THERMO BLACK CLAWSON INC.

A Thermo Fibertek company

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

M-14 RAGGER 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
4872091	97-M14-0357

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

Contents

Figures and tables are italized

Contents

Figures and tables are italized

Manual Overview

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

Your Thermo 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.

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

Thermo Black Clawson Inc.
605 Clark Street, Middletown, OH 45042-0160
Phone 1-513-424-7400
TOLL FREE 24-HOUR EMERGENCY SERVICE

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 help 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.

Safety Steps

- 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 for the ragger, the pulper, and the rag rope cutter 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:

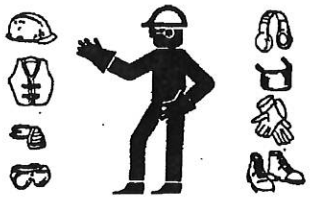
  - All guards and covers are in good condition and fastened in place.

  - 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 these guidelines and instructions. 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 rotor.
Exceeding design pressure of unit.	**WARNING** Seals, gaskets, or the vessel might fail and cause severe personal injury.	Know the correct operating pressure of the equipment. Refer to the manual and the certified drawings. Adhere to proper operating procedures.
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.

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

Hazardous voltage.

Lockout-- electrical power before servicing

Severe injury or death will result.

DANGER

Remote operation.

Do not operate without guards.

Lockout all power sources before servicing.

Severe injury or death will result

WARNING

To avoid personal injury prior to servicing:

Lockout both electrical and pneumatic controls.

Vent supply lines to depressurize systems.

Be sure to cover/guard open floor area.

DANGER

In-running nip.

Keep clear of nip.

Lockout power before servicing.

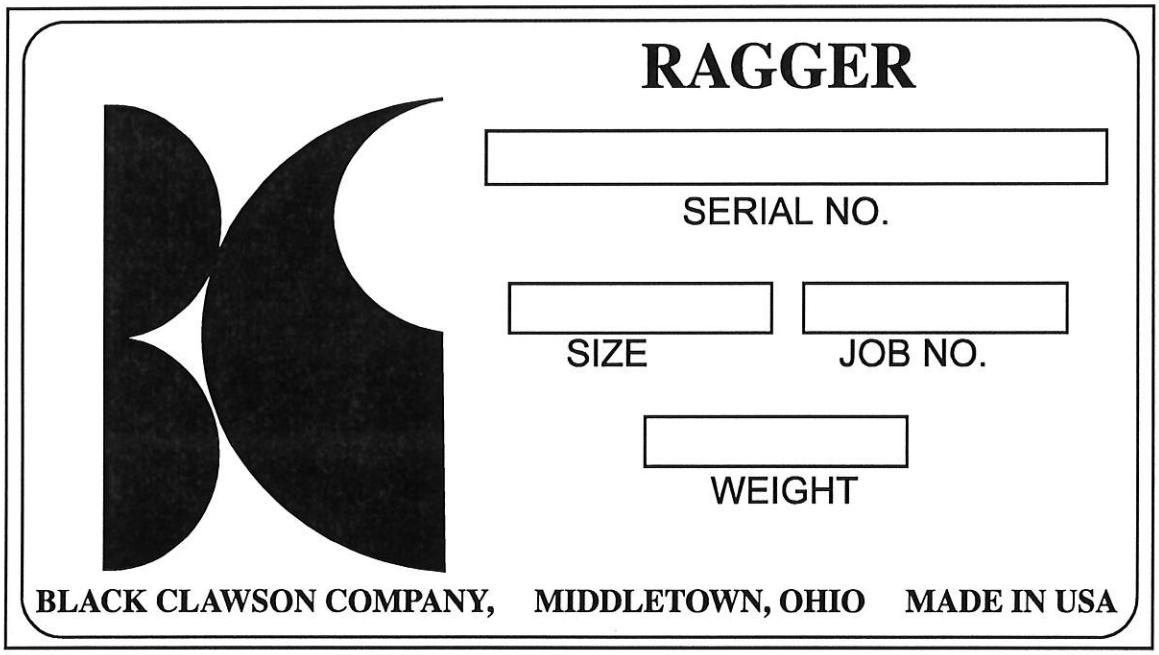
Severe injury or death will result.

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.



9600005

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

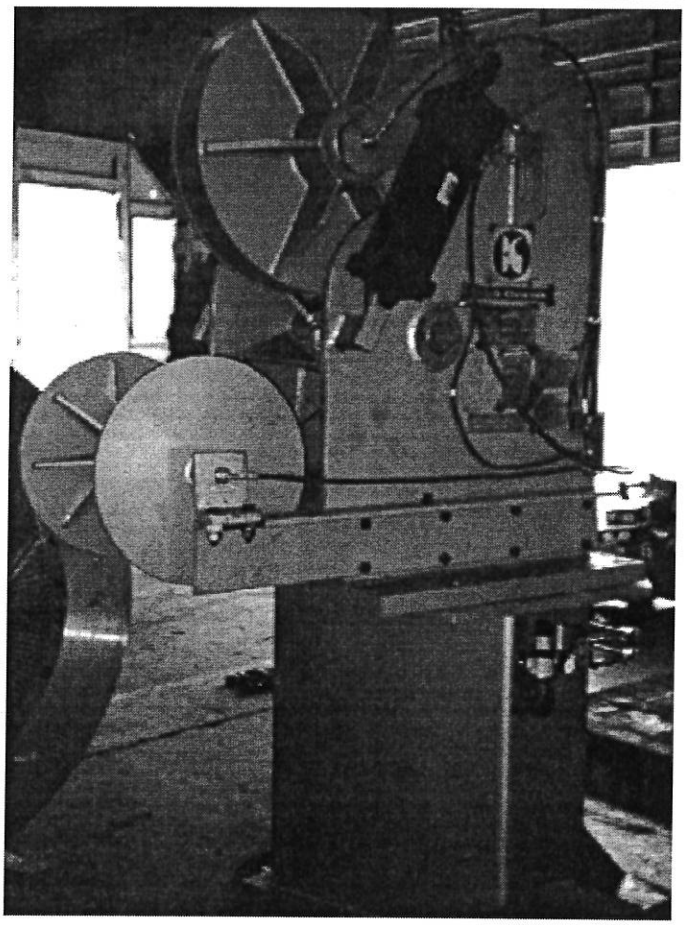
The serial number is on the nameplate and the certified drawings. When inquiring about service or maintenance problems, always provide the serial number, size, and type of unit.

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

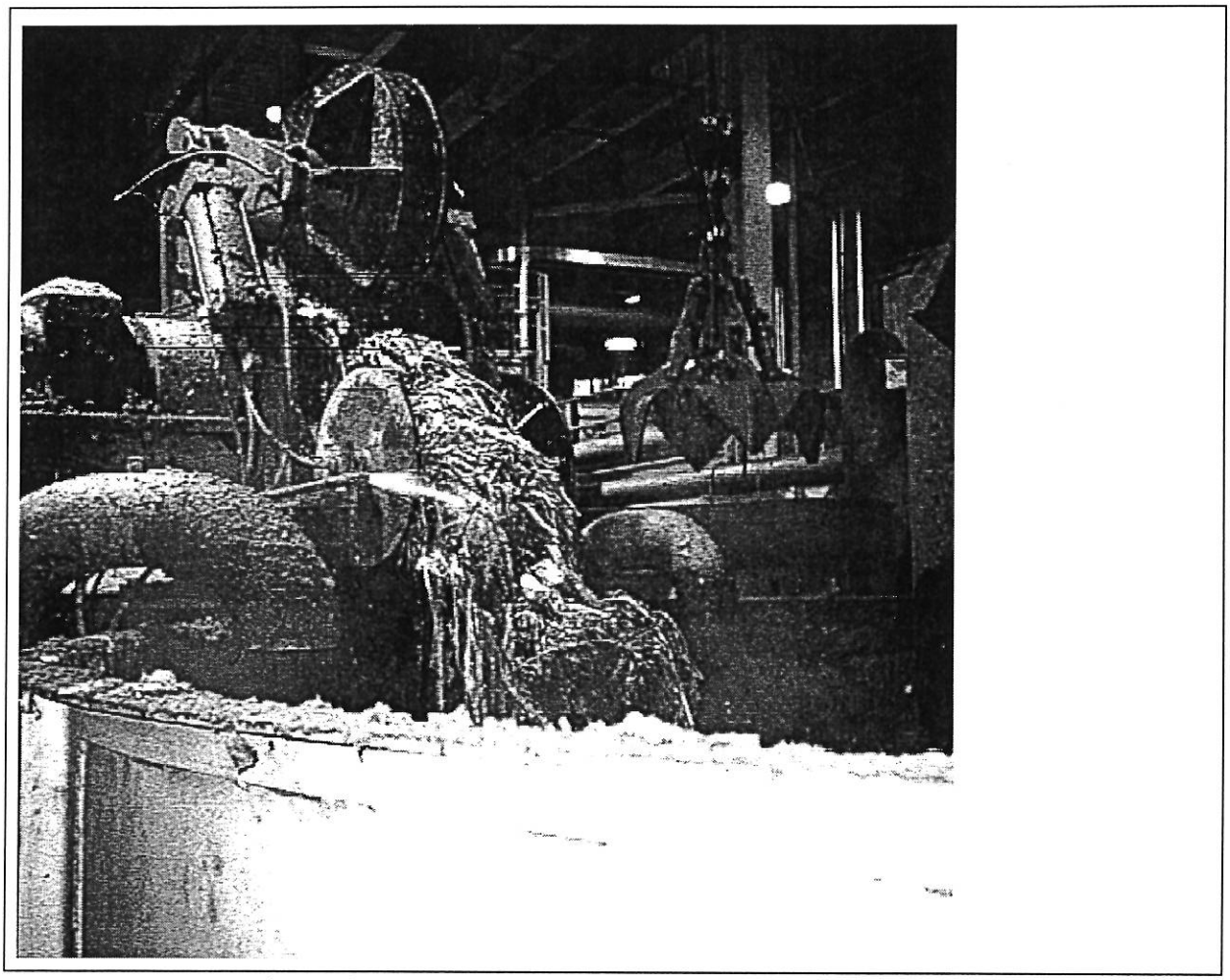
Thermo Black Clawson's M-14 Ragger incorporates the first significant change in ragger design since its development in the mid-1940s. Prior models depended on a weight wheel and an anchoring or long rope counterweight system to prevent rope slippage. Thermo Black Clawson's innovative design features the constant nip load of two 6-inch diameter pneumatic cylinders, which eliminate the need for anchors or counterweights.



RAGGER BEING BUILT AT A THERMO BLACK CLAWSON FACTORY

Ragger

The Thermo Black Clawson M-14 Ragger is designed as an accessory for use with the Hydrapulper to remove trash that results from slushing secondary fiber furnishes. It is supplied with an adjustable fabricated steel base that elevates the ragger to the proper operating height at the side of the Hydrapulper tub. Once positioned, the ragger uses the wire that binds the waste paper bales and the swirling hydraulic motion of stock being pulped in the tub to form a continuous wire-reinforced rope. The rope snags sheet plastic, rags, wet strength paper, and other light trash normally encountered in waste paper furnish.



