THERMO BLACK CLAWSON INC.

A Thermo Fibertek company

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HYDRADENSER™ MANUAL

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

Deliver manuals to:

US Gypsum Company
6825 Evergreen Avenue
Jacksonville, FL 32208

Attention: Kevin Turk

Prepared for: US Gypsum Company

Mill: Jacksonville, FL

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

Shop order number	Serial number
4871591	97-HD-1B9-0255

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

Thank you for purchasing a Thermo Black Clawson product.

Contents

Figures and tables are italized

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Manual Overview

This manual is for general information and guidance. For specific information concerning parts or items, refer to the certified drawing of the equipment.

Your Black Clawson unit will provide many years of dependable service when installed, operated, and maintained according to our recommended procedures. The instructions in this manual are recommended procedures for installing, operating, and maintaining your unit. Correct installation of the unit is critical. Reasonable operation and maintenance will not compensate for poor installation.

All information, illustrations, and specifications in this manual are based on the latest information available at the time of publication.

Drawings in this manual are only sketches that exist for no other purpose other than to provide a visual reference for the text within this manual. The drawings in this manual are not to be used for construction purposes.

It is the responsibility of the purchaser of this equipment to make sure that operators, maintenance personnel, and anyone else involved with this equipment is aware of this manual, has easy access to this manual, and has read and understands the contents of this manual. It is also the purchaser's responsibility to keep this manual in legible condition.

WE RESERVE THE RIGHT TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE.

Thermo Black Clawson Inc.

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TOLL FREE 24-HOUR EMERGENCY SERVICE

1-800-448-5422

1.0 SAFETY

1.1 SAFETY INTRODUCTION

This manual is a guide for safe and trouble-free installation and operation of your Thermo Black Clawson equipment. Follow the recommendations in this manual to ensure the safety of your personnel along with the dependable operation of your Thermo Black Clawson equipment. Your particular situation may require additional procedures and safety measures.

You--the purchaser of this equipment--are responsible for ensuring that your personnel are trained in the safe operation and maintenance of this equipment. We recommend that your personnel obtain refresher sessions covering safety, operation, and maintenance procedures periodically throughout the life of your Thermo Black Clawson equipment. **Note**: Thermo Black Clawson offers qualified field service instructors to help train your operators and maintenance personnel.

FOLLOW THE SAFETY INFORMATION IN THIS MANUAL

RECOGNIZE SAFETY INFORMATION. The triangle to the left with the exclamation mark within it is the international safety alert symbol. When you see this symbol on your equipment or in this manual, be alert to the potential for personal injury. Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

DANGER

Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. ***Danger*** is to be limited to the most extreme situations.

WARNING

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

CAUTION

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

NOTE: Notes place special emphasis on information.

- Carefully read all safety messages in this manual and on your machine safety signs.
- Do not operate equipment until it has been fully integrated into the system.
- Do not perform service or maintenance work on this equipment until all sources of energy have been locked out and any stored energy has been relieved--unit is at zero mechanical state (ZMS).
- Keep safety signs in good condition, clean, and legible.
- Replace missing or damaged safety signs.
- Learn how to operate the machine and how to use controls properly.
- Do not let anyone operate the machine without instructions.
- Keep your machine in proper working condition.
- Do not modify the equipment without authorization from Thermo Black Clawson. Unauthorized modifications may impair the function, shorten the machine life, and/or render built-in safety features useless.
- Inspect the unit before starting and make sure that the following conditions are met:

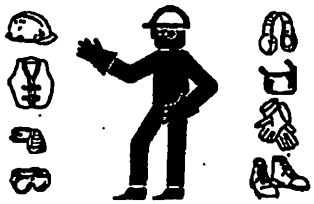
    - All guards and covers are in good condition and fastened in place.

    - No parts are loose, worn, damaged, or missing.

    - All personnel are clear of equipment.

Safe Maintenance Overview

- Keep equipment area clean and dry.
- Keep all equipment parts in good condition and properly installed.
- Understand service procedures before you do the work.
- Replace worn, broken, or missing parts.
- Do not operate damaged equipment--fix damage immediately.



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

- Consult applicable federal, state, and local codes for proper installation and guarding.

1.2 SAFETY GUIDELINES

Do not use or service this equipment until you read and understand the guidelines and instructions below and throughout this manual. If you have any questions, contact your supervisor.

Safety Guidelines

HAZARD	WHAT COULD HAPPEN	PREVENTION
Stock leaks from pipe connections, blind flanges, body joints, open access doors, etc. Water leaks from shower water, inlet dilution water, or other water sources.	**WARNING** Skin contact with stock might result in chemical or thermal skin reaction, such as skin irritation or scalding.	Lock out unit. Follow shut down and start up guidelines. Be sure that you have locked out all energy sources. Tighten or replace loose, leaking connections.
Valves - air and electrically operated.	**WARNING** Amputation or severe injury to fingers, hands, or arms, could result.	Lock out valves and their energy sources and ensure that equipment is at zero mechanical state (ZMS). **NOTE: Controls may not be independent.** Extreme care must be used when isolating power sources. Be sure of what will shut down when energy sources are locked out. Make sure that other automatic equipment connected to source will also shut down. Do not insert fingers, hands, arms, head, or and other body parts into such devices.

HAZARD	WHAT COULD HAPPEN	PREVENTION
Motor/drive units	**WARNING** Amputation or severe injury to fingers, arms, or hands could result.	Do not expose electrical units to water. Shut down and lock out unit before cleaning or servicing. Do not operate the unit with covers, hoods, or guards removed. Note: Manual rotation of rotating elements may be required with enclosures removed. Be sure all personnel are clear of unit before manually rotating screw or motor.
Discharged debris from trash chamber.	**WARNING** Cuts, abrasions, skin irritation, and scalding could occur.	Wear eye protection and protective clothing.
V-belts/sheaves, drive shafts	**WARNING** Amputation or severe injury could occur.	Do not operate unit with guards removed. Be sure unit is shut down and lock-outs are in place before installing guards that have been removed.
Exceeding 5 PSI inlet pressure	**WARNING** Seals, gaskets, or the vessel might fail and cause severe personal injury.	Do not operate above 5 PSI inlet pressure.

1.3 SAFETY PRACTICES

Post the laminated safety sign (provided by Thermo Black Clawson and pictured below) in plain view on or near the equipment at installation and keep it clean.

SAFETY INSTRUCTIONS

STOCK PREPARATION AND PULP MILL EQUIPMENT

Failure to follow these safety instructions may result in serious personal injury or death.

DO NOT PROCEED until you READ and UNDERSTAND these instructions.

1. READ and UNDERSTAND the machine's instruction/operation manual and ALL applicable OSHA regulations (29CFR1010.261).

2. FOLLOW the SHUT DOWN PROCEDURE in the manual.

3. The machine must be brought to a ZERO MECHANICAL STATE and LOCKED OUT with YOUR PADLOCK BEFORE any maintenance, inspection, cleaning, adjusting, or servicing is performed.

a) The MOTOR MAIN POWER DISCONNECT switch must be LOCKED OUT.

b) CHECK DISCONNECT. Try to start motor BEFORE proceeding further.

c) ALL SOURCES OF POWER AND FLOW OF MATERIAL must be SHUT OFF including BLEED OFF of pressure and LOCKING OUT ALL **pneumatic, hydraulic, electrical circuits, steam systems, chemical systems, gas systems, and flows of material stock.**

NOTE: See the glossary in the equipment manual to obtain the definition of zero mechanical state.

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

DO NOT assume the machine is locked out. ALWAYS check yourself.

NOTE: If services are not independent of the main supply, DO NOT PROCEED--contact your supervisor.

d) Place or attach a "DANGER - PERSONNEL WORKING" sign near lockout.

e) BLOCK any rotating elements to prevent accidental rotation.

4. DO NOT ENTER vessel or unit unless you have at least ONE OTHER PERSON OUTSIDE the visceral unit at all times. Certain vessels require use or harness, gas masks, and other specialized safety equipment.

5. Upon completion, follow the START UP PROCEDURES in the manual for this equipment.

6. NEVER START the machine UNLESS

a) All personnel are clear of the machine. b) All doors and hatches are closed.

c) All guards and covers are in place.

If you have any questions, contact your supervisor.

Middletown, Ohio 45042-2117 USA

THERMO BLACK CLAWSON INC.

A Thermo Fibertek company

Toll Free 24 Emergency Service: 800-448-5422

Laminated Safety Sign

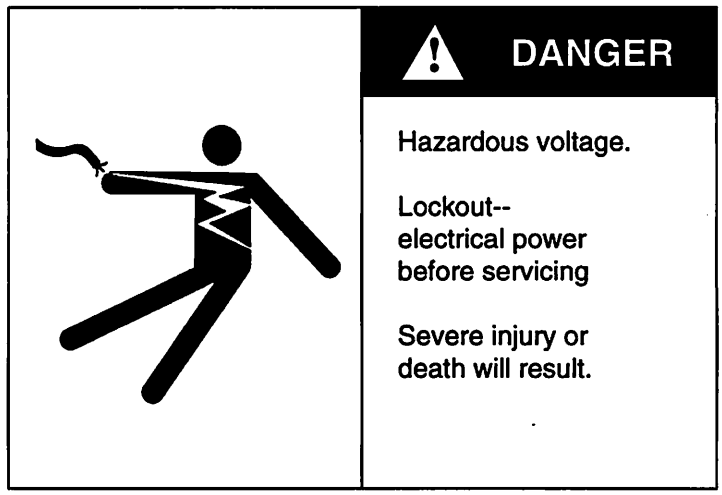
1.4 SAFETY SIGNS

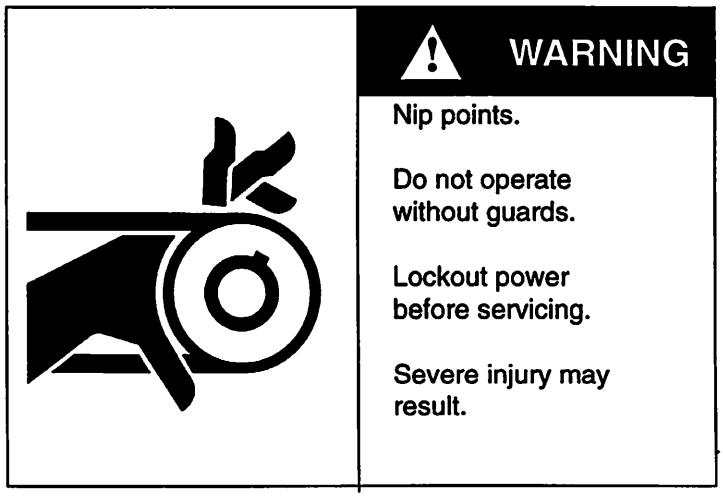
READ AND FOLLOW

Thermo Black Clawson furnishes safety signs with each piece of equipment. These signs are factory installed and should remain on the unit for the life of the machine and should be kept clean and legible.

