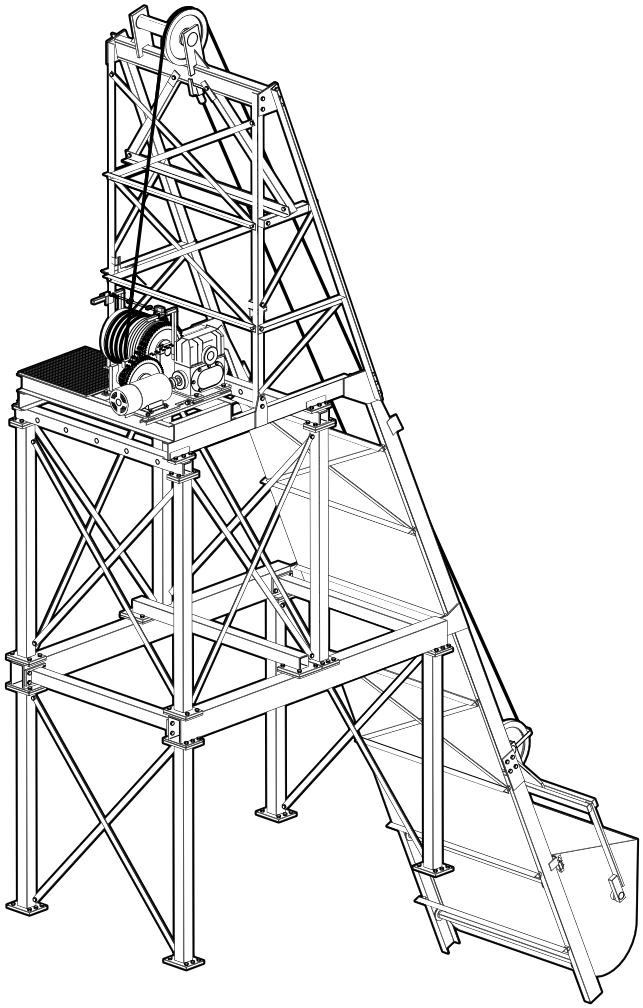
BESSER

SKIP LOADER

MODEL 120 CUBIC FOOT



MAINTENANCE/OPERATION MANUAL

466370F9702

JUNE 1997 • US$250

BESSER World Headquarters
801 Johnson St. • Alpena, Michigan, 49707 • U.S.A.
Phone (517) 354-4111

BESSER

COMPANY NAME: .....

SERIAL NUMBER: .....

ASSEMBLY NUMBER: .....

WIRING DIAGRAM NUMBER: .....

INSTALLATION DRAWING NUMBER: .....

SKIPLOADER 120
TABLE OF CONTENTS

SKIPLOADER 120
TABLE OF CONTENTS

SKIPLOADER 120
LIST OF ILLUSTRATIONS

SKIPLOADER 120
LIST OF TABLES

SECTION 3 MAINTENANCE

SAFETY BULLETIN

This notice is issued to advise you that some previously accepted shop practices may not be keeping up with changing Federal and State Safety and Health Standards. Your current shop practices may not emphasize the need for proper precautions to insure safe operation and use of machines, tools, automatic loaders and allied equipment and/or warn against the use of certain solvents or other cleaning substances that are now considered unsafe or prohibited by law. Since many of your shop practices may not reflect current safety practices and procedures, particularly with regard to the safe operation of equipment, it is important that you review your practices to ensure compliance with Federal and State Safety and Health Standards.

IMPORTANT

The operation of any machine or power-operated device can be extremely hazardous unless proper safety precautions are strictly observed. Observe the following safety precautions:

- Always be sure proper guarding is in place for all pinch, catch, shear, crush and nip points.
- Always make sure that all personnel are clear of the equipment before starting it.
- Always be sure the equipment is properly grounded.
- Always turn the main electrical panel off and lock it out in accordance with published lockout/tag-out procedures prior to making adjustments, repairs, and maintenance.
- Always wear appropriate protective equipment like safety glasses, safety shoes, hearing protection and hard hats.
- Always keep chemical and flammable material away from electrical or operating equipment.
- Always maintain a safe work area that is free from slipping and tripping hazards.
- Always be sure appropriate safety devices are used when providing maintenance and repairs to all equipment.
- Never exceed the rated capacity of a machine or tool.
- Never modify machinery in any way without prior written approval of the Besser Engineering Department.
- Never operate equipment unless proper maintenance has been regularly performed.
- Never operate any equipment if unusual or excessive noise or vibration occurs.
- Never operate any equipment while any part of the body is in the proximity of potentially hazardous areas.
- Never use any toxic flammable substance as a solvent cleaner.
- Never allow the operation or repair of equipment by untrained personnel.
- Never climb or stand on equipment when it is operational.

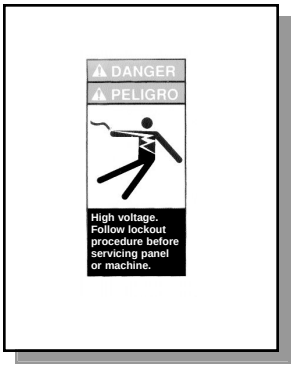
It is important that you review Federal and State Safety and Health Standards on a continual basis. All shop supervisors, maintenance personnel, machine operators, tool operators, and any other person involved in the setup, operation, maintenance, repair or adjustment of Besser-built equipment should read and understand this bulletin and Federal and State Safety and Health Standards on which this bulletin is based.

SAFETY SIGNS

Sign	Description	Required
1	Electric Motor	1
2	All Machines	1
	All Panels	1
3	Mixer	4
4	Block Machine	1
	SF-7 Cuber	8
	BTO-6	2
	Overhead Block Transfer	3
	Depalleter	2
	AF-7 Block Pusher	2
5	Concrete Products Machine	1
6	Concrete Products Machine	1
7	Concrete Products Machine	2
8	Besser-Matic	4
9	Besser-Matic	4
10	Pallet Transport System	4
11	LSC-40	4
	Overhead Block Transfer	4
12	Conveyors	6
13	SF-7 Cuber	8
14	AF-7 Block Pusher	2
	Pallet Transport System	4
15	All Machines	1
	All Panels	1
16	SF-7 Cuber	3
	AF-7 Block Pusher	2
	Slat Conveyors	2
17	Skiploader [***Available in 1998***]	6
18	Generic Falling Hazard [***Available in 1998***]	2
19	Skiploader [***Available in 1998***]	2
20	Skiploader [***Available in 1998***]	2
21	Skiploader [***Available in 1998***]	1

To order safety decals, contact your local Besser representative or the Besser Central Order Department.
Thank you!

1



2

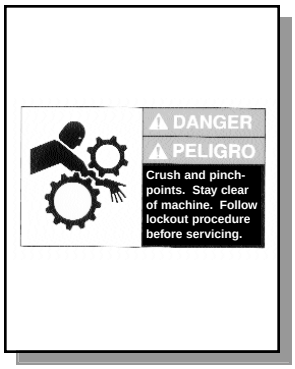
3

4

5

6

7



8

9

10

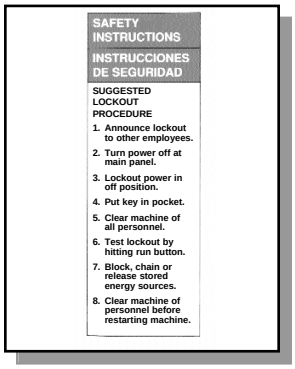
11

12

13

14

15



16

SAFETY SIGNS

ELECTRICAL DATA

20 HP Skiploader Motor

Plant Power Supply	380 volt, 3 phase, 50 hz
Total Horsepower	20
Total Kilowatts	14.91
Control Panel Transformer	500 volt-amps
Total Amp Load	35.62
Recommended Branch Circuit Distribution Switch	60 amp
Recommended Branch Circuit Fuse (FRS-R)	50 amp
Recommended Branch Feeder (THHN)	no. 8 AWG [8.4 sq. mm]
Recommended Branch Circuit Feeder Conduit	0.5 inch [12 mm]
Short Circuit Interrupting Capacity	200,000 AIC

Device (Approximate Load)	Horsepower	Kilowatts	Amperes
Skiploader Motor	20.00	14.91	34.30

Electrical Data Notes:

For safety purposes, Besser Company requires that this equipment be connected to a lockable electrical disconnect.

CAUTION:

To comply with Articles 110-9 and 110-10 of the National Electrical Code:

- The customer shall supply a branch circuit protective device to feed this control panel.
- The protective device shall have a short circuit interrupting rating of no less than the available short circuit current. (Besser Company recommends the use of protective devices with interrupting ratings of no less than 200,000 amps rms symmetrical.)
- See table above for the recommended protection.

Failure to comply with these guidelines may result in a rupture of the protective device while attempting to clear a fault.

SKIPLOADER 120
SPECIFICATIONS

Skiploader

Electrical-mechanical bucket loader that transports mixed concrete from the mixer system to the mixed material hopper.

APPROXIMATE SHIPPING WEIGHT: 24,000 pounds [10909 kg]

MAXIMUM BUCKET SPEED: 20.5 feet per minute [6.2 mpm]

BUCKET:

Maximum weight capacity: 12,000 pounds [5455 kg]
Maximum volume capacity: 120 cubic feet [3.4 m3]

ELECTRIC MOTOR HORSEPOWER: 20 horsepower [14.9 kw]

DIMENSIONS: See Figure A

OPERATING CONDITIONS: Besser machinery and equipment is designed to comply with the essential health and safety regulations (EHSR) that apply to directives which are applicable to an industrial environment.
Buyer shall utilize this equipment in a manner consistent with its design and only in an industrial environment.

OPERATING RANGES: Here are the normal operating ranges for machine sensors (limit, proximity) and control devices contained within the control panels.

Ambient operating temperature range: 32° to 131°F [0° to 55°C]

Humidity range: 5 to 95% (non-condensing)

Line voltage: 85 to 132 volts – AC 50/60 Hz

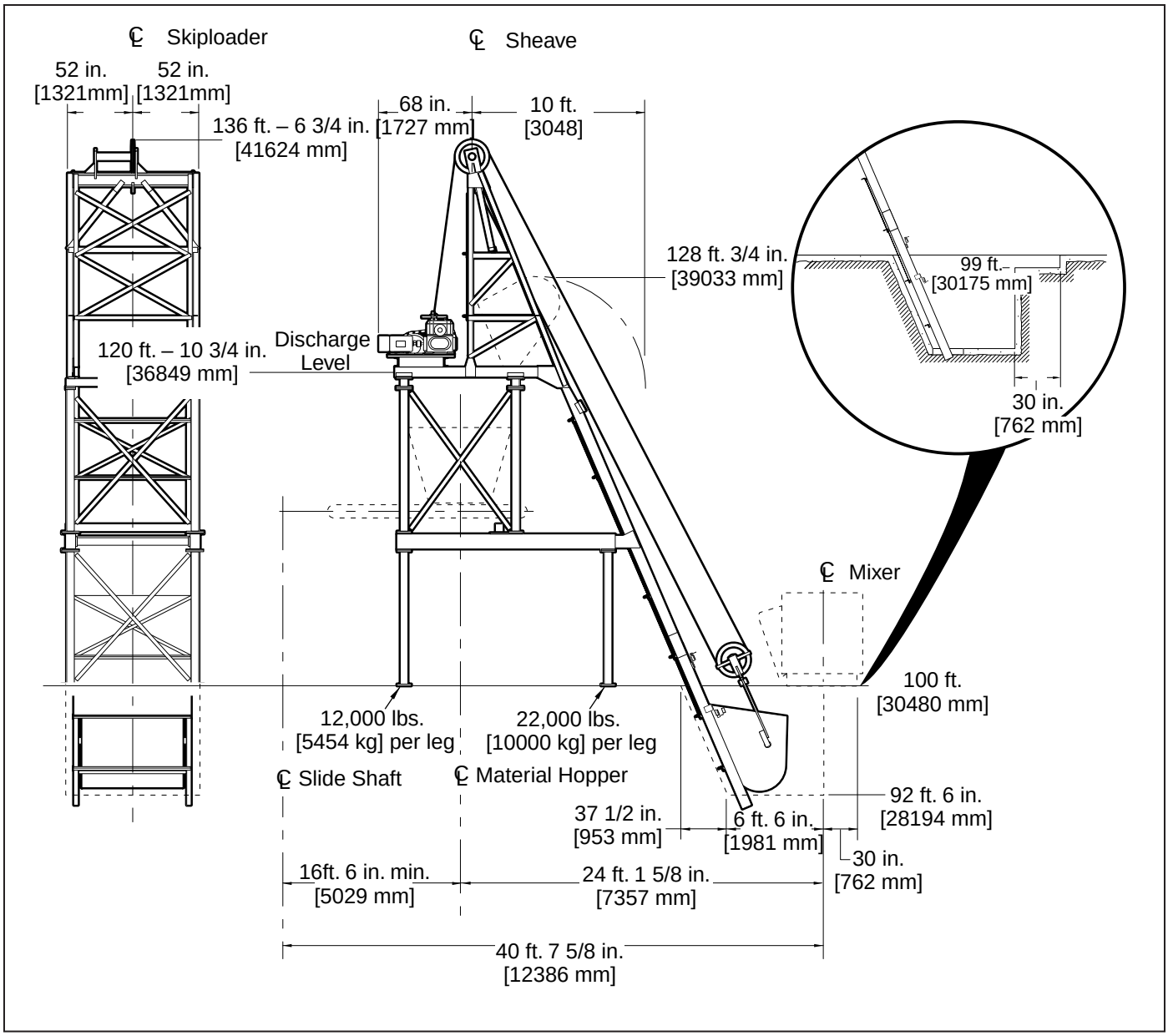


Figure A *Skiploader Dimensions*

SECTION 1
INTRODUCTION

1.1 OVERVIEW

The Besser Skiploader transports mixed concrete from the floor level to a mixed material hopper. The hopper then feeds a conveyor which feeds the Concrete Products Machine. All Skiploader functions are automatically controlled by the batch processing system and other external equipment.

1.2 ORGANIZATION OF THIS GUIDE

This guide includes procedures for properly operating and maintaining the Skiploader. It's divided into the following major Sections:

- **Introduction**: Provides an overview of the Skiploader, identifying its major functions components.
- **Operation**: Describes the Skiploader's sequence of operation, as well as its functional modes.
- **Maintenance**: Provides the recommended schedule for routine service, as well as lubrication, adjustment and repair procedures.

1.3 TERMS AND ABBREVIATIONS

The following terms and abbreviations are used throughout this manual.

- ACR — Auto Control Relay
- bar — Unit of Pressure
- CB — Circuit Breaker
- gpm — Gallons Per Minute
- lpm — Liters Per Minute
- LS — Limit Switch
- MCR — Master Control Relay
- Fu — Fuse
- PER — Photoelectric Cell
- PRS — Proximity Sensor
- psi — Pounds Per Square Inch
- UC — Unloading Conveyor
- vac — Volts, Alternating Current

1.4 DESIGN CHARACTERISTICS

Figure 1.1 illustrates the Skiploader assembly and calls out its major components.

The Skiploader is composed of a heavy-duty welded steel structure that includes the following components and design characteristics.

- **Gear Motor**: Powers the Skiploader drive cable drum which wraps and unwraps the bucket hoist cable.
- **Hoist Cable**: Raises and lowers the bucket assembly along the tracks.
- **Cable Switch**: De-energizes the Master Control Relay and shuts off the Skiploader drive if the hoist cable contacts the trip cable or travels beyond the up or down position limits.
- **Up Stop Limit Switch**: Signals the batch processing system when the bucket reaches its up stop (dump) position.
- **Up End Travel Limit Switch**: Signals the batch processing system that the bucket assembly has reached the up safety stop position to prevent bucket over-travel.
- **Bucket Track**: Provides a guided path for the bucket assembly.
- **Bucket Assembly**: Transports the mixed concrete from the mixer to the mixed material hopper. The bucket includes two sets of (upper and lower) rollers that fit into the tracks.
- **Down Stop Limit Switch**: Signals the batch processing system that the bucket assembly has reached the down stop (loading) position.
- **Down End Travel Limit Switch**: Signals the batch processing the system that the bucket assembly has reached the down safety stop position.
- **Safety Stops**: Hold the bucket in the safety stop position, preventing it from reaching the home-down position. Holding the bucket in the safety stop position protects maintenance personnel while they are down in the bucket pit clearing debris.
- **Bucket Pit**: Houses the bucket when the bucket is positioned in the home-down position.

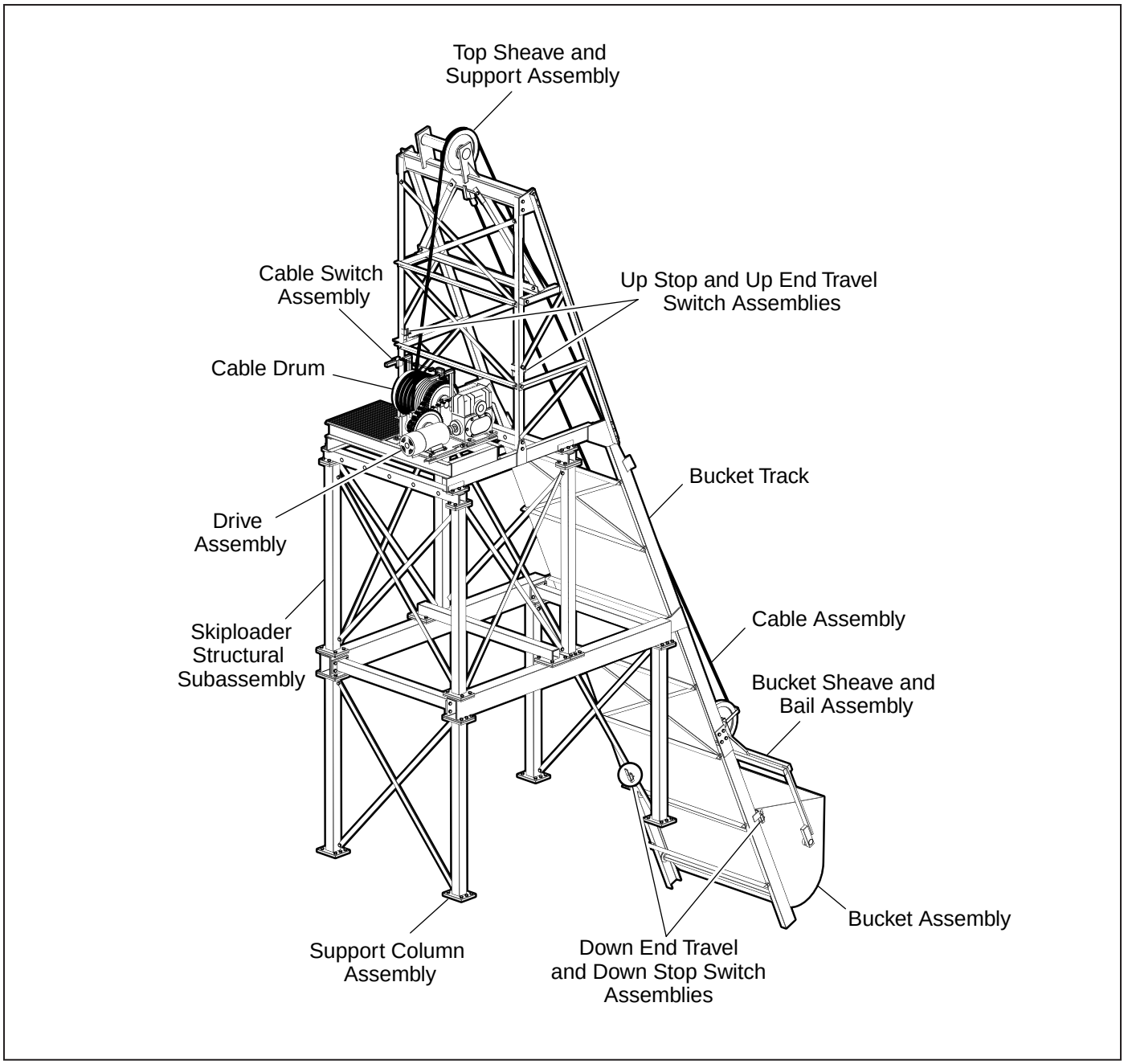


Figure 1.1 *Skiploader Main Context View*

SECTION 2
OPERATION

2.1 GENERAL

The Skiploader is independently controlled by the batch processing system. Under normal conditions, it operates automatically without any user input. There is only one mode of operation.