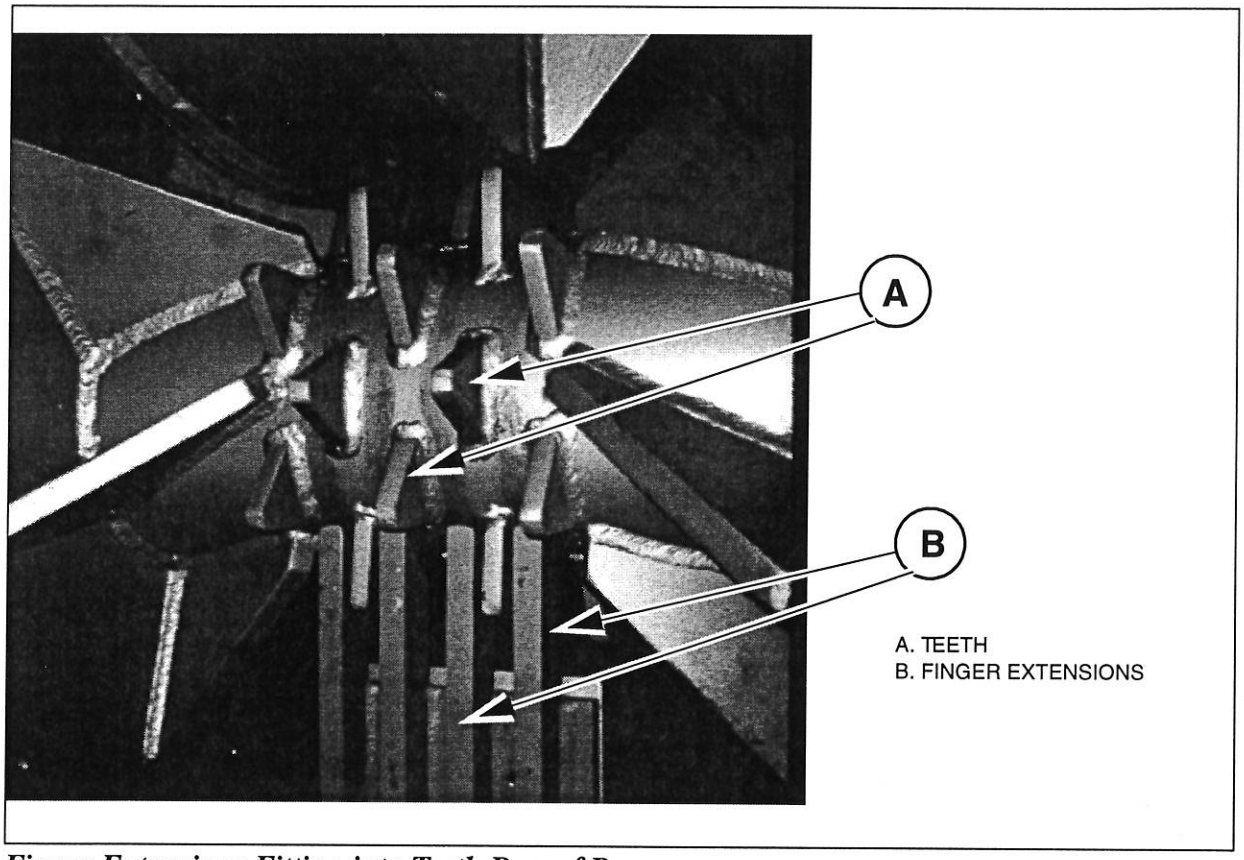
Rag Rope Passing Through Front of Ragger

The ragger's operating speed can be adjusted, according to the amount of trash in the furnish, to maintain a fairly consistent rope diameter. The ragger spool then reels the rope over the side of the tub for disposal.

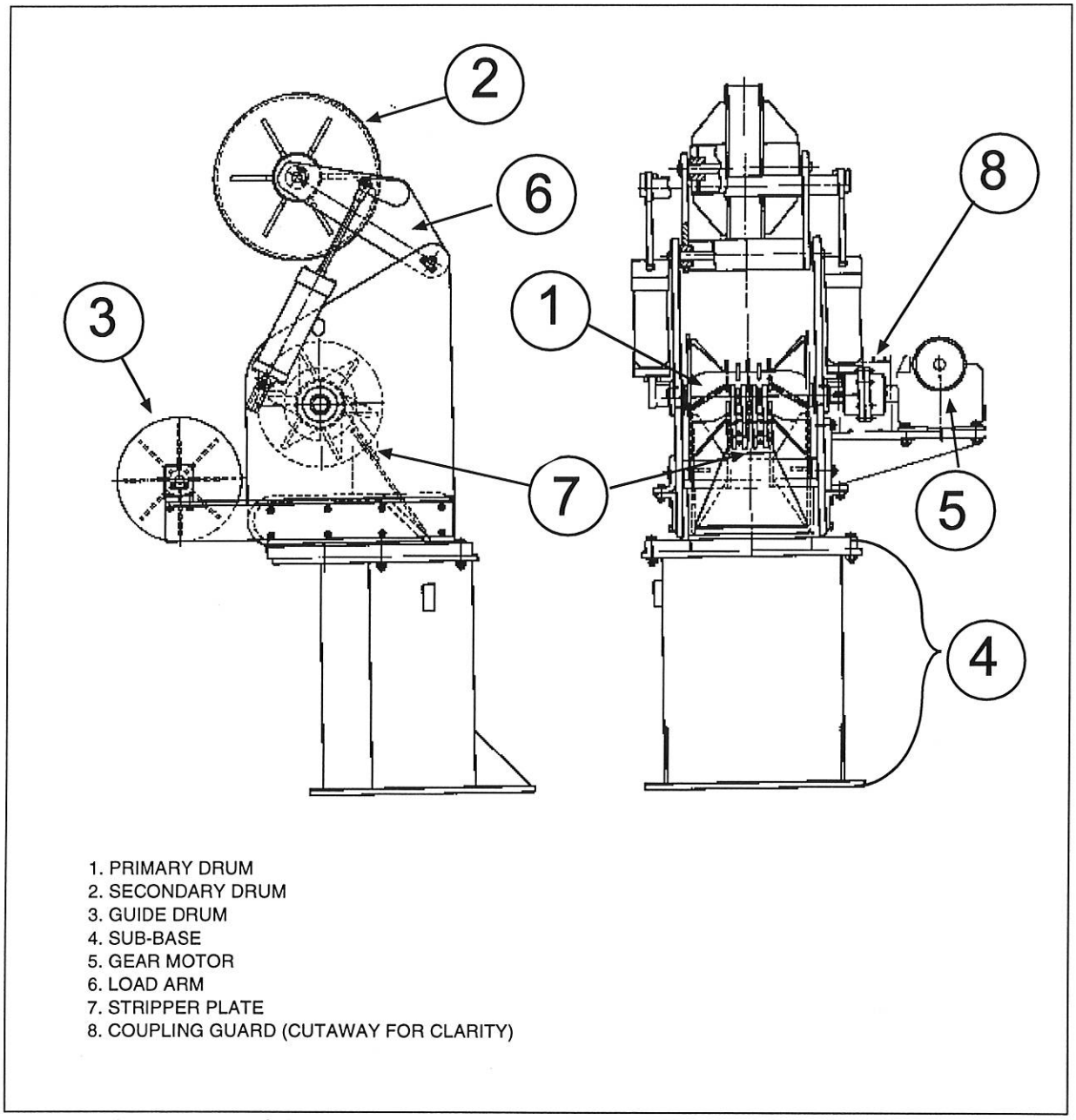
The same hydraulic action that forms the rope creates a washing and wringing action that limits fiber loss to only one pound per ton of material handled.

The M-14 Ragger is furnished with an adjustable front guide drum. The guide drum centers the rope into the bottom drum/top reel nip area. The guide drum can be adjusted out to change the angle of the rope into the tub. This may be necessary to prevent rope damage from bales entering the pulper.

The M-14 Ragger also features an adjustable stripper plate at the bottom rear of the drum. Finger extensions fit into the teeth rows on the drum to strip any stray wires off the drum to follow the primary rag rope.



Finger Extensions Fitting into Teeth Row of Ragger



Front and Side View of the M-14 Ragger

3.3 SPECIFICATIONS

Specifications Table

Item	Measurement
Weight with sub-base	7,005 pounds
Weight without sub-base	5,665 pounds
Air pressure - normal	20 to 30 PSI
Air pressure - maximum	60 PSI
Power	3 HP
Voltage options	380, 460, 575
Brakes	see attachment
Drum speed	4 RPM
Range of angle adjustment	10 degrees in either direction

3.4 FEATURES

The Thermo Black Clawson M-14 Ragger features include the following:

- Constant nip load securely holds rag rope, eliminating the need for anchoring or long rope counterweights to prevent rope slippage.

- Ragger driven by a 3 HP gear motor, efficiently removes the rag rope from the pulper tub, eliminating the need for a winch.

- Timers located within a control panel regulate the frequency and duration of primary drum operation. This enhances the formation of uniform rope diameter, aids in efficient removal of the rag rope, and requires minimal operator involvement.

- Ragger operation can be sequenced with Thermo Black Clawson's 24 inch or 30 inch rag rope cutters.

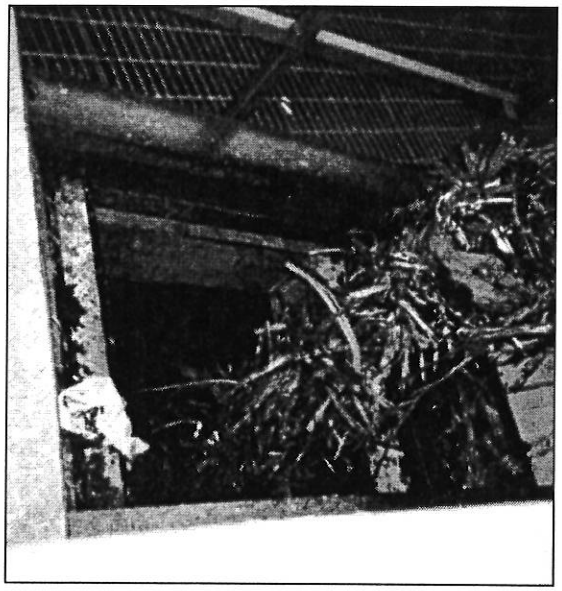
3.5 ACCESSORY EQUIPMENT

Rag Rope Cutter

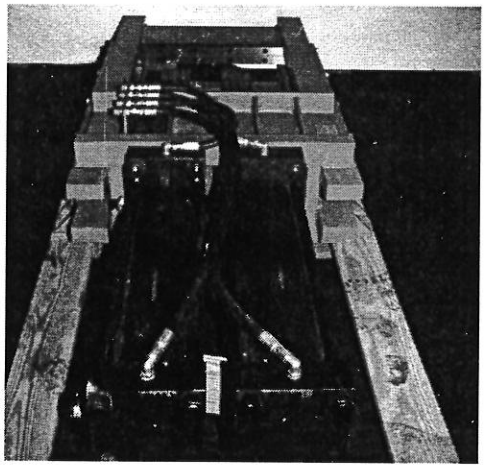
A continuous rag rope is formed by the action in the pulper tub. To aid in the disposal of the rope, the M-14 Ragger can be used with a hydraulic rag rope cutter that has either a 24 inch or 30 inch square opening. The cutter can be used to chop the rope into 2' or 3' long sections for easier disposal. The cutter is a double cylinder guillotine design with a replaceable hardened steel knife blade and anvil. It is furnished complete with a hydraulic system that includes a 15 HP motor and pump capable of developing 2,000 PSI pressure.