Do not remove the signs unless replacement signs are in hand and installed immediately after the old signs are removed.

The following safety signs are attached to the unit.





DANGER

Remote operation.

Do not operate without guards.

Lockout all power sources before servicing.

Severe injury or death will result

WARNING

Rotating element.

Keep clear.

Lockout power before servicing.

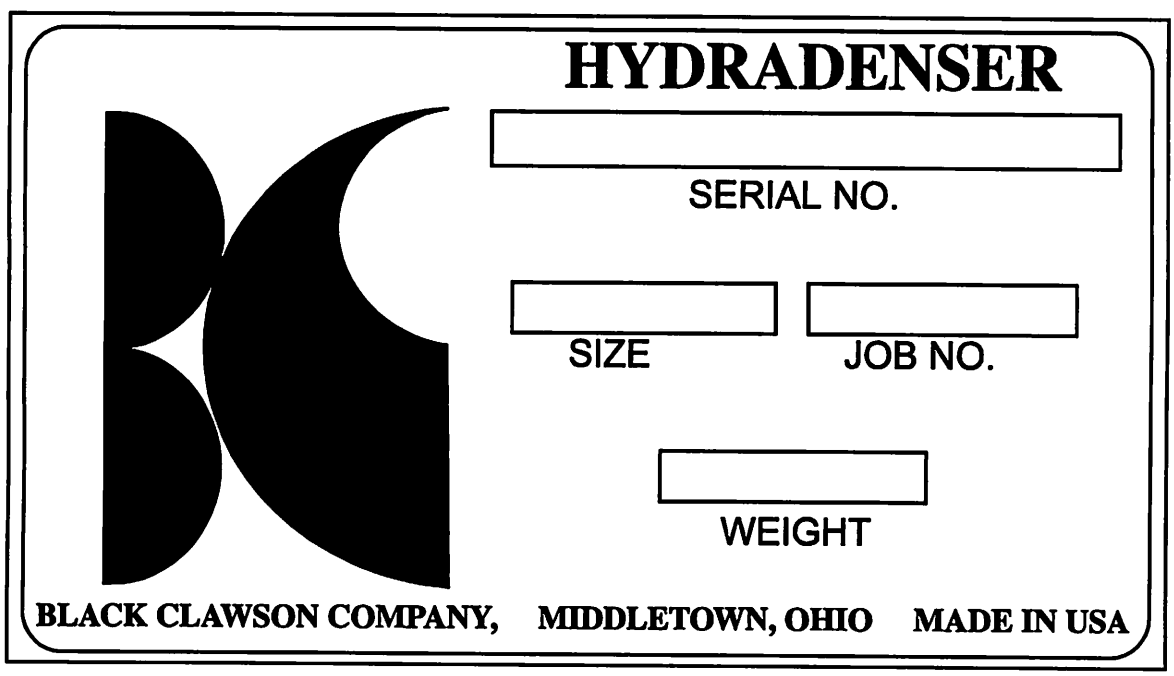
Severe injury may result.

2.0 EQUIPMENT IDENTIFICATION

2.1 NAMEPLATE

Product identification numbers include the serial number, job or shop order number, and model number. They are provided to help identify this unit if it needs service.

THERMO BLACK CLAWSON NEEDS THESE NUMBERS WHEN YOU ORDER PARTS.



3.0 GENERAL INFORMATION

3.1 EQUIPMENT DETAIL

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

The information in this manual should cover most situations. Should questions arise that are not covered in this manual, contact us for additional information:

Customer Service

Thermo Black Clawson Inc.
605 Clark Street
Middletown, OH 45042
Phone 1+513-424-7400
FAX: 1+513-424-1168

Serial Numbers

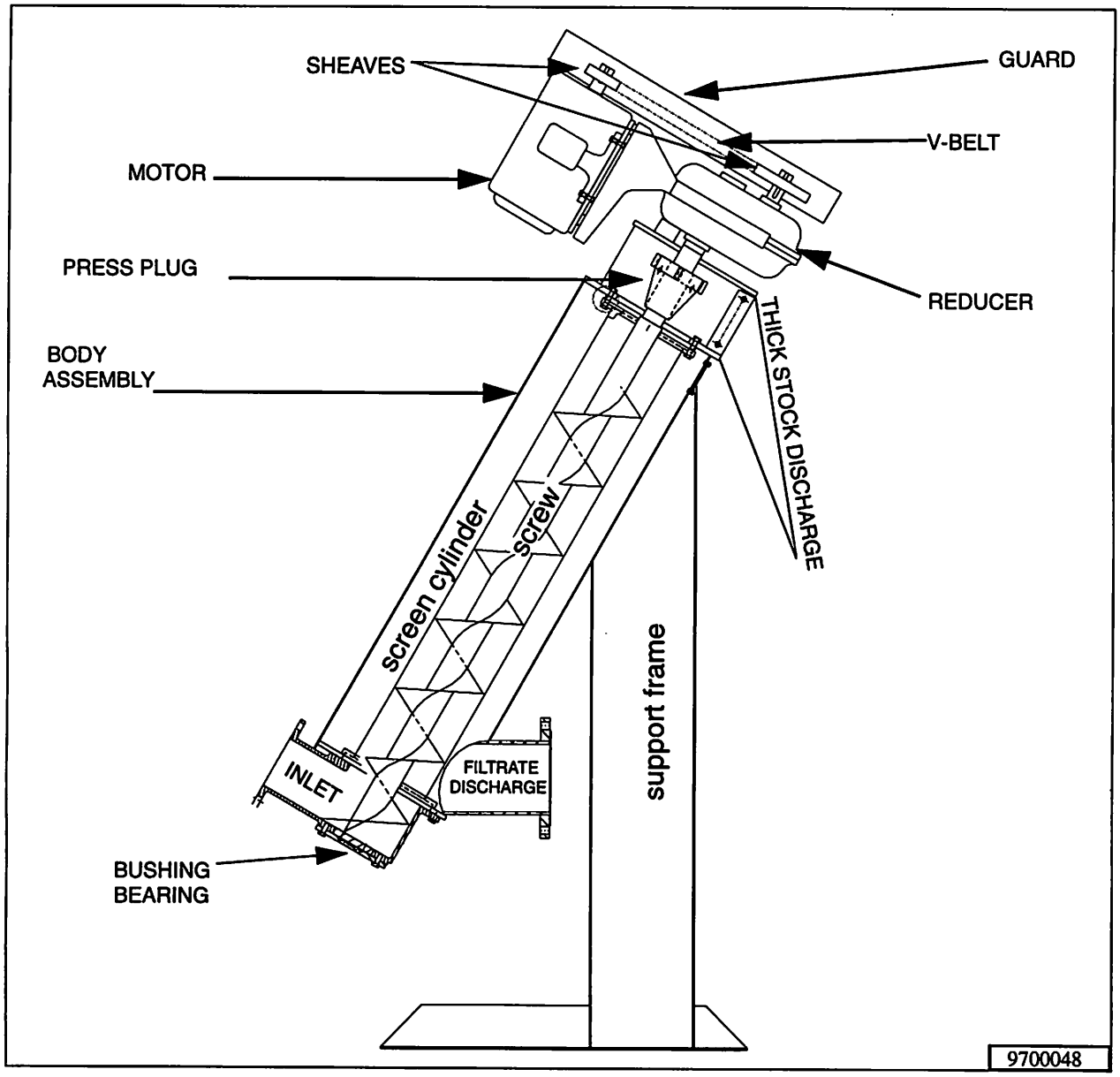
The serial number is on the nameplate and the certified drawings. When inquiring about service or maintenance problems, always provide the serial number, size, and type of unit.

Renewal Parts

Orders for renewal parts should state the serial number(s) and include the item number, description, and part number shown on the parts list of the certified drawings. **Part numbers are not specified in this manual.** Refer to your certified drawings for part numbers.

3.2 DESCRIPTION

The Thermo Black Clawson Hydradenser is an inclined screw thickener for the purpose of continuous extraction of liquid from a solids-liquid slurries ranging from virgin to secondary furnishes, as well as dewatering of reject materials such as knots, plastic, coarse fibers, or shives. A continuous spiral flite screw conveys the slurry inside a perforated cylinder and upon discharge is thicker than on entry.



Hydradenser

Applications

- High-density storage of virgin, waste paper and broke pulps
- De-inking, bleaching and refining systems

- Pre-thickening for high-density pressing
- General thickening of dilute fibrous or granular materials

Before using the Hydradenser for any application which has not been mentioned, call Thermo Black Clawson Engineering.

Components

Body Assembly

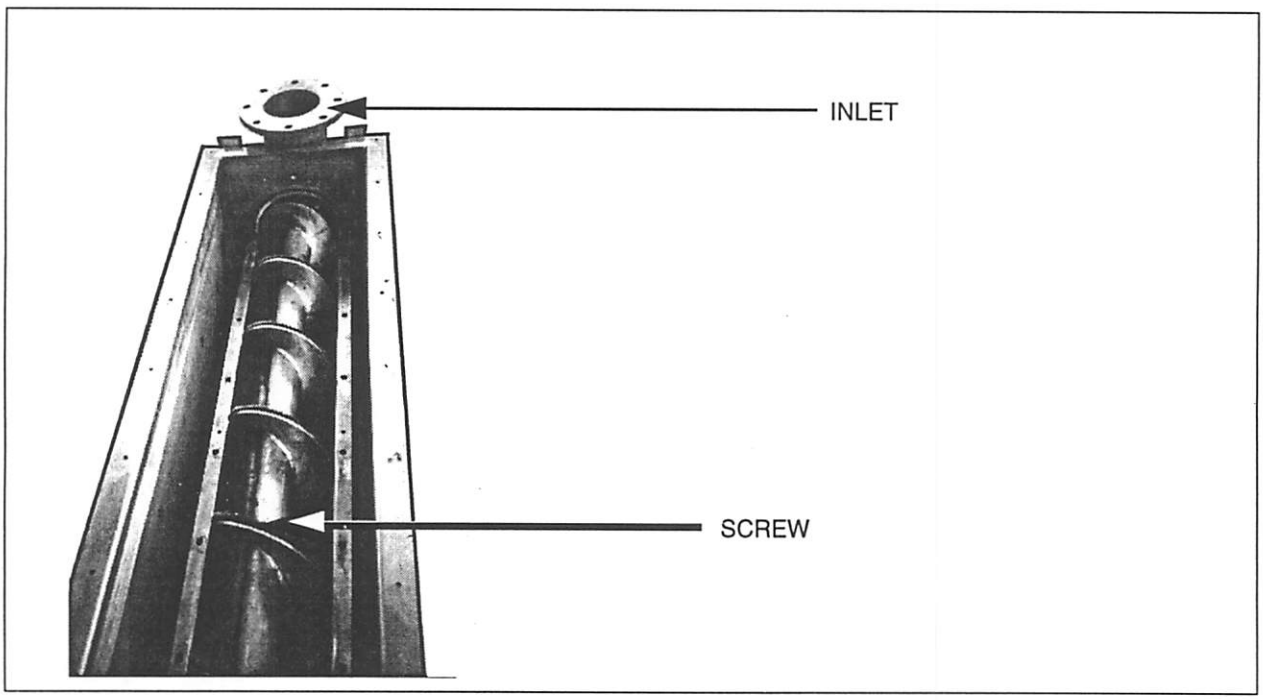
The body assembly forms a chamber around the perforated cylinder. It consists of an inlet chamber for introducing the slurry, a main body which contains the white water return line, and a discharge trough where the thickened stock is expelled.

