

INSTRUCTION MANUAL

StrikoDynarad CORPORATION

MODEL RL-24R

INGOT PREHEATER/LOADER

Electrical Schematic: D 0956

StrikoDynarad

575 Whitney Street

San Leandro, California 94577

Phone (510) 638-2000

Fax (510) 639-4564

e-mail: Dynarad@ix.netcom.com

INSTRUCTION MANUAL

FERRIS WHEEL[™] **AUTOMATIC INGOT PREHEATER/LOADER**

Version 2.0

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I INTRODUCTION

The StrikoDynarad ingot preheater/loader is designed to deliver, upon demand, preheated ingots into a melting furnace. The StrikoDynarad ingot preheater/loader operates fully automatically, bringing together reliable automation of ingot preheating and furnace charging.

This manual contains information for the proper operation and maintenance of the ingot preheater/loader as well as important safety recommendations. Plant managers, machine operators and helpers, and all maintenance personnel should read this manual in its entirety. Complete understanding and knowledge of this equipment will help maximize its useful operating life while personnel awareness of safety precautions will help eliminate accidental injury.

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II INSTALLATION

A. Inspecting Shipment

1. Check for damage - Check all crates and shipping containers for damage which may have occurred in transit. Look for obvious signs of damage such as fork lift holes, etc.
2. Report any Damage - Immediately report any damage to the freight carrier. Visible signs of damage to crates or containers should be noted on the bill of lading and acknowledged by the freight carrier's driver or other representative.
3. Hidden Damage - Check further for any hidden freight damage which may have been previously missed. Immediately report any such damage found to the freight carrier.

B. Installing Ingot loader

1. Refer to Drawings - The ingot preheater/loader should be installed in relation to the melting furnace in accordance with the attached drawings in the Appendix at the back of this manual.
2. Firm Attachment Required - It should be firmly attached to the floor or support platform to avoid movement after installation which could cause damage or injury.

C. Electrical Connections

1. Wiring Preparation - Refer to the electrical schematic and interconnection wiring diagram in the Appendix at the back of this manual.
2. Main Switch - The main disconnect switch is located on the side of the panel. Run a conduit with properly sized wires to this disconnect. Refer to the serial number plate on the lower left side of the control panel to determine the correct operating voltage and maximum current. Please check with StrikoDynarad Corporation if there are any questions regarding the power requirements.

CAUTION: When working on the ingot loader and/or melting furnace, all supply disconnect switches or circuit breakers should be locked out.

3. Ground the Loader and Control Panel - Be sure to run heavy gage ground wires from suitable points on the ingot loader frame or the control panel to a solid plant ground, such as a cold water pipe.
4. Wire external signal - Again referring to the schematic diagram, connect the terminals for the external extract signal to a normally open set of contacts. The contacts can come from a counter, metal level sensor or any other device that can determine when metal should be added to the furnace. Also be sure that all connections are tightened securely.
5. Delay Power Test - **Do not turn on power until ingot loader is safe to operate.** If a StrikoDynarad installation assistant will be helping with the ingot loader startup, **do not** turn power on until he arrives and performs a second wiring check prior to the initial power test. If a StrikoDynarad installation assistant will not be helping, wait until all exposed wiring is covered and protected and otherwise completely safe for the initial power test which follows below.

D. Initial Electrical Check

1. Close and screw shut all terminal covers and check to be sure all high voltage connections are closed and protected in preparation for electrical checking.
2. Close the main disconnect. The green "Power On" lamp should light. If the red "Emergency Stop" lamp is lit, press the "RESET" button so that the green "Power On" lamp will light.
3. Check the main drive motor rotation:
 - a. When the power is turned on or after an ingot is extracted the ingot magazine (paddle wheel) should start turning so that cold ingots from the lower half of the magazine rotate towards the "cat whisker" limit switch located just below one of the oven doors.
 - b. If the ingot magazine paddle wheel rotates in the wrong direction, turn off and lock out the incoming power to the control panel and reverse any two of the three wires going to the drive motor. This can be conveniently accomplished inside the control panel at the terminal block numbers 1271, 1272 or 1273.
4. After completing all tests, turn off the main power switch. The ingot preheater/loader is now ready for regular operations.

E. Lubrication Check

1. Drive Gearbox - The main drive gearbox is a double reduction worm gear type which requires oil in the main gearbox. Refer to the manufacturer's bulletin in the Appendix at the rear of this manual for checking and filling instructions as well as lubrication specifications for this gearbox.