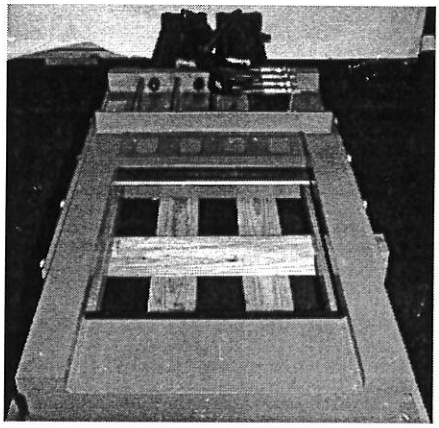
Features of the Thermo Black Clawson Rag Rope Cutter include the following:

- 24 inch or 30 inch square opening, enables cutting ropes up to 18 inch maximum.
- Normally positioned horizontally following the ragger
- Double acting hydraulic cylinders, 7 inch bore
- Can be sequenced with Thermo Black Clawson M-14 Ragger for automatic rope cutting
- Provides safe, convenient method of rag rope length control for easier handling and disposal
- Rugged, compact, heavy duty design



ABOVE: RAG ROPE PASSING DOWN THROUGH RAG ROPE CUTTER





RIGHT: RAG ROPE CUTTER ON WOODEN SKID

Rag Rope Cutter

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**

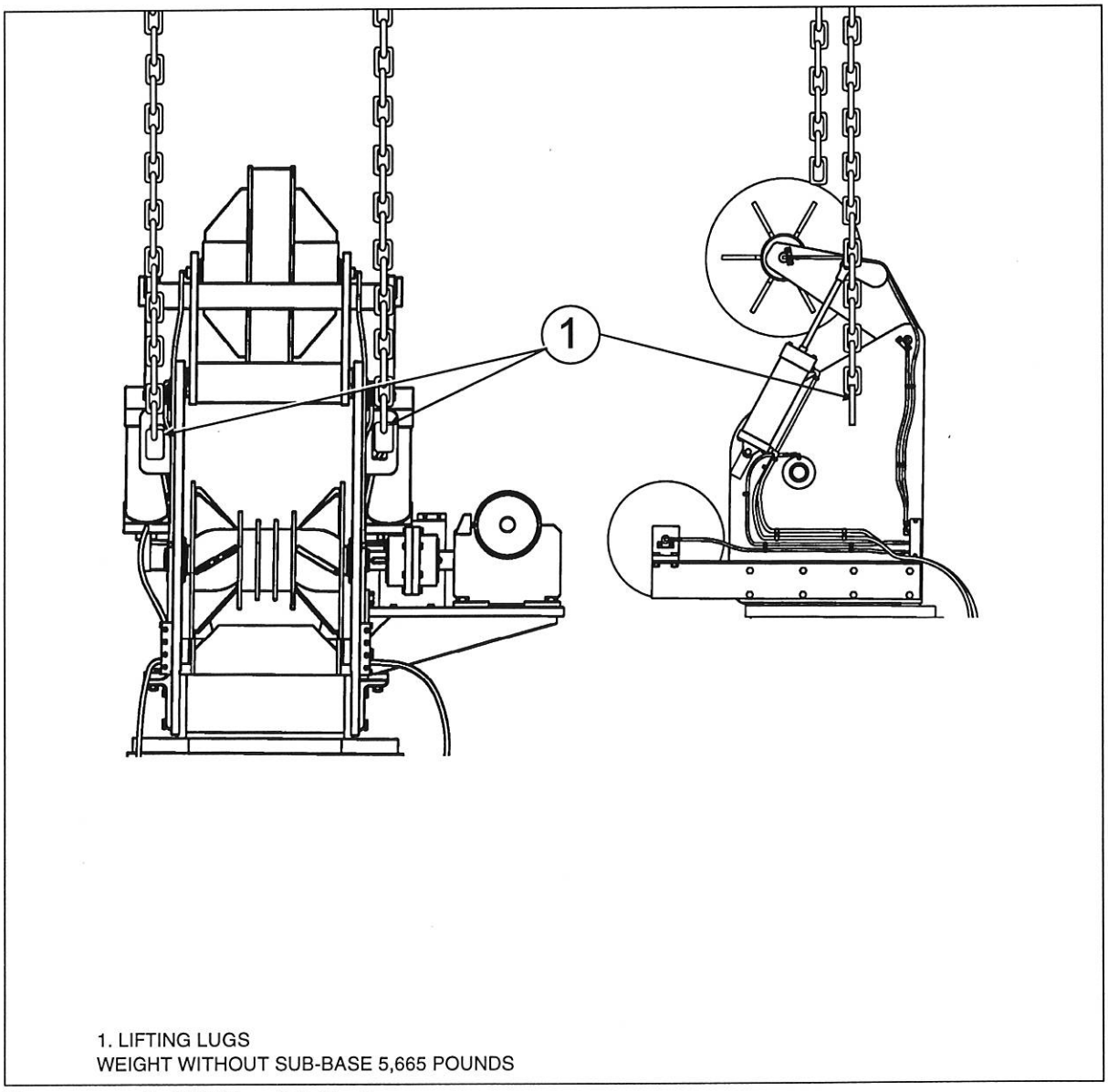
Bracing Material

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 eyebolts and 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.



1. LIFTING LUGS
WEIGHT WITHOUT SUB-BASE 5,665 POUNDS

Recommended Lifting Method

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. Instead, remove these items from the unit and store them indoors.
- 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

ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD READ AND UNDERSTAND ALL SAFETY INFORMATION BEFORE USING OR SERVICING THE EQUIPMENT AND SHOULD HAVE ACCESS TO THIS INFORMATION 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.

Do not exceed the maximum operating pressure of the air cylinders. Maximum safe pressure of the air cylinders is stated on the certified drawings.

Lock out ragger, pulper, and rag rope cutter before servicing. All energy sources and stock supply must be shut-off and locked out properly on the ragger, pulper, and rag rope cutter before and during installation, maintenance, inspection, cleaning, or adjusting the ragger. The ragger, pulper, and rag rope cutter must all be at zero mechanical state (ZMS) before any service work is performed.

WARNING

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

Check disconnect. Try to start motor before servicing unit.

Bleed off pressure and 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. All factory installed attachments are tightened to industry standard torque specifications.

Check torque of hold-down bolts prior to start up.

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.

CHECK THE CERTIFIED DRAWINGS TO DETERMINE IF ANY 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 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.

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

Leveling Instruments

A four foot carpenter's level is sufficient to adjust the base of the unit at installation. Level in both directions and avoid a *soft foot* condition.

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

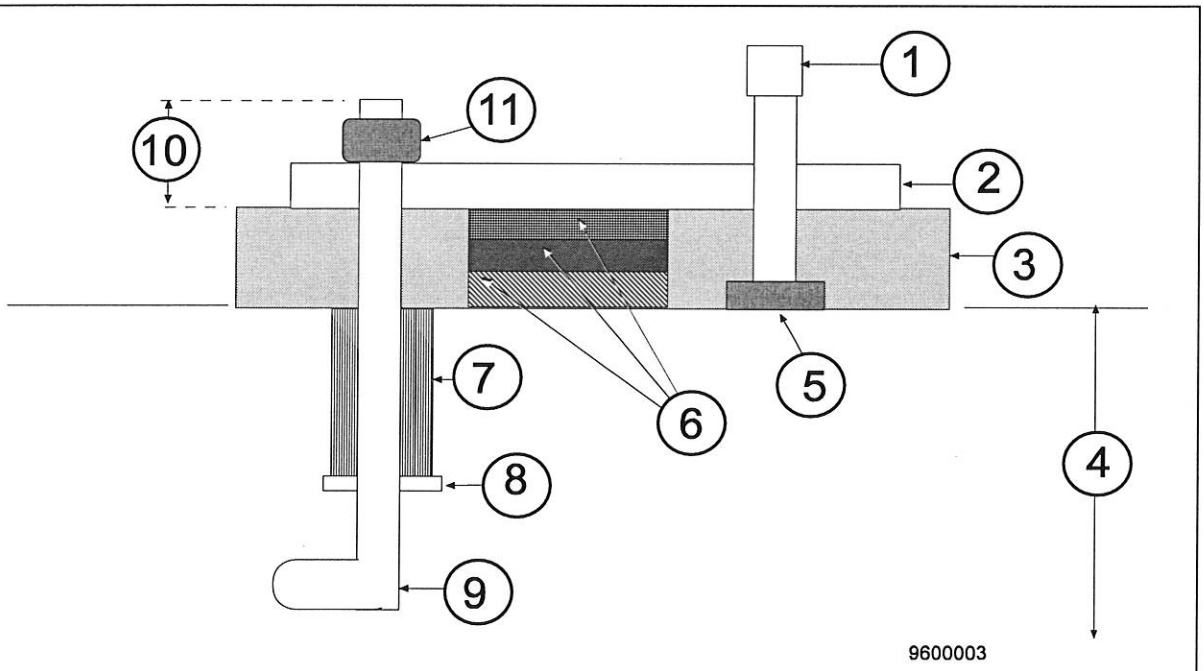
Steel shims will be required to level the unit before it is grouted in place. Mill supply must include 3 inch x 3 inch shims.

Anchor Bolts

Bolts must be sufficient length to project at least ¼ inch through the nut when the unit is bolted down. Allow for grout, thickness of soleplate/footpads, and thickness of nut when determining proper bolt length. See the following sketch for typical anchor bolt arrangement. Your certified drawings call out the anchor bolt sizes, typical spacing, and layout. Thermo Black Clawson recommends that anchor bolts be encased by using sleeves (as shown) to make allowance for minor deviations in mounting hole location. Several sleeve types are commercially available.

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.

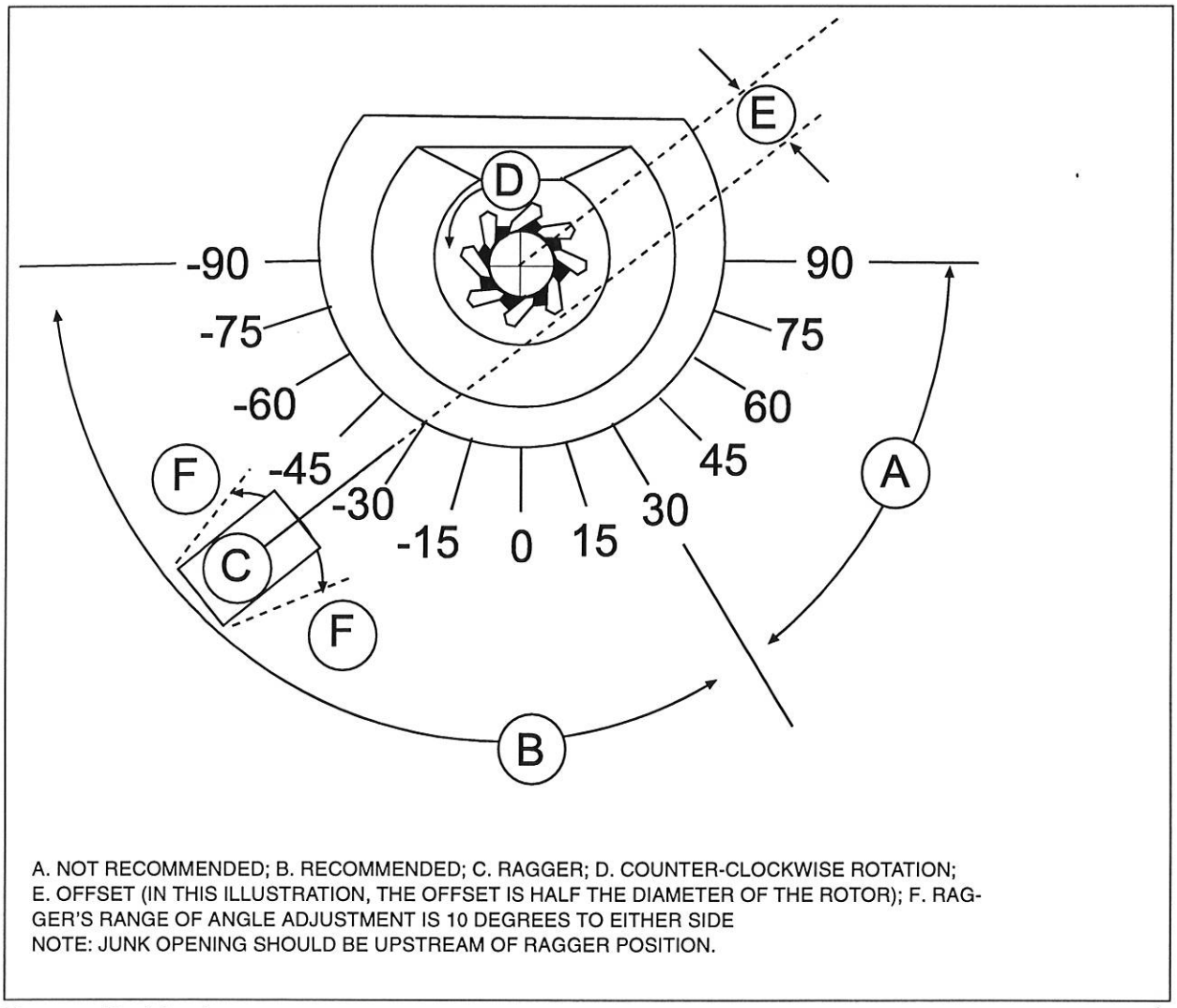


1. LEVELING SCREW; 2. BASE PLATE; 3. GROUT; 4. FOUNDATION; 5. STEEL BLOCK; 6. SHIM PACK; 7. SLEEVE; 8. WASHER; 9. ANCHOR BOLT; 10. DISTANCE PROVIDED IN CERTIFIED DRAWINGS; 11. NUT

Recommended Anchor Bolt Method

Positioning, Leveling, and Grouting

- Install the fabricated ragger base over the anchor bolts.
- Assemble the washers and nuts on the anchor bolts. Do not tighten the anchor bolts.
- Lift and position the ragger onto the fabricated base. See "Unloading/Handling" on page 23.
- Position centerline to be tangent to outside diameter of rotor.
- Fasten the base and the ragger together with the bolts provided.
- Level the ragger by using a 4 foot carpenter's level on top of the ragger base and shimming underneath the base. Level in both directions and use care not to distort the alignment of the unit when shimming.
- In accordance to industry standards, snug the nuts on the anchor bolts to hold the unit while the grout is poured and sets.