2.2 START-UP AND LOCKOUT

Control equipment and external system components vary from plant to plant. Start-up and lockout procedures will therefore vary as well. Refer to your control equipment documentation for more information.

2.2.1 General Lockout Procedures

For protection of servicing personnel, most machine maintenance must be performed with the electrical power shut off and locked out. This precaution prevents injury from accidental movement of machine components. Here are general procedures to secure the machine system in a lockout condition:

1. Announce lockout to other personnel.
2. Switch off power at main panel.
3. Using your shop's authorized key and lock system, secure the main power switch in the lockout position.
4. Remove your key from the lock and keep the key with you at all times while performing system maintenance.
5. Clear machine of all personnel.
6. Test the lockout condition by trying to operate the machine from the control panel. Verify that all controls are inoperative.
7. Block, chain or release stored energy sources.
8. Clear machine of personnel before restarting machine.

WARNING:
This lockout procedure is a minimum precaution for the safety of servicing personnel. Do not attempt to avoid or shortcut these procedures.

2.3 SEQUENCE OF OPERATION

Figure 2.1 illustrates the Skiploader sequence of operation.

1. Skiploader bucket is in down stop position. LS-3 is tripped.
2. The mixer gate opens.
3. The mixer discharges the correct amount of mixed concrete into the Skiploader bucket (which is positioned in the home-down position in the bucket pit).
4. When the mixer gate closes, the Skiploader cable drive starts. The drive winds the cable and pulls the bucket up the track.
5. When the front Skiploader bucket rollers contact the horizontal track stops, the bucket pivots on its front rollers, dumping the mixed concrete into the mixed material hopper.
6. When the bucket trips the up stop limit switch (LS-6), the Skiploader cable drive becomes disengaged.
7. After dumping the load, the Skiploader drive reverses, lowering the bucket back down the track.
8. The bucket trips the down stop limit switch (LS-3), indicating to the batch processing system that it has reached the home-down (load) position.
9. The entire cycle repeats.

NOTE:
Normal operation must be interrupted to clear debris from the bucket pit. See 3.5 for more information.

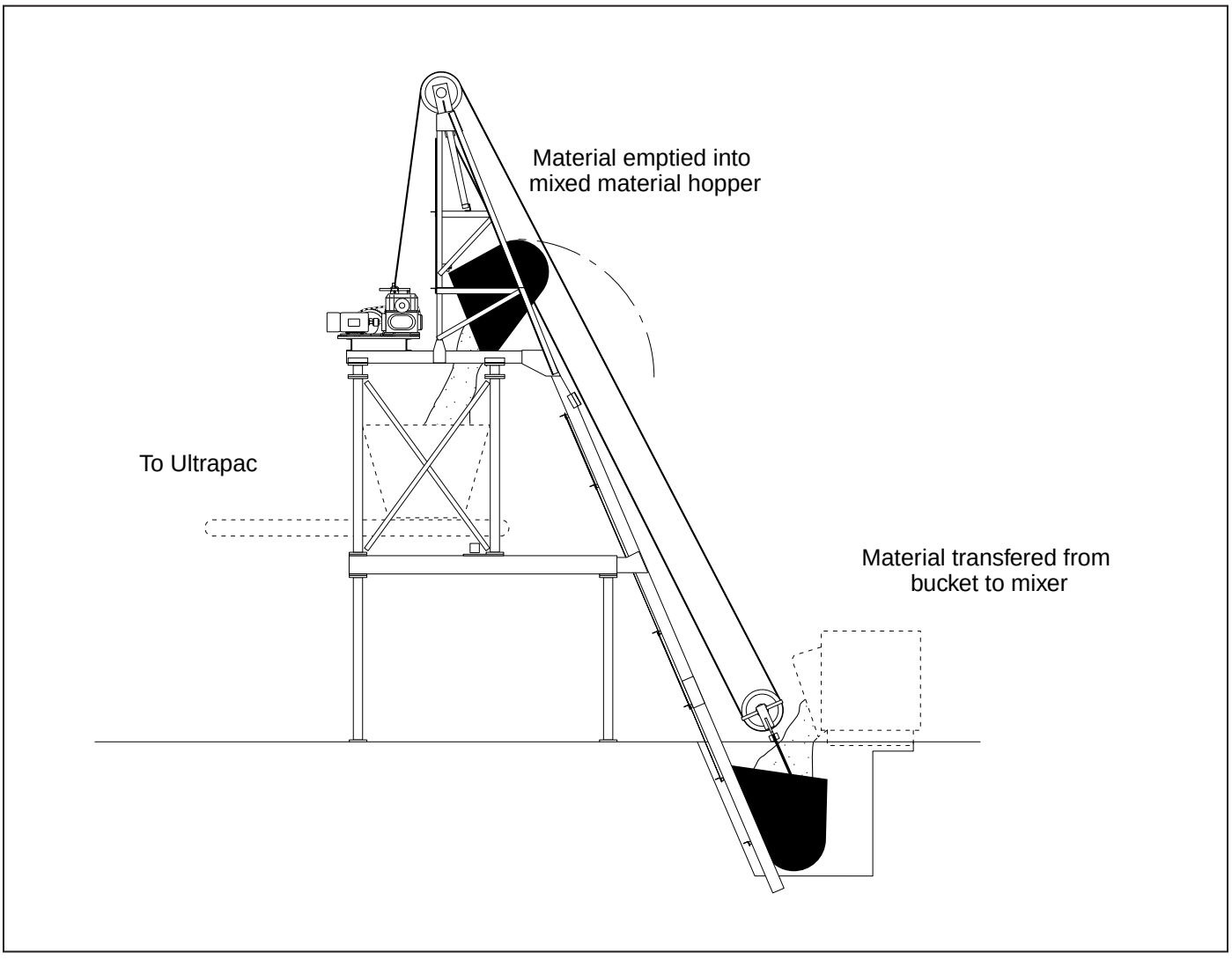


Figure 2.1 *Sequence of Operation*

2.4 CONTROL SYSTEM

This section covers the man/machine interface of the Skiploader control system.

2.4.1 Control Station

Operation of the Skiploader is controlled from the control station. Figure 2.2 shows the Skiploader control station.

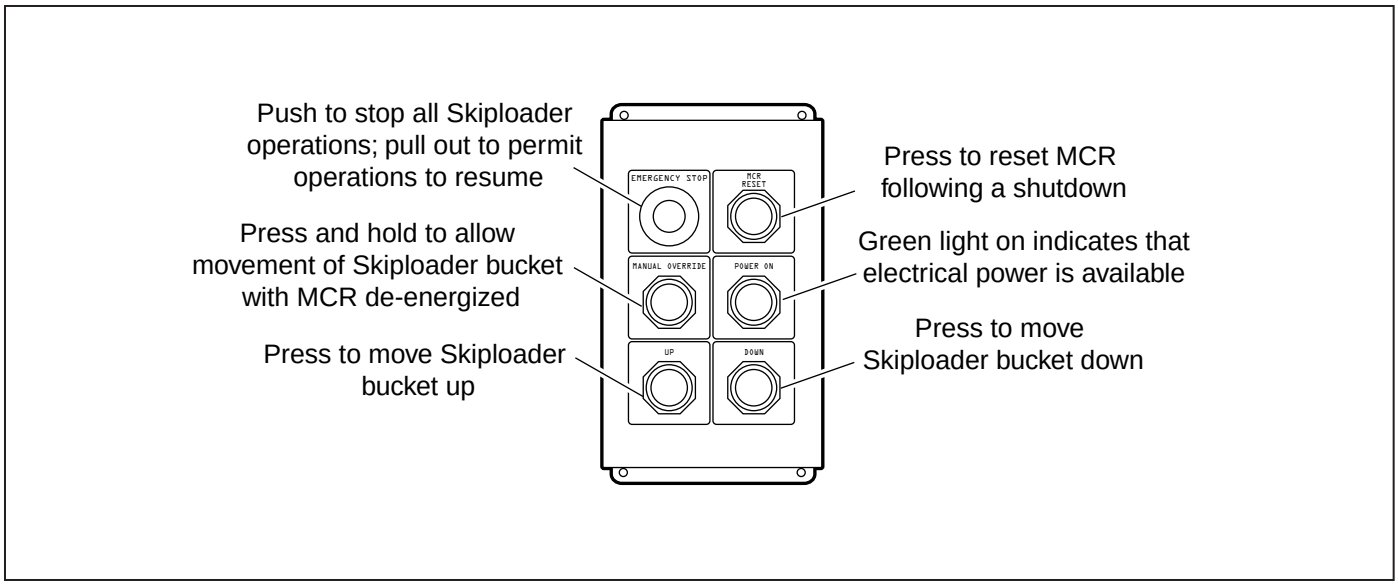


Figure 2.2 *Control Station*

2.4.2 Remote Control Station

The remote control station consists of an additional emergency stop switch for shutting down the Skiploader in emergency situations. Figure 2.3 shows the Skiploader remote control station.

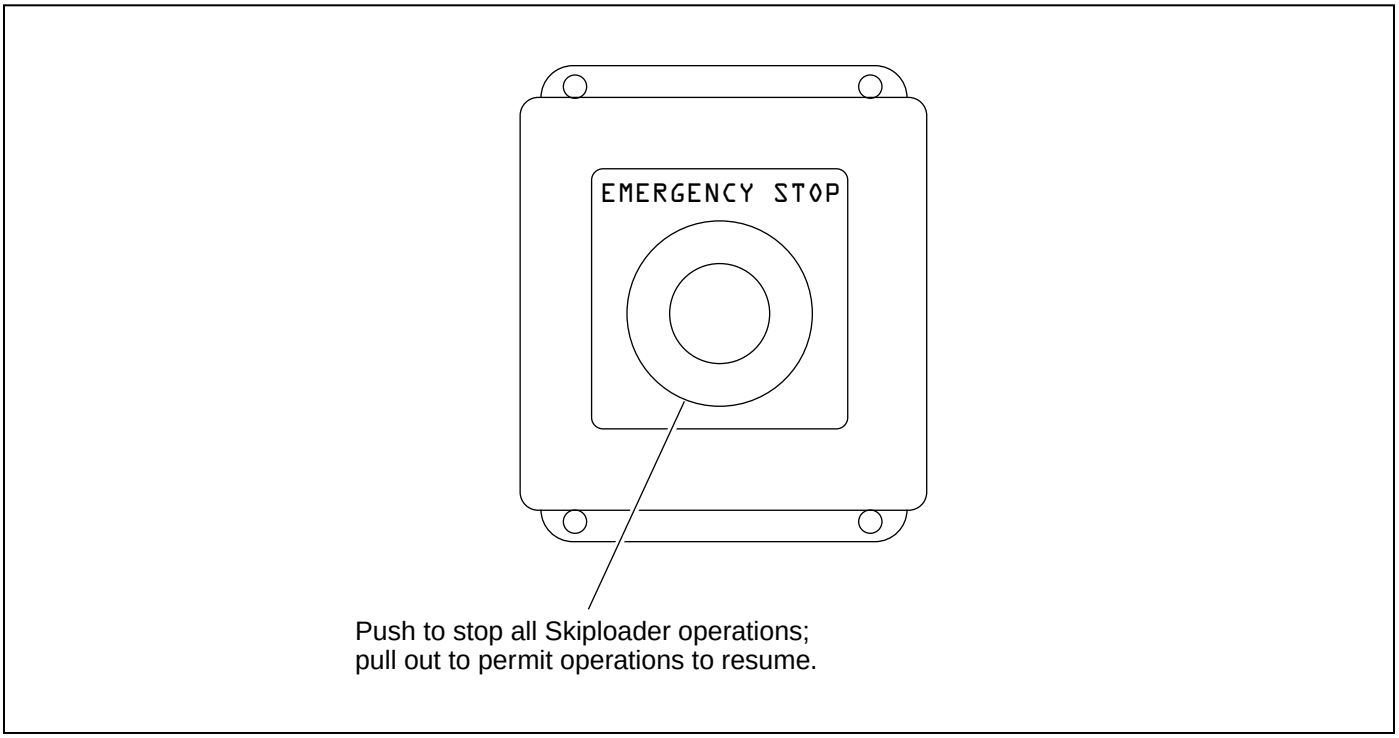


Figure 2.3 *Remote Control Station*

2.4.3 Control Panel

The control panel contains the electrical hardware necessary to operate the Skiploader. Figure 2.4 shows the Skiploader control panel.

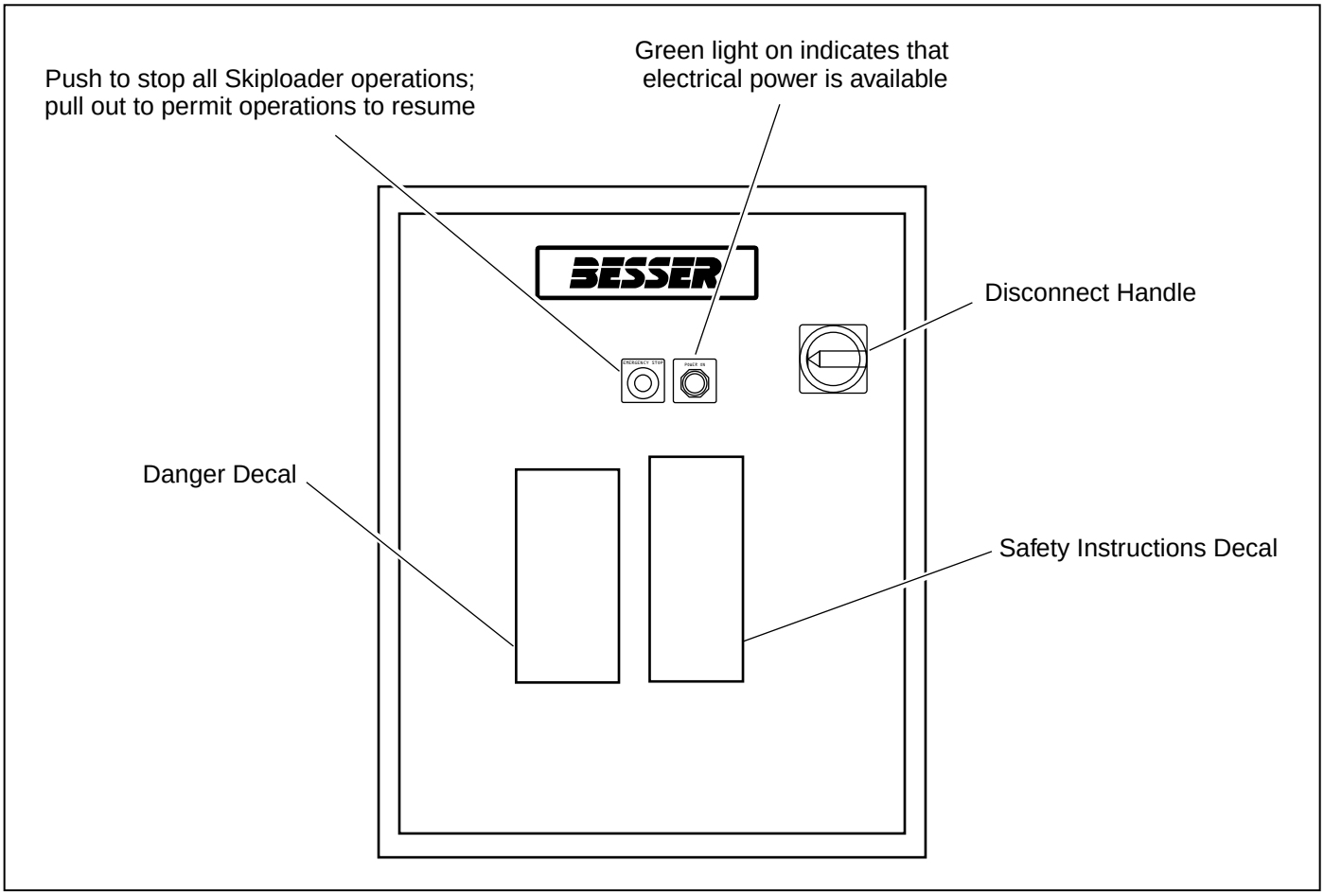


Figure 2.4 *Control Panel*

2.4.4 Cable Switch (LS-5)

The cable switch, illustrated in Figure 2.5, consists of:

- A pair of trip wires, and
- Two clamps that set the left (bucket down) and right (bucket up) cable travel limits.

This switch shuts down the Skiploader drive if the bucket hoist cable travels beyond its predetermined up and down stop limits.

2.4.4.1 Cable Switch Operation

As the Skiploader cable winds and unwinds, it moves laterally (side-to-side) on the grooved cable drum. If the cable exceeds the travel limits set by the clamps and trip wire, the cable switch shuts down the Skiploader drive.