NOTE: If this gearbox is not properly filled and maintained with oil, rapid gear wear will result followed by complete failure.

2. Main ingot magazine heavy drive chain - Apply a coating of high temperature oil to the heavy drive chain located at the outside rear of the machine. Remove any dirt or residue and reapply at regular intervals to be sure chain and sprockets operate smoothly.

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III SAFETY PROCEDURES

A. Read This Manual Before Operating Machine - This ingot preheater/loader should NOT be operated until all supervising, operating and maintenance or repair personnel have read and understood this instruction manual, particularly with respect to personal safety procedures and requirements.

B. Emergency Stop Buttons - StrikoDynarad Corporation has provided two (2) Emergency Stop Push buttons which will immediately stop all machine motion when pressed. One is located on the front of the control panel and the second is on the side of the control panel facing the front of the machine. All operating personnel should familiarize themselves with the location of both Emergency Stop Buttons so they will be prepared to react in an emergency.

C. Protective Clothing - Any individual operating the machine, helping the machine operator, or working in close proximity to the ingot preheater/loader should wear protective clothing. Items such as hard hat (head protection), safety glasses (eye protection), nonflammable clothing (cotton is recommended; no polyesters or nylons), hot mill gloves, safety toe shoes and spats are required for safe operation of this ingot preheater/loader. The guidelines established by the Occupational Safety and Health Act (OSHA) and/or California OSHA should be closely followed.

D. Inspect for Safe Operating Conditions - An inspection of the general area of the ingot preheater/loader and the adjacent melting furnace should be made prior to operation of the equipment on each shift to ensure the safety of the operator. Should these inspections disclose unsafe conditions for the operator, or infractions of OSHA and/or California OSHA safety requirements, the situation must be remedied BEFORE the operator is allowed to operate the equipment.

E. Keep Work Area Clean - Cleanliness of the machine and the surrounding area is extremely important to avoid accidental injury. Oil, debris, and other unnecessary items on or around the machine may cause slips, falls, and other avoidable injuries.

F. Stay Clear of Moving Machinery - DO NOT, for any reason, stand or climb on an operating machine. Movement of the machine can cause an accidental fall which could lead to serious personal injury.

G. Stay Alert - Should the operator observe any unusual machine motion or sound, he should immediately shut down the machine and inform a supervisor. Observation and caution of this kind will help avoid accidental injury, as well as prolong the life of the machine.

H. Wiring and Controller Logic - DO NOT make any changes in the wiring or the logic in the programmable controller (PLC) of your StrikoDynarad ingot preheater/loader without the specific written consent of StrikoDynarad Corporation. And then, only trained and authorized personnel should be allowed to work on the electrical control system of this ingot loader. The electrical system is very complex and even a minor wiring change could cause a hazardous situation during operation.

CAUTION: Any time, for any reason, a wire is purposely disconnected, that wire (and its destination terminal, if possible) should be immediately tagged and identified to help prevent reconnecting to an incorrect terminal.

StrikoDynarad Will Help - It is the policy of StrikoDynarad Corporation to assist its customers by providing whatever mechanical or electrical information they request regarding their machine. If necessary, StrikoDynarad will send a service technician to the user's plant to help with any electrical changes that may be required.

I. Control Panel Electrical Safety

1. **DANGER - HIGH VOLTAGE!** - Turn power off before opening the control panel door. The fused disconnect switch which supplies power to the control panel should always be opened and locked out before opening the control panel door and particularly before performing any maintenance work inside the panel.

2. **Do not rely on the door switch** - While the control panel is equipped with a safety door switch which opens the high voltage contactor and shuts off the low voltage (120 VAC) control power, it is still possible to sustain dangerous and potentially lethal electrical shock if personnel should touch any terminals behind the protective barrier, or if the barrier should be removed and not replaced, or if any components such as contactors should become defective and remain closed when they are turned off and are expected to be open.

J. Alteration or Removal of Safety Devices - No safety guards, safety devices, or signs on the ingot preheater/loader provided by StrikoDynarad Corporation may ever be removed or altered in any way. Should any of these safety devices need securing, do not operate the machine until the necessary repairs are made to the safety devices and signs.

IV SAFETY GUARDS

While StrikoDynarad Corporation supplies important safety equipment for its ingot preheater/loader, additional in-plant guarding is strongly recommended to fit each plant's individual needs.