A. NOT RECOMMENDED; B. RECOMMENDED; C. RAGGER; D. COUNTER-CLOCKWISE ROTATION; E. OFFSET (IN THIS ILLUSTRATION, THE OFFSET IS HALF THE DIAMETER OF THE ROTOR); F. RAGGER'S RANGE OF ANGLE ADJUSTMENT IS 10 DEGREES TO EITHER SIDE
NOTE: JUNK OPENING SHOULD BE UPSTREAM OF RAGGER POSITION.

Ragger Positioning

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.
- No parts are loose, worn, damaged, or missing.
- All personnel are clear of the equipment.

A FIRST-TIME CHECKOUT SHOULD INCLUDE THE FOLLOWING:

- Check the freeness and rotation of the primary drum, secondary drum, and guide drum.
- Check all electrical connections and make sure that the motor rotates in the proper direction.
- Check ragger alignment to rotor in pulper.
- Check the clearance of the stripper plate to the primary drum (1/32 inch). ✳
- Check that all bearings are greased.
- Check that all guards are in place.
- Check that cylinders have air supply and actuate properly.

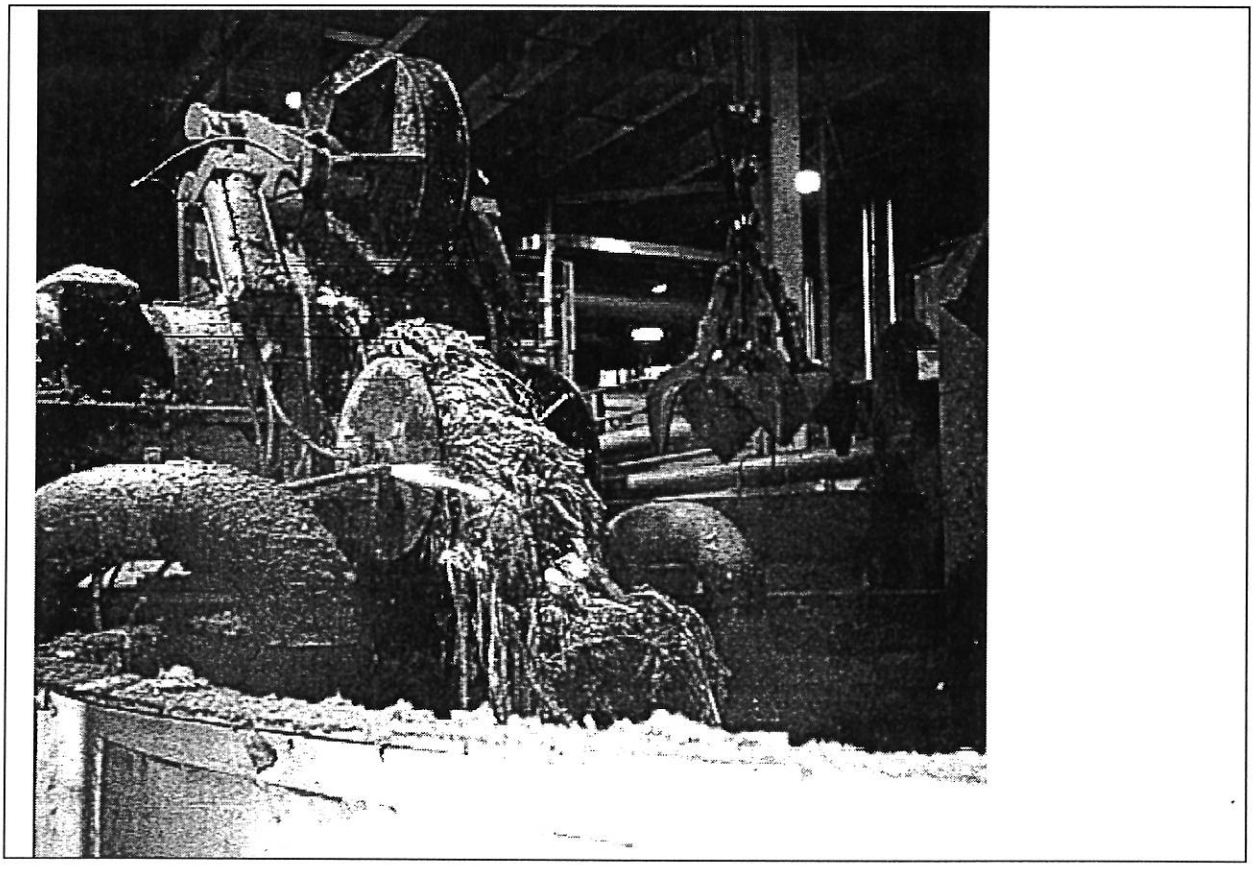
7.2 OPERATION

Before starting the ragger, check to see that the gearhead motor has been properly lubricated in accordance with the manufacturer's recommendations.

Starting the Rag Rope

> **WARNING**
>
> Be sure that the pulper and rag rope cutter are shut off and brought to a zero mechanical state (ZMS).

Cut five strands of soft bailing wire ten to fifteen feet in length. Run the wire through one end of a swivel until the strands are of equal length on each side of the swivel. Bend the strands at the swivel and tie them together in a bundle with a piece of wire. (The *starter* rope may be strengthened by using several pieces of dryer carrier rope in addition to the wires.) This now makes ten strands of wire five to seven and one half feet long. Run a piece of hemp rope 1 1/2 to 2 inch in diameter and 30 feet long through the other end of the swivel until it is centered. Tie the rope together near the swivel at the end and several places in between.



Rag Rope Passing Through Front of Ragger

With the pulper and rag rope cutter shut down and in ZMS, use a piece of wood plank to carry the starter rope until it passes over the guide drum until its own weight will guide it into the pulper slurry. Lower the secondary drum onto the primary drum and run the motor in the forward direction to feed the rope into the operating portion. Start the pulper.

The swivel should not be allowed to get into the stock. It will become entangled with wires.

The swirling stock in the Hydrapulper will start rags, sheets of plastic, wires and wet strength papers twisting around the wires. This accumulation of rejects forms what is called a rag rope. The rag rope should be allowed to build up until it is between 10 to 12 inches in diameter. The rope size will depend upon the type of contaminants.

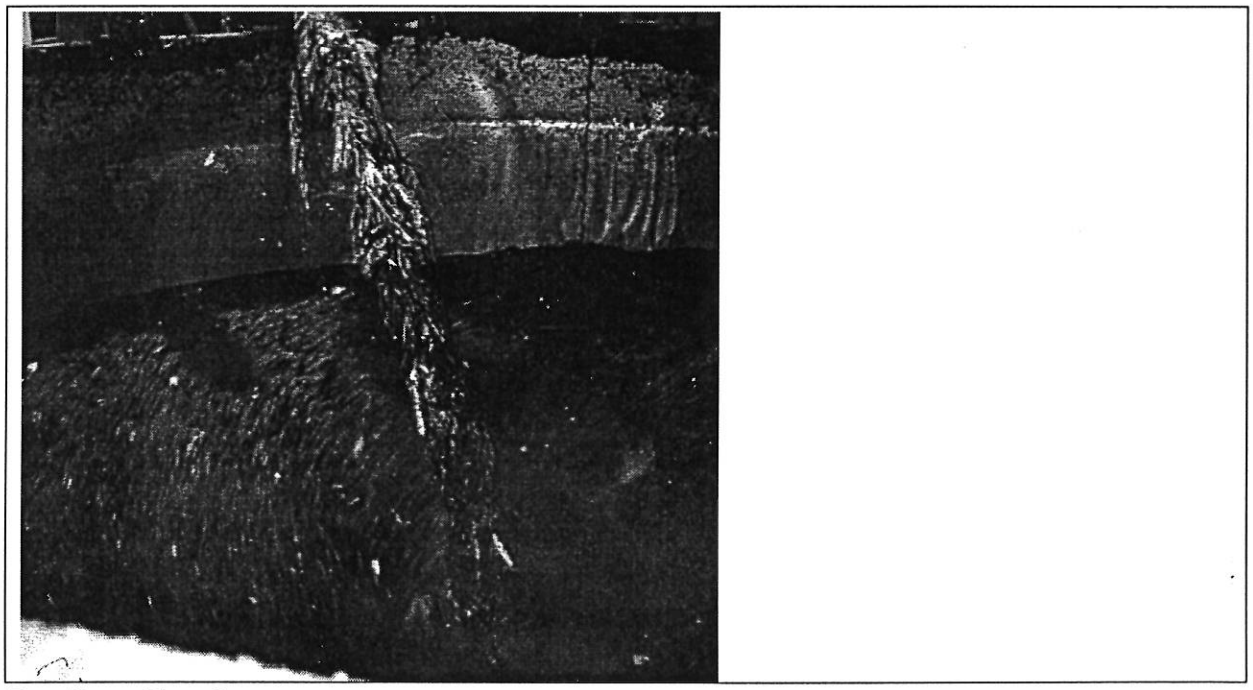
If the ragger has an automatic control, set the ***ON*** timer and ***OFF*** timer for the desired values and set the selector switch on ***AUTOMATIC***.

The operator should watch the rope carefully and adjust the ***ON*** timer and ***OFF*** timer for a ragger speed which will maintain a rag rope of approximately 10 to 12 inches in diameter.

White water is discharged onto the rope at a point below the top of the Hydrapulper tub. This flow of water prevents recoverable fibers from being trapped in the rag rope and washes them back into the pulper.

Once a rope is started, most mills do not run it completely out of the tub. It is drawn up above the water level during maintenance and returned to operating position when the work is completed.

When cutting off the extracted rag rope, take care not to make the cut too close to the ragger, as the weight of the rope inside the Hydrapulper might pull the rope out of the ragger. A hydraulic rag rope cutter, properly located, is recommended for this application.



Rag Rope Forming

Determining Timer Settings

The rate of pull out will depend on the amount of contaminants in the pulper. Optimum performance yields a rag rope of about 10 to 12 inch in diameter. A typical starting point for the timer is to operate the ragger every 20 minutes for 3 to 4 seconds. This sequence should be adjusted based on the contaminants in the furnish. A consistent pull out of rope will result in a consistent rope diameter. If the rope is left in one position too long a large ball, which may be too large to clear the frame of the ragger, will form. If the pull out is too frequent, the diameter of the rope will not be sufficient to prevent breakage. A reversing motor on the ragger allows the operator to pull the tail out part way to check the formation.

The ragger will need to be shut off if the conveyor is temporarily shut off. We recommend pulling the rope out of the pulper to prevent damage to its diameter during shut down. When the pulper production is resumed, the ragger should be put back into automatic.

Normal Shut Down

Turn the selector to the ***OFF*** position and pull the rope out of the pulper.

Emergency Shut Down

Hit the ***Emergency Stop*** button.

7.3 CONTROL INFORMATION

The basic components of the M-14 Ragger include the following:

One primary drum mounted on a shaft supported by two side frames.

One secondary drum suspended from a shaft by load arms pneumatically loaded against the primary drum, pinching the rag rope between.

The load arm is operated by the cylinder control valve. This is a three position hand valve. During normal operation of the ragger, this valve should be positioned on ***Load***. This position will load the secondary drum against the rag rope on the primary drum with a constant force. The force can be adjusted by adjusting the filter regulator for optimum pressure.