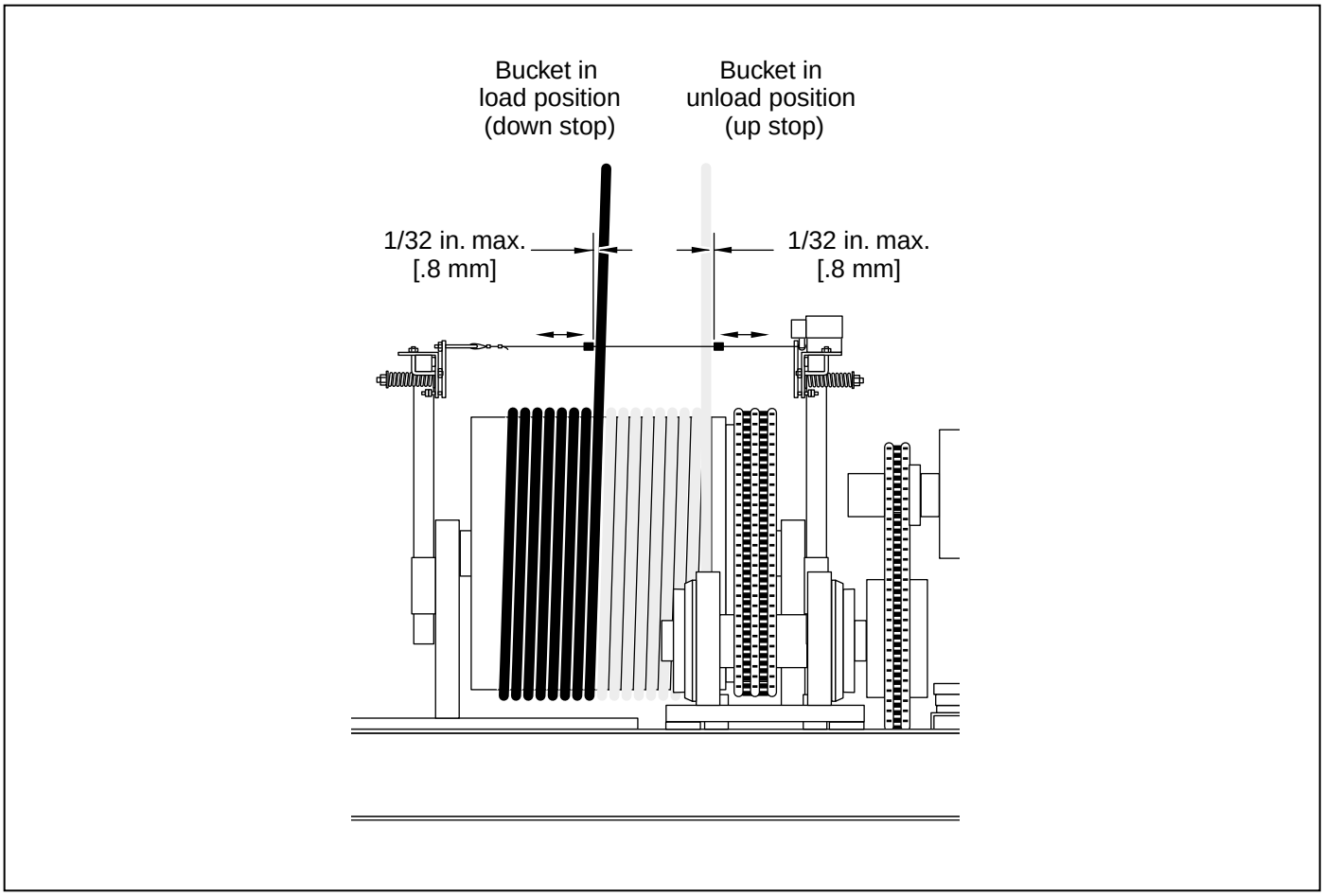


Figure 2.5 *Cable Switch*

2.4.4.2 Cable Switch Shut-Down – Bucket Up

If the cable switch or up end travel limit switch trip, they de-energize the Master Control Relay (MCR). To reset the MCR and restore normal operation, refer to the following procedure:

1. Press and hold manual override. Refer to Figure 2.6, Step 1.
2. Press MCR Reset.
3. Press up or down to move the Skiploader bucket and clear the tripped limit switch. Refer to Figure 2.6, Step 2.
4. Once the limit switch is clear, release manual override. The MCR should remain energized.

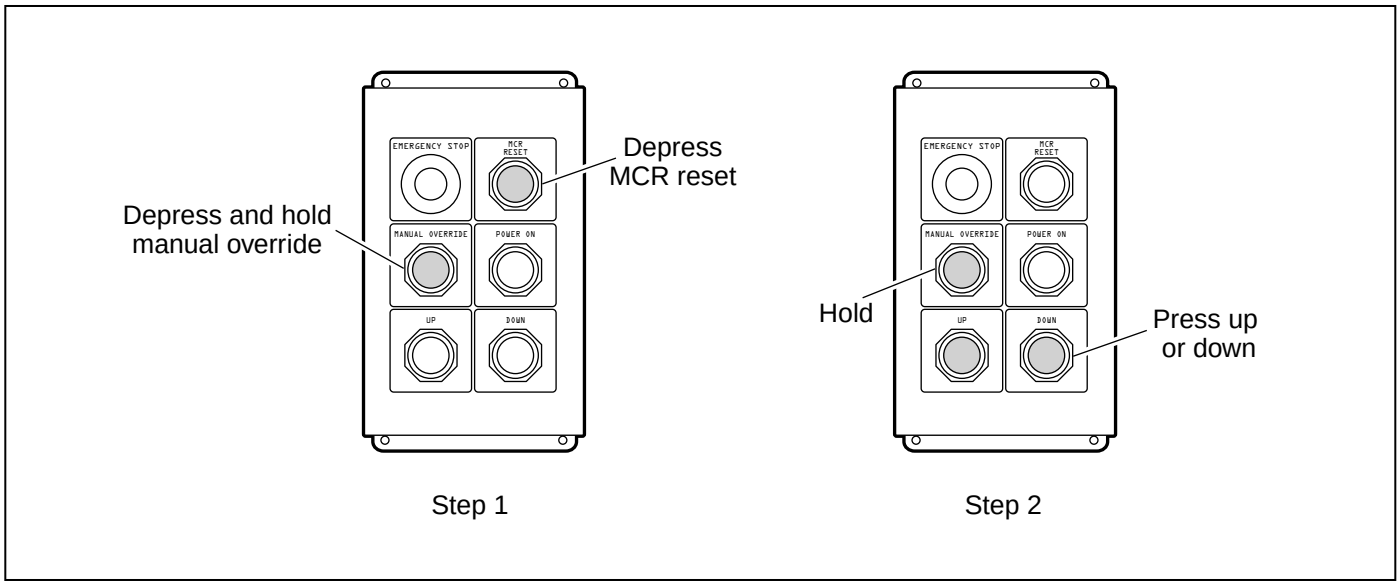


Figure 2.6 *Resetting the MCR*

2.4.4.3 Cable Switch Shut-Down – Bucket Down

If the down end travel limit switch trips, it de-energizes the down contactor. This prevents the Skiploader bucket from traveling in the up direction while the MCR remains energized. This condition can occur if the down stop limit switch malfunctions. To clear this condition, press up or down to manually move the Skiploader off the switch. Refer to Figure 2.7.

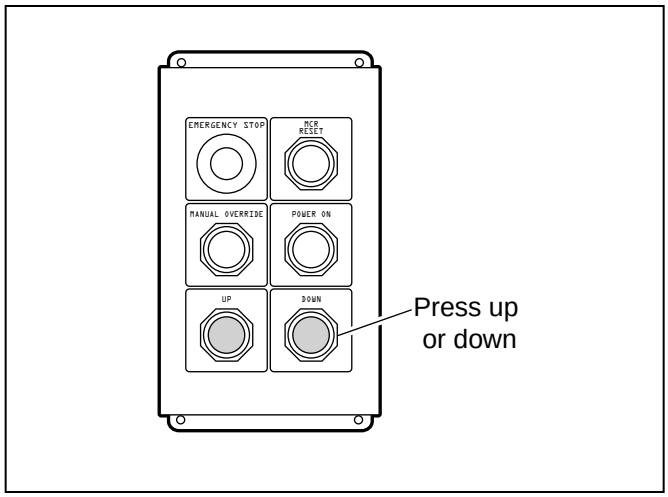


Figure 2.7 *Clearing the Down Contactor*

SECTION 3
MAINTENANCE

3.1 OVERVIEW

This Section of the manual highlights important service and maintenance procedures required to maximize the Skiploader operating life and ensure optimum performance.

Major topics include:

- 3.2 General Lubrication
- 3.3 General Inspection and Cleaning
- 3.4 Gear Reducer
- 3.5 Bucket Pit
- 3.6 Cable System
- 3.7 Coupling
- 3.8 Electric Motor
- 3.9 Chain System
- 3.10 Stearns Brake
- 3.11 Switch Maintenance
- 3.12 Component Replacement

3.1.1 General Lockout Procedures

For protection of servicing personnel, most machine maintenance must be performed with the electrical power shut off and locked out. This precaution prevents injury from accidental movement of machine components. Here are general procedures to secure the machine system in a lockout condition:

1. Announce lockout to other personnel.
2. Switch off power at main panel.
3. Using your shop's authorized key and lock system, secure the main power switch in the lockout position.
4. Remove your key from the lock and keep the key with you at all times while performing system maintenance.
5. Clear machine of all personnel.
6. Test the lockout condition by trying to operate the machine from the control panel. Verify that all controls are inoperative.
7. Block, chain or release stored energy sources.
8. Clear machine of personnel before restarting machine.

WARNING:
This lockout procedure is a minimum precaution for the safety of servicing personnel. Do not attempt to avoid or shortcut these procedures.

3.2 GENERAL LUBRICATION

Regularly lubricating the Skiploader's moving parts is vital to ensure optimum performance and a long operating life. Table 3.1 lists the recommended frequency of lubrication as well as lubricant specifications. Note that the numbers in the "Item" column correspond to the item number in Figure 3.1.

Item	Equipment/Component	Special Instructions	Scheduled Maintenance
1	Bearings – Cable Drum	Purge with grease as needed – see Section 3.2.2.	Daily
2	Bearing – Jack Shaft	Purge with grease as needed – see Section 3.2.2.	Daily
3	Cable Sheave and Bushing – Top	Purge with grease as needed – see Section 3.2.1.	Daily
4	Cable Sheave and Bushing – Bucket	Purge with grease as needed – see Section 3.2.1.	Daily
5	Pins – Bail/Bucket	Purge with grease as needed – see Section 3.2.1.	Daily
6	Rollers and Bushings – Bucket	Purge with grease as needed – see Section 3.2.1.	Daily
7	Gear Reducer – Oil Reservoir	Check oil level and top off as needed – see Section 3.4.1	Weekly
7	Gear Reducer – Oil Change	Drain and change oil at regular intervals – see Section 3.4.2 for recommended frequency.	As Needed
7	Gear Reducer – Grease Fittings	Refill lubricators with recommended grease.	As Needed
8	Chain – Reducer/Jack Shaft	Lubricate. See Section 3.2.2	Daily
9	Chain – Jack Shaft/Cable Drum		
10	Cable	See Section 3.6	Weekly

Table 3.1 *Skiploader Lubrication Points and Schedule*

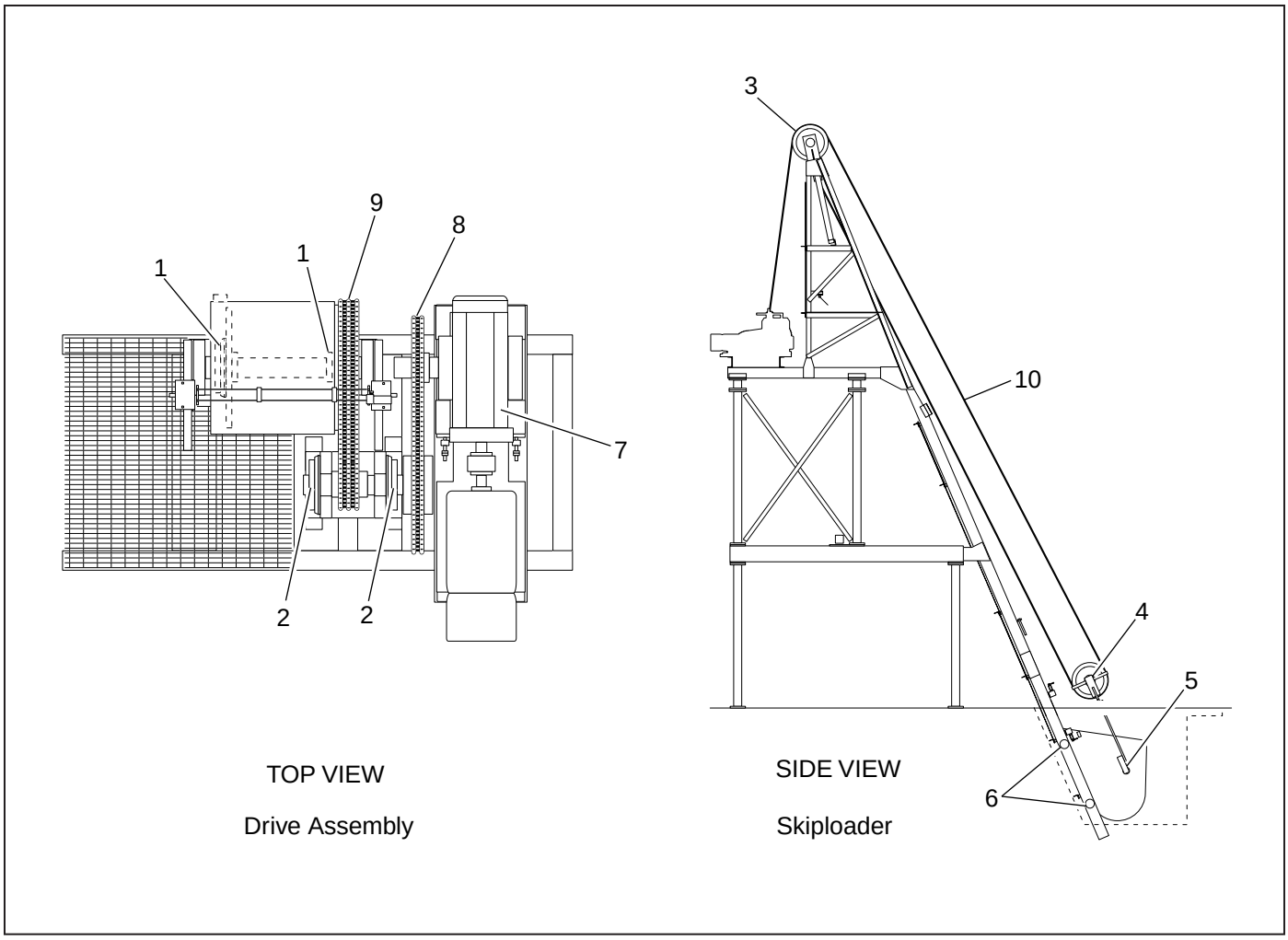


Figure 3.1 *Skiploader Lubrication Points*

3.2.1 Bucket Wheel, Bucket Pins and Cable Sheave Lubrication

Purge daily with Mobilux EP#1 or Shell Alvania EP#1 lubricant.

3.2.2 Jack Shaft and Cable Drum Bearing Lubrication

Bearings are factory-lubricated with #2 consistency lithium base grease which is suitable for most applications. Extra protection may be required if the bearing is subject to excessive moisture, dust or corrosive vapor. In these cases, the bearing should contain as much grease as operating speed permits. (A full bearing with consequent slight leakage through the seal is the best protection against contaminants.)

In extremely dirty environments, the bearing should be purged daily to flush out contaminants. For added protection, Besser recommends you shroud the bearing from falling material.

3.3 GENERAL INSPECTION AND CLEANING

Table 3.2 identifies the important visual inspection points for the Skiploader. Note that the numbers in the "Item" column correspond to the item numbers in Figure 3.2.

Item	Equipment/Component	Special Instructions	Scheduled Maintenance
1	Bucket Pit	See Section 3.5	Every 4 hours of Skiploader operation
2	Bearing – Jack Shaft	Inspect for dirt and debris	Weekly
3	Bearings – Cable Drum		Weekly
4	Cable	See Section 3.6	Daily
5	Down Stop and Down End Travel Switches	Adjust as needed Verify integrity and proper operation	
6	Up Stop and Up End Travel Switches		
7	Cable Switch		
8	Drive Assembly (General)	Visually inspect, unusual noises	
9	Skiploader and Pit Guards	Verify integrity	
10	Brake – Electric Motor	Adjust as needed	Weekly
11	Electric Motor	Visually inspect	
12	Coupling		
13	Gear Reducer		
14	Sprocket Gear Reducer		
15	Chain – Reducer/Jack Shaft	Adjust as needed – See Besser drawing 468339	Daily
16	Sprocket – 1st Reducer/Jack Shaft	Visually inspect	Weekly
17	Sprocket – 2nd Reducer/Jack Shaft		
18	Chain – Jack Shaft/Cable Drum	Adjust as needed – See Besser drawing 468339	Daily
19	Sprocket – Cable Drum	Visually inspect	Weekly
20	Clamp – Cable Drum		
21	Cable Sheave and Bushing – Top		
22	Shaft – Top Cable Sheave		
23	Cable Sheave and Bushing – Bucket		
24	Rollers and Bushings – Bucket		
25	Safety Stops – Bucket	Verify integrity	Daily
26	Cable Drum	Visually inspect – See Section 3.6.4	Weekly
27	Pins – Bail/Bucket		Weekly
28	Axle – Bucket – Top		Monthly
29	Axle – Bucket – Bottom		
30	Bucket Guide Rails (Tracks)		
31	Wiring and Conduit		
32	Starter		
33	Bail – Bucket	Visually inspect	Quarterly
34	Bucket		
35	Jack Shaft	Inspect when replacing bearings, sprockets and related parts	Other
36	Cable Drum Shaft		
37	Pin – Cable Sheave – Bucket		
38	Pin – Cable Anchor		

Table 3.2 *Skiploader Inspection Points*

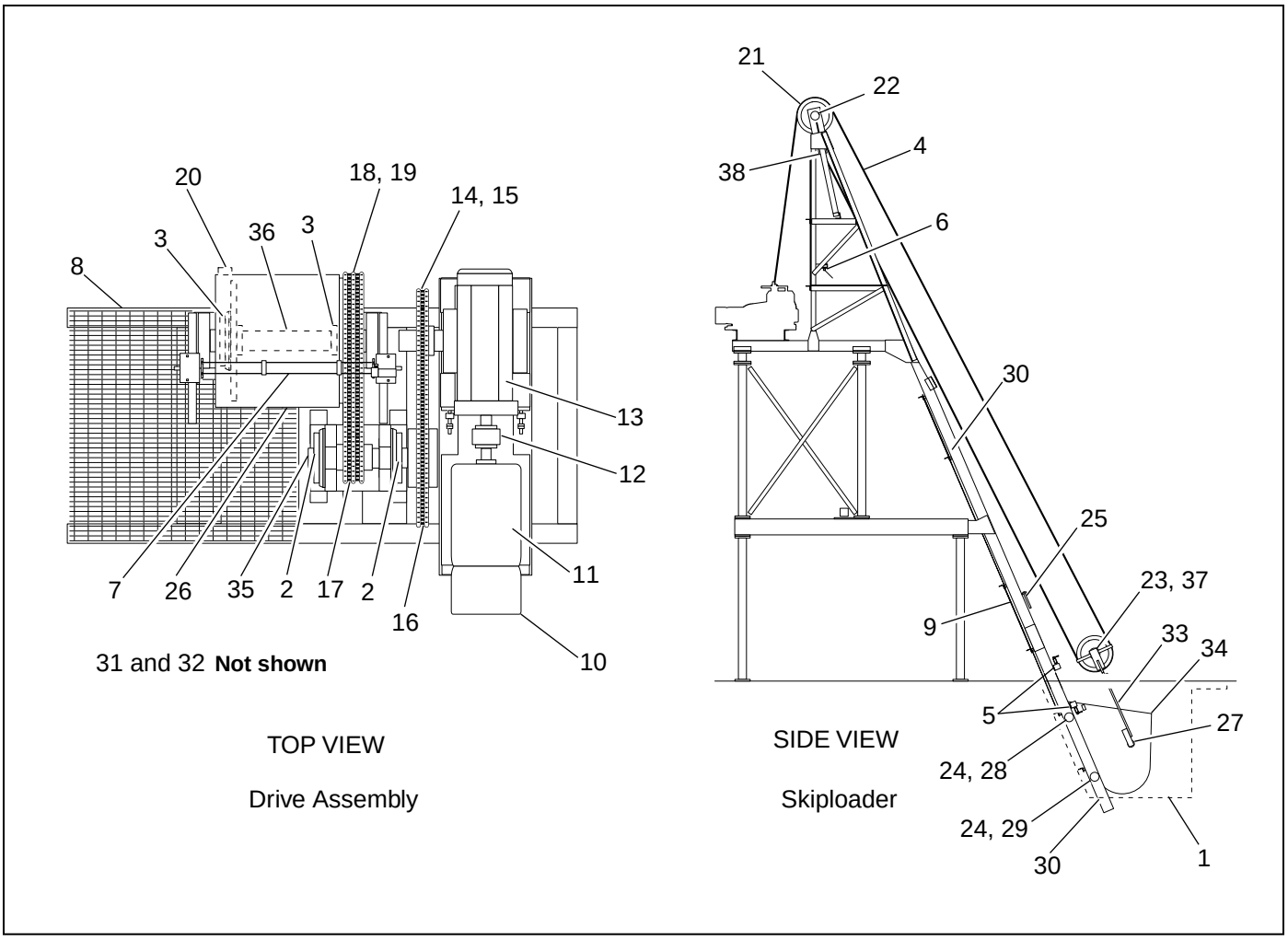


Figure 3.2 *Skiploader Inspection Points*

3.4 GEAR REDUCER

This section details maintenance requirements for the Skiploader gear reducer assembly.