Screen Cylinder

The thickening function is accomplished by the screen cylinder which has a perforated wall of either holes or slots through which the liquid can pass.

Screw

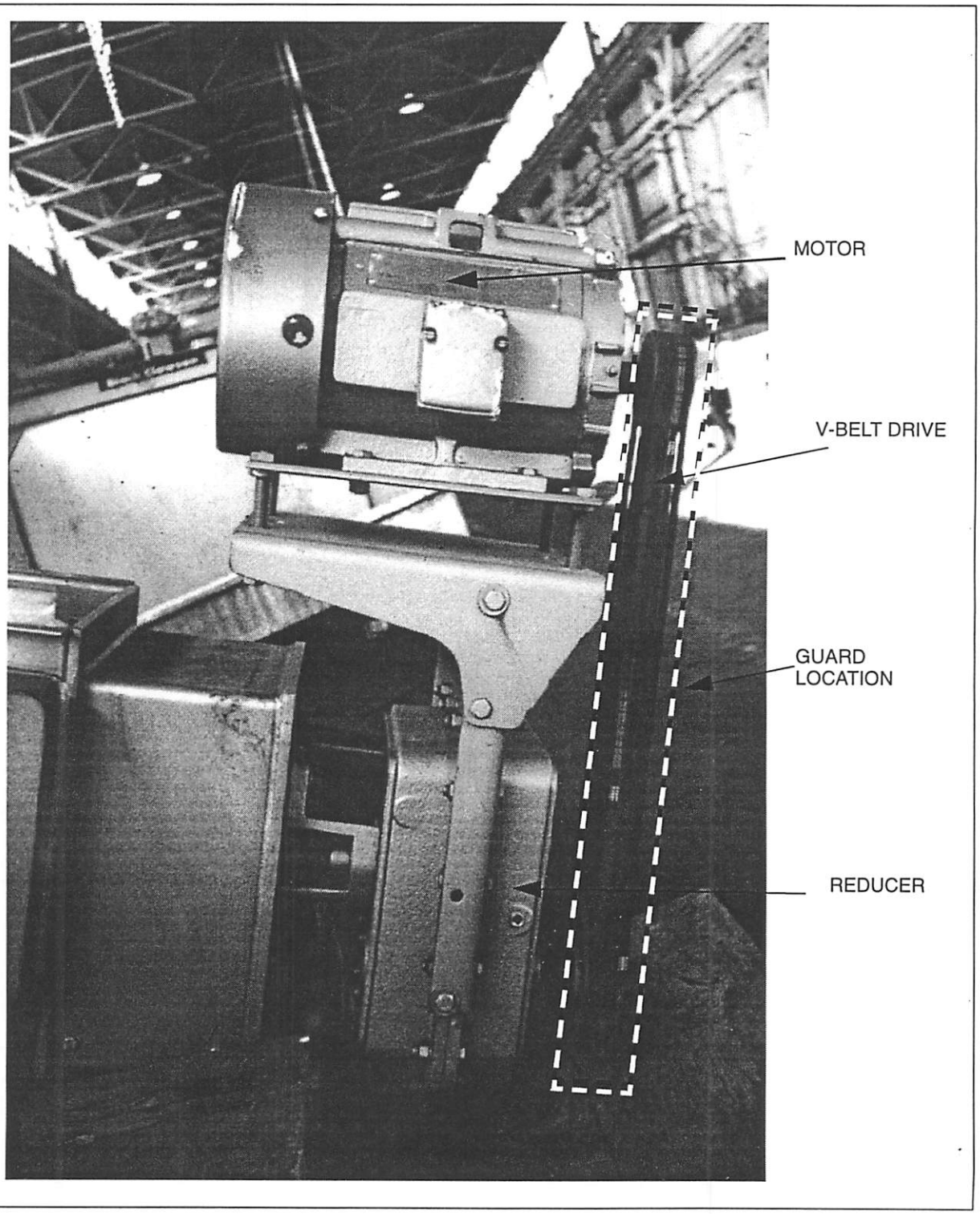
The stock flow through the Hydradenser is facilitated by a conveyor screw inside the perforated cylinder. As the stock thickens and loses its ability for fluid flow, the screw acts as a conveyor to carry it up the cylinder. In addition, the screw acts as a compactor pushing the stock up against the formed plug at the top of the cylinder. This action squeezes more liquid from the slurry.



Open Trough View

Drive

The screw is driven through a shaft mounted reducer which is connected to the drive-motor via V-belts and sheaves and gear box reducer for proper output speeds.



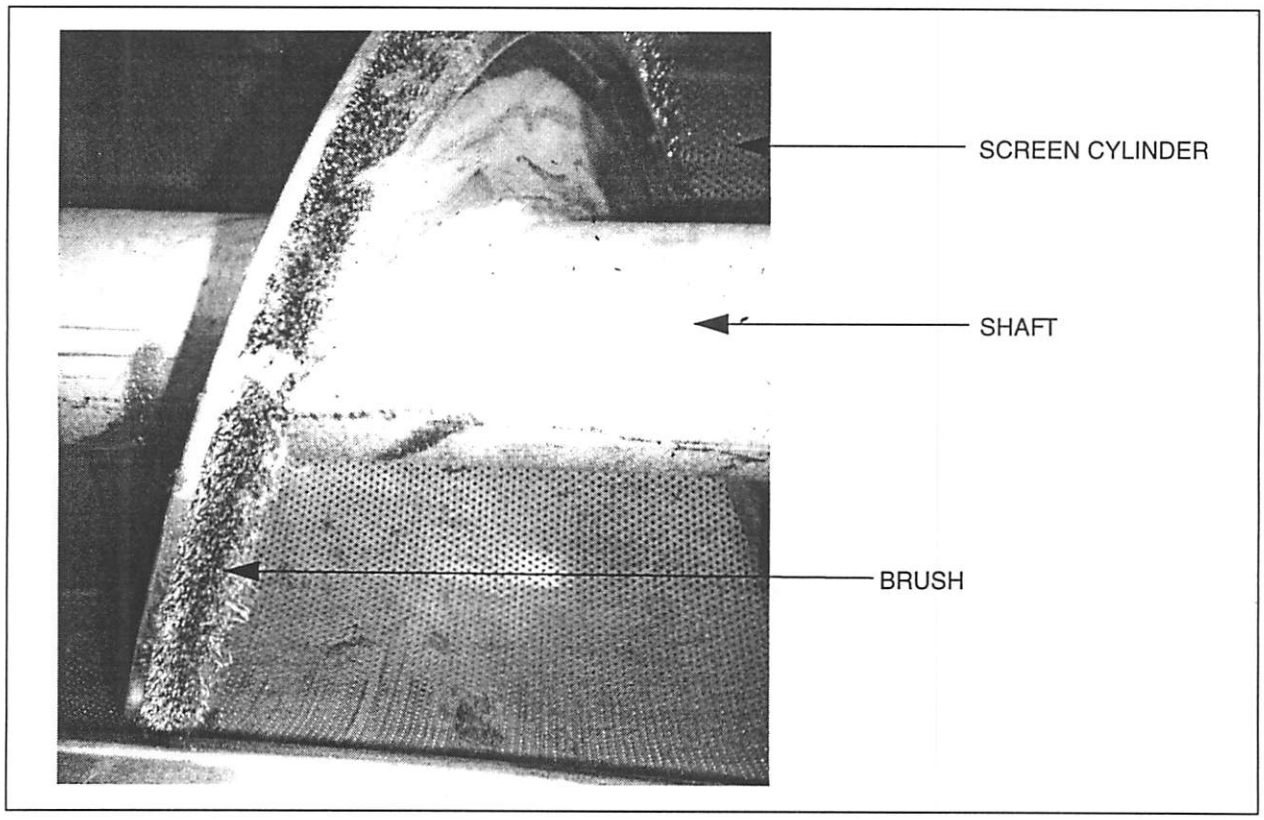
V-Belt Drive

Press Plugs

Two press plugs (metal plates) bolted to the screw shaft at the discharge determine the consistency. Lowering the press plugs restricts the opening through which the stock plug must pass, thereby increasing the consistency of the discharged stock.

Brush

Attached to the screw flite is a brush. Its primary function is to wipe the inside of the cylinder to prevent blinding over of the perforations or actual plugging. The condition of the brush is important to the proper operation of the Hydradenser.