During the start of a new rope or during maintenance of the ragger, it might be necessary to raise the load arm. This is done by moving the cylinder control valve to ***Raise***. The load arm will raise until the cylinder has extended its full length or until the cylinder control valve is switched to ***Stop***. When the cylinder control valve is switched to ***Stop***, the load arm will freeze at that level.

The primary drum is coupled to a reversible gearhead motor which is controlled in one of the following ways.

Manual Operation

The motor is controlled by two push-buttons. One push-button pulls the rag rope out of the tub, the other push-button lowers the rag rope in the tub. The motor will start when either of these buttons is pushed and will continue to operate until the button is released.

Automatic Operation

The motor is controlled by a three-way selector switch marked ***Automatic - Off - Hand***.

- With the selector switch set on ***Automatic***, two timers are activated. One controls the ***On Time*** which is the length of time the ragger motor will operate. It can be set for any interval from zero seconds to six seconds. The other timer controls the ***Off Time*** which is the length of time between operations of the motor. It can be set for any interval from zero seconds to twenty minutes. On ***Automatic***, the rotation of the ragger drum is always clockwise when viewed from the side opposite the motor. This draws the rope out of the tub.
- With the selector switch set on ***Hand***, the ragger motor is controlled by push-buttons. One button is marked ***Raise*** and, when depressed, will cause the ragger to draw the rope out of the tub. The other button is marked ***Lower*** and will cause the ragger to feed the rope into the tub. Depressing either of these buttons will cause the ragger motor to operate until the button is released.

7.4 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

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.

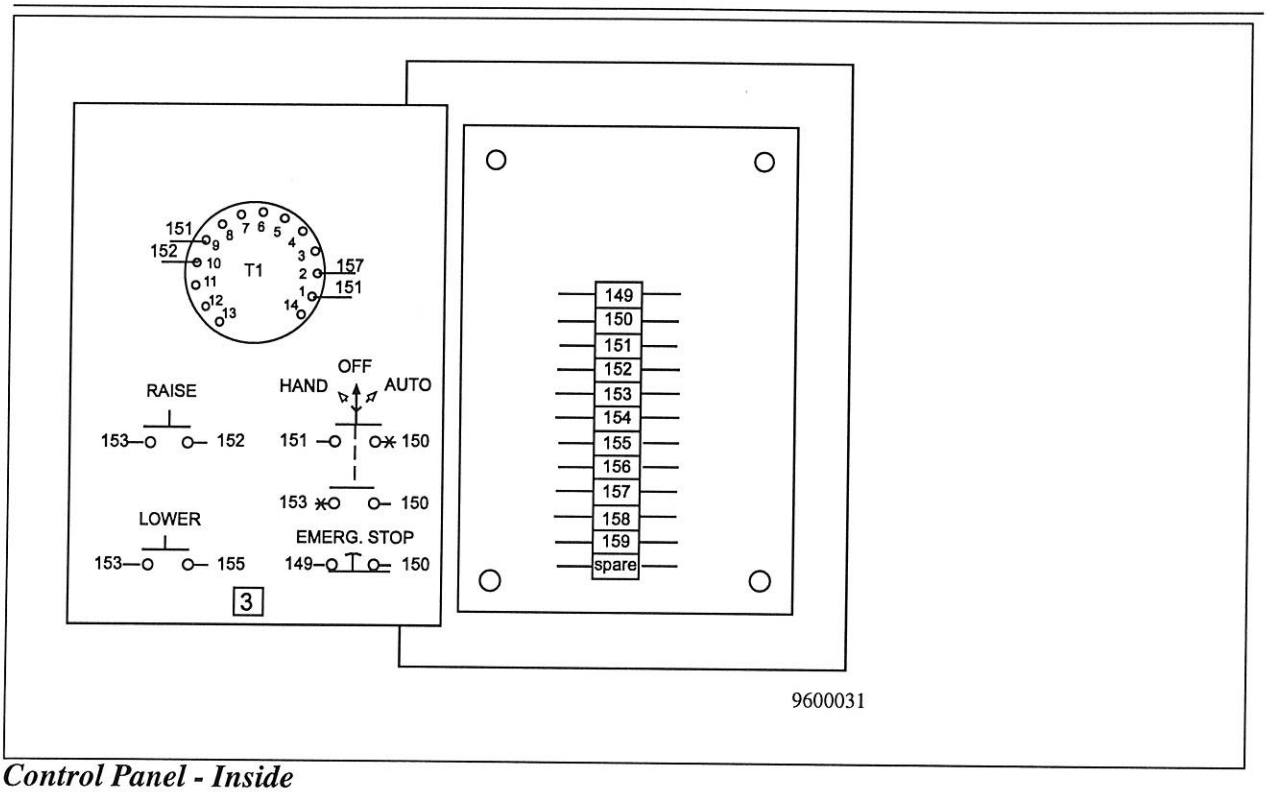
Control Panels

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.

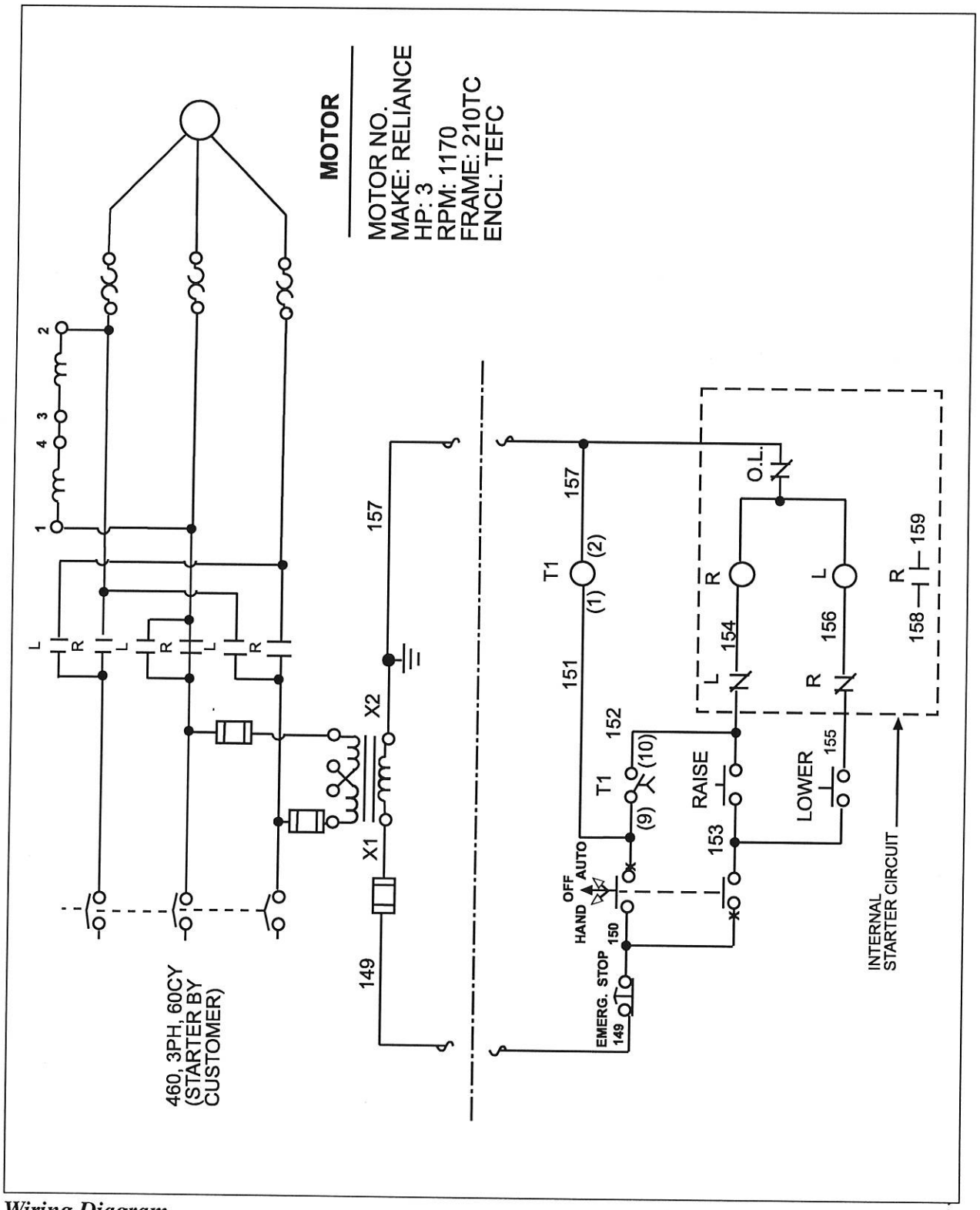
The power feed should include an equipment grounding conductor to bond the enclosure to building earth ground.

DANGER

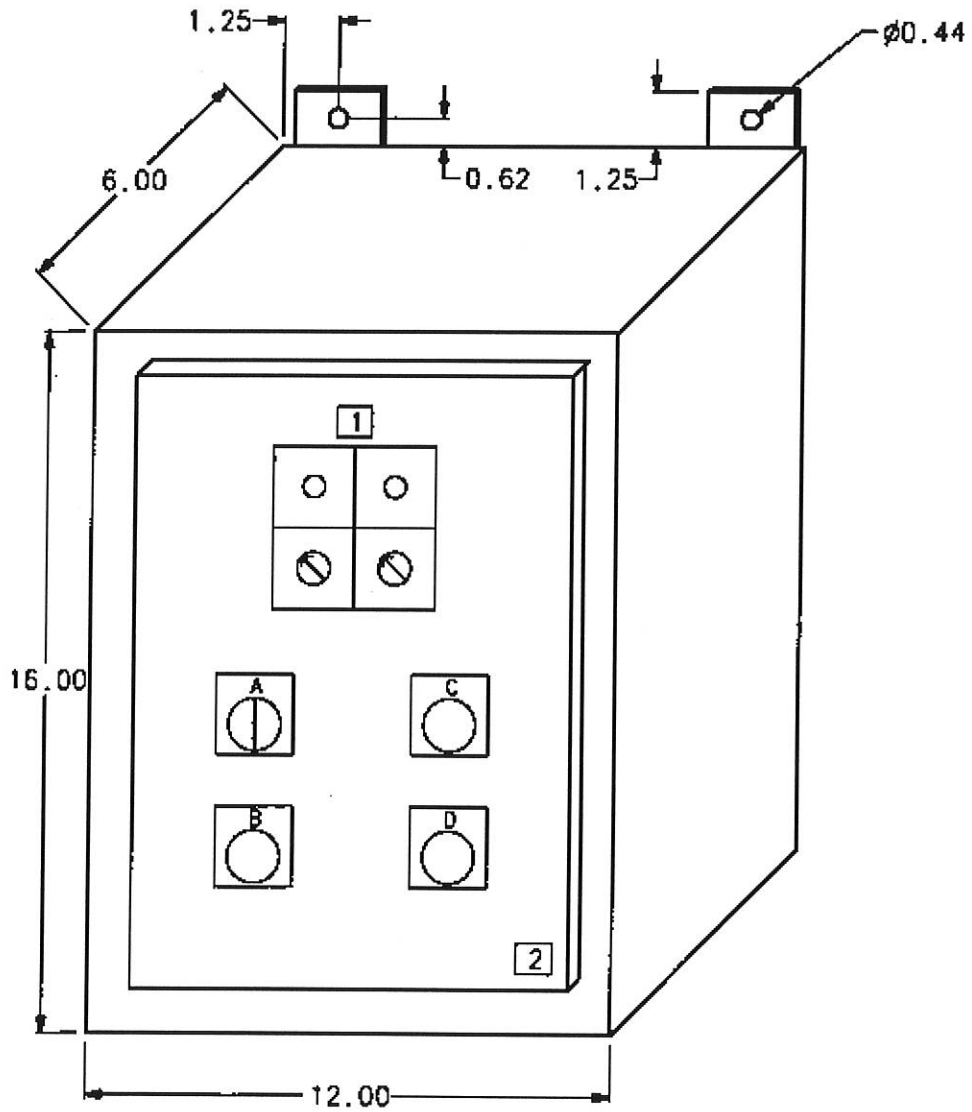
Touching exposed live electrical wires will cause serious personal injury or death.