3.4.1 Weekly Inspection

Perform the following tasks on a weekly basis:

- Check the gear reducer oil level and top-off as necessary. Refer to Section 3.4.3 for gear reducer oil requirements.
- Add two shots of grease to the bearing lubricators (if the unit is equipped with grease-lubricated bearings). For units equipped with screw-in lubricators, screw in the lubricator two complete turns.
- Refill all lubricators as necessary, using the recommended grease.

3.4.2 Regular Oil Changes

You must change the gear reducer oil regularly to prevent damage due to oil breakdown. The following factors determine the maximum recommended interval between oil changes:

- Oil temperature (taken while the gear reducer is operating normally, under load)
- Type of oil (plain mineral oil or oil containing additives)
- Operating environment (dust and humidity)
- Normal operating conditions (shock loading)

Refer to Tables 3.3 and 3.4 to determine the appropriate oil change schedule for your unit. Refer to Section 3.4.3 for recommended oil requirements.

CAUTION:
Operating oil temperature must not exceed 200° F [93° C].

NOTE:
The specifications provided in Tables 3.3 and 3.4 represent oil temperature when the unit has reached normal running temperature while operating under load. Elevated operating temperatures significantly reduce the effective operating life of the oil – especially if the oil contains fatty or EP additives. Severe operating conditions may require more frequent oil changes.

Typical Oil Temperature (Normal Operating Temperature Under Load)	**Recommended Interval between Oil Changes (Use Shortest Interval)**
170° F [77° C] or less	5000 hours of operation or 12 months
180° F [82° C]	3500 hours of operation or 6 months
190° F [88° C]	2500 hours of operation or 6 months
200° F [93° C]	1000 hours of operation or 3 months

Table 3.3 *Oil Change Intervals for Gear Reducers Using Plain Mineral Oil*

Typical Oil Temperature (Normal Operating Temperature Under Load)	**Recommended Interval between Oil Changes (Use Shortest Interval)**
170° F [77° C] or less	5000 hours of operation or 12 months
180° F [82° C]	3000 hours of operation or 6 months
190° F [88° C]	2000 hours of operation or 6 months
200° F [93° C]	750 hours of operation or 3 months

Table 3.4 *Oil Change Intervals for Gear Reducers Using Oils Containing Additives*

3.4.3 Gear Reducer Oil Capacity

Gear reducer oil capacity is 4.80 U.S. gallons [18.144 L]. Oil quantities are approximate. To ensure correct oil level, check unit using oil level plug or dipstick provided. Over filling can result in overheating and oil leakage.

3.4.4 Gear Reducer Oil Recommendations

The gear reducer nameplate provides the David Brown Radicon Grade Number for the required oil. The grade number on the nameplate is a general recommendation for most applications. However, grade required depends largely on the ambient temperature of the operating environment. Table 3.5 shows the recommended oil grade for various operating environments.

NOTE:
These recommendations are based on information provided by oil suppliers – Besser cannot accept responsibility for the quality or suitability of oil, nor for premature mechanical wear/damage caused by unsatisfactory lubrication.

3.4.5 Oil Seal Replacement

Refer to the following procedure when replacing the gear reducer oil seals.

Clean and drain unit.

1. Remove the holding screws and withdraw the oil catcher.

NOTE:
Take care not to damage the shims or alter the shaft position.

2. Check for burrs or scratches on the shaft which could damage the new seal.
3. Tap the old seal out of the housing using an appropriately-sized drift.
4. Make sure the joint faces and shims are clean and position the shims in the oil catcher.
5. Coat the joint faces of the oil catcher and case with a good jointing compound (such as Welseal).
6. Replace the oil catcher and tighten the screws.
7. Fit the replacement seal on a seal guide, slide it along the shaft and press the seal into the housing.
8. Refill the gear reducer with the correct volume of an approved oil.

	Ambient Temperature		
	25 - 60° F [-4-16° C]	60 - 70° F [16-21° C]	70 - 100° F [21-38°
David Brown Grade No.	5	6	7
Representative Suppliers	Shell Omala 220 Texaco Meropa 220	Shell Omala 320 Texaco Meropa 320	Shell Omala 680 Texaco Meropa 680

Table 3.5 *Recommended Gear Reducer Oil Specifications*

3.5 BUCKET PIT

It is extremely important to regularly clear debris from the bucket pit.

Excessive build-up in the pit prevents the bucket from reaching its home-down position, resulting in improper and potentially dangerous operation. Before entering the bucket pit, perform the following procedure to insert the safety stops.

Figure 3.3 illustrates the safety stops.

DANGER:
Never enter the bucket pit without blocking the Skiploader bucket with the safety stops. Failure to heed this warning can result in death or serious injury.

1. Wait for the bucket assembly to completely clear both safety stops as it makes its way up the guided track.
2. Standing clear of bucket, completely insert the left and right safety stops in the holes in the skiploader tracks as shown. Each stop must go through both track flanges.

DANGER:
The safety stops will not support the weight of the bucket unless they are fully inserted through both channel flanges.

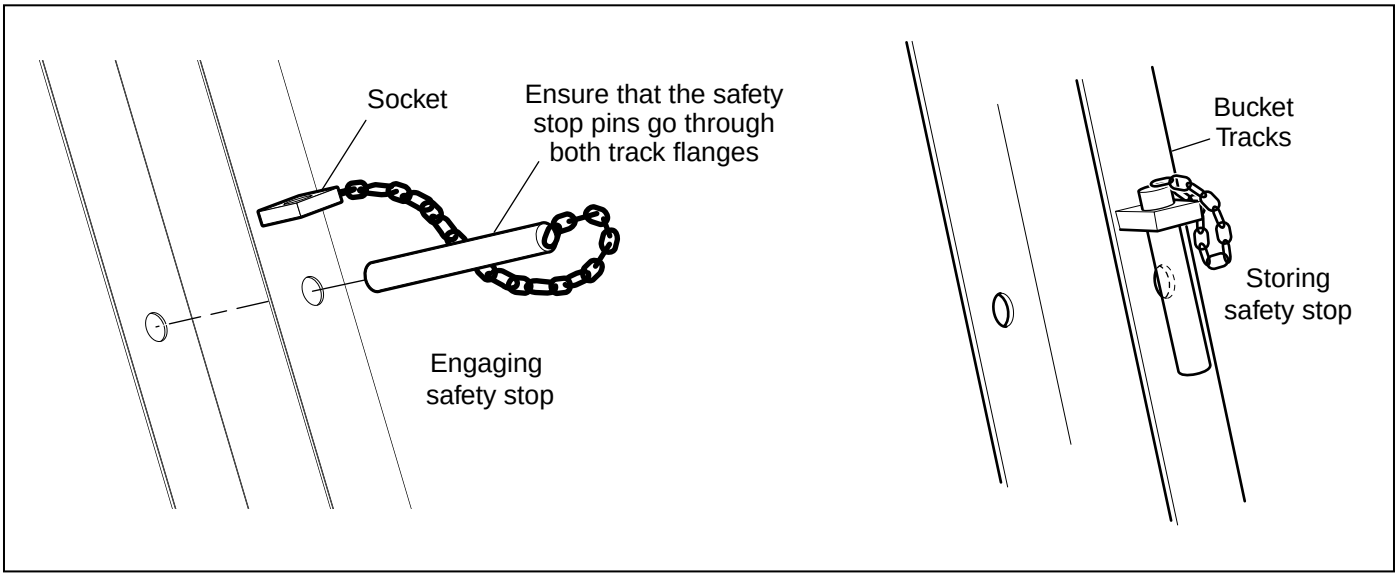


Figure 3.3 *Safety Stops*

3. Stand clear of the Skiploader as the bucket lowers down the track onto the safety stops.
4. After the bucket comes to rest, make sure the safety stops are securely in place and are bearing the weight of the bucket. See Figure 3.3.
5. Follow the recommended lockout procedure of Section 3.1.1 to shut-down the batch processing system including the mixer and the Concrete Products Machine.

NOTE:
Control equipment and external system components vary from plant to plant. The lockout procedure will therefore vary as well. Refer to your control equipment documentation for more information.

DANGER:
Never enter the bucket pit without wearing and using all specified safety equipment.

6. Clean out the bucket pit.
7. Following the cleaning of the bucket pit, return to production by completing these steps:
   - Turn the power on by reversing the lockout procedure.
   - Raise the bucket. See Figure 3.3.
   - Pull the safety stops out and insert in socket. See Figure 3.3.
   - Resume production.

3.6 CABLE SYSTEM

During the course of normal Skiploader operation, the bucket hoist cable contacts the sheaves, drum and rollers, all of which contribute to cable wear. Cable, when loaded, stretches like a coil spring. When bent over a sheave, this stretching causes the cable to rub against the drum and sheave grooves. All Skiploader components that directly or indirectly affect cable movement must be properly maintained to prevent premature cable damage.

3.6.1 Safety Systems

Make sure that safety devices are correctly installed and are in satisfactory working order. Pay particular attention to cable connections at the drum and bucket. Before inspecting the cable system or performing any maintenance to the cable or mechanical components, make sure that the bucket safety locks are correctly installed and that the electrical system is shut down and locked out.

WARNING:
Do not peform cable system maintenance while the Skiploader is capable of any operating movement. Make sure that the system electrical power is off and locked out.

Cable maintenance should be performed under the guidance of an experienced cable engineer or technician. Such a individual would have field experience in the maintenance of cable or wire ropes.

3.6.2 Breaking In New Cable

After correctly installing the cable, start the Skiploader and permit it to run through a cycle of operation at a very slow speed. During this trial operation, pay close attention to all moving components including sheaves, drum and rollers. Make sure the cable runs free of restriction as it operates. If you do not observe any problems, run through several Skiploader cycles at a reduced speed under light load. This procedure allows the new cable to gradually adjust to the operating environment. Before beginning full operation, measure and record cable diameter for use in evaluating cable condition over time. See Section 3.6.3.2.

3.6.3 Cable Inspection and Troubleshooting

Inspect the Skiploader cable system daily. Follow the working path of the cable and inspect the condition of all components. Table 3.6 identifies the symptoms and possible causes for many common cable failures. During inspection, look for any of these possible trouble areas and replace or adjust as necessary.

A cable that shows broken wires, deformed strands or other significant change from its normal appearance must be considered for replacement.

3.6.3.1 Inspection Records

Keep records of daily inspections and reference them to track changes in cable condition.

3.6.3.2 Monitoring Cable Diameter

Cable diameter is an important indication of overall condition. Measure and record the diameter of the new cable when it is first placed in service. During initial operation, cable diameter will decrease quickly at first, then level off. Following this initial break-in period and during most of the cable's operational life, cable diameter should decrease only slightly and on a straight line basis. When cable measurement shows another sharp decrease in diameter, this indicates that the cable core has begun to deteriorate and that the cable must be replaced.

3.6.4 Sheave and Drum Inspection

Inspect the size and condition of the Skiploader sheave and cable drum grooves on a weekly basis.

3.6.4.1 Inspecting Groove Size

Use a groove gage to measure size, contour and amount of wear. Figure 3.4 shows the use of a groove gage. Make sure the gage is designed to measure worn grooves (rather than new or re-machined grooves). The gage should contact the groove for about 150° of arc. In general, any groove that does not meet this minimum requirement should be replaced to prevent damage to the cable. When using a worn groove gage, daylight under the gage is not acceptable. If a full over-size gage is used, some daylight may be acceptable but this must be judged according to the actual size of the cable. An excessively tight groove pinches and damages the cable. A groove that is too large does not provide adequate support, causing the cable to flatten and restrict the free sliding action of the wires and strands.

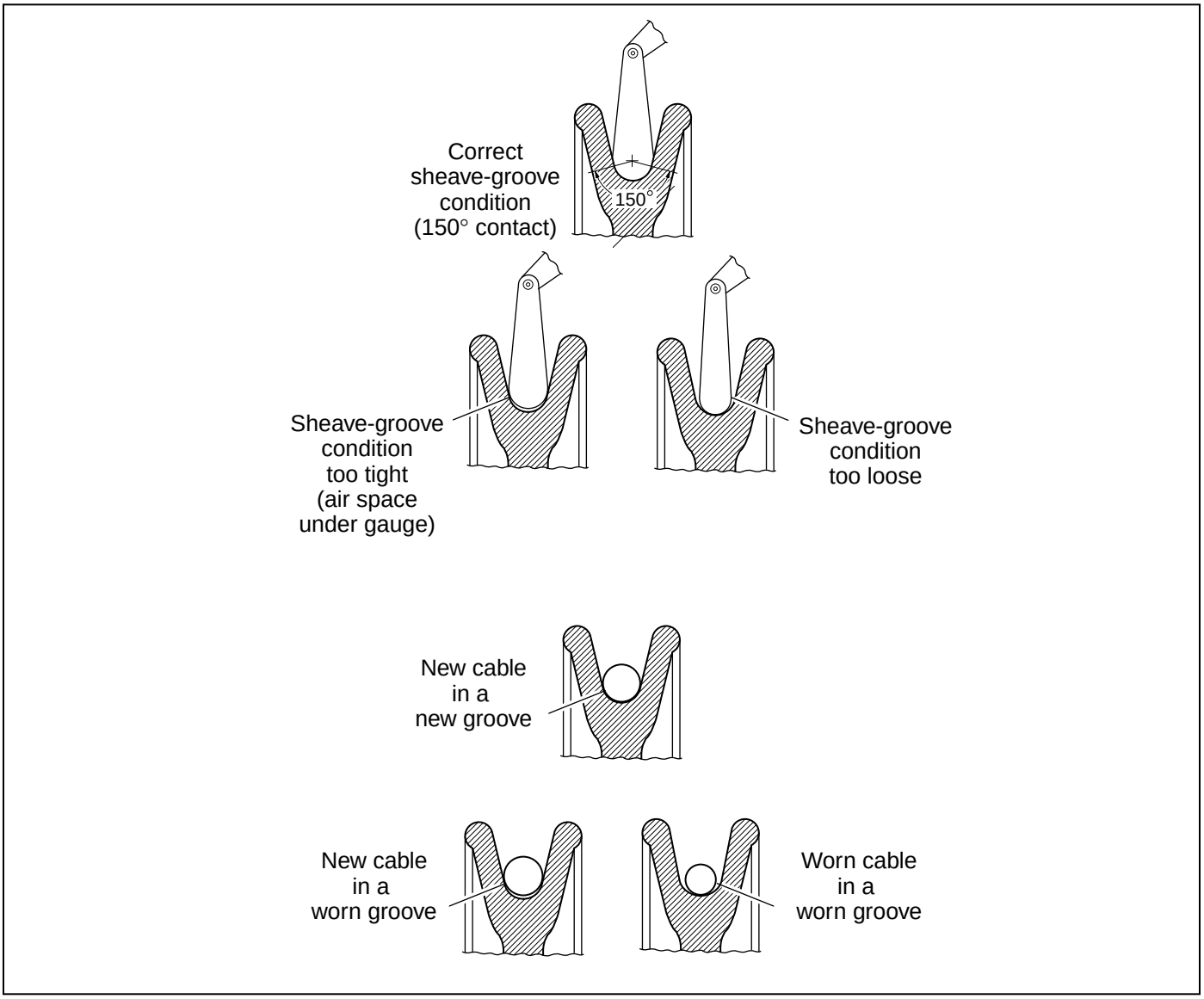


Figure 3.4 *Using a Cable Groove Gauge*

NOTE:
If the fleet angle is unusually large, it may be necessary to accept smaller arc of contact at the throat (130° for example). This prevents excessive cable scrubbing at the sheave flange.

3.6.4.2 Inspecting Groove Condition

Sheave and drum grooves should be smooth, not corrugated. Imprinted grooves should be machined. A deep corrugation may require that you replace the sheave or drum. Also check for flat spots that can induce “whip” into the line.

3.6.4.3 Inspecting Groove Wear Pattern

It is important to monitor how the grooves are wearing. Grooves worn off center force the cable to undercut or rub against the flange. If you encounter this condition, correct the alignment of the cable system.

3.6.4.4 Inspecting Sheave and Roller Integrity

As you inspect the sheave and drum grooves, also check the mechanical condition of the sheave itself, as well as any related rollers and bearings.

- Rollers and bearings should turn easily. If not, lubricate each bearing.
- Wobble in the sheave, caused by broken or worn bearings, is not acceptable. Bad bearings cause vibrations that can rapidly deteriorate the cable and create excessive friction and load.
- Sheaves with broken flanges can allow the cable to jump from the sheave and become fouled in the machinery. Replace broken flanges immediately.

3.6.5 Cable Lubrication

For effective system operation and to obtain maximum service life from the cable and associated components, the Skiploader cable should be lubricated weekly. In harsh operating conditions with unusually high levels of heat, humidity, dirt or corrosion, more frequent lubrication could be required to properly maintain the cable.

For proper cable maintenance, use a cable lubricant that meets these requirements:

- Free from acids and alkalis
- Sufficient adhesive strength to remain on the cable
- Light viscosity capable of penetrating into the cable core
- It should not be degraded by concrete mixtures
- High film strength
- Resistant to oxidation

Before applying lubrication to the cable, remove accumulations of dirt or other abrasive material. Clean the cable with a stiff wire brush dipped in solvent or compressed air. Lubricate the cable immediately after cleaning.

For all cable lubrication that involves manually applying lubricant to the cable, be careful to follow all safety precautions. Make sure the system power is shut off and locked out.