Brush

Support Frame

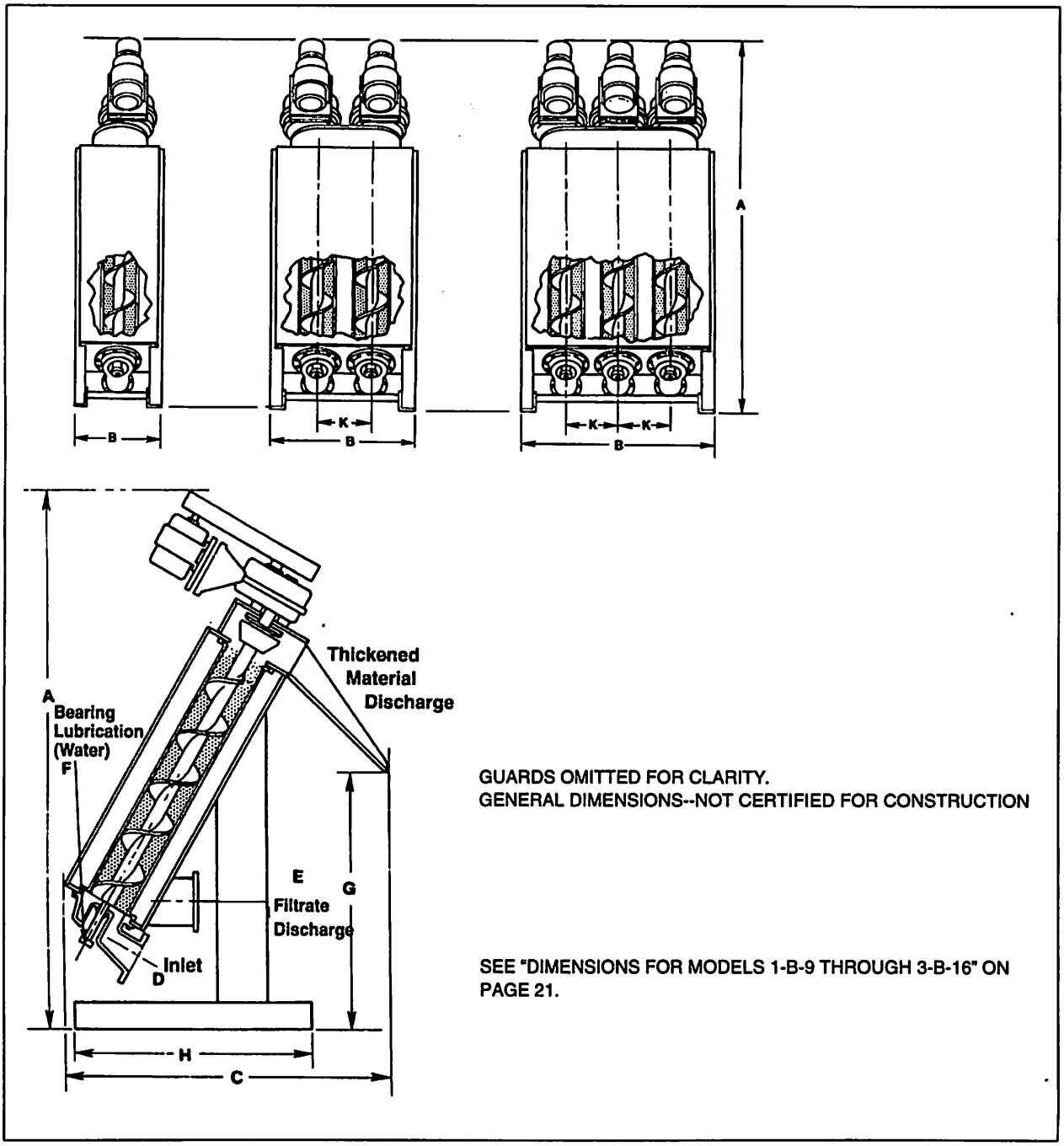
The support frame is a fabrication which anchors to the floor and supports the unit at an angle of 60 degrees to the horizontal.

Bottom Bearing

The conveyor screw is carried at the bottom by a bush bearing of ultra high density material. This bushing is pressed into the end of the screw and rotates on a hard surfaced bearing which is bolted to the bottom of the Hydradenser. A 1/2 inch NPT is provided in the bottom of the bearing for fresh water supply for lubrication. Approximately 1 GPM is required at 5 PSI,

3.3 SPECIFICATIONS

The specifications below are standard. Refer to your certified drawings to verify the specifications of your unit. The Hydradenser is manufactured in a variety of models to meet most of the needs of the industry. The model number designates the diameter of the cylinder (9 inch or 16 inch) and the number of cylinders (1, 2 or 3). Examples: I-B-9 - one 9-inch diameter cylinder; 3-B-16 - three 16 inch diameter cylinders. Units having 2 or 3 cylinders can be supplied with either a separated or non-separated chamber.



Models 1-B-9 Though 3-B-16

Dimensions for Models 1-B-9 Through 3-B-16

		1-B-9	2-B-9	3-B-9	1-B-16	2-B-16	3-B-16
A	inches	96.0	96.0	96.0	142.8	142.8	142.8
	mm	2438	2438	2438	3626	3626	3626
B	inches	22.3	40.3	58.3	33.4	62.4	91.4
	mm	565	1022	1480	848	1584	2321
C	inches	60.0	60.0	60.0	84.0	84.0	84.0
	mm	1524	1524	1524	2134	2134	2134
D	inches	6.0	6.0	6.0	8.0	8.0	8.0
	mm	152	152	152	203	203	203
E	inches	8.0	10.0	12.0	10.0	12.0	12.0
	mm	203	254	305	254	305	305
F	inches	0.5	0.5	0.5	0.5	0.5	0.5
	mm	13	13	13	13	13	13
G	inches	41.0	41.0	41.0	71.8	71.8	71.8
	mm	1041	1041	1041	1822	1822	1822
H	inches	42.0	42.0	42.0	63.0	63.0	63.0
	mm	1067	1067	1067	1600	1600	1600
K	inches	-	18.0	18.0	-	29.0	29.0
	mm	-	457	457	-	737	737
WT (empty)	lb	1,170	2,233	3,276	4,100	7,660	11,230
	kg	531	1,013	1,486	1,860	3,475	5,094
power require-ment	HP/ BAR-REL	5 TO 7- 1/2			10 TO 15		
	kw	4 TO 5.5			7.5 TO 11		

3.4 FEATURES

- Heavy duty construction and simple basic design--low maintenance
- Improved screw design--higher capacities
- Improved basket design--easier installation and extended life
- Optional flow and pressure control systems--wide range of applications
- Dependable, water lubricated, bottom bearing--low maintenance
- Six models: 9 inch and 16 inch units with one, two, or three barrels
- Thickens from 1.5 - 4.5% to 12 - 20% solids (depending upon freeness and temperature):
    - reduced storage volume
    - heat and chemical recovery
    - better refining or dispersion
- Available with stainless or polymeric brushes to keep perforations open for less downtime and lower maintenance

3.5 ACCESSORY EQUIPMENT

Thermo Black Clawson offers complete system design or individual units to integrate into an existing system. Your local Thermo Black Clawson Sales Manager or our Systems Engineering Group is available to assist you with your specific application requirements.

4.0 SHIPMENT CHECK

4.1 SHIPMENT/RECEIVING

Carrier

Thermo Black Clawson units and accessory equipment are shipped by truck.

Shipping Papers

One set of shipping papers is attached to the shipment in plain view to those unloading the unit. Another copy of the shipping papers was mailed to your receiving department.

WARNING

Check weights shown on shipping papers and determine if your crane or hoist can lift the heaviest item safely.

Check-Off

During unloading, check-off parts from shipping papers. Report shortages to Thermo Black Clawson within 24 hours. File damage claim against transportation company within 24 hours.

Unloading Patterns

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

Wooden Boxes (Crates)

Clamps, bolts, nuts, cap screws, eyebolts, and other small parts are shipped in one or more wooden boxes. **Do not store these boxes outdoors.**

Bracing Material

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

4.2 UNLOADING/HANDLING

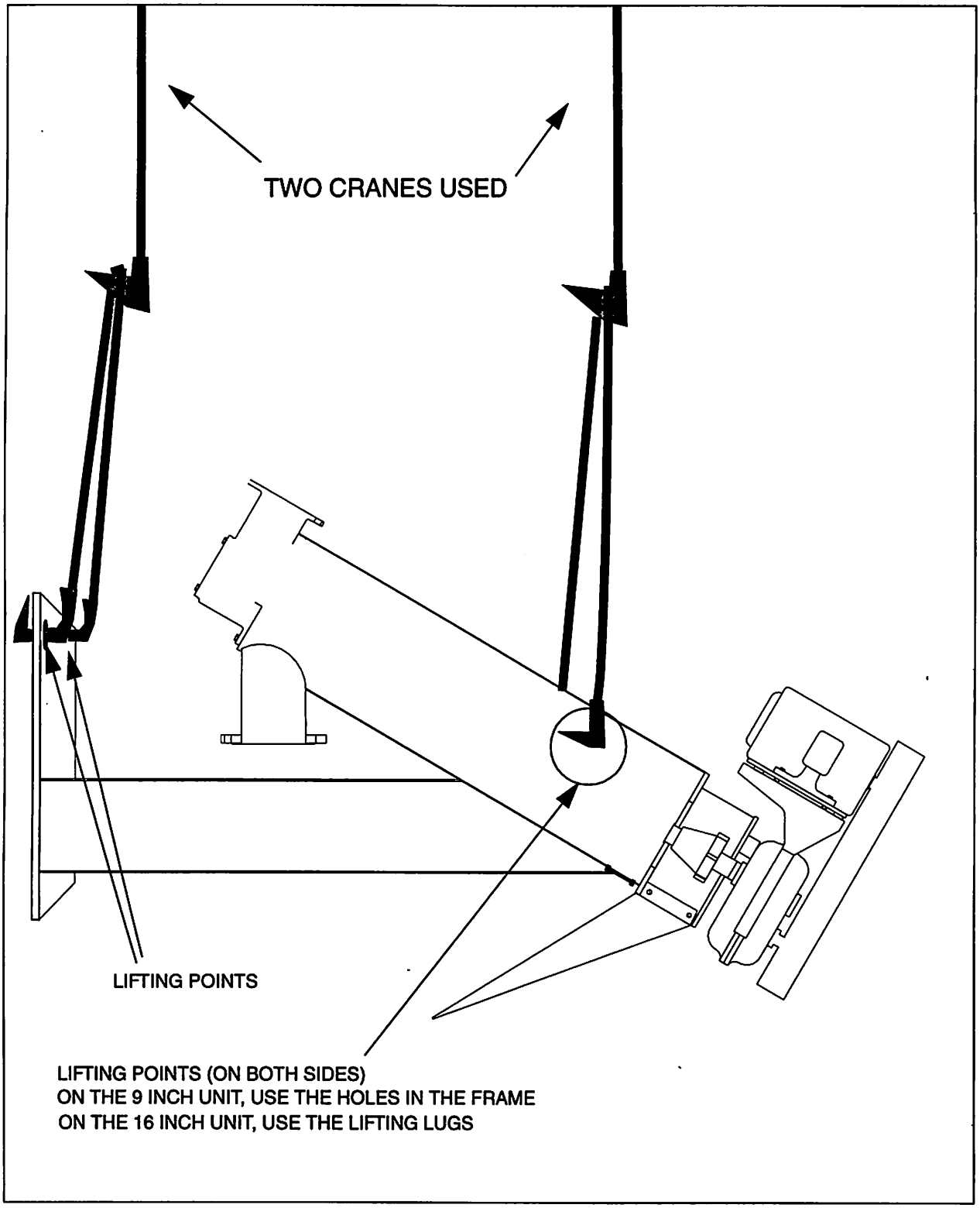
Lifting, Unloading, and Moving Unit

- Check to be sure that lifting hooks are attached securely and have appropriate lifting rating.
- Straighten the sling as the slack is removed. Test by allowing the weight of the piece to be supported by the crane while the piece is not more than one or two inches above the truck bed.
- Lift pieces carefully and smoothly. With cast parts, the flanges will break next to the cored holes if pieces are jerked suddenly by the crane.
- Use properly sized rigging.
- All lifting and rigging must comply with federal, state, and local safety codes.