Control Panel - Inside



Wiring Diagram



1. CYCLE TIMER; 2. DANGER TAG; A. HAND / OFF /AUTO-MATIC; B. EMERGENCY STOP; C. RAISE; D. LOWER

Control Panel - Face

- Power feed should have a disconnect or breaker capable of being locked in the open position.
- Wire field devices per certified 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.

8.0 MAINTENANCE

8.1 ROUTINE MAINTENANCE

Perform a general inspection of the equipment at least every three months or every 1000 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.

To prepare for a maintenance check, inspection, or maintenance procedure, shut down and lock out the ragger, the pulper, and the rag rope cutter and bring all of them to a zero mechanical state (ZMS) according the proper procedure. A wash down of internal parts and surfaces may be required.

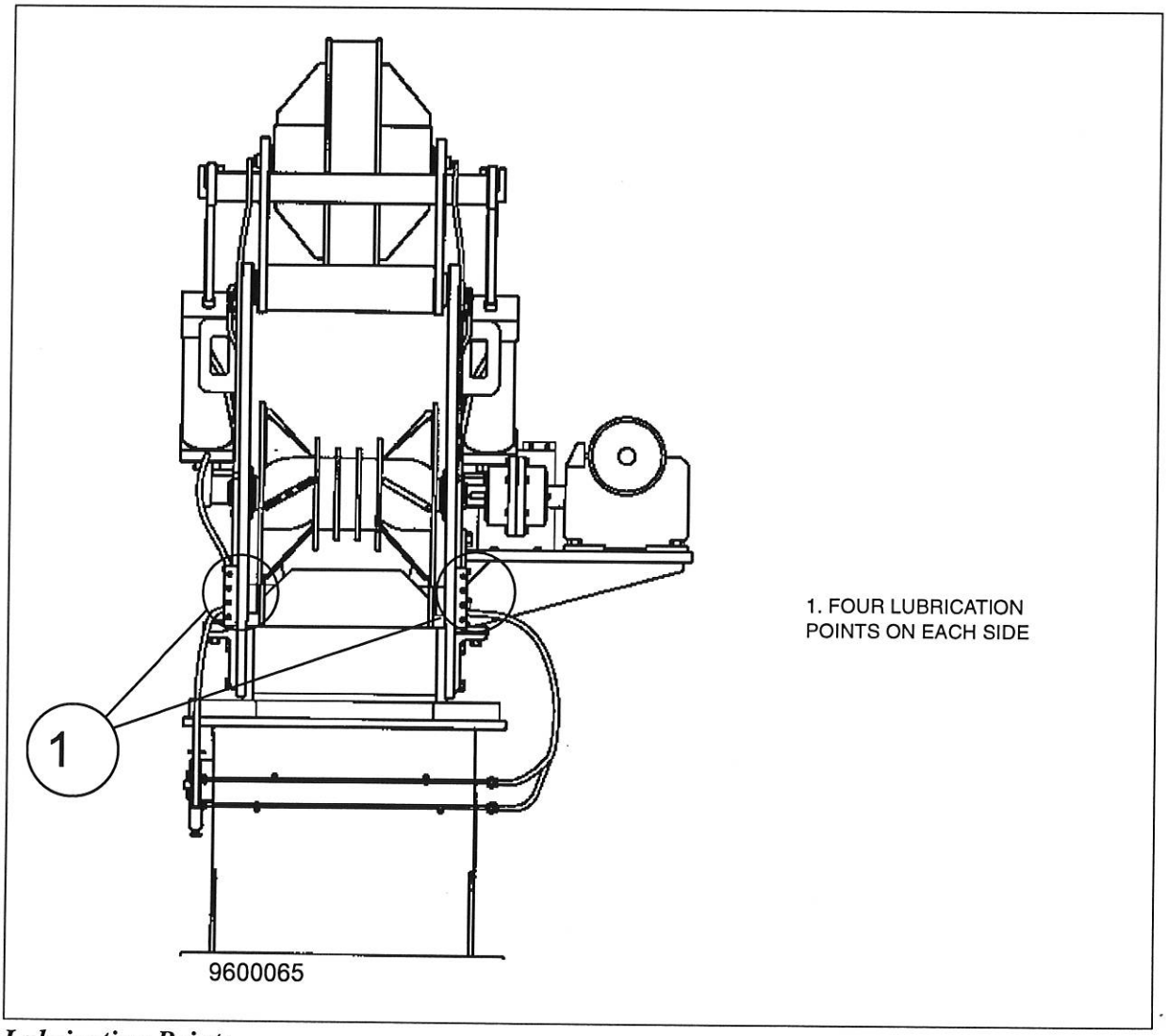
Components Requiring Routine Maintenance

COMPONENT	SERVICE	FREQUENCY
Primary drum teeth	repair or rebuild	yearly
Stripper plate	repair or rebuild	yearly
Stripper plate	adjustment	monthly
Bearings	lubricate	weekly
Bearings	complete cleaning and packing with fresh grease	yearly or whenever there is a major rebuild or cleaning
Bearings	replace	as needed
Air cylinders	replace	as needed
Filter regulator	check for correction adjustment	daily

Lubrication

A grease manifold is provided to give a central lube point. Use a lithium-based grease, NLGI 2, for cup service, gear boxes, ball and roller type bearings. This grease shall not contain fillers such as resin, resinous oils, soapstone, powered mica, asbestos, clay, or any other type of grit. The following are some of the lubricants that meet the minimum requirements of this specification. Mobil - Mobilith SHC 220 and Texaco - Starplex 2. Note: We don't imply that all products are of the same quality.

Maintaining a clean work environment is critical when equipment greasing is performed. Grease fittings should be wiped clean prior to grease injection to prevent contaminants from entering the equipment. Bearing housings should be maintained 1/3 to 1/2 full of grease. Over greasing should be avoided because over greasing can result in excessive heating. Periodic relubrication should be supplemented by complete cleaning and packing with fresh grease.



Lubrication Points

8.2 TROUBLESHOOTING

Troubleshooting Guide

CONDITION	CHECK FOR
Rope not being removed from tub	- Worn teeth on drum - Ball, lump, or kink area preventing rope from passing through top drum/bottom drum nip area - rope held up on something following ragger, such as not passing smoothly through floor or cutter opening
Damage or breakage of rope	- Rope too long in pulper tub--being damaged by rotor - Rope being removed too fast, forming small diameter areas which break easily - Uncut wires on bales, solid bales hitting rope
Wires wrapping drum	Worn stripper plate or clearance too large

See "Front and Side View of the M-14 Ragger" on page 18.

Adjusting Stripper Plate

Adjust stripper plate to 1/32 inch clearance by loosening the stripper plate hold down bolts and adjusting accordingly.

9.0 SERVICE 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

605 Clark Street

Middletown, OH 45042

Phone: 1-513-424-7400

Fax: 1-513-422-1168

After-hours emergency parts and service (800) 448-5422

E-Mail: CUSTSERV@BLACKCLAWSON.COM

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 numbers. (Product identification numbers include the serial number, shop order number and model number.) Generally, allow eight to twelve weeks for delivery.

Do not modify the equipment without written authorization from Thermo Black Clawson. Unauthorized modification may impair the function, shorten the machine life, and/or render built-in safety features useless.

Recommended Spare Parts

Description	Quantity
Cylinder, Parker Series 2A Heavy Duty Air - Model #6BB-2AS1414	1
Cylinder, Parker Series 2A Heavy Duty Air - Model #6BB-2A1414	1
Motor, Reliance - Master XL Right Angle Gear #213CGA04	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
drum	wheel or reel.
EMI	electromagnetic interference
GPM	gallons per minute
HP	horse power
OCC	old corrugated container
OD T/D	oven dried tons per day
PSI	pounds per square inch
stripper plate	doctor fingers, stripper fingers, or stripper blade.
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.

12.0 BRAKE INFORMATION ATTACHMENT

12.1 STEARNS

Sheet 300.8 (effective 5/31/95)

Installation and Service Instructions for 87,700 Series Double C-Face Coupler Brake

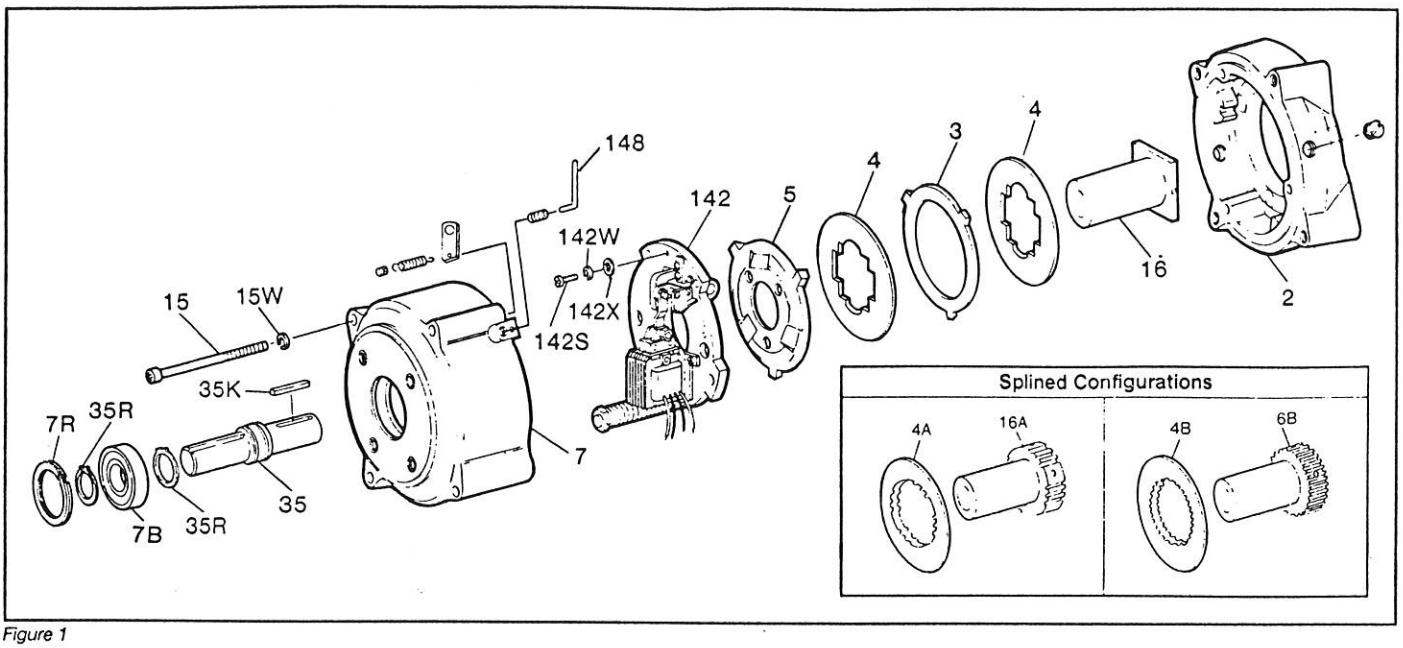


Figure 1

Important

Please read these instructions carefully before installing, operating, or servicing your Stearns brake. Failure to comply with these instructions could cause injury to personnel and/or damage to property if the brake is installed or operated incorrectly. For definition of limited warranty/liability, contact Rexnord Corporation, Stearns Division, 120 North Broadway, Milwaukee, Wisconsin 53202, (414) 272-1100.

Caution

1. Installation must be made in compliance with all local safety codes including Occupational Safety and Health Act (OSHA). All wiring and electrical connections must comply with the National Electric Code (NEC) and local electric codes in effect.
2. Do not install the brake in atmospheres containing explosive gases or dusts.
3. To prevent an electrical hazard, disconnect power source before working on the brake. If power disconnect point is out of sight, lock disconnect in the *off* position and tag to prevent accidental application of power.
4. Make certain power source conforms to the requirements specified on the brake nameplate.
5. Be careful when touching the exterior of an operating brake. Allow sufficient time for brake to cool before disassembly. Surfaces may be hot enough to be painful or cause injury.
6. Do not operate brake with housing removed. All moving parts should be guarded.
7. Installation and servicing should be performed only by qualified personnel familiar with the construction and operation of the brake.
8. For proper performance and operation, only genuine Stearns parts should be used for repairs and replacements.
9. After usage, the brake interior will contain burnt and degraded friction material dust. This dust must be removed before servicing or adjusting the brake.