Failure Mode	Symptom(s)	Possible Cause(s)
Fatigue	• Wire break is transverse – either straight across or Z-shaped • Broken ends appear grainy	• Cable bent around excessively small radius • Vibration or whipping • Wobbly sheaves • Rollers too small • Reverse bends • Bent shafts • Tight grooves • Corrosion • Small drums and sheaves • Incorrect cable construction • Improper installation • Poor end terminations • Long service life
Tension	• Wire break reveals a mixture of cup and cone fracture and shear breaks	• Overload condition • Sticky, grabby clutches • Jerky conditions • Loose bearing on drum • Fast starts and/or stops • Broken sheave flange • Wrong cable size and/or grade • Poor end terminations • Other factors that place excessive strain on cable • Long service life
Abrasion	• Wire break mainly displays outer wires worn smooth to knife-edge thickness • Wire broken by abrasion in combination with another factor will show a combination break.	• Change in cable or sheave size • Change in load • Overburden change • Frozen or stuck sheaves • Soft roller, sheave or drum surfaces • Excessive fleet angle • Misalignment of sheaves • Kinks • Improperly attached fittings • Grit and sand • Objects imbedded in cable • Improper grooving
Abrasion Plus Fatigue	• Reduced cross-section broken off square, thereby producing a chisel shap	• Condition associated with normal wear
Abrasion Plus Tension	• Reduced cross-section is necked down as in a cup and cone configuration • Tensile break produces a chisel shape	• Condition associated with normal wear
Cut, Gouged or Rough Wire	• Wire ends are pinched down, mashed and/or cut in a rough diagonal shear-like manner	• Any previously noted mechanical abuse problem • Abnormal or accidental forces during cable installation
Torsion or Twisting	• Wire ends show evidence of twist and/or cork-screw effect	• Any previously noted mechanical abuse problem • Abnormal or accidental forces during cable installation
Mashing	• Wires are flattened and spread at broken ends	• Any previously noted mechanical abuse problem • Abnormal or accidental forces during cable installation • Commonly occurs on drums
Corrosion	• Wire surfaces are pitted with break showing evidence of either fatigue tension or abrasion	• Improper lubrication or storage • Corrosive environment

Table 3.6 *Cable Troubleshooting*

3.6.6 Cable Removal

This section and section 3.6.7 describe how to replace a worn cable. It is important to follow all safety precautions before removing the cable. Befor changing the cable follow the procedure for inserting the safety stops:

1. Wait for the bucket assembly to completely clear both safety stops as it makes its way up the guided track.
2. After the bucket assembly clears both safety stops, stop the skip bucket.
3. Standing clear of bucket, completely insert the left and right safety stops in the holes in the Skiploader tracks. Each stop must go through both channel flanges.

DANGER:
The safety stops will not support the weight of the bucket unless they are fully inserted through both channel flanges.

4. Stand clear of the Skiploader as the bucket lowers down the track onto the safety stops.
5. After the bucket comes to rest, make sure the safety stops are securely in place and bearing the weight of the bucket.
6. Make sure bail and sheave are supported throughout this process.
7. Make sure that there is slack in the cable and that the bucket is supported entirely by the safety stops.
8. Follow the recommended lockout procedure to shut down the batch processing system including the mixer and the Concrete Products Machine.

NOTE:
Control equipment and external system components vary from plant to plant. The lockout procedure will therefore vary as well. Refer to your control equipment documentation for more information.

9. To Remove the cable:

DANGER:
Never change the cable without blocking up the Skiploader bucket with the safety stops. Failure to heed this warning can result in death or serious injury.

- During cable removal, independently guide and secure cable ends to prevent cable from falling.
- Remove the cable clamp.
- Unwrap the cable from the drum on the drive assembly.
- Take the cable out of the sheaves.
- Remove the cable from the top sheave support.

3.6.7 Cable Installation

To install the new cable:

1. Secure the cable to the underside of the top sheave support as shown in Figure 3.5.
2. Thread the cable down through the sheave on the bucket bail and back up over the sheave on the top sheave support.
3. Wrap the cable twice around cable drum on the drive assembly and thread it under the clamp on the drum. See Figure 3.6.
4. There must be a full snug wrap between each clamp groove.
5. Confirm that the cable is wrapped in the direction shown in Figure 3.6, and make sure that the end of the cable projects at least 4 inches [102 mm] from clamp.
6. Secure the cable clamp with grade 5, 1 inch [25 mm] bolts. Use Loctite #242 and torque to 600-650 ft. lbs. [813-881 N•m]
7. Following the installation of the cable return to production by completing these steps:
   - Turn the power on by undoing the lockout procedure.
   - Raise the bucket.
   - Pull the safety stops out and insert in socket.
   - Resume production.

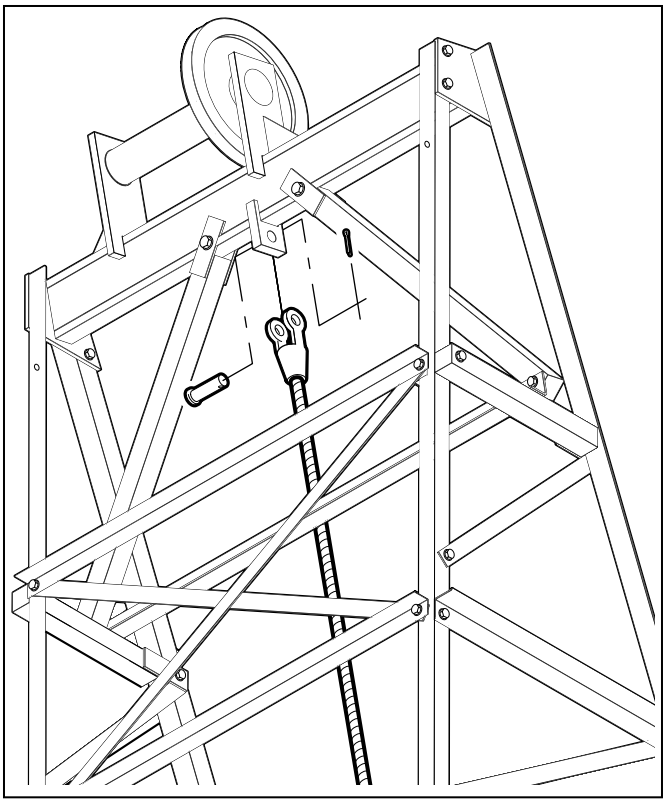


Figure 3.5 *Install Cable – Stationary End*

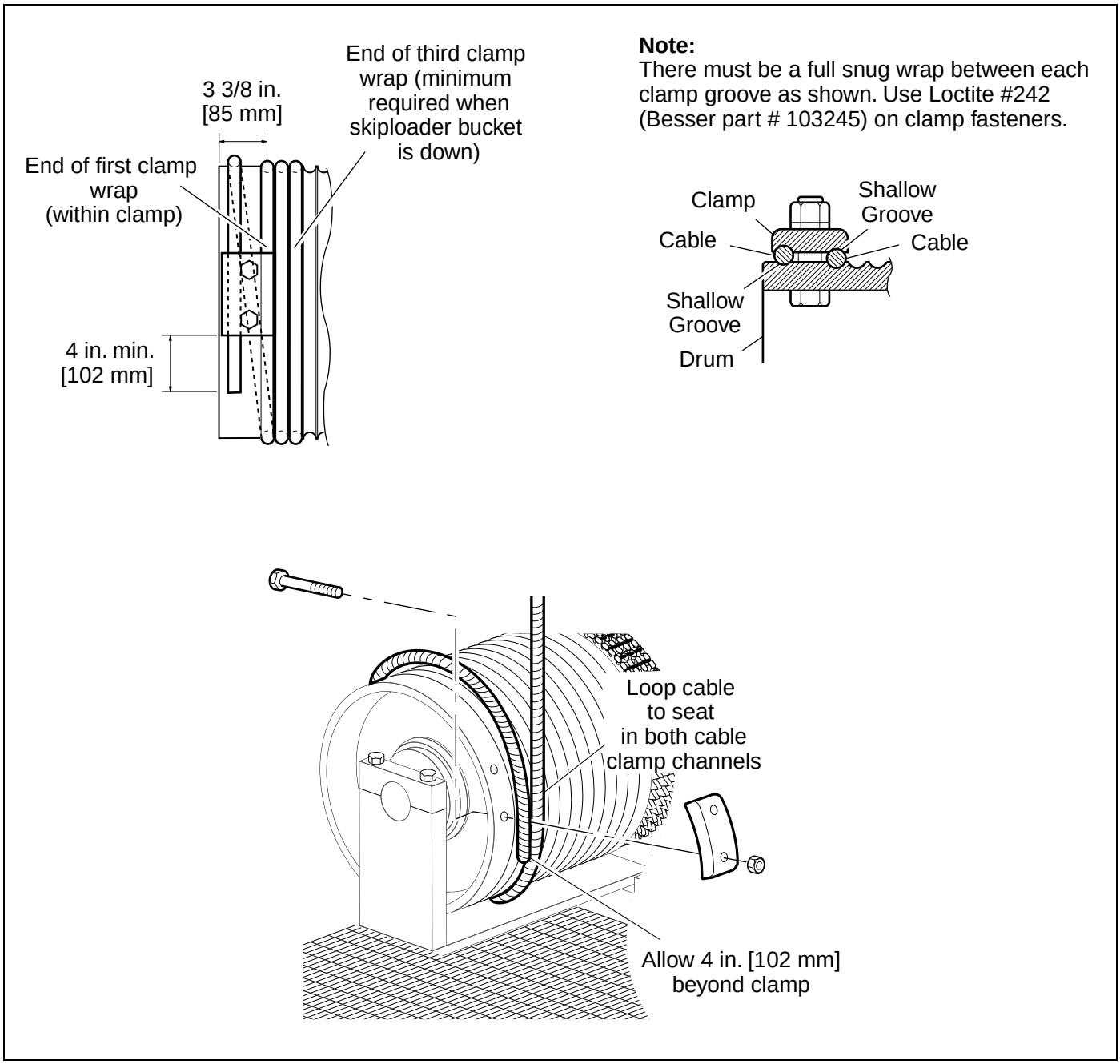


Figure 3.6 *Install Cable to Drum*

3.7 COUPLING

A flexible coupling connects the shafts of the electric motor and the gear reducer. The coupling reduces system noise and vibration and compensates for minor misalignment of the two shafts.

3.7.1 Coupling Alignment

Figure 3.7 shows the misalignment capabilities of the coupling. The values of 1 degree angular and 0.015 inches [4 mm] parallel are maximum values for which the coupling can compensate. If shaft misalignment exceeds these values, the motor or gear reducer must be repositioned to bring the shafts into closer alignment.

3.7.2 Coupling Inspection

After initial 100 hours of operation and annually thereafter, disassemble the coupling and inspect the insert for wear. Heavy or uneven wear on the insert indicates excessive coupling misalignment. Reposition motor or gear reducer to reduce misalignment. If insert wear is significant, replace the insert before reassembly.

3.7.3 Coupling Installation

Follow these precautions when installing the coupling after inspection or insert replacement:

- Couplings are bored to “push fit” tolerances. If fit is too tight, check shaft for burrs.
- There should be complete shaft engagement within the bore.
- To check alignment, place a .005 scale straight edge at top and side of coupling. Use a 0.005 inch [.13 mm] feeler gauge under scale for final inspection. See Section 3.7.1 for alignment tolerance.
- Secure equipment mounts and recheck alignment for movement.
- Install the insert in the coupling positioning hubs in contact with lip around outside of insert.
- Before tightening set screws, run the coupling and check for separation of hubs or “creep”. Recheck alignment and tighten set screws. Torque set screws to 300 – 310 inch pounds [33.9 – 35 N•m].

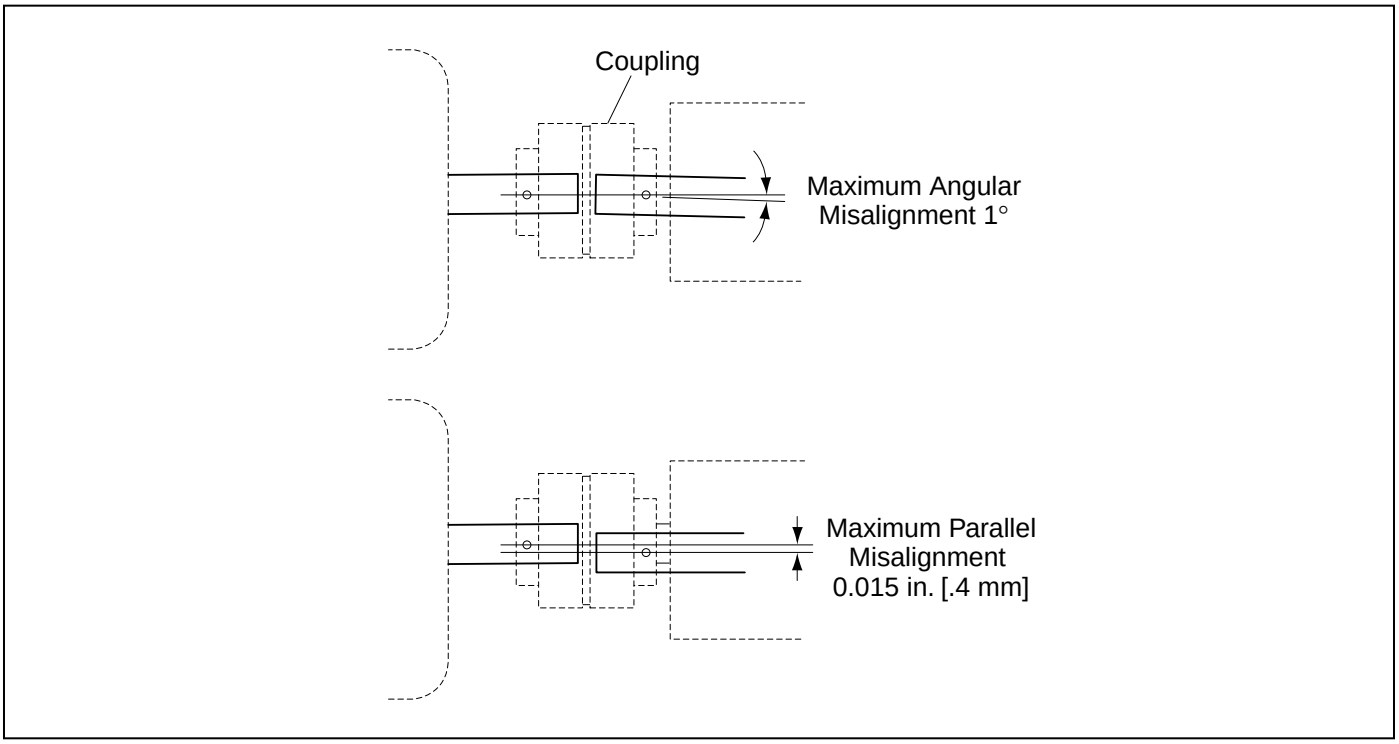


Figure 3.7 *Coupling Alignment*

3.8 ELECTRIC MOTOR

The electric motor is engineered to provide a reliable, low-maintenance service life. The motor requires no lubrication. Table 3.7 lists the required scheduled maintenance.

Type of Maintenance	Special Instructions	Scheduled Maintenance
Clean	• Use moderate air pressure to blow out dirt from windings. Clean slip rings.	Every six months
Inspect connector	• Inspect and tighten all connections on motor and controls.	
Check current	• Check current draw and compare with normal	
Check mounting	• Retighten all mounting bolts. With motor running, verify that motor operation is smooth and vibration-free.	

Table 3.7 *Electric Motor Maintenance*

3.8.1 Electric Motor Troubleshooting

Table 3.8 lists possible motor operating problems along with probable causes and corrective actions.

Problem	Indication/Cause	Corrective Action
Motor fails to start	• Blown fuse or open circuit breaker	• Replace fuse or reset circuit breaker.
	• Overload tripped	• Check and reset overload.
	• Improper line connection	• Check connection against prints.
	• Open circuit in winding or starting switch	• Evidenced by a humming sound from motor when switch is closed. Check inside motor to determine if switch is closed. Check for loose connections.
	• Improper current supply	• Check to determine that power supply matches motor name plate specifications.
	• Mechanical failure	• Determine that motor and drive turn freely. Check bearings.
	• Short circuited stator	• Indicated by blown fuses. Motor must be rewound.
	• Poor stator coil connection	• Remove end bells and locate with a test lamp.
	• Defective rotor	• Look for broken bars or end rings. Replace rotor.
	• With 3-phase power source, one phase may be open	• Check line for open phase.
	• Defective capacitor	• Replace capacitor.
Motor stalls	• Low line voltage	• Check across AC line and correct if possible.
Motor runs and then stops	• Partial loss of line voltage	• Check for loose connections. Check for proper main power supply.
	• Stator shorts when motor warms up	• Replace stator.
Motor does not come up to speed	• Voltage too low at motor terminals	• Check across AC line an correct if possible.
	• Broken rotor bars	• Look for broken bars or end rings. Replace rotor.
Motor takes too long to accelerate	• Loose connections	• Check connections and tighten where necessary

Table 3.8 *Electric Motor Troubleshooting*

Problem	Indication/Cause	Corrective Action
Motor overheats above nameplate specification	• Motor fan may be clogged with dirt preventing proper ventilation	• Remove fan cover and clean.
	• With 3-phase power source, one phase may be open	• Check to insure that all connections are tight.
	• Partially shorted stator coil	• Motor must be rewound
	• Line voltage too high	• Check across AC line and correct. Stepdown transformer may be required.
	• Line voltage too low	• Check across AC line. Consult power company. Step-up transformer may be required.
	• Rotor rubs stator bore	• Replace bearings and seals.
	• Worn bearings	• Replace bearings and seals.
Motor vibrates	• Motor mounting bolts are loose	• Tighten mounting bolts.
	• Driven equipment is unbalanced	• Balance driven equipment.
	• Worn motor bearings	• Replace bearings and seals.
	• 3-phase motor is running on single phase	• Check for open circuit and correct.
	• Bent motor shaft	• Replace shaft or rotor.

Table 3.8 *Electric Motor Troubleshooting – Continued*

3.9 CHAIN SYSTEM

WARNING:
To prevent serious personal injury, comply with the following guidelines when installing or servicing Skiploader chains and sprockets.

3.9.1 Chain System Maintenance Guidelines

Comply with each of the following guidelines when installing or servicing Skiploader chains and sprockets.

1. Guards must be provided on all chain and sprocket installation in accordance with provisions of ANSI/ASME B15.1-1984 "Safety Standards for Mechanical Power Transmission Apparatus," and ANSI/ASME B20.1-1990 "Safety Standards for Conveyors and Related Equipment" or other applicable safety standards. When revisions of these standards are published, the updated editions shall apply.
2. Allways follow the recommended lockout procedure to shut down the batch processing system including the mixer and the Concrete Products Machine before installing, removing, lubricating or servicing a chain system.
3. When connecting or disconnecting a chain:
   - Eye and body protection is required. Wear safety glasses, protective clothing and safety shoes.
   - Support the chain(s), Skiploader cable and Skiploader bucket to prevent uncontrolled movement of chain and parts.
   - Use of pressing equipment is recommended. Tools must be in good condition and properly used.
4. Determine correct direction for pin/rivet removal or insertion.