A. Safety Barrier - Because standing near the rear of the ingot preheater/loader and its extraction mechanism and exit chute during operation can be dangerous, a protective safety barrier such as a fence or barricade should be constructed to keep personnel away from this area to avoid potential injury during the ingot loader's operation.

B. Electrical Interlock - Further, any gate or access through this barrier should be electrically interlocked directly with the ingot loader controls using a suitable limit switch or similar means so that if the gate is opened, the ingot loader will turn off automatically. This should also be inspected before each shift to insure the operator's safety.

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V SETUP PROCEDURE

A. Setting the Extraction Window Limit

1. When the power is first turned on the ingot preheater/loader should start rotating either clockwise or counter-clockwise depending on whether the machine has been built to a left or right configuration. In either case the correct direction of rotation should be from the lower ingot magazine charging area towards the "cat's whisker" safety limit switch located just below one of the oven doors. This is the direction that will allow ingots to pass through the heating chamber before they are extracted. As mentioned earlier (§II.D.3.b. on page 4), if the motor rotates in the wrong direction, any two of the three motor leads should be reversed to cause the motor to rotate in the opposite direction.

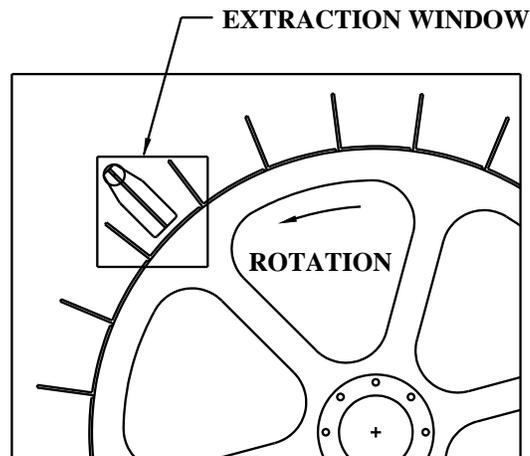


Figure 1 - CORRECT SETUP

2. When rotation stops by itself, open the oven doors (this should kill power to the control panel). Check if the ingot extraction "club" is centered between the wheel push paddles so that it will clear the paddles and that the top of the paddles are within the extraction window opening as shown in **Figure 1**. (NOTE: If your ingot preheater/loader rotates in the opposite direction as the example, visualize Figures 1, 2 & 3 as exact mirror opposites to those shown.)

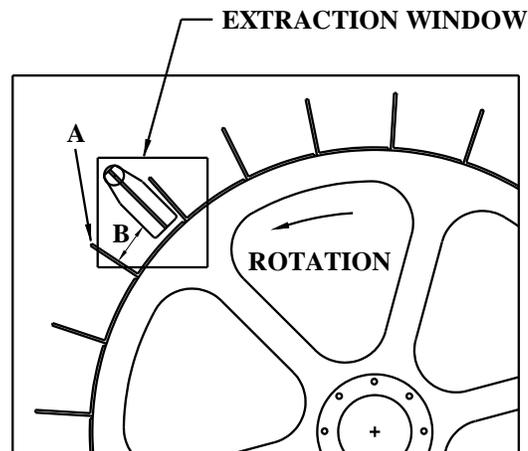
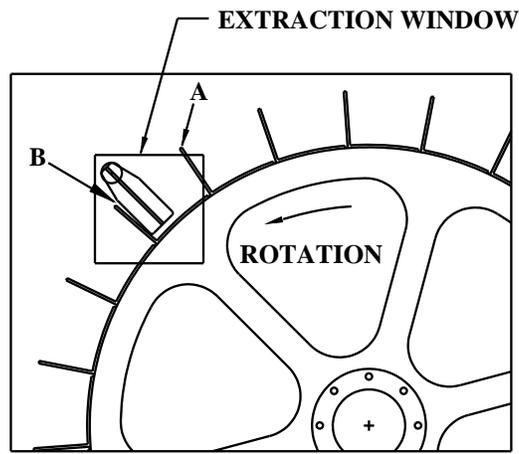


Figure 2 - INCORRECT SETUP (Rotated too far)

3. If the paddle limit switch located on the front of the machine is not set correctly the wheel can rotate too far as shown in **Figure 2** above. If the paddles should move too far, the ingot can catch on the bottom of the extraction window when the extraction club attempts to extract it (refer to "A" in **Figure 2**). Also, if the extraction club should be positioned too close to the upper paddle making the gap between the club and the ingot too large (refer to "B" in **Figure 2**), it is possible the club could miss the ingot entirely when it attempts to extract it. Either of these errors can be eliminated by adjusting the limit switch so the extraction club is centered between paddles when stopped by the switch as shown in **Figure 1**.

