processing into chips, lumber, or other wood products.

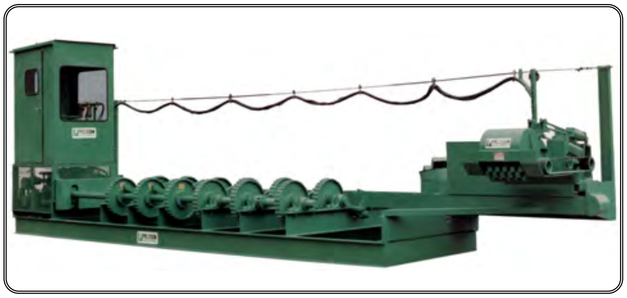


Figure D.2-B. Precision Husky Rosserhead Debarker

Defect - Crook, conk, decay, split, sweep, or any other injury that decreases the amount of useable wood that can be obtained from a log.

Digester - Large tank used in a pulp mill to cook wood chips and chemicals at high temperatures to separate the cellulose fibers.

Disc - A round plate that is mounted in the chipper base. The chipper knives are mounted to the disc. The disc rotates to perform the cutting of material into chips.

Discharge Chute *(Top Discharge Chippers)* - The passage through which the chips exit the chipper.

Dote - General term used to denote decay or rot in timber.

Fan Blade *(Top Discharge Chippers)* - Device attached to the chipper disc that creates an air stream, moving the chips out of the chipper base.

Feed Plate - Steel plate, attached to the canted side of the infeed spout that directs incoming material toward the anvils.

Feed Plate Clamp Bar - Plate that is bolted to the chipper base and is used to help keep the feed plate properly positioned.

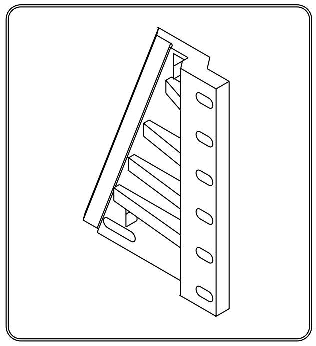


Figure D.2-C. 84″ - 96″ Chipper Feed Plate

Feed Plate Jacking Blocks - Two blocks attached to the infeed spout used to correctly position the feed plate.

Fiber - General term for any long narrow cell of wood.

Fines - Chips that are very thin or short in length.

Figure D.2-D. Fines

Hardwoods - Trees that are usually seasonal and have broad leaves instead of needles. Also known as dicotyledons or dictledonous trees. The term hardwood does not necessarily refer to the hardness/softness of the wood.

Hood - The metal housing that covers the upper half of the chipper disc, and is fastened to the chipper base.

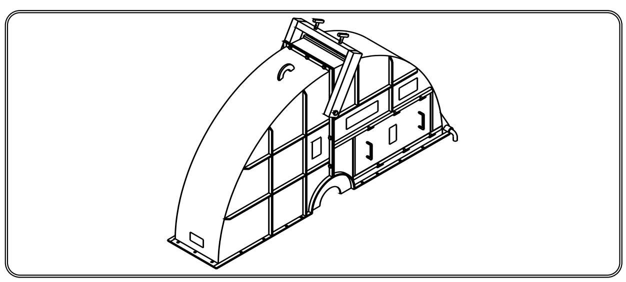


Figure D.2-E. 112″ Chipper Hood

Horizontal Anvil - Fixed steel block that sits between the infeed spout and the chipper disc and functions as a cutting surface for the chipper knives.

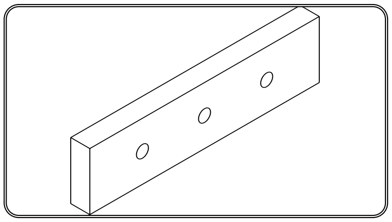


Figure D.3-A. 84″ & 96″ Horizontal Anvil

Infeed Spout - The passage through which material is supplied to the chipper.

Inspection Plate - *(See Feed Plate).*

Knife - Replaceable piece of steel with sharpened edge; attaches to the rotating disc.

Knife Clamp - Keeps the knife secured to the chipper disc.