   DO NOT BLOW OFF DUST using an air hose. It is important to avoid dispersing dust into the air or inhaling it, as this may be dangerous to your health.

   a) Wear a filtered mask or a respirator while removing dust from the inside of a brake.

   b) Use a vacuum cleaner or a soft brush to remove dust from the brake. When brushing, avoid causing the dust to become airborne. Collect the dust in a container, such as a bag, which can be sealed off.

General Description

The 87,700 Series coupler is a spring set, electrically released, self adjusting brake. The double C-face allows the brake to directly couple a C-face motor to a C-face gear reducer. Or, for in-line application, the brake can be mounted directly to a foot mounted C-face motor, using the bearing mounted output shaft as an in-line drive shaft.

Note: Coupler brake is designed for in-line applications only. Do not apply overhung or side load to brake output shaft.

Operating Principle

The 87,700 Series brake utilizes one, two or three rotating friction discs driven by a hub which is mounted on the motor shaft. The solenoid air gap is factory set, and normally requires no resetting even when changing friction discs. A wrap spring clutch permits the solenoid air gap to be adjusted automatically to compensate for friction disc wear or normal expansion.

When brake is wired into motor circuit, starting the motor will energize the solenoid and compress the pressure spring. This action removes the force against the disc pack components and allows the friction discs to rotate freely. De-energizing the motor de-energizes the solenoid and restores pressure spring force against the disc pack, thereby stopping and holding the load.

When the motor is *off* and the load is to be moved without energizing the motor, the manual release lever should be used. This removes the holding torque from the motor shaft, allowing it to be rotated by hand, however drag may be noted. The brake will remain in the manual release position until the release lever is returned manually to its *set* position or until the brake is reenergized electrically and the release lever or rod returns to its set position automatically.

Note: The motor should not be run with the brake in the manual release position to avoid overheating of friction disc(s).

I. Installation Procedure

Note 1: Check face of motor to which brake is to be mounted, to be sure NEMA dimensions of 0.004" T.I.R. on concentricity and face run out are met. Shaft run out is to be within 0.002" T.I.R. Maximum shaft end float is 0.020". Use standard length NEMA shaft.

Note 2: The effectiveness of the dust-tight waterproof brake enclosure depends on a fully enclosed motor C-face as the brake face is not sealed.

P/N 8-078-927-07
S-369-1

A. Remove hub (16) from brake assembly. With key (not furnished) in place on motor shaft, slide hub (square, or splined, end first) into shaft to 1" (± 1/32") of standard motor C-face. Securely tighten both set screws to 87 in-lbs of torque on 1/4" diameter, 156 in-lbs on 5/16" and 290 in-lbs on 3/8".

Note 3: On most applications, particularly in vertical position, a set screw dimple drilled into shaft is recommended.

B. Remove housing bolts (15), lock washers (15W) and housing (7).

C. Depress solenoid plunger (29) and tie plunger to frame (79).

D. Remove entire support plate assembly (142) by evenly unscrewing screws (142S). Remove screws, conical spring washers (142W), and flat washers (142X).

E. Remove pressure plate (5), friction disc (4) and stationary disc (3).

Note 4: Brakes with a single friction disc do not have stationary discs. Vertically mounted brakes will have special pins which hold spacer springs and, in some cases, spring washers (except one disc vertical below). Note color coded sequence of springs and location of washers, if used, or refer to Sheet 301.3 for proper assembly of vertical mounting components.

F. Attach endplate (2) to NEMA C-face of motor using four 1/2-13 socket head cap screws and medium spring lock washers (not supplied) torque per manufacturer's specifications. (Head of cap screws must not project above friction surface.)

Note 5: If motor, with or without reducer, is to be ceiling mounted after assembly, entire brake will have to be rotated 180° or "upside down" so it will be positioned with solenoid plunger (29) above frame when final assembly is mounted on ceiling. Similarly, for horizontal wall mounting, rotate 90°.

G. Reassemble friction discs (be sure friction discs slide freely, file I.D. if necessary), springs (if vertical), stationary discs, and pressure plate in correct sequence and position. All parts must slide freely. The universal mounting pressure plate presently used has three tapered reliefs on outboard face. However, some older brakes used a pressure plate with a single tapered relief marked *top*, which must be installed with relief in area of sector gear (31).

H. Mount support plate assembly, torque screws to 50 in-lbs in endplate. Conical spring washer installed under the screw head. Flat washer used under the conical spring washer only with aluminum support plate. Be sure that assembly is mounted with the solenoid in a vertical position (plunger above frame) as shown when brake is horizontal. If plunger was not tied down and has allowed the mechanism to overadjust, it will have to be reset before mounting support plate. In this case the lever arm (17) throat will be near, or touching, the pinion (32) teeth. Refer to Figure 6 and *Self-Adjust Maintenance*. Loosen pressure spring cap screw (19) until pressure spring (11) is free, mount support plate assembly to endplate, and retighten spring cap screw until snug. Do not overtighten! Torque to a maximum of 100 in-lbs.

I. Remove plunger tie-down. Manually lift solenoid plunger to maximum travel and release. Complete electrical connections. (See Section on *Electrical Connection of Brake*.) Depress solenoid plunger manually or electrically, and allow it to snap up. Repeat this process several times to set air gap on solenoid. (Check *Self-Adjust Maintenance* Section for proper gap measurement, or corrective action for improper gap.)

J. See Section on *Electrical Connection of Brake*, Note 2.

K. Assemble housing and shaft assembly, rotating shaft (35) to engage key (35K) into hub keyway. Be sure housing is assembled with manual release on right hand (solenoid) side (looking at output shaft side) or release lever (148) will not latch. Replace housing bolts and tighten evenly to 118 lb-ft of torque.

L. For reducer application, mount and secure brake/motor combination to mounting face of reducer.

For alignment when brake shaft is direct-connected to another shaft by a coupling refer to coupling manufacturer's suggested procedure. Side or overhung load is not permitted. Consult factory for reversing applications.

II. Electrical Connection of Brake

Note 1: Brake coil connections described here cover common motor connections. For nonstandard motors or control connections, contact respective supplier or Stearns Div.

Note 2: Be sure lead wires to coil are not tight or pinched, and that leads will not be rubbed by friction disc, trapped between solenoid plunger and frame, caught between lever arm and endplate, or by linkage.

Note 3: On brakes with space heater, connect to appropriate power source. Heater is to be energized continuously, including storage periods, if rust may occur.

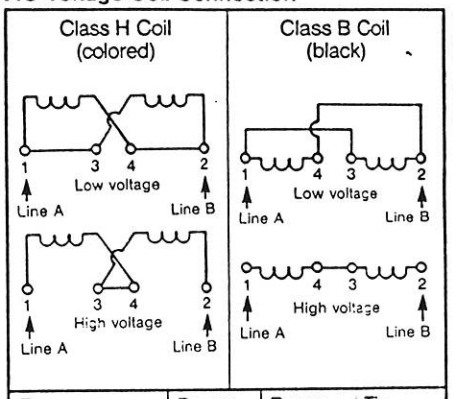
A. AC coils, single or dual voltage

1. Dual voltage coils may be factory preconnected for high voltage unless otherwise specified on brake purchase order. Checking coil connection is suggested.
2. On single voltage coils, connect coil to any two leads on single or three-phase motors of the same voltage as the brake. Refer to brake nameplate and coil number for correct voltage and frequency. See Figure 2 for dual voltage coil connection and connect to any two leads of single or three-phase motor of the same voltage. The brake can also be wired to external switch contacts providing proper voltage other than that used to control the motor. Normally, the motor and brake contacts are interlocked.

B. Connecting AC solenoid coils on dual voltage 230/460 three-phase motors

To use a 230 volt coil (or a 230/460 dual voltage coil connected for 230 volts) with a 230/460 dual voltage three-phase motor, the brake leads are connected across two motor terminals as shown, or other equivalent combinations. If a 230 volt brake coil is connected as shown in Figures 3 and 4 the motor can be operated on either 230 volts or 460 volts with no effect on brake operation.

AC Voltage Coil Connection



For	Power Line A	Power Line B	Tie Leads
Low voltage	1 and 3	2 and 4	-
High voltage	1	2	3 and 4

Figure 2

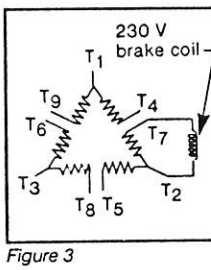


Figure 3

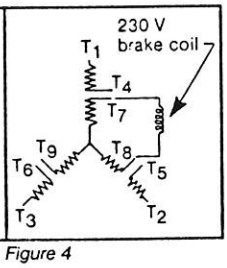
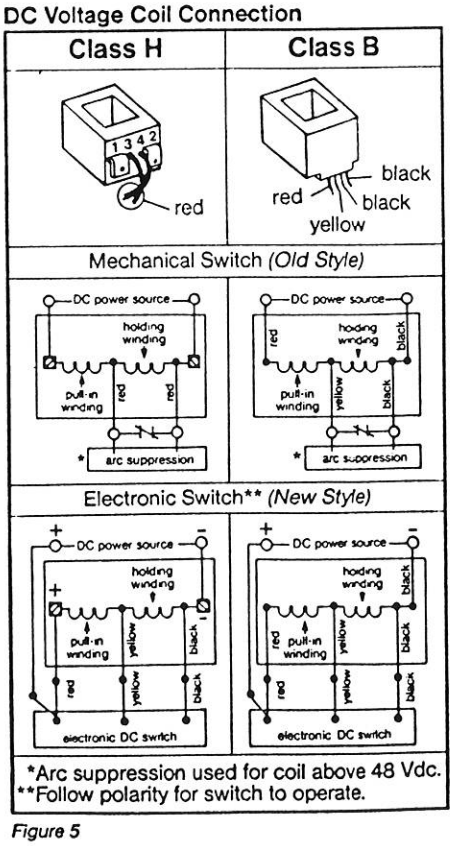


Figure 4

DC Voltage Coil Connection



*Arc suppression used for coil above 48 Vdc.
**Follow polarity for switch to operate.

Figure 5

C. DC coils - all models

1. All Stearns DC coils are single voltage dual winding. A high current pull-in winding is initially energized to start the plunger movement, while a low current holding winding is momentarily shunted from the circuit until the plunger has pulled in. The older design incorporated a mechanical switch mounted to the solenoid frame and actuated by an arm mounted to the plunger to bring the holding winding into the circuit. In addition, coils over 48 Vdc have an arc suppression module in parallel with the switch contacts to protect the contacts from arc erosion and suppress EMI. The polarity of the incoming power supply is immaterial with the mechanical switch. The new electronic switch design incorporates an electronic timing circuit to allow the plunger to pull in, then electrically switch to the holding winding. Polarity of the power supply to the electronic switch and coil must be maintained. Refer to Figure 5 for proper wiring.

   Caution! Never use a series resistor to drop power supply voltge to the coil as brake malfunction will result.

2. Due to high initial current demands of a DC solenoid, a separate DC power source of adequate current capacity is usually required.

   Caution! For electrical release of brake, apply full rated coil voltage instantly. Do not increase voltage slowly.

III. General Maintenance

Warning! Any mechanism or load held in position by the brake should be secured to prevent possible injury to personnel or damage to equipment before any disassembly of the brake is attempted or the manual release lever is operated on the brake. Observe all *cautions* listed at the beginning of this manual.

Note 1: Replacement part kits for many items are available and contain retrofit instructions.

Note 2: Do not lubricate any part of the brake as this may cause a malfunction and/or loss of torque.

A. Coil replacement

All standard NEMA AC voltage coils are available in kits. Select coil kit from appropriate Replacement Parts List for the particular brake series being serviced.