**Figure 3 - INCORRECT SETUP (Not rotated enough)**

4. If the limit switch is set so the wheel doesn't rotate far enough as shown in **Figure 3** above, the ingot can catch on the top of the extraction window (refer to "A" in **Figure 3**). It could also result in the club catching on one of the paddles (refer to "B" in **Figure 3**). This error can be corrected by adjusting the limit switch.

B. Setting the Timers - All timers are contained in the Allen-Bradley PLC-500 programmable controller. A hand held programming terminal (available from Allen-Bradley distributors or StrikoDynamad as an option) is required to alter timer settings.

While all timers have been factory set for a typical automatic loading application, some timers may need adjustment to conform to individual requirements including the cycle speed of the casting machine. The following guidelines are recommended:

1. Timer 1 - *Extractor Arm Forward* timer - This timer determines how long the extractor should take to reach the fully extended position. If the timer times out before the extractor extends, an *Extractor Jam* alarm will be generated. This means that the ingot loader, for one reason or another, was unable to extract an ingot. Check to see if there is enough air pressure or that an ingot did not jam inside the extraction window. Another cause could be that the extractor club got caught on one of the wheel's paddles.

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2. Timer 2 - *Extractor Arm Reverse* timer - This timer determines how long the extractor should take to return from the fully extended position. If the timer times out before the extractor returns, an *Extractor Jam* alarm will be generated. This means that the ingot loader, for one reason or another, was unable to close the extractor window. Check to see if there is sufficient air pressure or that an ingot did not jam inside the extraction window.
3. Timer 3 - *Open Furnace Door Delay* timer - This timer determines how long the ingot loader will wait before it opens the furnace door on an adjacent melting furnace. Make sure it is set long enough so that the infrared optical sensor can read the temperature of the ingot. If it is set for too short an interval, the infrared sensor might not have enough time to read the ingot temperature, causing a cold or no ingot alarm condition.
4. Timer 4 - *Close Furnace Door Delay* timer - This timer determines how long the ingot loader will keep the furnace door open.
5. Timer 5 - *Motor Off* timer - This timer determines how long the ingot magazine wheel motor has been off. This should be set to 6000 which is equal to 1 minute. Counter 1 will determine how many minutes (factory setting is 10 minutes) the motor has been off. After the counter reaches its preset the Honeywell controller will bring down the temperature of the heating chamber to keep the ingots from melting.
6. Timer 6 - *Turn On Delay* timer - Do not adjust this timer. It is set to 3500 so that when power is turned on the ingot loader will rotate to the next ingot. This allows you to load the ingot loader and skip the first ingot slot. This first slot cannot be loaded because the extraction club is in the way.
7. Timer 7 - *Window Rotated* timer - Do not adjust this timer. It is set to 2000 to allow the wheel to rotate far enough so that the rotary limit switch will disengage. Once this timer has timed out, the rotary limit switch will begin to look for the next extraction point.
8. Timer 8 - *Window Not Found* timer - Do not adjust this timer. This timer is used to detect when the wheel gets jammed or when a chain is broken. If this timer times out it means that the wheel didn't rotate to the next ingot position.
9. Timer 9 - *Extractor Arm Return Delay* timer - Do not adjust this timer. This timer is used to delay the return of the extractor arm.
10. Timer 10 - Not used.
11. Timer 11 - *Ingot Door Jam* timer - Do not adjust this timer. This timer starts when both limit switches for the ingot door are released. If the timer finishes before either limit switch is made, the ingot loader will go into alarm condition.

C. Testing the Limit Switches

1. Turn the main power on.
2. Open the doors to the heating chamber of the ingot loader. The power to the control panel should turn off. Close the doors. The power should return to the control panel.

3. Move the cat's whisker limit switch beneath the door to the heating chamber. The *Ingot Jam* light should come on and the alarm horn should sound. Press the *Reset* button on the front of the control panel. The *Ingot Jam* light and the horn should turn off.

