

# Equipment Manual



## LSR<sup>TM</sup>

Lumber Storage and Retrieval System

# Equipment Manual

# LSR™

## Lumber Storage and Retrieval System



*U.S. and other patents pending.*

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# Legal Notice

## Patents

Made and sold under one or more of the following patents:

U.S. 4,986,052	U.S. 5,385,339	U.S. 5,493,834	U.S. 5,568,862
U.S. 5,630,697	U.S. 5,636,494	U.S. 5,638,658	U.S. 5,640,832
U.S. 5,655,399	U.S. 5,678,395	U.S. 5,702,095	U.S. 5,707,204
U.S. 5,735,087	U.S. 5,810,341	U.S. 5,819,412	U.S. 5,833,222
U.S. 5,837,014	U.S. 5,854,747	U.S. 5,873,567	U.S. 5,884,448
U.S. 5,885,731	U.S. 5,906,264	U.S. 5,934,866	U.S. 5,947,460
U.S. 5,987,828	U.S. 5,996,303	U.S. 6,048,165	U.S. 6,112,968
U.S. 6,134,775	U.S. 6,170,688	U.S. 6,205,637	U.S. 6,212,849
U.S. 6,219,975	U.S. 6,260,263	U.S. 6,317,980	U.S. 6,389,762
U.S. 6,401,422	U.S. 6,412,246	U.S. 6,418,601	U.S. 6,539,615
U.S. 6,666,367	U.S. 6,702,269	U.S. 6,758,022	U.S. 6,817,392
U.S. 6,834,470	U.S. 6,907,820	*Other patents pending	

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## **Safety (English)**

For safety information in Spanish, refer to page xx.

**Be Careful.  
Be Safe.**



## Safety Indicators

The following safety alert symbols and signal words are used throughout this document to indicate safety hazards. Please pay careful attention when you see them. The level of severity differs for each symbol or signal word.

Failure to comply with the instructions accompanying each safety alert symbol may result in property damage, personal injury, or even death. Personnel must follow all safety procedures and practices to ensure the safest possible operation of this equipment. However, at no time is this document a substitute for common sense. Personnel must ensure that the work environment is safe and free of distractions.



### **DANGER**

Indicates an imminently hazardous situation which, if not avoided, is likely to result in death or serious injury.



### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.



### **CAUTION**

When CAUTION is used *with* the safety alert symbol shown here, it indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

When CAUTION is used *without* the safety alert symbol shown here, it indicates a potentially hazardous situation which may result in equipment damage.

**NOTICE**

### **NOTICE**

Calls attention to information that is significant to understanding the operation at hand.

**ENVIRONMENTAL**

### **ENVIRONMENTAL**

Applies to conditions that may affect the environment but do not have an immediate, direct effect on personnel or equipment.

## Safety Rules

Because it is impossible to anticipate every circumstance that might involve a hazard, the safety information provided in this equipment manual and on the machine is not all-inclusive. If this machine is operated or serviced using a procedure not specifically recommended by the manufacturer, the procedure shall be approved by a professional engineer to ensure it will not render the equipment unsafe. Use extreme caution and common sense at all times!

### Know Your Equipment

- Read this manual completely before using or maintaining the equipment. Do not operate this machine unless you have a thorough knowledge of the controls, safety devices, emergency stops, and operating procedures outlined in this manual.
- Read and follow all safety notes. Failure to comply with these instructions may result in economic loss, property damage, and/or personal injury including death.
- Refer to the lockout/tagout guidelines on the following pages to safely perform maintenance and troubleshooting of this equipment.
- Observe and obey all safety labels. Replace worn labels immediately.
- Use this equipment solely for the purpose described in this manual.
- Only qualified personnel should attempt to operate or perform maintenance on this equipment. “Qualified personnel” is defined as:

*...a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training, or experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work—ANSI B30.2-1983*

*...one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved—NEC 2002 Handbook*

### Personal Safety

- Always wear safety glasses and hearing protection in an industrial environment.
- Utilize a filtering facepiece (dust mask) when working near sawdust.
- Wear proper clothing and appropriate personal protective equipment (e.g., safety glasses and hearing protection.) Do not wear loose clothing or jewelry. Confine long hair by tying it back.
- Use caution when lifting heavy parts or material.

### Installing the Equipment

- Follow installation instructions completely.