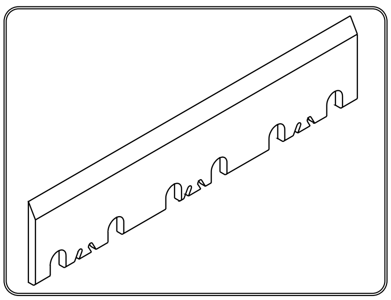


Figure D.3-B. 75″ Chipper Knife

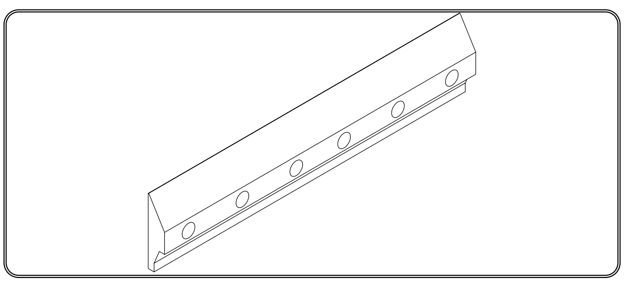


Figure D.3-C. 84″ Chipper Knife Clamp

Knife Holder - Mounting base for the knife assembly.

Kraft Process - Process used by paper mills where wood chips are heated under pressure with sodium hydroxide and sodium sulfide cooking liquor. The lignin that bonds the wood structure together is dissolved and a kraft brownstock pulp is produced.

Lignin - An organic substance, which acts as a binder for the cellulose fibers in wood.

Longwood - Pulpwood 120 inches or more in length. Pulpwood over 10 feet long.

Lower Casing Band *(Top Discharge Chippers)* - Temporary holding area in the chipper base for the chips, before they are blown out the discharge chute by the fan blades.

Metal Detector - Device normally used in conjunction with a vibrating conveyor that can stop the conveyor when it detects tramp metal in the material being fed to the chipper.

Overs - Any chips that are too long or too thick.

Figure D.3-D. Overs

Pull-in Angle - Angle formed between the knife edge and an imaginary vertical line starting at the knife point.

Pulp - Mechanically ground or chemically digested wood used in manufacturing paper.

Pulpmill - Mill that converts pulpwood into wood pulp.

Pulpwood - Wood used as a source of wood fiber in a pulp mill. Usually cone-bearing trees, with needle-like rather than blade-like leaves.

Rim Blades *(Top Discharge Chippers)* -Performs a similar function as the fan blades, except the rim blades remove chips that are caught under the chipper disc.

Rolled Chip Pocket - Term used to refer to when a knife holder has been worn down by wood chips to the point that the corner of the chip pocket behind the holder begins to wear.

Rotor - Any circular object that undergoes rotational movement.

Roundwood - A length of cut tree generally having a round cross-section, such as a log.

Shortwood - Pulpwood less than 120 inches in length. Trees or stemwood portions of trees delivered in product lengths of less than 15 feet and normally considered only for pulpwood.

Softwoods - Botanical grouping of trees that are usually evergreen that have needle-like or scale-like leaves. Also known as conifers and coneiferous trees. The term softwood does not necessarily refer to the hardness/softness of the wood.

Tolerance - The amount of variation permitted from an exact size or measurement.

Tramp Metal - Term used describe any stray ferrous material among the material that is being fed to the chipper.

Upper Casing Band - *See Hood.*

Vertical Anvil - Adjustable steel block located between the base and the end of the feed plate that provides a cutting surface for the knives.

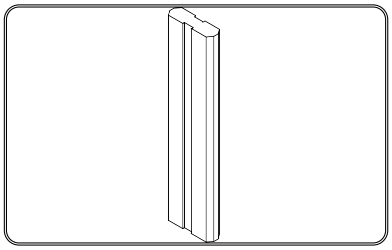


Figure D.4-A. Vertical Anvil

Wear Plate - A metal plate that protects the chipper disc and helps control chip size.

Wood Chip - Small piece of wood used to make pulp. Chips are made either from wood waste in a sawmill or pulpwood operation, or from pulpwood specifically cut for this purpose.

Figure D.4-B. Wood Chip

Appendix E

Service Log

To avoid major equipment failure, it is recommended you keep
a schedule of periodic maintenance on the Precision Husky Roundwood Chipper.

Date	Service Performed	Performed By

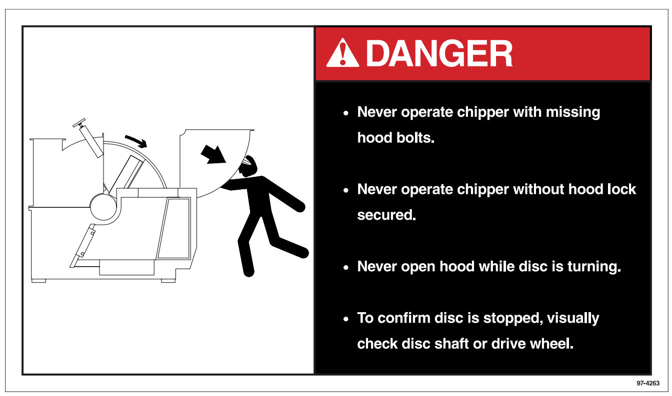
Service Log (Cont.)