D. Setting the Extraction Speed - Inside the pneumatic valve box on the rear of the machine there is a speed muffler on the extractor arm solenoid control valve. Close the muffler by turning the screw clockwise to decrease the speed of the extractor. Similarly, open the muffler by turning the screw counter-clockwise to increase the speed of the extractor.

DANGER: When adjusting the speed of the extractor, be sure you are standing well clear of the extractor carriage and guide track. The adjustments are near the extractor and if the ingot loader receives a signal to extract while the extractor is caught on something, it could let go and extend at high speed, much faster than someone could get out of its way. Please be careful!

E. Setting the Door Open and Close Speed - Inside the pneumatic valve box there is a speed muffler on the furnace door control valve. Turn the speed control valve on the muffler clockwise to decrease the speed of the door, and open the valve by turning it counter-clockwise to increase the speed of the door.

F. Calibrating the Optical Infrared Sensor - The infrared sensor assembly consists of three separate parts: the sensor optical head located inside the protective enclosure mounted on the end of the extractor guide rail support, the cold ingot detector (Action Pak Input Limit Alarm plug-in module) located inside the control panel and the 12 VDC power supply, also located inside the control panel.

The infrared sensor assembly has been factory calibrated and no further adjustment should be necessary unless these adjustments have been tampered with or a component has been replaced. The following procedure should be used should recalibration become necessary.

1. Infrared Sensor Head - The infrared sensor head has a black screw cover. Remove this cover to expose the emissivity adjustment. This should be set to 0.35. Turn the screw until the arrow is half way between 0.3 and 0.4 settings.

2. Cold Ingot Detector - This plug-in module has a setpoint potentiometer which must be adjusted to trip at 0.35 volts DC input from the Infrared Sensor Head. To make this adjustment, first temporarily disconnect terminal 2033 which is the voltage output from the Infrared Sensor Head. Then apply a test voltage of 0.35 volts DC across pins 4 and 5 of the module socket, positive to pin 4 and negative to pin 5.

(NOTE: If a DC voltage test source is not readily available, a simple source can be made by connecting the two outside terminals of a 5K or 10K potentiometer across the terminals of a 1½ volt flashlight battery to form a voltage divider. Then connect the negative output lead to the negative terminal of the battery and the positive output lead to the center terminal of the potentiometer. Connect this voltage source to the Cold Ingot Detector module as described above and adjust this potentiometer until the voltmeter next to the detector module reads 0.35 volts.)

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With a 0.35 VDC voltage source connected to the Cold Ingot Detector module, slowly rotate the setpoint potentiometer in the module until the trip indicator light inside the module changes from red to green or from green to red. Then slowly and carefully rotate the potentiometer back and forth only a few degrees and stop turning precisely at the trip point where the indicator light changes from red to green. The module is now calibrated to trip at 0.35 volts. Remove the voltage source from pins 4 and 5 and reconnect terminal 2033.

G. External Extraction Signal - An external extraction signal is required for the ingot loader to extract an ingot. This is accomplished by hooking up a casting machine cycle counter, metal level sensor, timer or any other device capable of giving the ingot loader a signal to extract. Terminals 1691 and 2111 in the control panel should be connected to the **normally open** contacts of the signal device you are using. When these contacts are closed the programmable logic controller (PLC) in the ingot loader control panel will register the external call for an ingot. Once this signal is received the PLC will not look for an other *Extract* signal until it has extracted an ingot.

WARNING: If the ingot loader PLC receives a *Cold or No Ingot* alarm from the infrared sensor, the ingot loader will not need another external *Extract* signal to resume operation. Instead it will automatically extract the next ingot when the *Reset* push button is pressed. Therefore, be sure that people or objects are not in the way of the extractor carriage when the *Reset* button is pressed.

VI SEQUENCE OF OPERATION

A. Equipment status at start of operating sequence:

1. Ingot loader storage magazine has been fully loaded with ingots.
2. Electric power to the ingot loader has been switched on and all safety guards are in place. Sufficient time has been allowed to preheat the ingots in the oven section.
3. The ingot loader has indexed to the next ingot, and is waiting for the external *Extract* signal.
4. Regular production operations with a die casting machine or other casting machine and furnace are about to begin.