### Lockout/Tagout

- Before performing maintenance on the pneumatic or hydraulic systems, bleed the lines to eliminate pressure.
- Lockout/tagout all energized systems before performing maintenance on them. Refer to the *Lockout/Tagout Guidelines* section on page xi.

### Keeping a Safe Environment

- Keep children away. All visitors should be kept a safe distance from the work area. Hazards may not be apparent to individuals unfamiliar with the machine.
- Keep work areas well lit.
- Keep the work area clean and free of any trip or slip hazards.
- Do not use the equipment in damp or wet locations, or expose it to rain or snow.

### Operating and Maintaining the Equipment

- Ensure that all people, tools, and foreign objects are clear of the restricted zones before operating this equipment. The restricted zones are shown on page xvi.
- Perform the safety tests recommended in the Safety Test section on page xvii before operating the equipment at the initial startup, after performing any maintenance, and in accordance with the maintenance schedule.
- In case of machine malfunction, stop the machine immediately using an E-stop and report the malfunction to a supervisor.
- Never leave the machine running unattended. Turn the power off! Do not leave the machine until all parts have come to a complete stop and all electrical power has been shut off.
- Check for worn or damaged parts regularly. Repair or replace them immediately.
- Keep the hydraulic, pneumatic, and electrical systems in good working order at all times. Repair leaks and loose connections immediately. Never exceed the recommended pressure or electrical power.
- Check that all safety devices are in working order before each shift starts. All protective guards and safety devices must be in place before and during use of the machine. Never disconnect or bypass any safety device or electrical interlock.
- Periodically inspect the quality of the finished product.

### Electrical Safety

- Do not use any liquids in the interior of electrical cabinets.
- When using solvents on and around the machine, remove power to the machine to eliminate the chance of sparking, resulting in explosion or fire. Wear a respirator approved for use with solvents. Wear protective clothing, gloves, and safety glasses.

## Lockout/Tagout

### Lockout/Tagout Guidelines

**All lockout/tagout guidelines must be met according to OSHA 29 CFR 1910.147.** A specific procedure should be included in your company's energy control program. This manual is not intended to replace your company's de-energizing or lockout/tagout procedure required by OSHA, but merely to provide general guidance.

The term "lockout," as used in this manual, means placing a lockout device on any and all energy sources to ensure that the energy isolating device and the equipment being controlled cannot be re-energized or operated until the lockout device is removed. The photos on the next page show where the electrical disconnects are located for this machine.



- Energy sources include electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- In the case of electrical energy sources, the main power and control power to the machinery must be turned off and physically locked in the "off" position.
- A lockout device is usually a keyed padlock.
- If more than one person is working in a restricted zone, use a group lockout device that will allow each person to use a lock that can be removed only by the person performing the maintenance.

"Tagout" means that a prominent warning is securely fastened to an energy-isolating device to indicate that the equipment shall not be operated.

## Electrical Lockout/Tagout Procedures

### When Working on a Machine Outside the Machine’s Main Electrical Enclosure



If working on the electrical transmission line to the machine, follow the procedure on page xiv.