All standard NEMA DC voltage coils are available in assemblies and may also be obtained from appropriate Parts List.

B. Friction disc replacement

Note: Replace friction discs in single disc brakes when wear surface area is one half the original disc thickness (1/4"). In multiple disc brakes, replace all friction discs when throat of lever arm (17) is within 1/16" of touching teeth of pinion (32).

1. Replacement friction discs for use with either square of splined brake hubs are available in kits. Select applicable kit from appropriate Parts List for the brake being serviced.

2. If brake uses metal carrier rings with bonded friction linings (part number 5-18-7001-00) for use with splined hub obtain required quantity. Then proceed as follows:

   a. Observe cautions and warnings preceding *Installation Procedure*, Section I. Follow Steps L and K then disconnect solenoid lead wires.

   b. Continue with Steps C through E and Steps G through L. Be sure to reconnect coil leads before replacing housing (7).

C. Other standard replacement parts

The standard 87,700 series brakes use replacement part kits or components depending on the items involved. Consult Parts List Sheet 366 for material needed.

D. Self-adjust maintenance

(See Figure 6)

Since the self-adjust brake automatically adjusts itself for friction disc wear, maintenance is held to a minimum. The solenoid is factory set with a 13/16" to 15/16" air gap, and requires no resetting, even when changing friction discs. The gap is determined by the position of wrap spring stop (76). Should air gap change, follow the steps listed below:

1. If (stop) screws (76S) had been loosened and retightened, the air gap may require resetting. The gap is measured between mating surfaces of plunger (29) and solenoid frame (79), and may be increased by raising slightly, or decreased by lowering slightly, wrap spring stop (76). Be sure to retighten (stop) screws (76S). Manually lift plunger to maximum travel and release. Depress plunger, manually or electrically, and allow it to snap up. Repeat several times, then recheck air gap for factory setting of 13/16" to 15/16".

   Note: To measure solenoid air gap on vertically mounted brakes, grasp solenoid link to hold plunger in a free horizontal position and move toward solenoid frame until spring pressure is felt. Holding firmly in this position measure air gap between mating (ground) surface on solenoid frame and solenoid plunger. Adjust to proper gap as directed in *Self-Adjust Maintenance*. Check gap by again holding plunger as directed.

2. Tang of wrap spring (71) must be below, and must make contact with, wrap spring stop (76) when solenoid lever (28) is manually raised. If stop is bent outward, allowing tang to bypass it, rebend to square position, assemble correctly, and reset solenoid air gap as described in Paragraph 1.

3. Should air gap have decreased or disappeared, the solenoid lever and pinion assembly (8) may have become contaminated due to lubrication or residue as a result of overheating of brake. Cleaning is required. Loosen pressure spring nut (19) until pressure spring (11) is free. Remove support plate assembly (142). Remove cotter pin (8P) from solenoid lever (28) and retaining ring (131R) from pivot pin (131). Note location of spacer washer (138) if used, and push pivot pin out to free affected assembly. Remove retaining ring (32R) from pinion (32) and disassemble. Parts should be thoroughly cleaned in a clean solvent that does not leave a film M.E.K. or equivalent. Dry all parts thoroughly and reassemble. Be sure that wrap spring (71) is tight against side face of solenoid lever (28), and that end of last turn

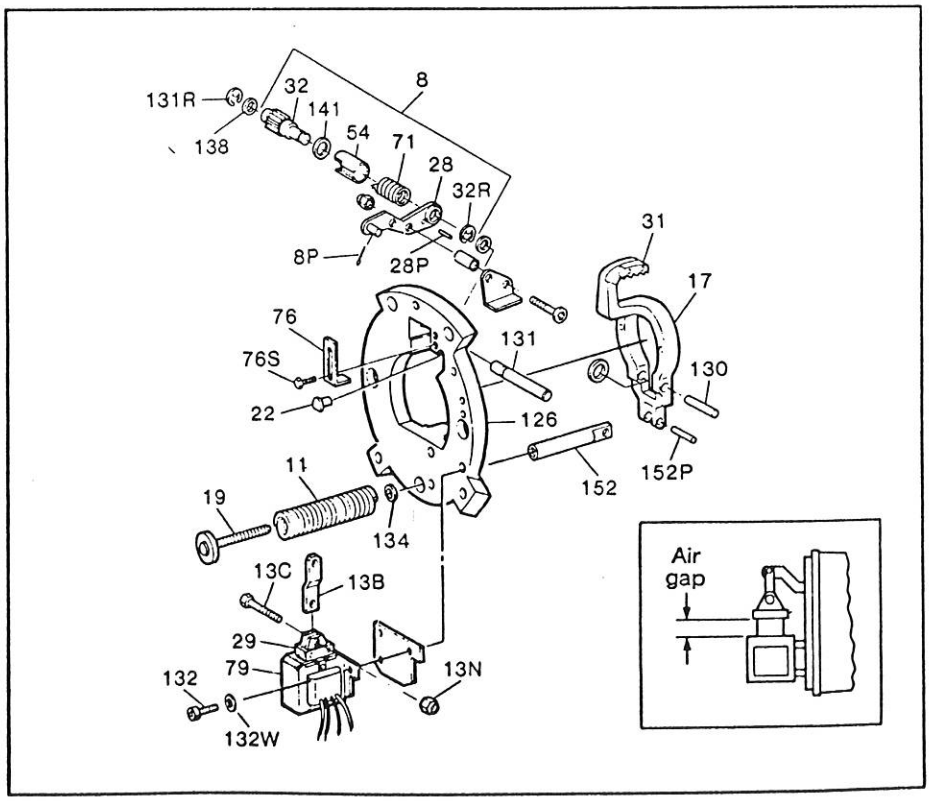


Figure 6

ches (without preload) spirol pin (28P), which should protrude out of solenoid lever for width of this turn. Reassemble in reverse order of Steps in this Paragraph. Do not retighten cap screw (19) until support plate assembly is mounted on endplate. Refer to Steps H and I of *Installation Procedure* to complete assembly.

4. Check condition and positioning of pinion (32) and rack (part of lever arm assembly, 17). Replace parts as necessary with complete assemblies.

E. Solenoid lever and pinion assembly replacement

If pinion (32) teeth are worn, replace entire assembly (8). Consult appropriate Parts List for kit number. Check sector gear of lever arm (17) for wear.

If sector gear teeth of lever arm (17) are worn, replace entire lever arm assembly available as a kit from appropriate Repair Parts List. Also check pinion (32) teeth for wear. See Item 8.

F. Pressure spring stud and nut replacement

On older designs of these brakes, Item (152) was a threaded shoulder stud nut (19), Item (152P) was a solid pin. These Items have been replaced by a spring tube, cap screw and spring pin. Replacement of any individual component requires replacement of all three new style components. Consult appropriate Repair Parts List for complete retrofit kit.

IV. Troubleshooting

A. If brake does not stop properly or overheats, check the following:

1. Is manual release engaged, and is motor energized?
2. Friction discs may be excessively worn, charred or broken.
3. Hub may have become loose and shifted on shaft.
4. Is hub clean and do friction discs slide freely?
5. Are controls which govern start of brake cycles operating properly?
6. Are limit switches, electric eyes, etc. functioning properly?
7. On vertically mounted brakes, are springs in place in disc pack? See Sheet 301.3.
8. Have mounting faces loosened?
9. Pressure spring may be improperly assembled or broken.
10. Is solenoid air gap adjusted correctly? (See *Self-Adjust Maintenance*, Section III, Item D.)
11. Check linkage for binding. The approximate pressure applied to the top of the solenoid link to move plunger is:

#5 coil	3 lbs
#6 coil (15 lb-ft)	5-1/2 lbs
#6 coil (25 lb-ft)	9 lbs
#8 coil	16 lbs

If excessive force is required, determine cause of binding and correct. Do not overlook bent, worn or broken plunger guides as a possible cause for binding.

12. Solenoid lever stop (22) must be in place on support plate.
13. Solenoid may not be energizing and release the brake. Check voltage at the coil and compare to the coil and/or nameplate voltage rating.
14. Whether brake is AC or DC a voltage drop may be occurring. If excessive drop in voltage is noted, check wire size of power source. Correct as needed.

Note: A method to check voltage at coil is to insert a block of wood of the approximate thickness of the solenoid air gap between the solenoid frame and plunger. (The block will prevent brake from releasing when coil is energized.) Connect voltmeter leads at the coil terminals or lead wires. Energize coil. Voltmeter needle will not fluctuate and reading can be taken. Reading should be taken immediately and the coil de-energized to prevent overheating of the coil. Compare voltage reading with coil rating.

15. If brake is DC solenod style, check switch actuation and condition of coil. The switch should open with the following approximate air gap. (This is plunger travel remaining before plunger seats to frame.) Solenoid size is used for reference:

#5 or 8 solenoid	3/16" to 7/32"
#6 solenoid	7/32" to 1/4"

If actuating arm is bent, replace plunger. Check switch contacts. If pitted, replace switch.

16. Check slots of endplate for wear at the areas where stationary discs are in contact. Grooves in the slots can cause hang-up or even breakage of ears of stationary discs. If grooving is noted, replace endplate.
17. Check that heads of mounting bolts do not extend above wear surface of endplate.
18. On vertical above brakes, check the vertical mounting pins to be sure shoulder of pin is flush with wear surface of endplate. Be sure pins are straight and the pressure plate and stationary disc(s) are free to slide on the pins. Be sure springs and spacers are installed in proper order. See Sheet 301.3.
19. Check pressure spring length to insure correct compressed height. Approximate original spring lengths are given in the following Table so that correct setting may be verified and corrected if necessary. With worn friction discs, add amount of wear to the approximate spring length shown in Table (see next column).

Color	Torque (lb-ft)	Compressed Spring Length
Blue or Black	6	3-1/2"
Blue	10	3-5/16"
Yellow	15	3-9/16"
Red	25 & 50	3-3/8"
Green	35, 75 & 105	3-3/8"
Black	10	3-1/4"
White	15	3-1/4"
Orange	25 & 50	3-1/4"
Purple	35, 75 & 105	3-1/4"

20. If a heater is supplied and excess rusting has occurred in brake, check power source to heater to be sure it is operating and that heater is not burned out.
21. If stopping time is more than two seconds (rule of thumb) and/or the application is more than five stops per minute, check thermal requirements of load versus thermal rating of brake.
22. Use Loctite® 242 to secure link screw nut (13N) to link screw (13C) if vibration causes nut to loosen.

B. If brake hums, solenoid pulls in slowly, or coil burns out, check the following:

1. Voltage supply at coil versus coil rating.
2. Is solenoid air gap excessive? (See *Self-Adjust Maintenance*.)
3. Shading coils may be broken.
4. Plunger guides may be excessively worn. Does solenoid plunger rub on solenoid frame laminations? If so, replace plunger guides.
5. Solenoid frame and plunger may be excessively worn.
6. Is solenoid dirty?
7. Solenoid mounting screws may have become loose, causing frame to shaft and plunger to seat improperly.
8. Sector gear and pinion teeth may be jamming due to excessive tooth wear.
9. Excessive voltage drop when motor starts. Check size of lead wires for motor starting current and solenoid inrush current. See Section IV-A, Item 11, 12, 14 and 15.

C. If brake is noisy during stopping:

1. Check mounting face run out, mounting rabbet eccentricity and shaft run out. See *Installation Procedure*, Section I, Note 1. Correct as required.
2. Check for signs of the outside diameter of the friction disc(s) rubbing on the inside diameter of the endplate. This would indicate brake is eccentric with respect to the motor shaft and/or the shaft is deflecting during a stop. Check alignment and shaft diameter. Also check for worn motor bearings. If realignment does not correct the problem, a larger diameter shaft may be required. Shaft deflection may also be caused by excessive overhang of brake from motor bearing. Additional shaft support may be required.
3. In cases where motor shaft extends through a fan casing or guard, the clearance hole may not be adequate. Rubbing of the shaft may occur causing a noise during a stop. If required, enlarge clearance hole.
4. Check for bad motor bearings. Replace if necessary. Check for excessive shaft endfloat. Correct as required.