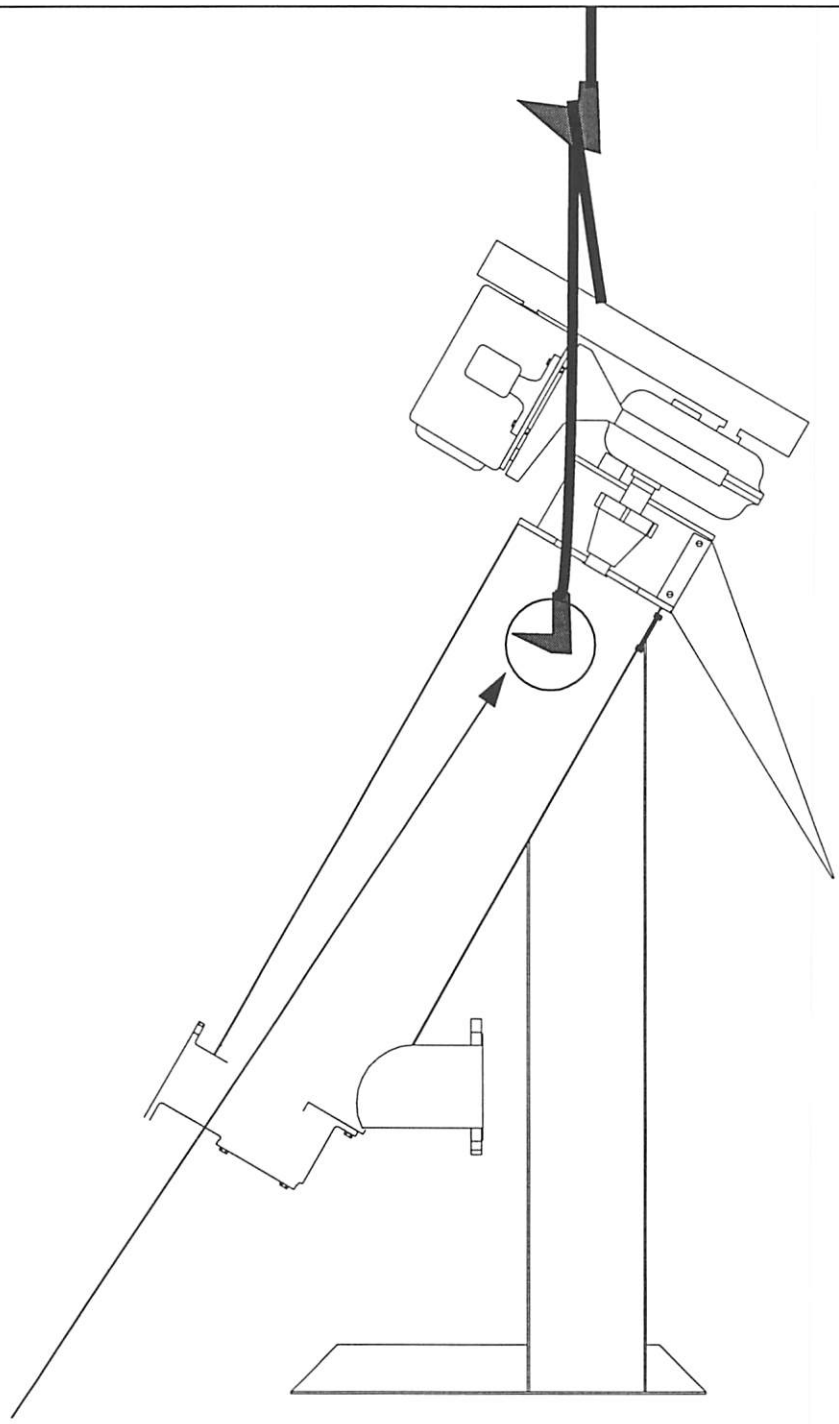
WARNING

Never stand underneath equipment that is being lifted. To do so is to risk severe personal injury or death.

- While unit is on the skid, it can be moved with a fork truck.
- To remove unit from skid or to move the unit into position when it is off the skid, use lifting methods depicted in "Moving the Hydradenser" on page 26 and "Positioning the Hydradenser" on page 27.
- Use shipping weight as a guide to determine lifting requirements. Verify that lifting equipment has sufficient capacity.
- Do not lift unit by chaining or slinging around pipe connections or motor stand.
- Use a spreader bar to prevent damage to the unit when lifting.
- Pad any contact points between the unit and the chains or slings.



Moving the Hydradenser



LIFTING POINTS (ON BOTH SIDES)
ON THE 9 INCH UNIT, USE THE HOLES IN THE FRAME
ON THE 16 INCH UNIT, USE THE LIFTING LUGS

Positioning the Hydradenser

5.0 STORAGE

5.1 UNIT STORAGE

Take the following precautions to minimize potential damage to the unit if outside storage is planned:

- Cover equipment with waterproof covering.
- Do not allow water to accumulate in or on the unit, especially if the weather conditions approach freezing (32 degrees F) or below.
- Do not store items such as valves, cylinders, switches, etc. outside.
- Consult the drive unit manual for any special storage requirements for the drive.

NOTE:

At the time of installation, all protective coatings must be removed carefully to prevent damage to the seals, etc. Bearings must be flushed and lubricated with lubricants that are clean and meet the specifications for the bearing application.

THERMO BLACK CLAWSON ASSUMES NO LIABILITY AS TO THE SPECIFIC STORAGE REQUIREMENTS FOR EQUIPMENT OR COMPONENTS.

6.0 INSTALLATION

6.1 SAFETY PRECAUTIONS

ATTENTION OPERATORS AND MAINTENANCE PERSONNEL! Read and make sure that you understand all of the safety information and correct procedures before using or servicing this equipment. This manual should be available to you at all times.

Do not modify the machine without authorization. Modifications could affect the function of the machine, shorten machine life, or render built-in safety features useless.

Never start the machine unless the following conditions are met:

- All personnel are clear of the machine.
- All doors and/or hatches are closed.
- All guards and covers are in place.

See "Operation" section for complete start-up procedure.

Lock out machine before servicing. All energy sources and stock supply must be shut-off and locked out with your padlock before and during installation, maintenance, inspection, cleaning, or adjusting this unit. Unit must be at zero mechanical state (ZMS) before any service work is done.

WARNING

Never remove another person's lock-out (padlock) or tag.

Check disconnect. Try to start motor before servicing unit.

Lock out all pneumatic, hydraulic and steam systems, electrical circuits, chemical and gas systems, water, and stock flow.

Do not proceed if services are not independent of the main supply. Contact your supervisor.

Follow installation and maintenance procedures in this manual along with your company's safety guidelines.

Use valves designed for lock-out and tagging. All valves used on this equipment should be designed to be locked out and tagged. Never operate unit without guards in place.

Tighten sheave bushings to manufacturer's specification.

Check torque prior to start up. Tack welding of bolt heads is an accepted industry practice.

CAUTION

Over tightening fasteners can result in failure of bolts and other attachments.

6.2 PRE-INSTALLATION

It will save time if all pre-installation work is completed before the unit is received. This section can be used as a check-list for preparation and installation.

Thermo Black Clawson prepares the following documents for every piece of equipment. They provide critical information for equipment installation.

- **Certified Drawings** - prepared by Thermo Black Clawson upon receipt of your purchase order and your returned approval drawings.
- **Owner's Manual** - sent with certified drawings.
- **Shipping List** - one is sent with the shipment and one is mailed to the mill the day shipment is made.

Foundation

Refer to the certified drawings for foundation information.

Equipment Placement

Certified drawings show space requirements for equipment operation and the anchor bolt plan. Adequate equipment clearances must be considered in your equipment layout. Consideration should be given to maintenance and installation requirements.

When equipment has to be lowered through an opening in the floor above, be sure that it is in correct foundation position before the unit is erected.

NOTE: CHECK THE CERTIFIED DRAWINGS TO DETERMINE IF ANY UNUSUAL CLEARANCE PROBLEMS WILL ARISE WHILE MOVING THE UNIT THROUGH THE MILL.

Lifting Equipment

We have attempted to ensure that the unit weights (not including crating weight) are on the certified general assembly drawings for each piece of equipment. If the weight is not on the drawing, contact Thermo Black Clawson. Verify that the hoist or crane at the mill has adequate load capacity to lift the unit safely. If it does not, it will be necessary to lease lifting equipment or contract for the services of a rigger.

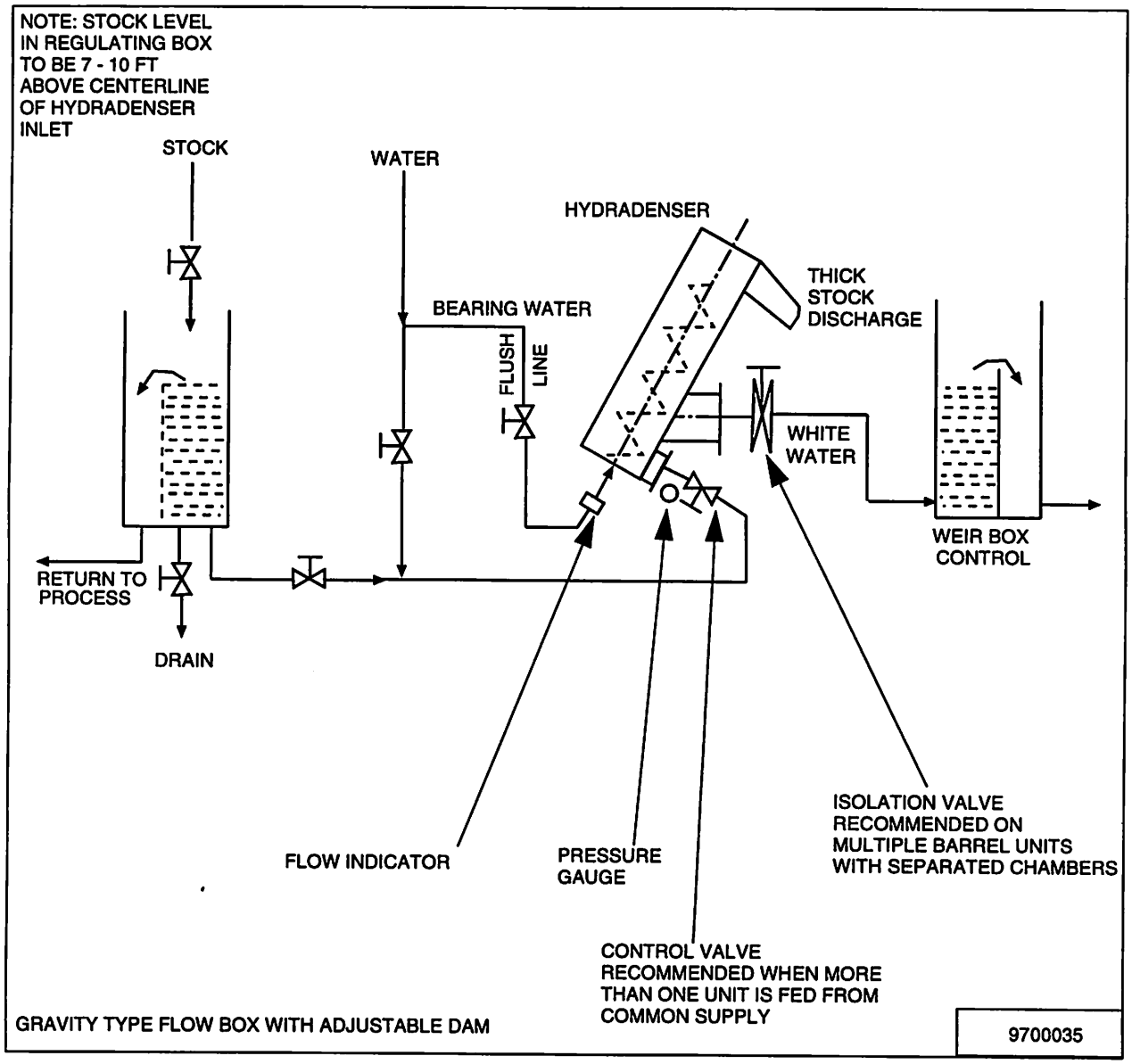
Electrical Requirements

Be sure that power cables and controls are properly sized, and can be routed to the unit with a minimum of bends and turns. Verify that the available electricity is correct for the equipment it is to operate.