3.9.2 Chain System Inspection and Troubleshooting

Inspect the Skiploader chain system for the following:

- Worn, damaged or broken parts
- Conditions that could cause the chain system to interfere with other Skiploader components

Table 3.10 identifies many typical chain system problems. Regular preventive maintenance will prevent most of these conditions.

3.9.3 Chain System Lubrication

Always follow the recommended lockout procedure to shut down the batch processing system including the mixer and the Concrete Products Machine before lubricating or servicing a chain system.

Apply oil with an oil filler or brush in the gap between the pin link and roller link on the slack side of the chain. Apply oil every eight hours or as often as necessary to prevent the bearing area of the chain from becoming dry. See Table 3.9.

Ambient Temperature	14° F [-10° C] 32° F [0° C]	32° F [0° C] 104° F [40° C]	104° F [40° C] 122° F [50° C]	122° F [50° C] 140° F [60° C]
Oil	SAE 20	SAE 30	SAE 40	SAE 50

Table 3.9 *Oil for Chain*

Condition	Indication/Cause	Corrective Action
Sprocket Misalignment	Wear on the sides of sprocket teeth generally indicates the sprockets and/or shafts have been improperly installed. If shafts are not parallel or not on the same plane, asymmetrical wear will appear on the sprockets or chain rollers.	Correct alignment, then retighten the screws on the sprocket hubs
Chain Wear and Elongation	Normal wear will slightly increase the length of the chain; however if chain length increases suddenly, look for severe wear on the tips of the sprocket teeth. This condition can be caused by: • Excessive loading or shock loading • Displacement of take-ups • Under-designed or faulty drive system **NOTE:** If chain elongation exceeds 2 1/2%, it may indicate that the chain and/or sprockets should be replaced. See Section 3.9.4 for information about calculating allowable chain stretch.	Before replacing a chain or sprocket: • Recalculate the initial drive design • Check chain for broken parts • Check chain tension if there is to much accumulated slack in the drive
Broken Chain Parts	Possible causes include: • Overloaded drive • Extreme misalignment • Excessive elongation causing the chain to jump sprocket teeth • Improper drive design geometry • Foreign objects obstructing the chain and/or sprocket	• Recalculate initial drive design and make the necessary corrections • Inspect sprockets and shafts for proper alignment or looseness and make necessary corrections
Link Plate Wear	Wear on the outer sides of the link plate may be caused by the chain contacting the frame, case or another fixed object.	• Remove or relocate the fixed object • Replace/readjust as necessary
Excessive Noise	Possible causes include: • Broken links and chain rollers • Extreme misalignment • Excessive elongation • Chain jumping sprocket teeth • Loose sprockets • Broken teeth • Accumulation of dirt packed into the chain or sprocket teeth • Interference by foreign objects • Contact by fixed object	• Check for worn, broken or missing parts • Check alignment of shafts and/or sprockets • Make necessary repairs or adjustments
Excessive Vibration	Possible causes include: • Unbalanced rotating parts • Broken or missing rollers • Excessive chain slack • Loose or misaligned sprockets or shafts	• Inspect chain and drive equipment • Make necessary repairs or adjustments
Improper Lubrication	Light or dark brown discoloration of pin-bushing joints and connecting link pins, or brown-red oxide color in oil may indicate chain plugged or malfunctioning lubrication system.	• Remove chain • Carefully clean and dry chain • Immerse chain in oil • Reinstall chain • Change oil in chain case and flush the case • Correct problem with lubrication system/oil supply

Table 3.10 *Chain System Troubleshooting*

3.9.4 Calculating Chain Stretch

2.5% chain stretch is acceptable for Skiploader operation. Use the following formula to calculate the allowable length of chain stretch, where S = allowable stretch, L = chain length and N = the number of surfaces (sprockets) contacting the chain.

$$S = \frac{(L) \times (.025)}{N}$$

Example: If a 100 inch chain is driven by 2 sprockets, L = 100 and N = 2. The allowable stretch (S) is calculated as follows:

$$S = \frac{(100) \times (.025)}{2} = \frac{2.5}{2} = 1.25 \text{ inches } [3.2 \text{ cm}]$$

3.9.5 Chain Service Procedures

This section includes the recommended procedures and guidelines for replacing or repairing the Skiploader drive chains.

NOTE:
Never alter chain parts or attempt make-shift repairs as a substitute for required maintenance. Always use replacement parts specified by Besser or the chain manufacturer.

Follow the recommended lockout procedure to shut down the batch processing system including the mixer and the Concrete Products Machine.

3.9.5.1 Chain Removal

Perform the following steps to remove a Skiploader chain.

1. Turn the drive until a connecting link is fully engaged with one of the sprockets, relieving tension on the connecting link pin.
2. Carefully remove the connecting link.

3.9.5.2 Cutting Riveted Chain

Drive the two pins of a pin link out of the link plate. Strike the pins alternately to avoid distorting the roller link plates and the plates on adjacent links.

3.9.5.3 Periodic Chain Cleaning

Refer to the following steps to perform chain cleaning:

1. Remove the chain from the sprockets and wash chain in kerosene.
2. If the chain is badly gummed, soak it in kerosene and re-wash in fresh solvent.
3. Drain off the kerosene and soak chain in oil to restore lubrication.
4. Drain off excessive lubrication by hanging the chain.
5. Carefully inspect the entire chain before reinstalling.
6. Wash the sprockets in kerosene.

3.9.5.4 Chain Storage

Refer to the following steps when removing a Skiploader chain from service, or when returning a chain to service from storage. Perform the following steps to remove a Skiploader chain from service for a prolonged period of time.

1. Remove the chain and cover with heavy grease.
2. Wrap the chain in heavy grease-resistant paper and store where the chain will not be exposed to abnormal moisture, extreme temperature, or abrasive or corrosive conditions.
3. Cover any sprockets that remain on shafts with heavy grease.

3.9.5.5 Returning Chain to Service

Perform the following steps to return a Skiploader chain to service from storage.

1. Remove the grease from the chain.
2. Thoroughly clean the chain and sprockets. Refer to Section 3.9.5.3 for chain cleaning procedures.
3. Follow the recommended lockout procedure to shut down the batch processing system including the mixer and the Concrete Products Machine.
4. Reinstall the chain.

3.9.5.6 Heating and Welding

- Do not attempt to weld any chain or chain components.
- Do not use a cutting torch to apply heat to a chain unless it is absolutely necessary to do so. If you must use a cutting torch to remove a chain, always replace the chain.

3.9.5.7 Inserting New Chain Links

Only insert new links on a new roller chain. Pitch variance between new links and links on an older chain – especially an older chain that is elongated due to wear – will cause shock when the new links reach the sprocket.

3.9.5.8 Installing a New Chain

Visually inspect chains and/or related parts for shipping damage prior to installation. Never install a new chain on badly worn or damaged sprockets.

NOTE:
As a temporary fix, reverse a worn sprocket on the shaft to present a new set of working tooth surfaces. Replace worn or damaged sprockets as soon as possible to avoid permanent damage to the chain.

3.9.6 Sprocket Alignment

For proper chain operation, the sprockets must be aligned within close tolerances. This section covers procedures for checking and adjusting sprocket alignment. Sprocket alignment is required following service to drive system components such as replacing cable drum or sprockets. See Figure 3.8 for sprocket and shaft designations.

A complete sprocket alignment covers the following procedures:

- 3.9.7 Check Sprocket Runout
- 3.9.8 Align Jack Shaft Sprocket and Cable Drum Sprocket
- 3.9.9 Align Jack Shaft Sprocket and Reducer Sprocket
- 3.9.10 Tighten Chains

3.9.7 Check Sprocket Runout

Check sprocket runout as follows:

1. Inspect jack shaft. Clean shaft and remove burrs. Verify that shaft is straight.
2. Using a machinist level, align jack shaft and cable drum shaft within tolerance of 0.010 inches per foot [0.84 mm per meter].
3. Measure radial and side runout of all four sprockets.

Table 3.11 shows the allowable sprocket runout.

NOTE:
Sprocket runout is not adjustable. If runout value is outside of specification, new sprockets will be needed.

Sprocket	50 HZ	60 HZ	Radial TIR	Side TIR
1	X	X	.012 in. [.3 mm]	.020 in. [.5 mm]
2	X	X	.022 in. [.6 mm]	.060 in. [1.5 mm]
3	X		.014 in. [.4 mm]	.020 in. [.5 mm]
4		X	.012 in. [.3 mm]	.020 in. [.5 mm]
5	X	X	.022 in. [.6 mm]	.060 in. [1.5 mm]

Figure 3.11 *Allowable Sprocket Runout*

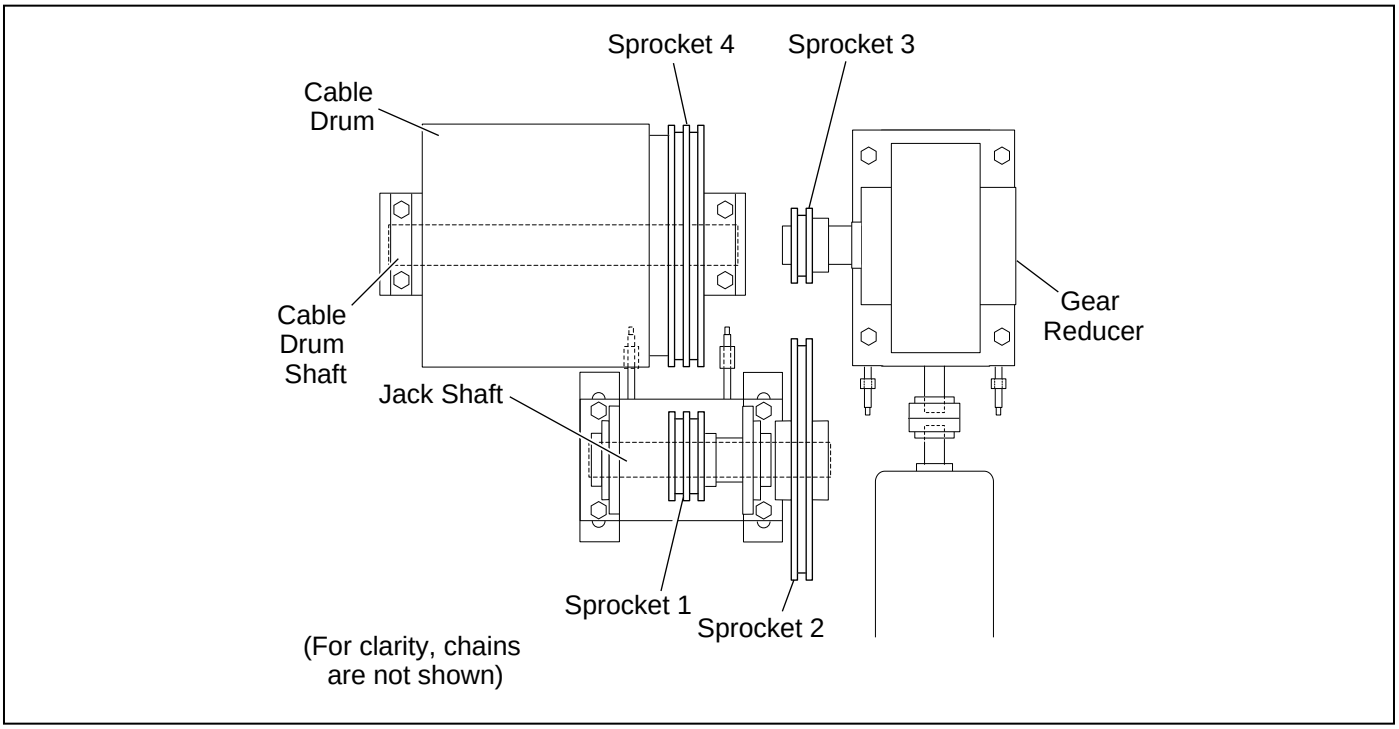


Figure 3.8 *Chain Drive System*

3.9.8 Align Jack Shaft Sprocket and Cable Drum Sprocket

Figure 3.9 shows the measurement positions and a side view of the alignment points. To align sprockets:

1. On cable drum sprocket 4, face G, use dial indicator to locate two equal runout points E.
2. Mount straightedge on face G across equal runout points E.
3. Determine average runout on jack shaft sprocket 2, face N. Locate and label average runout position point I.
4. Rotate point I to position C. Measure distance C between sprockets.
5. Rotate point I to position D. Measure distance D between sprockets.
6. Adjust jack shaft position to meet these requirements:
   - Distances C and D are equal within a tolerance of 0.010 inches [0.25 mm]
   - Jack shaft sprocket 1 and cable drum sprocket 4 are aligned axially within 0.056 inches [1.4 mm]

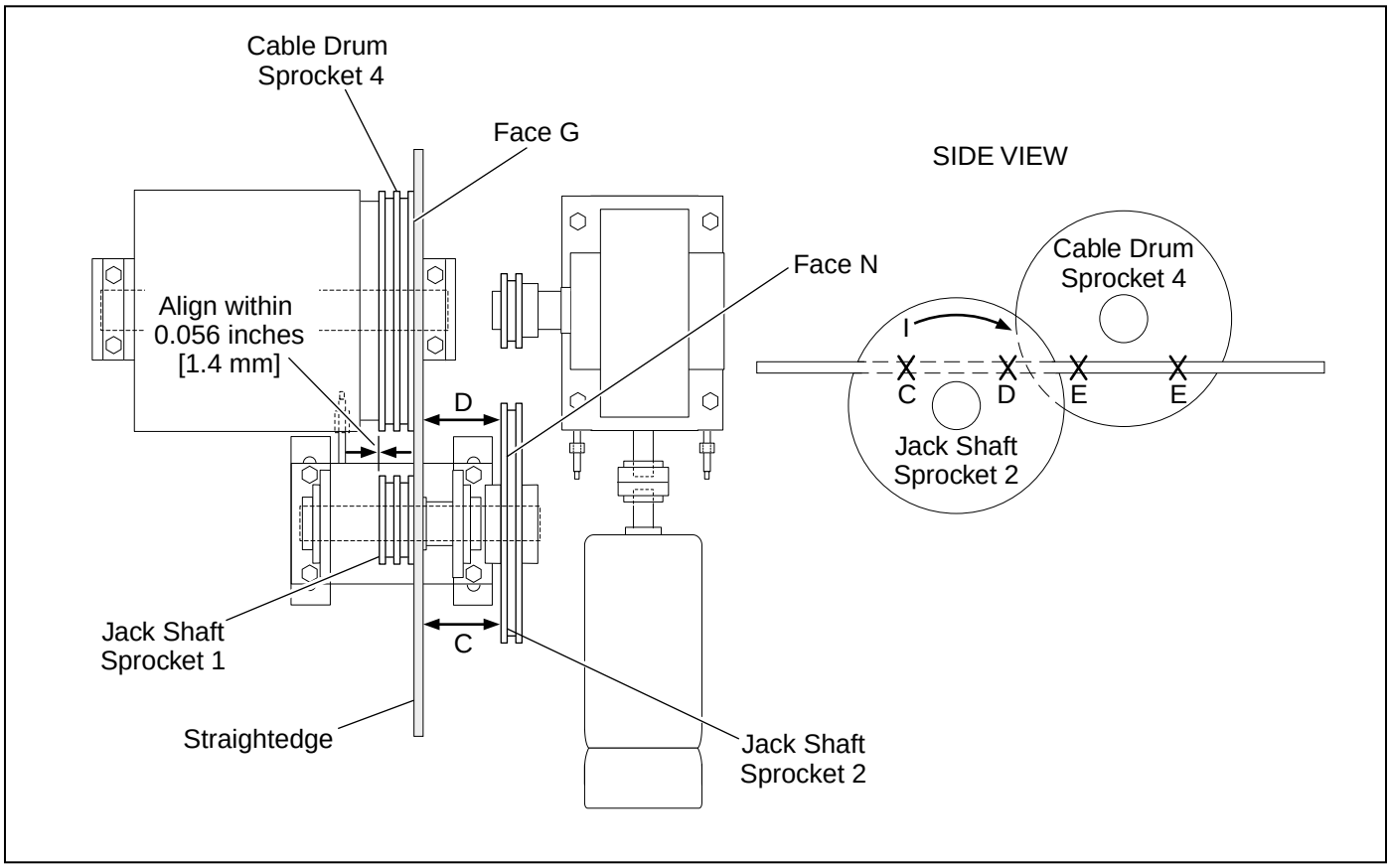


Figure 3.9 *Sprocket Alignment A*

3.9.9 Align Jack Shaft Sprocket and Gear Reducer Sprocket

Figure 3.10 shows the measurement positions and a side view of the alignment points. To align sprockets in step 4, use a combination of two adjustments:

- Use jack bolts to adjust gear reducer
- Shim the mounting plate under motor and gear reducer.