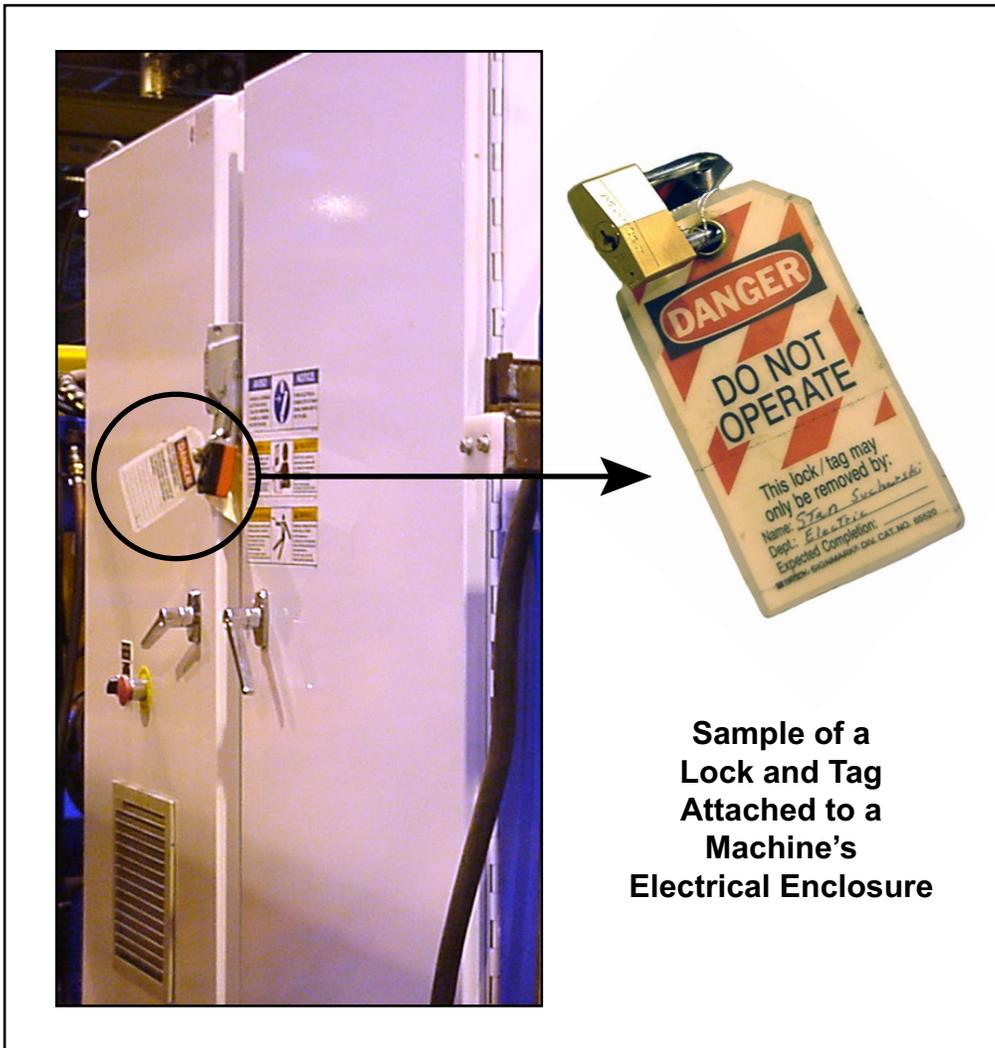
Before performing maintenance on any machine with electrical power, lockout/tagout the machine properly. When working on a machine outside of the machine’s main electrical enclosure, not including work on the electrical transmission line to the machine, follow your company’s approved lockout/tagout procedures which should include, but are not limited to the steps here.

1. Engage an E-stop on the machine.
2. Turn the disconnect switch handle on the machine’s main electrical enclosure to the “off” position. See Figure 4-1.

<b>WARNING</b>	
	<p><b>ELECTROCUTION HAZARD.</b></p> <p><b>When the disconnect switch is off, there is still live power within the disconnect switch’s enclosure. Always turn off power at the building’s power source to the equipment before opening this electrical enclosure!</b></p>

3. Attach a lock and tag that meet OSHA requirements for lockout/tagout.
4. Restrain or de-energize all hydraulic components and other parts that could have live or stored power.

**Figure 4-1: Lockout/Tagout on the Main Electrical Enclosure**



### **When Working on a Machine Inside the Machine's Main Electrical Enclosure or in the Electrical Transmission Line to the Machine**

Before opening the main electrical enclosure, or attempting to repair or replace an electrical transmission line to the machine, lockout/tagout the machine properly. Follow your company's approved lockout/tagout procedures which should include, but are not limited to the steps here.

1. Engage an E-stop on the machine.
2. Shut the power to the machine off at the machine's power source which is usually an electrical service entry panel on the facility wall. One example of a locked-out power source panel is shown in Figure 4-2.
3. Attach a lock and tag that meets OSHA requirements for lockout/tagout.
4. Open the door to the machine's main electrical enclosure, and using a multimeter, verify that the power is off.

**Figure 4-2: Lockout/Tagout on the Power Source Panel**



## Hydraulic System Lockout/Tagout Procedure

### When Lockout/Tagout is Not Required

If working on components other than the hydraulic system, but that requires you to be near the vicinity of movable hydraulic components, you must, at a minimum, physically restrain the hydraulic components from moving. If this is not possible, lockout/tagout the entire hydraulic system.

### When Lockout/Tagout is Required

Before attempting repair or maintenance on a hydraulic line or component, lockout/tagout the machine properly. Follow your company's approved lockout/tagout procedures which should include, but are not limited to the steps here.