Piping

Check certified drawings for pipe sizes. Be sure that correct sizes of pipe, fittings, and adapters will be available when the piping is installed. It is essential that all piping be well supported. Also, expansion loops or joints should be properly installed in the connecting pipes to allow for linear expansion. Piping must not be connected to the unit until the grout has hardened and the foundation bolts have been tightened. Connect the inlet and discharge piping. Where multiple units are being fed from a single supply line, control valves and pressure gauges should be installed on the

inlet to each barrel. Isolation valves should be provided for the white water discharge.



Typical Piping Diagram

Feed Arrangement

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

- Gravity feed through a regulating box where the operating head is controlled by an adjustable dam or gate.
- Gravity feed through a standpipe with a fixed level.
- Direct pumping with flow controls.

Stock Discharge

The discharge of thickened stock from the Hydradenser is by gravity down a chute. Care must be taken to ensure an unrestricted flow on the chute to prevent backing up into the Hydradenser.

A lower pond level will raise consistency; a higher pond level will lower discharge consistency. It is best to start with a high level and then lower the level slowly to avoid plugging the cylinder.

A weir box to control the pond level inside of the unit is helpful in obtaining the desired discharge consistency.

Leveling Instruments

A carpenter's level is adequate.

6.3 INSTALLATION

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

The general guidelines suggested in this manual are for those individuals involved in installing the unit. It is the responsibility of the customer's erection crew or agents to maintain *As Built* specifications during the installation of the unit. If you have any problems or questions concerning the installation of this equipment, please contact the Thermo Black Clawson Field Service Department.

Customer Supply

The customer is to furnish all foundations, anchor bolts, steel shims, piping, etc. Refer to quotations and certified drawings for a complete listing of parts and hardware furnished by Thermo Black Clawson.

Foundation Surfaces

Clean all loose concrete chips and dust from foundation.

Anchor Bolt Pockets

Remove all debris and dust from anchor bolt pockets before installing sleeves.

Shim Packs

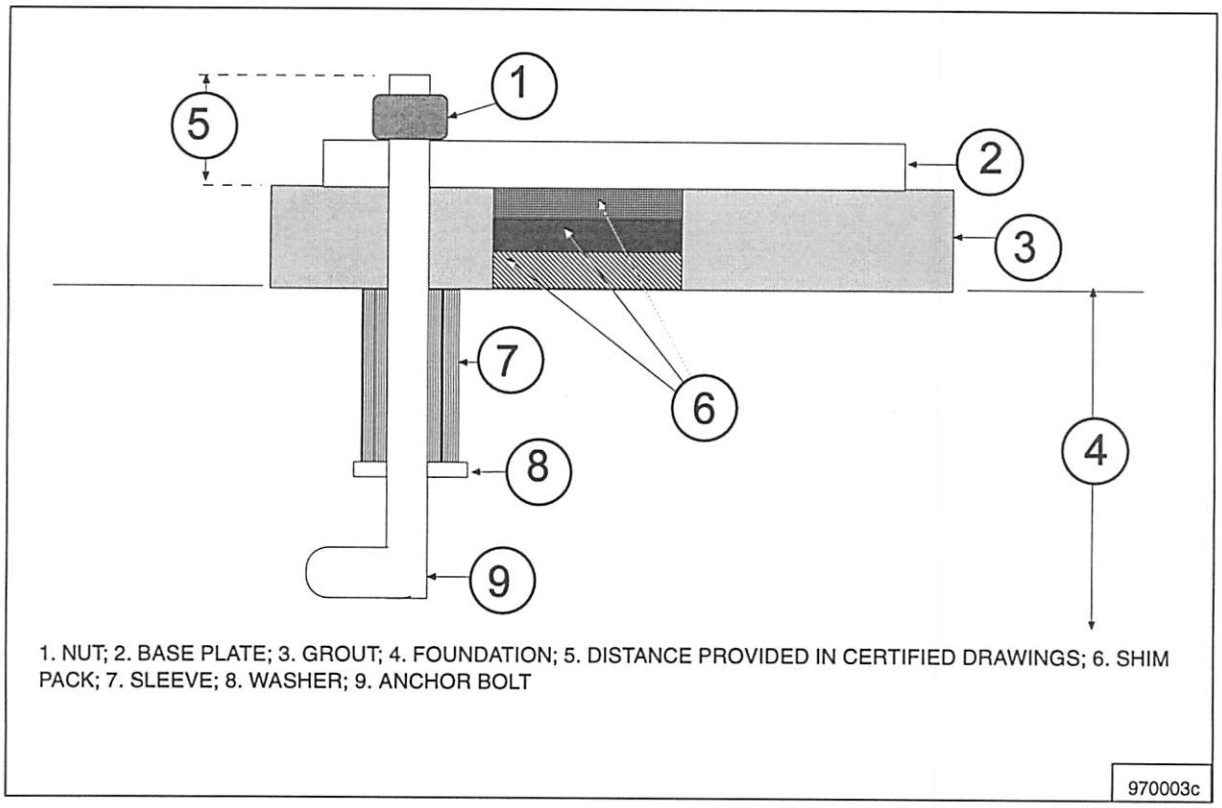
Steel shims will be required to level the unit before it is grouted in place. Mill supply must include 3 inch x 3 inch shims.

Anchor Bolts

Bolts must project at least ¼ inch through the nut when the unit is bolted down. Allow for grout and thickness of soleplate/footpads and nut when determining bolt length. See "Recommended Anchor Bolt Method" on page 34. The certified drawings call out the anchor bolt sizes, typical spacing, and layout. We recommend that anchor bolts be encased in sleeves to make allowance for minor deviations in mounting hole location.

Grout

All grout design and placement of grout is the responsibility of the customer. Deviations from standard grouting practice could result in structural failure. Piping must not be connected to the unit until the grout has thoroughly hardened and the foundation bolts have been tightened. All couplings should be final aligned after the piping is completed.



1. NUT; 2. BASE PLATE; 3. GROUT; 4. FOUNDATION; 5. DISTANCE PROVIDED IN CERTIFIED DRAWINGS; 6. SHIM PACK; 7. SLEEVE; 8. WASHER; 9. ANCHOR BOLT

Recommended Anchor Bolt Method

Leveling the Unit

Install the unit on the foundation by lowering it over the anchor bolts. Plumb legs top to bottom to within 1/8 inch. Place steel shims next to each anchor bolt and underneath unsupported lengths of the unit base. Use care not to distort the alignment of the unit when shimming. It is important not to twist or bow the base, since this will misalign the shaft as well as change the running clearance of the screw to the perforated screen cylinder. Snug the nuts on the anchor bolts to hold the unit while the grout is poured and sets. Firmly tighten the nuts on the anchor bolts after the grout has set.

Check the base pads to assure that they are all resting on the shim blocks before the anchor bolts are tightened. Use caution to not have a *soft foot* which would pull a base pad down as the anchor bolt is tightened.

V-Belt Drive

Mount the motor on the motor bracket (if motor was not supplied with unit). Install the sheave on motor shaft and align with sheave on the reducer drive shaft. Assemble the V-Belts and adjust for proper tension.

Air Bleed-Off

The top of the access cover is designed to fit loosely over the trough. This is to allow air to escape from within the liquid as it is discharged from the screen cylinder. Do not clamp or tighten this cover down at the top.

7.0 OPERATION

7.1 PRE-CHECKOUT

Many programmable solid state systems have the capability of simulating operation in a mode known as *Test Mode* or *Dry Run Mode*. These modes allow a user to check a program and correct obvious programming errors with outputs disabled. Unexpected machine motion and possible damage to equipment is avoided. These modes can also be used to verify proper system operation after a repair.

Many programmable systems provide for *Force On* and *Force Off* of inputs and outputs. These functions can reduce troubleshooting and maintenance time by enabling personnel to bypass certain operations without physically operating switches on a machine.

WARNING

Use care when using *Force* functions to avoid exposing personnel to hazardous machine motions or process operations which might cause severe personal injury or death.

Mechanical start-up involves the following steps, which must be carried out in sequence:

- Inspect the installation before the power is connected.
- Disconnect motors and other devices that cause machine motion.
- Test inputs.
- Test outputs.
- Enter and verify your program.
- Test the system with motors and other motion-causing devices reconnected.
- Go through a *dry run* of the application.

The purpose of these procedures is to isolate such problems as wiring mistakes, equipment malfunction, and programming errors in a systematic, controlled manner. Go through these procedures very carefully. Following a given set of steps will help avoid possible personal injury and equipment damage.

WARNING

During all phases of motion check-out, station a person ready to operate the power switch if necessary.

Inspect and make sure of the following before starting the unit:

- All guards and covers are in good condition and fastened in place (see "V-Belt Drive" on

page 18 or "Hydradenser" on page 16 for guard location).
- No parts are loose, worn, damaged, or missing.
- All personnel are clear of the equipment.

First Time Checkout

Drive

CAUTION

The Hydradenser is shipped without oil. To prevent damage, you must lubricate before using.

- The unit is equipped with a V-belt drive. Check the sheave alignment and adjust the motor bracket for proper-belt tension.
- Check the instructions for proper lubrication of the drive unit.
- Check the voltage rating of the motor. Be sure it is wired properly.

Rotating Screw

- The screw has a right hand flite and the direction of rotation is important for proper operation of the Hydradenser. Looking at the screw from the top, it should be turning in a clock-wise direction.
- There should be enough clearance between the screw and the cylinder to allow for proper operation. If there is metal-to-metal contact, there will be increased wear and shorter life for the components. Problems such as metal-to-metal contact should be corrected immediately.