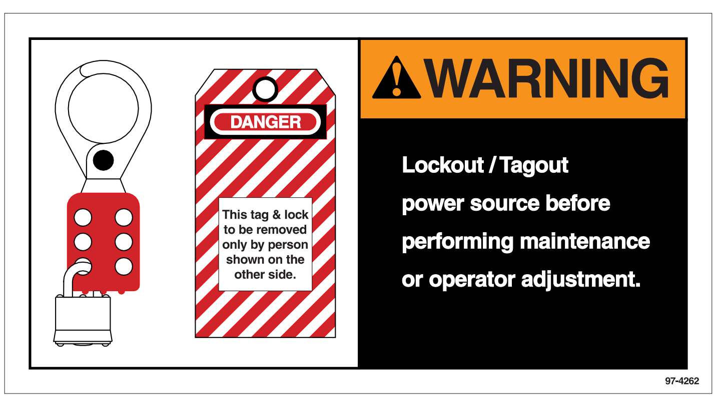
PRECISION HUSKY

Date	Service Performed	Performed By

Daily Maintenance Checklist

Maintenance Task	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Change or sharpen knives.							
Reset knife width with knife gauge.							
Clean out chip slot, removing any debris that may have collected around the knife assembly components.							
Check knife points to horizontal and vertical anvil clearance.							
Visually check knives, knife clamps, and wear plates for excessive wear and/or damage.							
Remove debris around bearing platforms.							
Conduct a complete walk-around inspection of the chipper and visually check for loose bolts and fasteners.							
Check the quality of the chips that are being produced.							

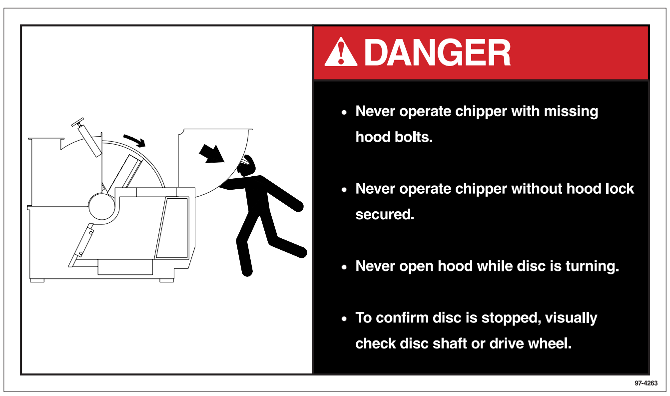


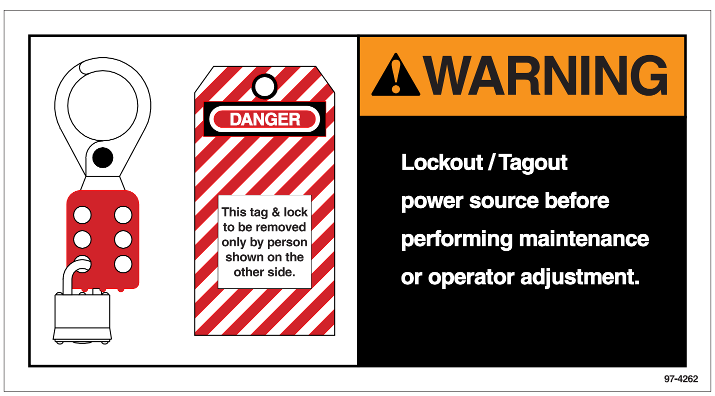


NOTES ________________________________ Week of ______________

Daily Maintenance Checklist

Maintenance Task	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Change or sharpen knives.							
Reset knife width with knife gauge.							
Clean out chip slot, removing any debris that may have collected around the knife assembly components.							
Check knife points to horizontal and vertical anvil clearance.							
Visually check knives, knife clamps, and wear plates for excessive wear and/or damage.							
Remove debris around bearing platforms.							
Conduct a complete walk-around inspection of the chipper and visually check for loose bolts and fasteners.							
Check the quality of the chips that are being produced.							





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Service Bulletins

You may periodically receive service bulletins containing important upgrade information about part updates, revisions, maintenance, or servicing on your Precision Husky Roundwood Chipper. For convenience and easy reference, place the bulletins in this section of the manual.

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