To align sprockets:

1. On jack shaft sprocket 2, face N, use dial indicator to locate two equal runout points P.
2. Mount straightedge on face N across equal runout points P.
3. Pivot straightedge through 3 positions J, K, L and M.
4. Adjust gear reducer position to meet these requirements:
   - Distance J, K, L and M are equal within .005 inches [.13 mm].
   - Jack shaft sprocket 2 and gear reducer sprocket 3 are aligned axially within 0.056 inches [1.4 mm]

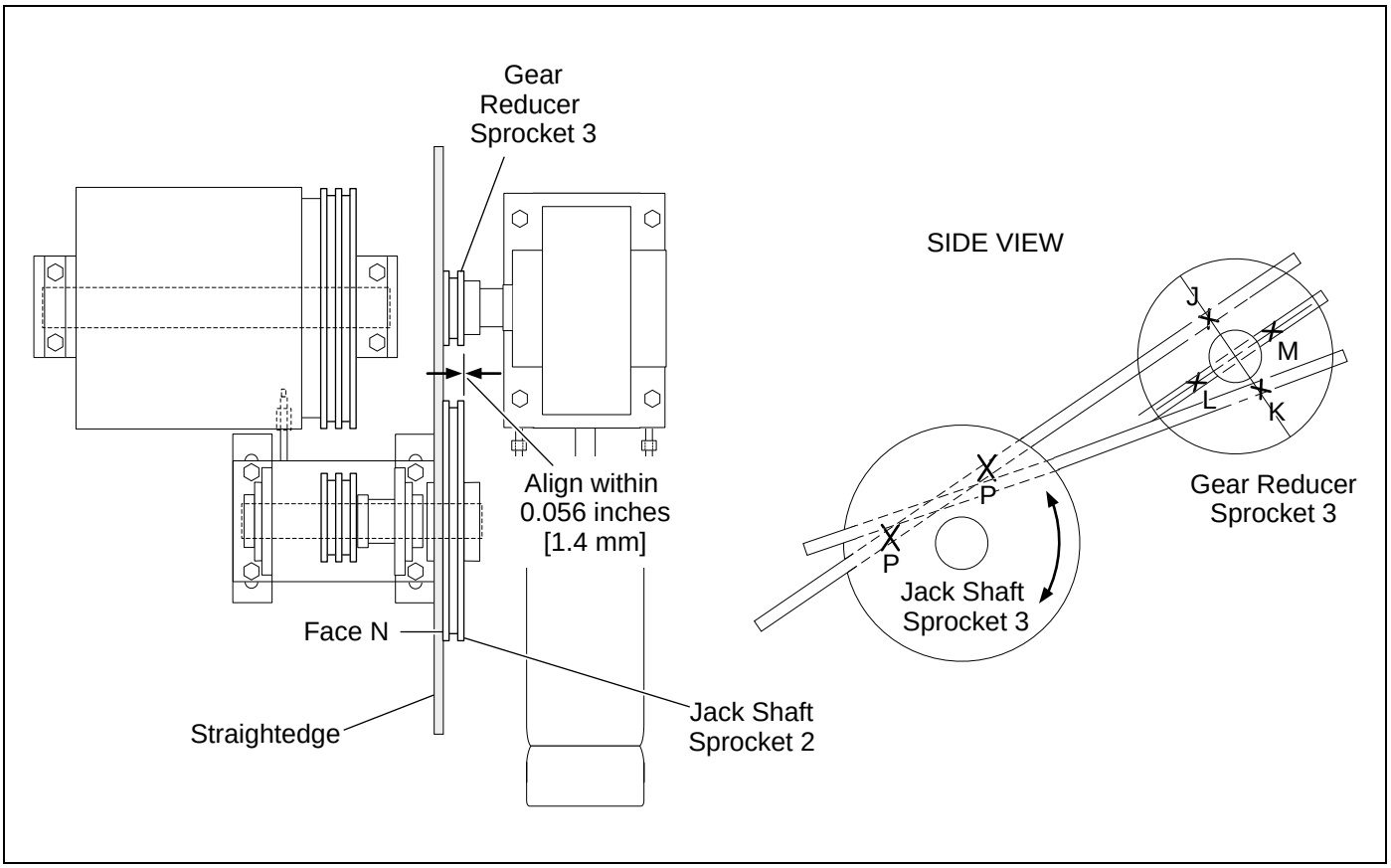


Figure 3.10 *Sprocket Alignment B*

3.9.10 Tighten Chains

Check chain tension following all service work on sprockets and drive components. Chain tension is determined by measuring total chain deflection at a point mid-span between sprockets. Check chain tension when the chain is tightest; rotate drive to determine the tightest position.

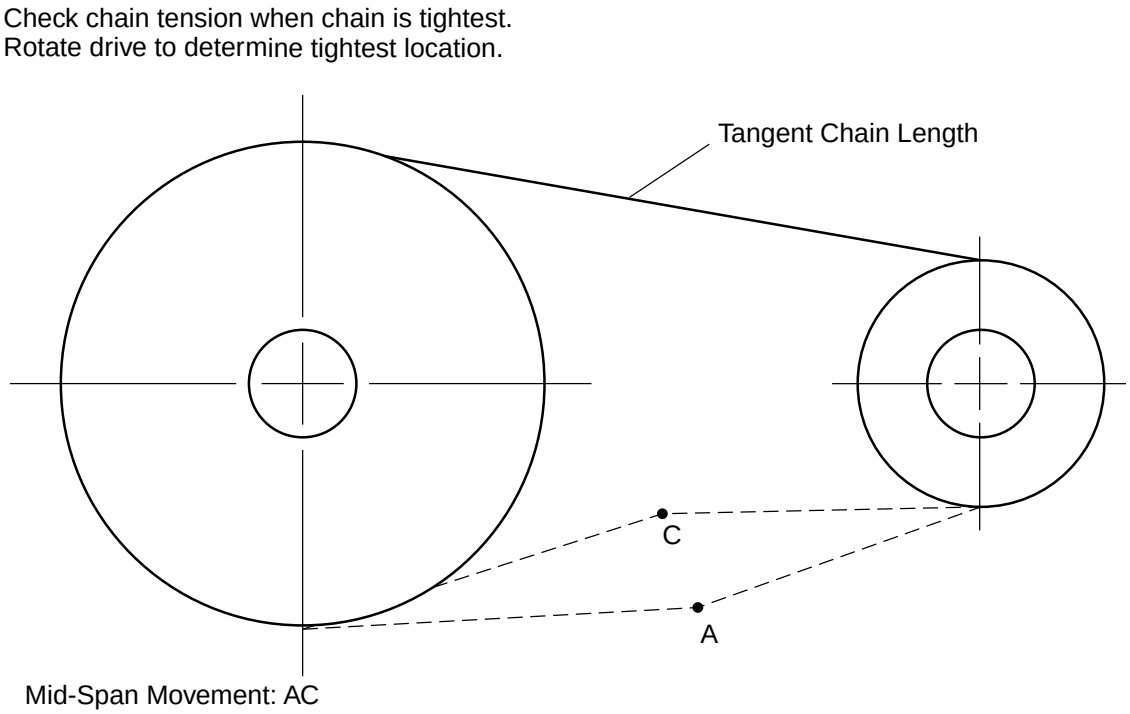
Figure 3.12 shows how to measure:

- The tangent chain length between sprockets
- Mid-Span Movement

Figure 3.11 also shows maximum allowed values for deflection and sag.

When tightening chains, verify that you are maintaining proper alignment:

- For the cable drum/jack shaft chain, use dial indicators on jack shaft bearings to maintain alignment between the jack shaft and the cable drum shaft.
- For the gear reducer/jack shaft chain, use dial indicator on gear reducer housing to maintain alignment between the jack shaft and the gear reducer.



Tangent Chain Length	Inches	15	20	25	30
	mm	381	508	635	762
Recommended Mid-Span Movement AC	Inches	0.75	1.0	1.25	1.5
	mm	19	25	32	38

Figure 3.11 *Chain Tightening*

3.10 STEARNS BRAKE

Stearns brakes are spring-set, electrically released disc brakes which stop and hold a load. Stearns brakes self-adjust for friction wear and mount directly to NEMA C-face motors. See Figure 3.12.

The following installation and service instructions are the Stearns Spring Set Disc Brakes Installation and Service Instructions, P/N 8-078-927-00, dated 5/15/96. Therefore Besser assumes no responsibility for this information. This information is listed here for convenience of maintenance. References to brakes other than the 87,000 series have been deleted.

3.10.1 General Lockout Procedures

For protection of servicing personnel, most machine maintenance must be performed with the electrical power shut off and locked out. This precaution prevents injury from accidental movement of machine components. Here are general procedures to secure the machine system in a lockout condition:

1. Announce lockout to other personnel.
2. Switch off power at main panel.
3. Using your shop's authorized key and lock system, secure the main power switch in the lockout position.
4. Remove your key from the lock and keep the key with you at all times while performing system maintenance.
5. Clear machine of all personnel.
6. Test the lockout condition by trying to operate the machine from the control panel. Verify that all controls are inoperative.
7. Block, chain or release stored energy sources.
8. Clear machine of personnel before restarting machine.

WARNING:
This lockout procedure is a minimum precaution for the safety of servicing personnel. Do not attempt to avoid or shortcut these procedures.

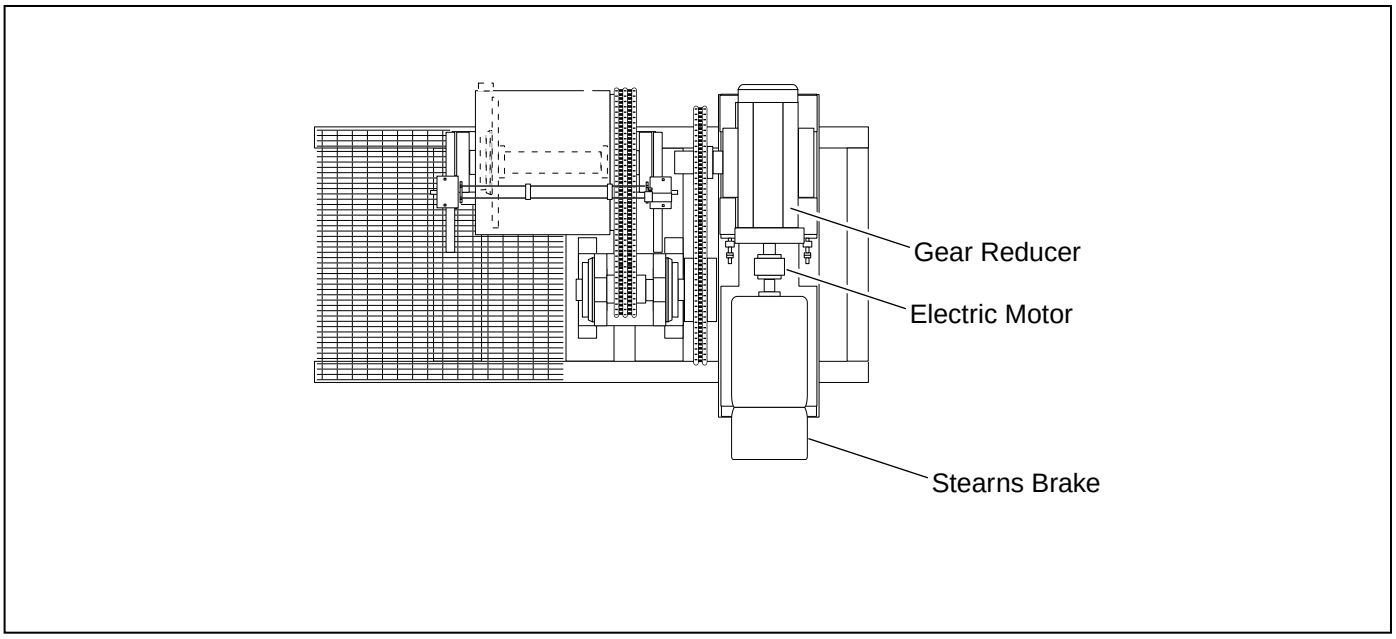


Figure 3.12 *Stearns Brake*

WARNING:
Please read these instructions carefully before installing, operating, or servicing your Stearns brake. Failure to comply with these instructions could cause injury to presonnel 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, WI 53202, (414) 272-1100.

CAUTION:
Installation and servicing 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.

CAUTION:
Do not install the brake in atmospheres containing explosive gases or dusts.

CAUTION:
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.

CAUTION:
Make certain power source conforms to the requirements specified on the brake nameplate.

CAUTION:
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.

CAUTION:
Do not operate brake with housing removed. All moving parts should be guarded.

CAUTION:
Installation and servicing should be performed only by qualified personnel familiar with the construction and operation of the brake.

CAUTION:
For proper performance and operation, only genuine Stearns parts should be used for repairs and replacements.

CAUTION:

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.

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

CAUTION:
Do not run motor with the brake in the manual release position to avoid overheating of friction disc.

CAUTION:
Do not lubricate any parts of the brake.

CAUTION:
Do not adjust brake torque. The nominal static torque is factory pre-set and should not be altered.

3.10.2 General Description

The 87,000 Series is a spring-set, electrically released disc brake for controlled stopping and holding of a load. It is self-adjusting for friction disc wear and mounts directly to a NEMA C-face motor with 8 1/2 inch [216 mm] (AK) register and a 7 1/4 inch [184 mm] (AJ) bolt circle.

The brake is provided with a manual release lever or rod. When the motor is off and the load is to be moved without energizing the motor, the manual release lever or rod 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 or rod is returned manually to its set position, or until the brake is re-energized electrically and the release lever or rod returns to its set position automatically.

3.10.3 Installation Procedure

1. Remove manual release knob (148) (on pull type), housing nuts (15) and housing (7). Housings equipped with side manual release do not have release knob.
2. Depress solenoid plunger (29) and pull release rod (146) back to lock brake mechanism in manual release position or wire tie plunger (29) to frame (79).
3. Remove entire support plate assembly (142) by evenly unscrewing screw (142S). Remove screws, conical spring washers, and flat washers if supplied.
4. Remove pressure plate (5), friction disc (4), and stationary disc (3).

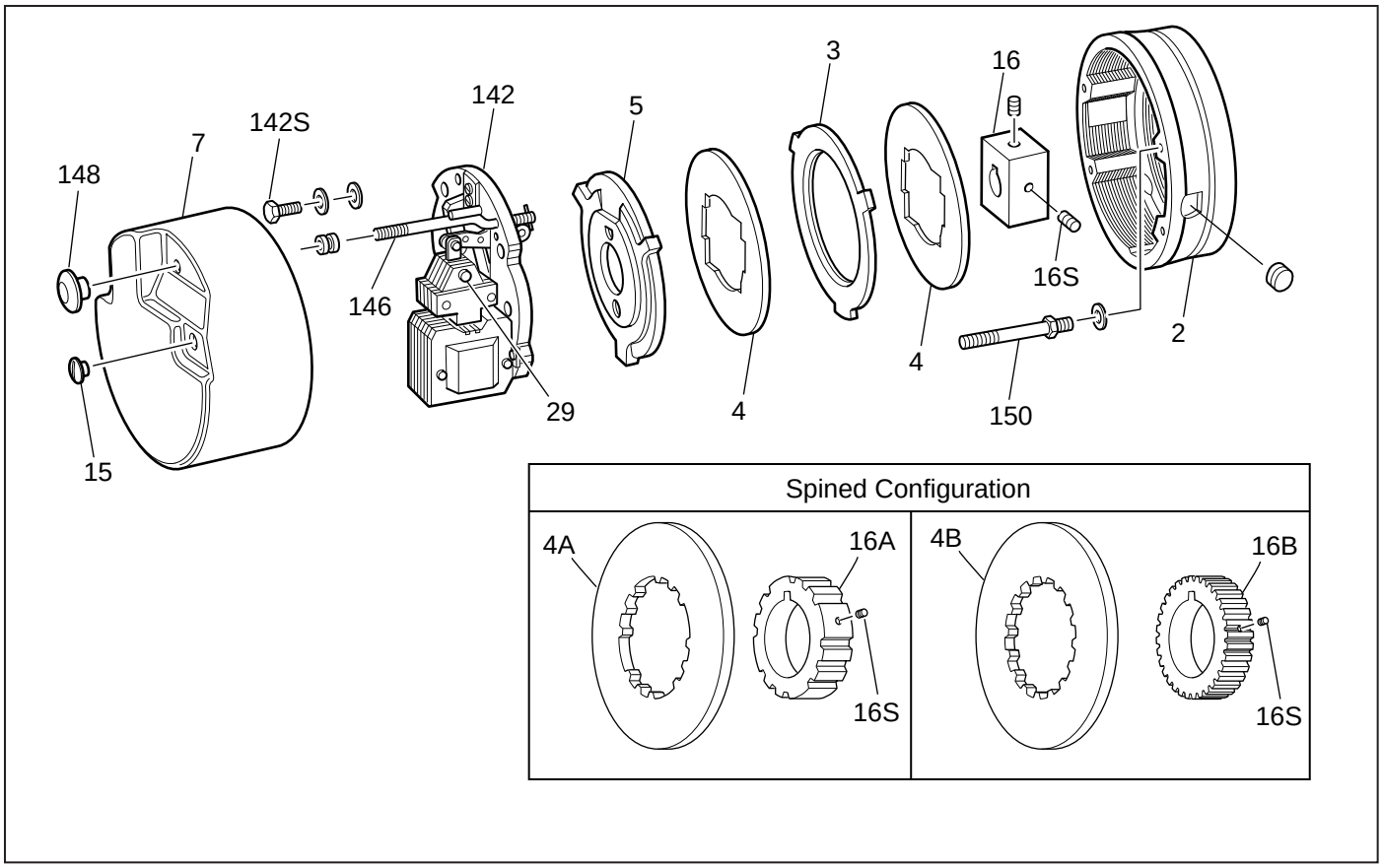


Figure 3.13 *Brake Components*

NOTE:
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 Instruction Sheet P/N 8-078-937-05 (Sheet 301.3) for proper assembly of vertical mounting components.

5. Attach endplate (2) to NEMA C-face of motor using four 1/2 inch [13 mm] diameter socket head cap screws (not supplied) and torque per manufacturer's specifications. (Head of cap screws must not project above friction surface.) If foot mounted, secure foot mounting bracket to foundation. The use of dowels to insure permanent alignment is recommended. Foot, machine or C-face mounted brakes must be carefully aligned within .004 inch [.1 mm] on concentricity and face runout. Shaft runout should be within .002 inch [.05 mm] T.I.R. Maximum permissible shaft endfloat is .020 inch [.5 mm].

NOTE:
If motor 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°.

NOTE:
The brake nameplate states mounting position; "horizontal, vertical above or vertical below." The brake must be mounted in that position. Horizontal brakes rated 35 lb-ft [47.5 N•m] and less do not require modification to be mounted vertical below.

NOTE:
A dimple drilled into the motor shaft for the hub set screw (16S), 90° from the key is recommended for vertical mounting.

6. Position hub (16) and key (by customer) on the motor shaft so outboard face of hub will protrude approximately 1/32 inch [.8 mm] to 1/16 inch [1.6 mm] beyond face of last outboard friction disc. (Position may be determined by assembling friction disc(s) and stationary disc(s) onto hub, noting hub position, and removing disc(s). Torque set screw (16S) as follows: 5/16 inch [8 mm] diameter - 13 ft-lb [17.6 N•m], 3/8 inch [9.5 mm] diameter – 24 ft-lb [32.5 N•m] and 1/2 inch [13 mm] diameter - 52 ft-lb [70.5 N•m]. If brake utilizes vertical mounting springs, do not assemble them when measuring for hub location.
7. Reassemble friction disc (be sure friction discs slide freely), spring (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 facing manual release rod (146).

8. Mount support plate assembly, torque screws to 50 in-lbs [5.6 N•m] in endplate. Conical spring washer is installed under the screw head. Flat washer is 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 release rod (146) is not in manual release position 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 3.14 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 ovetighten! Torque to a maximum of 8 ft-lbs [10.8 N•m].