Bottom Bearing Water

- The bottom bearing bushing must be property lubricated by clean water. The water line to each barrel should have a valve to regulate flow and an indicator, such as a Rotormeter, for visual observance of flow. Approximately 1 GPM is required.

CAUTION

Avoid excessive damage to the bushing by always operating the Hydradenser with bearing water.

7.2 CONTROL GUIDELINES

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

Power Supply

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

Main Power Disconnect

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

Activating Devices When Troubleshooting

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

Operation Safety Precaution

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

Program Alteration

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

Hardwired Circuitry

WARNING

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

Safety Recommendation for Maintenance Personnel

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

Follow the appropriate work practices of the National Fire Protection Association (NFPA) for Electrical Standards for Industrial Machinery.

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

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

Control Panels

The control panels are designed using all NEMA (National Electrical Manufacturer's) and/or UL (Underwriter's Laboratory) approved components suited for the environment in which it is being placed. Every effort is made to adhere to the NEC (National Electrical Code), OSHA (Occupational Safety and Health Act), ANSI (American National Standards Institute), and mill standards as they apply to your application.

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

DANGER

Touching exposed live electrical wires will cause serious personal injury or death.

- Power feed should have a disconnect or breaker capable of being locked in the open position.
- Wire field devices per certified installation drawings furnished with the control panel.
- Route field wiring to separate the AC from the DC and/or low level signals.
- All the electronic instruments were factory programmed to a fail safe state (if a component failure occurs). The panels include a power push button that, when pushed, will power down the main processor, closing all valves.

Education and Knowledge Lead to Safety

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

7.3 OPERATION

DANGER

Before attempting any maintenance procedure, shut down the unit according to "Normal Shut-Down" on page 41, bring the unit to zero mechanical state, and lock out it out.

General Application

The Hydradenser must be operated with a proper feed consistency and within a flow range as determined at the time of purchase. Changes in inlet consistency or flow rate to the Hydradenser will reflect in the throughput tonnage and may vary the final consistency of the discharged material.

The amount of thickening which can be obtained is determined by several factors:

- Freeness or drainage rate of material being thickened
- Consistency of inlet stock
- Pressure head of the inlet stock
- Restriction or back pressure at the discharge
- Diameter of perforations in screen cylinder
- Plug length
- RPM of the screw

Normal Start-Up

CAUTION

The Hydradenser is shipped without oil. To prevent damage, you must lubricate before using.

- Turn on lubrication water to the bottom bearing.
- Energize the Hydradenser motor.
- Open the inlet valve gradually.
- Set the operating head at 3 to 5 PSI to obtain the desired thru-put.

NOTES:

- *Increasing the operating head increases the thru-put and tends to lower the discharge consistency.*
- *Decreasing the operating head decreases the thru-put and tends to raise the discharge consistency.*
- *The discharge consistency is primarily a function of the position of the press plugs. Lowering the press plugs restricts the area through which the plug can pass thereby increasing the discharge consistency. Raising the press plugs will decrease the discharge consistency.*

WARNING

Adjustment of the press plugs must be made when the Hydradenser is not in operation.

- Check the amperage reading for possible over-load conditions.
- Check for proper flow of discharged stock.

Typical Operating Conditions

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

Emergency Shut-Down

- De-energize Hydradenser motor.
- Immediately close inlet valve.
- Immediately close bottom bearing lubrication water valve.

Normal Shut-Down

- Close the inlet valve.
- Allow the Hydradenser to run until the system is cleared of stock.
- De-energize the Hydradenser motor.

Long Term Shut-Down

- Close the inlet valve.
- Open the fresh water valve.
- Allow Hydradenser to run until the system is cleared of stock.
- Close fresh water valve and de-energize the Hydradenser motor.
- Remove the cover and hose off the screen cylinder.

8.0 MAINTENANCE

8.1 ROUTINE MAINTENANCE

Perform a general inspection of the equipment at least every three months or every 1,000 hours of running time. Locating and eliminating minor problems will extend the service life of the unit.

Periodic Inspection

Perform a general inspection and tightening of the machine twice a year. Locating and eliminating minor problems will assure long and dependable service. In many instances, periodic inspections will eliminate costly shut-downs and delays.

WARNING

Follow your prescribed safety procedures and those listed in this manual to prevent accidental starting while inspecting or servicing the unit.

DANGER

Before attempting any maintenance procedure, shut down the unit according to "Normal Shut-Down" on page 41, bring the unit to zero mechanical state, and lock out it out.

A wash down of internal parts and surfaces may be required.

Components Requiring Routine Maintenance

COMPONENT	SERVICE	FREQUENCY
bearings	lubricate	weekly
v-belts and sheaves	check tension, alignment, and wear	quarterly
screen/ screen cylinder	check clearances and wear	quarterly
screw brushes (if supplied)	check for wear	quarterly

8.2 TROUBLESHOOTING

Plugging

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

When plugging starts, increase the flow rate of dilution water until the operation returns to normal.

DANGER

Before attempting any maintenance procedure, shut down the unit according to "Normal Shut-Down" on page 41, bring the unit to zero mechanical state, and lock out it out.

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

Metal to Metal Contact

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

Troubleshooting Guide

CONDITION	ADJUSTMENT
low discharge consistency	lower pond level inside of cabinet
discharge consistency too high	raise pond level inside of cabinet

8.3 SERVICE INSTRUCTIONS

DANGER

Before attempting any maintenance procedure, shut down the unit according to "Normal Shut-Down" on page 41, bring the unit to zero mechanical state, and lock out it out.

Screen Cylinder

The Hydradenser screen cylinder is supplied in two halves to facilitate assembly and removal. Both halves are flanged and drilled for bolting together. Split rings are bolted together along with the flanged halves to support the screen plate. One ring is located at each end and bolting these rings to the Hydradenser body centers the cylinder in the unit. Intermediate rings are also used and these are located closer together at the upper or discharge end of the cylinder where the plug - forms.

Screen Cylinder Removal

- Remove the two socket head cap screws which hold each of the-support rings together.
- Remove the four cap screws which fasten the end rings to the Hydradenser body.
- The top half of the screen cylinder can now be lifted out.
- Rotate the bottom half around the screw and remove.

Screen Cylinder Installation

CAUTION:When installing a new screen cylinder, the closer spaced intermediate rings are at the top of the Hydradenser (toward the drive).

- Place one half of the screen cylinder in the Hydradenser, laying it on the screw.
- Place one half of each of the split support rings on the cylinder half, locating them over the drilled holes in the flanges.
- Rotate the screw 180 degrees which will take it to the underneath side.
- Place the other half screen cylinder on top along with the remaining halves of the support rings.
- Align the two halves-by inserting short pieces of 1/4 inch diameter rod in the dowel holes provided.
- Rotate the screw 90 degrees. Align the support ring halves and the drilled holes in the cylinder flange and install the cap screws. Do not pull the cap screws up tight.
- Rotate the screw 180 degrees and install the cap screw in other side of the clamp rings.
- Rotate the screw 90 degrees so that the cap screw heads are up. Remove the 1/4 inch dowel pins.
- Align and bolt the two end rings to the Hydradenser body.
- Tighten the cap screws in the support ring halves.

Conveyor Screw Removal

- Remove cylinder cover plate.

- Remove cylinder top section.
- Remove belts and sheaves.
- Remove gear box dust cover.
- Remove thrust plate.
- Remove gear box.
- Remove press plug.
- Lift screw out of bottom bearing and toward the gear box end until the bottom of the screw clears the body assembly wall.
- Remove the screw from the body assembly at the inlet end of the machine.

Brush Replacement

We recommend that brush replacements be made as often as is necessary to maintain efficient operation of the Hydradenser.

- Remove the top half of the screen cylinder.
- Remove the worn brush by breaking the welds that hold the brush to the flite section.
- Clamp the coiled brush to the flite section using the previous welds and the bottom half of the screen cylinder as a guide.
- Weld the brush to screw flite--take care not to overheat. Space the welds approximately 6 inches apart.

Air Bleed-Off

The top of the access cover is designed to fit loosely over the trough. This is to allow air to escape from within the liquid as it is discharged from the screen cylinder. Do not clamp or tighten this cover down at the top.

8.4 LUBRICATION

Bottom Bearing

The Hydradenser is furnished with a water lubricated ultra high density polyethylene bush bearing at the bottom. The bearing spindle or stud is drilled and tapped for water supply. Approximately 1 GPM is required. The bearing water should be free of suspended matter. Any foreign material could be abrasive and shorten the life of the bearing.

Reducer

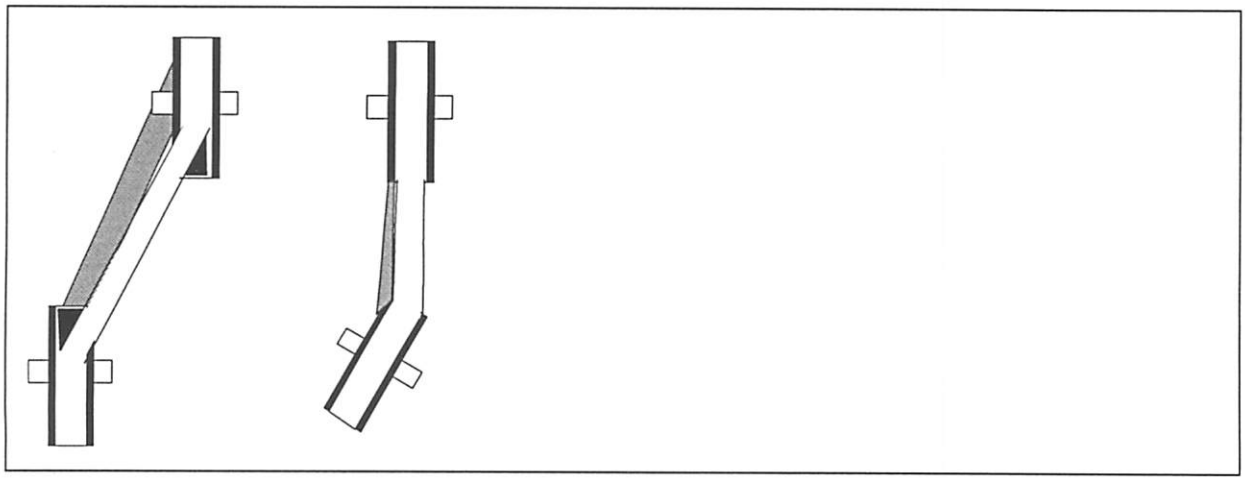
For lubrication of the reducer drive gears and bearings, please refer to the service bulletin supplied by the manufacturer. These are attached to the units.

CAUTION

The Hydradenser is shipped without oil. To prevent damage, you must lubricate before using.