1. Follow instructions in the electrical and pneumatic lockout/tagout sections to lockout/tagout or prevent movement of these components.
2. Attach a lock and tag that meet OSHA requirements for lockout/tagout to the machine's main electrical enclosure. Lockout/tagout of the electrical system will prevent startup of the HPU.
3. Bleed all pressure from all hydraulic lines.
4. Use caution when disconnecting any hydraulic lines or components as there may or may not be stored pressure. Wear proper personal protective equipment.

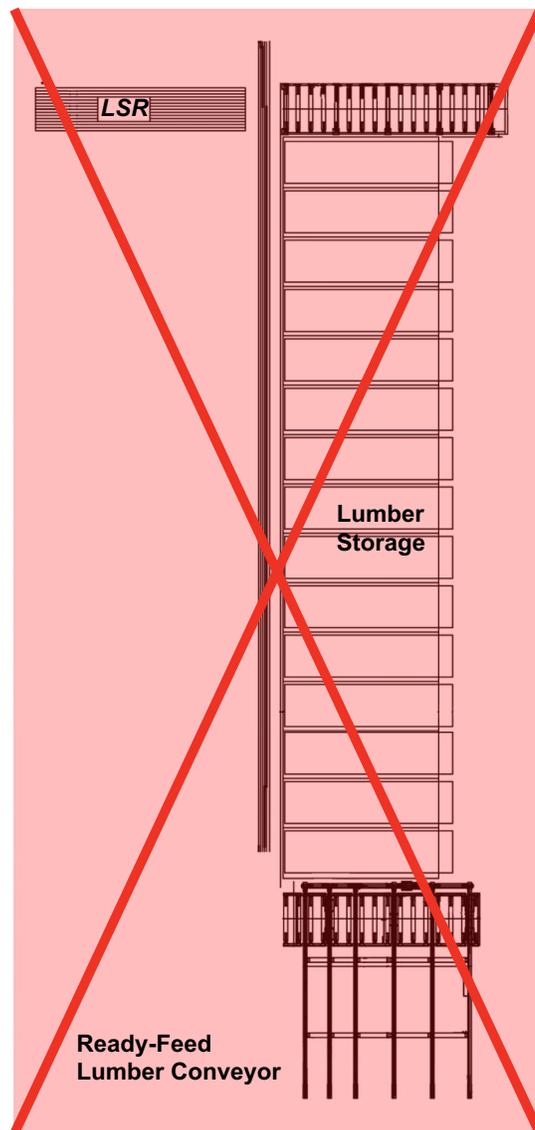
## Troubleshooting With an Energized Machine

Only a qualified electrician, using the personal protective equipment and following the procedures recommended in NFPA 70E should ever attempt service or repair of or near an energized area or component of the machine.

Whenever maintenance is performed while the equipment is electrically energized, there is a potential electric arc flash hazard. Refer to NFPA 70E for the personal protective equipment required when working with electrically energized components. Pneumatic and hydraulic components may move unexpectedly if not de-energized. Physically restrain any components capable of movement when working on or near those components.

## Restricted Zone

<b>DANGER</b>	
	<b>Stay out of the restricted zone when equipment is in use. Serious injury or death may result if personnel are in the restricted zone.</b>



## Safety Test

<b>WARNING</b>	
	<p><b>CRUSH HAZARD.</b></p> <p>Perform the safety tests described before operating the equipment at the initial startup, after performing any maintenance, and in accordance with the maintenance schedule.</p>

The test procedures **MUST** be performed by qualified personnel at startup and after ANY maintenance, adjustment, or modification. Testing ensures that the safety systems are functioning properly and that the *LSR* is receiving signals from the safety devices.

### Testing the Light Curtains

1. Ensure the disconnect handle is in the ON position.
2. Press the START button on the operator control.
3. While the *LSR* is sitting still, pass a board through the beam between the right light bar set.
4. Move the joystick in the direction for forward motion. The *LSR* should not move.
5. Repeat steps 2 through 4 for all light bars.
6. If any of the light bars fail this test, refer to the light bar manual to repair the problem, then repeat the test.

## Testing the Perimeter Guard Photo Eyes

1. Ensure the disconnect handle is in the ON position.
2. Press the START button on the operator control.
3. While the *LSR* is sitting still, pass a board in front of one of the perimeter guard photo eyes.