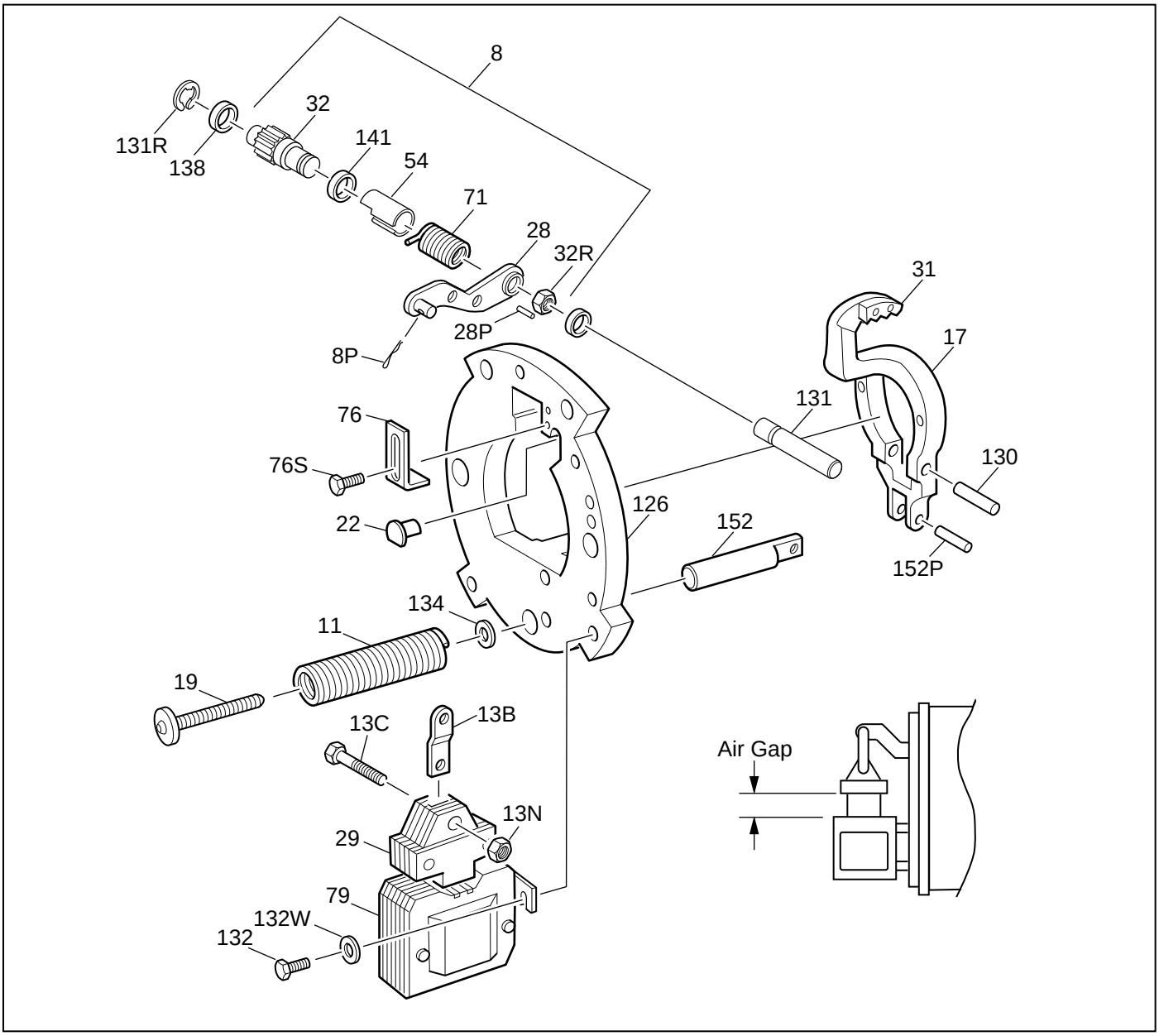


Figure 3.14 *Self-Adjusting Brake Components*

9. Manually lift solenoid plunger to maximum travel, and release. Complete electrical connection. (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 of improper gap.)
10. Replace housing, nuts and manual release knob.

3.10.4 Electrical Connection of Brake

CAUTION:
Inverter Motor and Special Control Systems. This brake contains either a single phase AC coil or DC coil that requires instantaneous power within ± 10% of rating at the coil. A separate power source is required when this brake is used in conjunction with a motor or control system that limits voltage or current input (i.e. inverter motors) or causes a ramping of the power supply.

CAUTION:
Class H coils with terminals. Do not bend lead wire crimp connection as this causes a fatigue in the metal which may break under vibration.

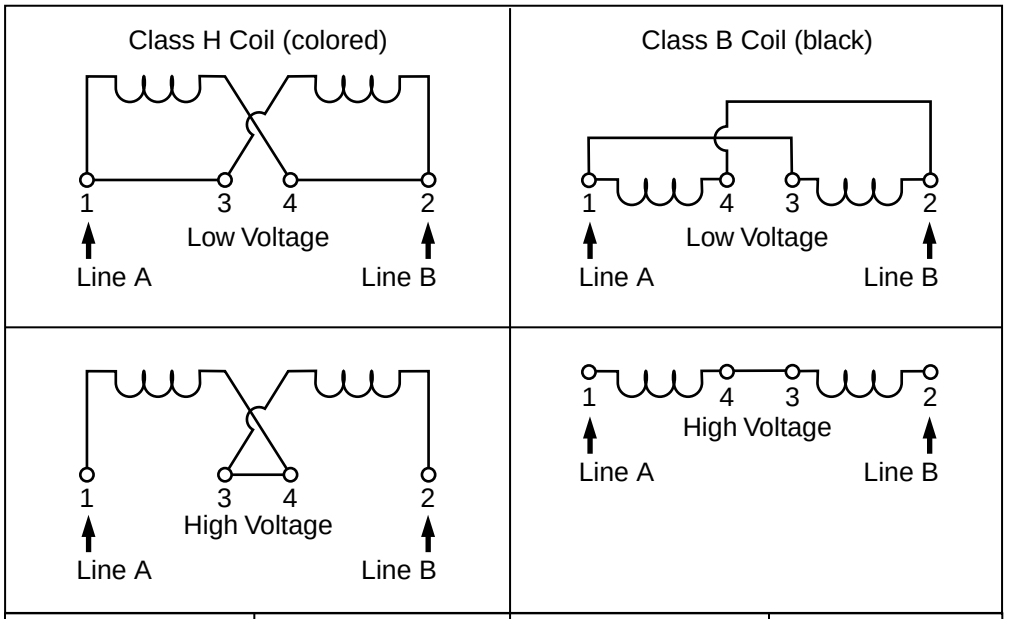
NOTE:
Brake coil connections described here cover common motor connections. For non-standard motor or control connections, contact respective supplier or Stearns Div.

NOTE:
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:
On brakes with spacer heater, connect to appropriate power source. Heater is to be energized continuously, even during storage or rusting may occur.

3.10.4.1 AC Coils, Single or Dual Voltage

1. Dual voltage coils may be factory pre-connected for high voltage with wire nuts. 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 3.15 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.



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 3.15 *Dual Voltage Coil Connection*

3.10.4.2 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 in Figure 3.16 or other equivalent combinations. If a 230 volt brake coil is connected as shown in Figure 3.16 the motor can be operated on either 230 volts or 460 volts with no effect on brake operation.

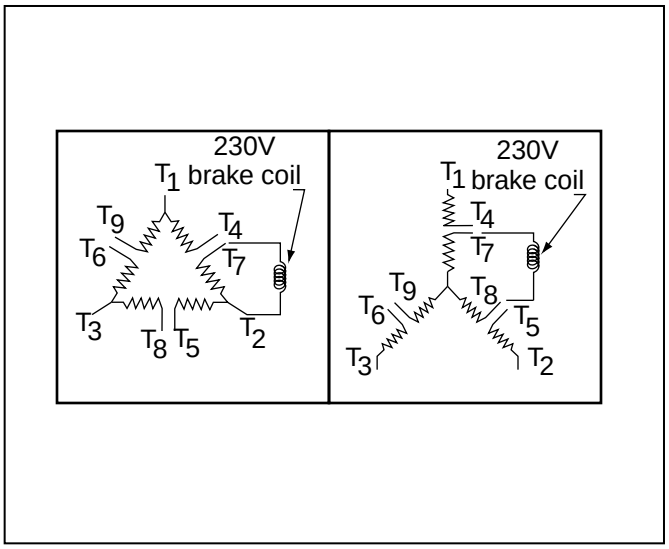


Figure 3.16 *AC Voltage Coil Connection*

3.10.4.3 DC Coils

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 3.17 for proper wiring.

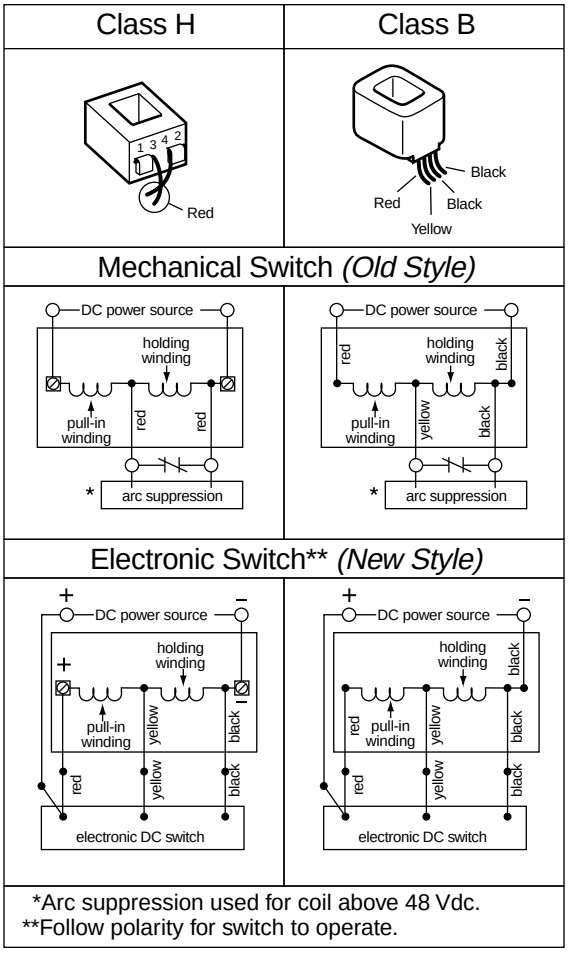


Figure 3.17 *DC Voltage Coil Connection*

CAUTION:
Never use a series resistor to drop power supply voltage 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.

3.10.5 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 knob or lever is operated on the brake. Observe all cautions listed at the beginning of this section.

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

3.10.5.1 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 standards NEMA DC voltage coils are available in assemblies and may also be obtained from appropriate parts list.

3.10.5.2 Friction Disc Replacement

NOTE:
Replace friction disc in single disc brakes when wear surface area is one-half the original disc thickness. In multiple disc brakes, replace all friction discs when throat of lever arm (17) is within 1/16 inch [1.6 mm] of touching teeth of pinion (32).

1. Observe Cautions and Warnings preceding Installation Procedure, in Section 3.10.1, follow Step 1, then disconnect solenoid lead wires.
2. Continue with Steps 2 through 4 and Steps 7 through 10. Be sure to reconnect coil leads before replacing housing (7).

3.10.5.3 Self-Adjust Maintenance

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 inch [21 mm] to 15/16 inch [24 mm] air gap, and requires no resetting, even when changing friction discs. Measure air gap with brake fully assembled without housing.

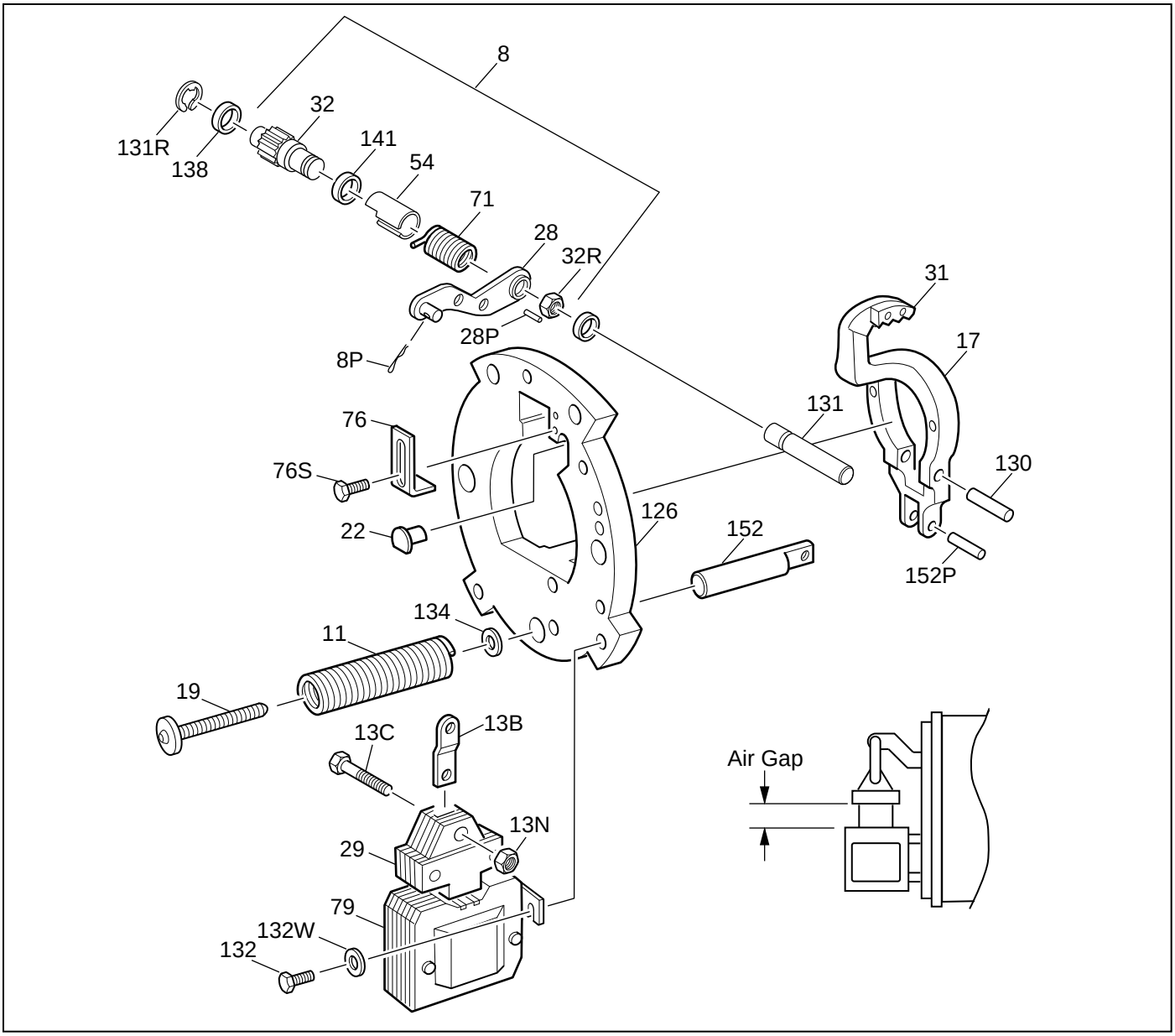


Figure 3.18 *Self-Adjusting Brake Components*

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 and check gap by again holding plunger as directed.

The gap is determined by the position of the wrap spring stop (76). The normal operating gap is 13/16 inch [21 mm] to 15/16 inch [24 mm]. Should this change, follow the steps listed:

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 (2) 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 vertically mounted brakes, refer to previous note).

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 directed in Step 1.
3. Should air gap disappear due to overheating, oil or other lubricant may have been applied to solenoid lever and pinion assembly (Q). Remove support plate assembly (142). Loosen pressure spring nut (19) until pressure spring (11) is free. 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 M.E.K. or equivalent solvent that does not leave a film. 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 touches (without preload) a square stop which protrudes out of solenoid lever for width of this turn. Reassemble in reverse order. Do not retighten cap screw (19) until support plate assembly is mounted on endplate. Refer to Steps 8 and 9 of Installation Procedure to complete assembly.
4. Check condition and position of pinion (32) and rack (part of lever arm assembly, 17). Replace parts as necessary with complete assemblies. See following Sections.

3.10.5.4 Solenoid Lever and Pinion Assembly Replacement

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

3.10.5.5 Lever Arm Replacement

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.

3.10.5.6 Pressure Spring Stud and Nut Replacement

On older designs of above brakes, Item (152) was threaded shoulder stud, 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 older style components. Consult appropriate repair parts list for complete retrofit kit.

3.10.6 Troubleshooting

3.10.6.1 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 braking cycles operating properly?
6. Are limit switches, electric eyes, etc. functioning properly?
7. On vertically mounted brakes, are springs in place of disc pack? See P/N 8-078-937-05 (Sheet 301.3).
8. If brake is floor mounted, check alignment. See Section 3.10.3, Step 5.
9. Pressure spring may be improperly assembled or broken.
10. Is solenoid air gap adjusted correctly? See *Self-Adjust Maintenance*, Section 3.10.5.3.
11. Check linkage for binding. The approximate pressure applied to the top of the solenoid link to move plunger is:

#5 coil	3 lbs [1.4 kg]
#6 coil (15 lb-ft) [20 N•m]	5 1/2 lbs [2.5 kg]
#6 coil (25 lb-ft) [34 N•m]	9 lbs [4 kg]
#8 coil	16 lbs [7.3 kg]

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 releasing 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 solenoid style, check switch actuation and condition of coil. The switch should be 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 inch to 7/32 inch [5 mm - 5.5 mm]
#6 solenoid	7/32 inch to 1/4 inch [5.5 mm - 6 mm]

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 brakes with cast iron endplates, check the vertical mounting pins to be sure shoulder of pin is flush with wear surface of endplate. Be sure pins are straight and pressure plate and stationary disc(s) are free to slide on the pins. Be sure springs and spacers are installed in proper order. See P/N 8-078-937-05 (Sheet 301.3).
19. Check pressure spring length to insure correct compressed height. Original spring lengths are given in the following Table 3.12 so that correct setting may be verified and correct if necessary. With worn friction discs, add amount of wear to the approximate spring length shown.
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), the brake torque rating may be insufficient. If the brake stops high inertial loads and/or brake stops more than five times per minute, check thermal requirements of application versus thermal capacity rating of brake.
22. Use Loctite® 242 to secure link screw nut (13N) to link screw (13C) if vibration causes nut to loosen.

Color	Torque lb-ft [N•m]	Compressed Spring Length
Blue	10 [13.6]	3 5/16 inch [84 mm]
Yellow	15 [20.3]	3 9/16 inch [90 mm]
Red	25 & 50 [33.9 & 67.8]	3 3/8 inch [86 mm]
Green	35, 75 & 105 [47.5, 101.7 & 142.4]	3 3/8 inch [86 mm]
Black	10 [13.6]	3 1/4 inch [83 mm]
White	15 [20.3]	3 1/4 inch [83 mm]
Orange	25 & 50 [33.9 & 67.8]	3 1/4 inch [83 mm]
Purple	35, 75 & 105 [47.5, 101.7 & 142.4]	3 1/4 inch [83 mm]

Table 3.12 *Pressure Spring Data*

3.10.6.2 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 shift 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 3.10.6.1, Steps 11, 12, 14 and 15.

3.10.6.3 If Brake is Noisy During Stopping

1. Check mounting face runout, mounting rabbet eccentricity and shaft runout. See *Installation Procedure*, Section 3.10.3, Step 5. 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.

3.11 SWITCH MAINTENANCE

The following switches also require periodic inspection and adjustment:

- Up stop and up end travel switches (refer to Section 3.4 of the Skiploader Installation Guide.)
- Down stop and down end travel switches (refer to Section 3.4 of the Skiploader Installation Guide.)
- Cable switch (refer to Section 2.4 of this guide)

3.12 COMPONENT REPLACEMENT

The following Skiploader components can be replaced:

- All drive components
- Brake
- Electric motor
- Coupling
- Gear reducer
- Sprockets and chains (all)
- Jack shaft bearings
- Cable drum
- Cable drum bearings
- Cable (wire rope)
- Top sheave and bushing
- Shaft – top sheave
- Sheave – bucket and bushing
- Pin – bucket sheave
- Pins – bail/bucket
- Bail
- Bucket
- Rollers – bucket
- Axles – bucket
- Tracks – bucket – up
- Tracks – bucket – down

Refer to the Skiploader Parts and Accessories Catalog for more information about ordering these parts.