8.5 V-BELT DRIVE

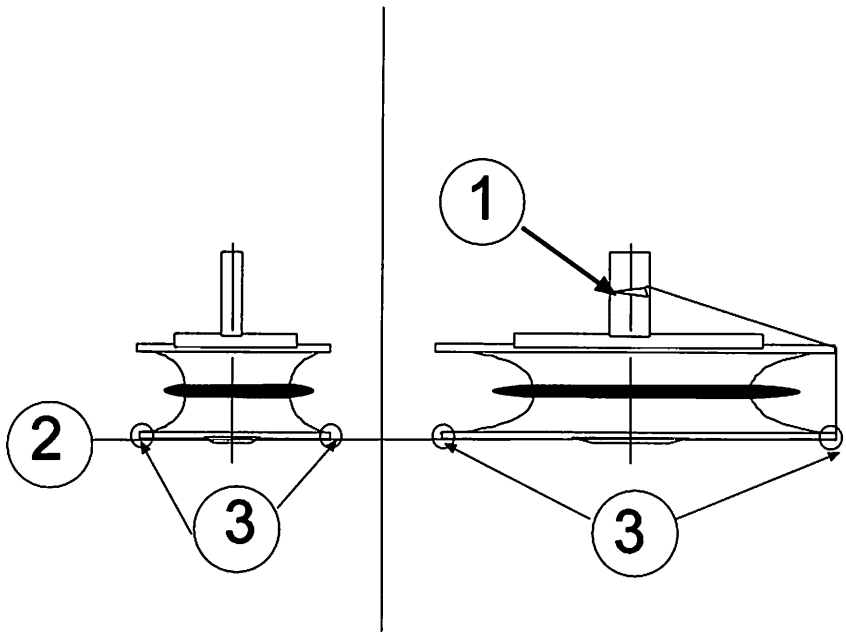
Misapplied or incorrectly assembled belts can over-load and cause overheating of the windings or the bearings. Follow instructions of the V-belt manufacturer carefully. A noisy drive should be corrected at once. Visual inspections are also helpful in finding trouble before a breakdown occurs. Rubber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



Misaligned Belts

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

When a suitable straight edge is not available, misalignment of sheaves can be detected readily with the aid of a cord as shown in the drawing to the right. Assuming that the shafts are parallel, as they should be, a light, strong cord secured around one shaft and held straight and tight along the sides of both sheaves should just touch at all points as shown. Each sheave can be checked by rotating it, and noting whether or not the rim contact with the cord is disturbed. If either of the rim contacts pull away, it indicates misalignment which must be corrected to obtain expected belt and equipment life.



1. CORD TIED TO SHAFT 2. CORD 3. WHERE CORD TOUCHES PULLEYS

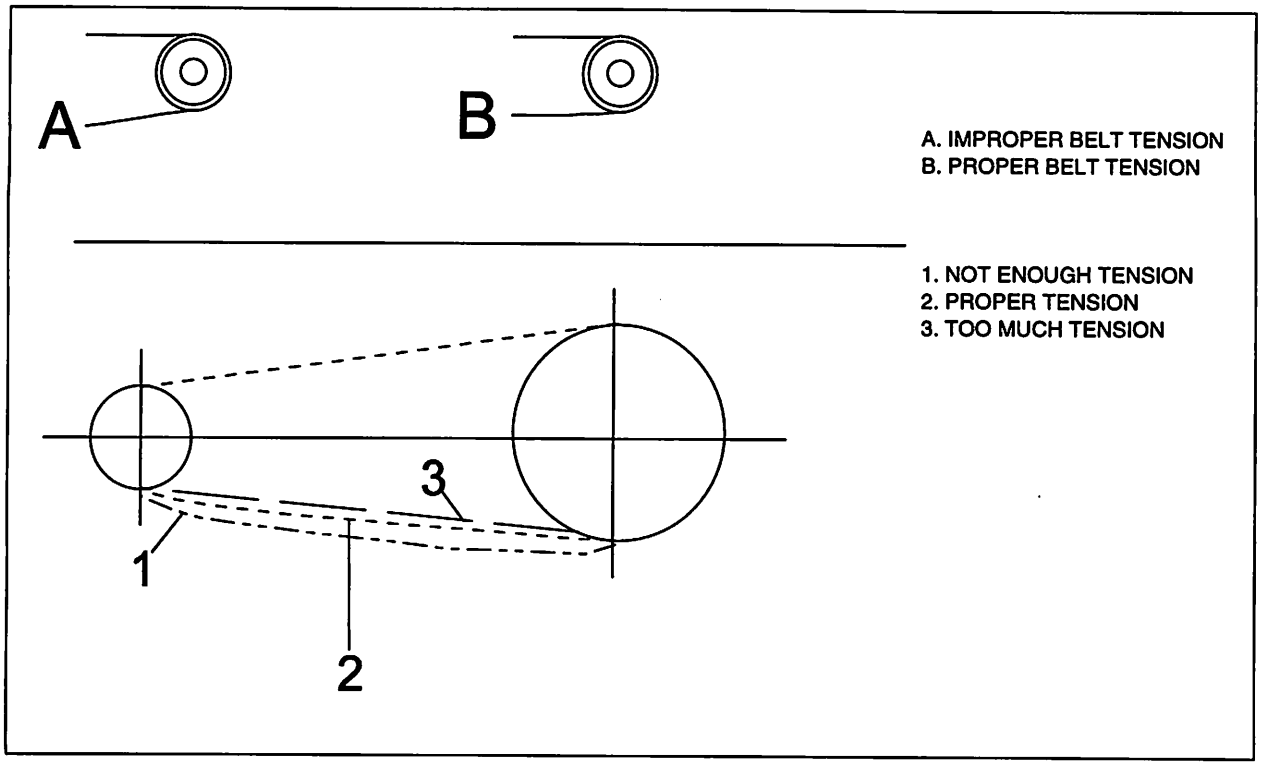
Sheave Alignment

Proper belt tension is important to provide full grip around the sheaves. While a V-belt does not depend on tension to provide grip, it is dependent on tension for the extent of its grip. As you can see from the diagrams, inadequate tension allows a V-belt to hang away from the bottom of a sheave, reducing the arc of contact. A properly adjusted V-belt is wrapped around the sheave in a full arc. Proper contact is important because horsepower ratings for the different sizes of V-belts are based on a 180 degree arc contact. Actually, this arc varies from one drive to another and allowance is made for the variation when the drive is engineered.

When a properly engineered drive is delivered to you, you must maintain that proper tension and proper contact arc. Otherwise, the belts will slip. Because many mills have no means to measure equipment in terms of pounds-pull, common practice is to measure by rule of thumb. Some of these rules are more superstition than science. Some are good. Perhaps the best one is this:

A slack V-belt feels dead when you thump it with your hand;

a properly taut V-belt has alive springiness.



Belt Tension

V-Belt Drive

CONDITION	POSSIBLE CAUSE	TO CORRECT
belt slips (side-walls glazed)	oil on belts	replace belts
	not enough tension	increase tension
mismatched belts	new belts installed with old	replace belts in matched sets
sheave grooves worn unevenly or improper groove angle	shafts not parallel	replace sheaves
		align drive
belt turned over	broken cord caused by pry-ing	replace belts correctly
	impulse loads	apply proper tension
	misalignment	realign drive
	worn sheave grooves	replace sheaves
	excessive vibration	check drive and equipment mounting
		consider banded belts
belt breaks	shock loads	apply proper tension
	heavy starting loads	apply proper tension
	belt pried over sheaves	use compensator starting
	foreign objects in drive	replace belts correctly
		provide drive shroud
belt wear	sheave grooves worn	replace sheaves
	mismatched belts	replace with matched belts
	belt slippage	increase tension
	sheaves misaligned	align sheaves
	oil or heat condition	eliminate oil
		ventilate drive

9.0 SERVICE PARTS

9.1 RECOMMENDED PARTS

We recommend that you keep the following parts on hand for repairs and routine maintenance. This list does not include specific part numbers for your unit. You should refer to your certified drawings for individual part numbers or, if you would like a list of part numbers for your unit, contact:

Customer Service Department
Thermo Black Clawson Inc.
605 Clark Street
Middletown, OH 45042
Phone: (800) 448-5422
Fax: 1+513-424-1168

IMPORTANT: When ordering spare parts or requesting a parts list, refer to the certified drawings and give the item number, drawing number, and part description, along with the product identification numbers. Product identification numbers include the serial number, shop order number and model number.

Recommended Spare Parts

Description	Quantity per barrel
perforated screen cylinder	1
conveyor screw, complete with brush, bushing, and shaft extension	1
coiled brush	1
ultra-high density bottom bearing	1
bottom bearing gasket	1

10.0 CUSTOMER INPUT

10.1 QUALITY ASSURANCE THROUGH CUSTOMER INPUT

As a Thermo Black Clawson customer, you can help us toward our goal of providing high quality manuals that meet or exceed our customers' expectations. We would like to hear from you if you have suggestions or comments that would help us toward this effort. From procedures to safety issues and other areas, your input and concerns are important to us. Perhaps we haven't described something as much as you think we should have. Maybe you have a technique that you'd like to share with us. If you have input that would help us improve our manuals, write or fax your comments to us:

Thermo Black Clawson Inc.
Technical Writing
605 Clark Street
Middletown, OH 45042
Fax: 1+513-424-1168

11.0 GLOSSARY

Term	*Synonym/s* Definition/Function
EMI	electromagnetic interference
GPM	gallons per minute
HP	horsepower
junk trap	junk chamber, junk box
kPa	kilopascal
kW	kilowatt
LPM	Liters per minutes
OCC	old corrugated container
OD T/D	oven dried tons per day
PSI	pounds per square inch
T/D	tons per day
T.I.R.	total indicated runout (on a dial indicator)
ZMS	zero mechanical state - (1) Every power source that can produce a machine member movement has been locked off; (2) Pressurized fluid (air, oil, or other) power lockoffs (shut-off valves), if used, will block pressure from the power source and will reduce pressure on the machine side port of that valve by venting to atmosphere or draining to tank; (3) All accumulators and air surge tanks are reduced to atmospheric pressure or treated as power sources to be locked off, as stated in paragraph 1 and 2; (4) The mechanical potential energy of all portions of the machine is at its lowest practical value--so that opening of pipe(s), tubing, hose(s), or actuation of any valve(s) will not produce a movement that could cause injury; (5) Pressurized fluid (air, oil, or other) trapped in the machines lines, cylinders, or other components is not capable of producing a machine motion upon actuation of any valve(s); (6) The kinetic energy of the machine members is at its lowest practical value; (7) Loose or freely movable machine members are secured against accidental movement; (8) A workpiece or material supported, retained, or controlled by the machine shall be considered as part of the machine if the workpiece or material can move or can cause machine movement.