B. Normal machine operating sequence:

1. An external *Extract* signal from the user supplied device is received by the ingot loader to extract an ingot to begin the operating cycle.
2. The ingot loader activates the extraction solenoid valve, pulling the hottest ingot out of the ingot preheating section. The ingot slides down the transfer chute to the melting furnace entrance where it is blocked by the "guillotine" door (supplied separately).
3. The optical infrared sensor checks the temperature of the ingot and compares it with a preset minimum which should be set high enough to prevent moisture from entering the furnace. If it is not sufficiently hot, an alarm sounds and an indicator lamp lights. If it is hot enough, the ingot loader activates the furnace "guillotine" door solenoid valve to permit the hot ingot to enter the furnace. The ingot loader then closes the furnace door when the *Close Door* timer times out.
4. The ingot magazine starts turning slowly and stops when it has rotated exactly one ingot space, bringing a new, preheated ingot into the extraction window as well as a new, unheated ingot into the first preheating oven position.
5. The ingot loader then waits for an other external extraction signal. When received, the ingot loader returns to Step 1 and the cycle repeats.

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VII ALARMS

A. Alarm Conditions - Six different occurrences will result in alarm conditions:

1. Emergency Stop Buttons - Pressing any of the three *Emergency Stop* push buttons will cause an alarm condition. This will light the *Emergency Stop* lamp and shut down all loader movements by killing power to all drive components.
2. Extractor Jam
 - a. If the cat's whisker limit switch under the heating chamber door is tripped, an *Extractor Jam* alarm will be generated which will stop the ingot magazine wheel. This will prevent an ingot from ripping off the oven door if it hasn't been properly placed in the magazine.
 - b. If an ingot gets jammed on something and interferes with the movement of the extractor arm, the *Extractor Arm Reverse* timer will time out causing an *Extractor Jam* alarm. This will stop the wheel from rotating and will keep the ingot from damaging anything.
3. Cold or No Ingot - When the extractor carriage has completed a cycle an ingot should have slid down the chute. If the infrared sensor detects that the ingot is too cold or if no ingot was extracted the *Cold or No Ingot* alarm will activate. This will prevent a cold ingot that might have moisture on it from entering the furnace. It will also signal if no ingot was extracted which could mean that the ingot loader is empty.

B. Alarm Reset - Before resetting the alarm, make any corrections to cure the original cause of the alarm, being sure to disconnect electric power and mechanically secure the ingot loader in the interests of safety. When the problem is corrected, restore power and press the *Reset* push-button.

VIII RECOMMENDED LUBRICATION SCHEDULE

A. DRIVE GEAR BOX

Oil levels and oil quality should be checked at frequent intervals, depending on usage. Oil changes are required at intervals of 10,000 operating hours or every two years, whichever comes first. If a synthetic oil lubricant is used, this period can be extended to 20,000 operating hours or every four years, whichever comes first. In applications where hostile operating conditions exist, such as high humidity, corrosive environment, or large temperature changes, the lubricant should be changed at more frequent intervals.

Grease packed bearings should be cleaned and regreased every 10,000 hours or 20,000 hours for synthetic grease. Input (high speed) bearings should not be overgreased. They should be filled with grease not to exceed 1/3 of the bearing's free volume. For output bearings and bearings with replaceable grease shields, fill to 2/3 of their free volume.

LUBRICANTS FOR THE DRIVE GEAR BOX								
(Model 562 gear case capacity = 0.16 gallon)								
Type of lubricant	Ambient air temperature range	Kin viscosity at 40°C (cSt) approx.	Gulf Oil Co.	Chevron Oil Co.	American Oil Co.	Mobil Oil Co.	Shell Oil Co.	Texaco Oil Co.
Oil	+32°F to +104°F	680	Gulf EP Lubricant HD 680	Chevron Non-Leaded Gear Compound 680	Perma-gear EP 680	Mobil-gear 636	Shell Omala Oil 680	Meropa 680

Important Note: If the recommended lubricant is not available, use a lubricant having equivalent characteristics. However, do not mix lubricants of different brands and under no circumstances mix synthetic lubricants with one another, or with mineral base lubricants.

B. SLIDE GATE

- Clean and replace the high temperature lithium-moly grease in the upper and lower gate tracks weekly.

C. PNEUMATIC CYLINDERS

- Be sure supply air is clean and dry.
- Check fasteners and tighten if loose.
- Check fittings for leaks and repair.

D. IDLER SPROCKET

- Set idler sprocket to remove any unnecessary slack in drive chain.
- Lubricate the sprocket shaft with a high temperature lithium-moly grease annually.

E. WHEEL BEARINGS

- Check fasteners and tighten if necessary.
- Lubricate with a high temperature lithium moly grease annually.