<b>WARNING</b>	
	<p><b>CRUSH HAZARD.</b></p> <p><b>The board should be freestanding. Personnel must not be in the restricted zone while the machine is capable of movement.</b></p> <p><b>Failure to exercise caution may result in severe personal injury or death.</b></p>

4. Move the joystick in the direction for forward motion. The *LSR* should not move.
5. Press and release the START button to reset the safety indicators.
6. Repeat this test for the remaining photo eye.

## Testing Stop and Slowdown Locations

1. Ensure the disconnect handle is in the ON position.
2. Press the START button on the operator control.
3. Move the joystick in the FORWARD or REVERSE direction to place the *LSR* in the center of the track.
4. Press and hold the FORWARD directional button on the operator control to move the *LSR* in the forward direction until it passes over the sensor bar located approximately 10 ft from the end of the track. The *LSR* should slow down noticeably.
5. Continue to move the *LSR* in the forward direction until it passes over the sensor bar located at the offload location. The hydraulic motor should slow down and the *LSR* should coast to a stop.
6. Press and hold the REVERSE directional button on the operator control to move the *LSR* in the reverse direction until it passes over the sensor bar located approximately 10 ft from the other end of the track. The *LSR* should slow down noticeably.
7. Continue to move the *LSR* in the reverse direction until it passes over the sensor bar located near the end of the track. The hydraulic motor should slow down and the *LSR* should coast to a stop.

## **Seguridad (Español)**

**Sea cuidadoso.  
Protéjase.**



## Indicadores de seguridad

Los siguientes símbolos de alerta de seguridad y palabras de advertencia se utilizan a lo largo de este documento para indicar riesgos de seguridad. Preste suma atención cuando los vea. Cada símbolo o palabra indica un nivel de gravedad diferente.

El no cumplimiento de las instrucciones que acompañan a cada símbolo de alerta de seguridad puede producir daños a la propiedad, lesiones personales e incluso la muerte. El personal debe seguir todos los procedimientos y prácticas de seguridad establecidos para asegurar el uso más seguro posible de este equipo. No obstante, en ningún caso este documento reemplaza el sentido común. El personal debe asegurarse de que el entorno de trabajo sea seguro y esté libre de distracciones.



### **PELIGRO**

Indica una situación de riesgo inminente que, si no se evita, pudiera producir la muerte o lesiones graves.



### **ADVERTENCIA**

Indica una situación potencialmente peligrosa que, si no se evita, puede producir la muerte o lesiones graves.



### **PRECAUCIÓN**

Cuando la PRECAUCIÓN se utiliza **con** el símbolo de alerta de seguridad aquí ilustrado, indica una situación potencialmente peligrosa que, si no se evita, puede producir lesiones menores o moderadas.

Cuando PRECAUCIÓN se utiliza **sin** el símbolo de alerta de seguridad aquí ilustrado, indica una situación potencialmente peligrosa que podría producir daños al equipo.

### **AVISO**

### **AVISO**

Llama la atención a información importante para entender la operación que se desea realizar.

### **AMBIENTAL**

### **AMBIENTAL**

Se aplica a condiciones que pueden afectar el entorno pero que no tienen un efecto inmediato o directo sobre el personal o el equipo.

## Reglas de seguridad

Debido a la imposibilidad de anticipar todas las circunstancias que podrían constituir un riesgo, la información de seguridad suministrada en este manual del equipo y sobre la máquina no es exhaustiva. Si se utiliza o realiza el mantenimiento de esta máquina utilizando un procedimiento no recomendado específicamente por el fabricante, el procedimiento deberá ser aprobado por un ingeniero profesional para asegurarse de que no afecte la seguridad del equipo. ¡Manéjese! siempre con suma precaución y sentido común!

### Conozca su equipo

- Lea este manual en su totalidad antes de utilizar o mantener el equipo. No utilice esta máquina a menos que esté perfectamente familiarizado con los controles, los dispositivos de seguridad, los frenos de emergencia y los procedimientos operativos que se describen en este manual.
- Lea y siga todas las notas de seguridad. El no cumplimiento de estas instrucciones podría producir pérdidas económicas, daños a la propiedad y lesiones personales, incluida la muerte.
- Refiérase a las pautas de bloqueo/etiquetado proporcionadas en las siguientes páginas para realizar el mantenimiento y solucionar problemas de este equipo en forma segura.
- Observe y cumpla con todas las etiquetas de seguridad. Cambie las etiquetas gastadas inmediatamente.
- Utilice este equipo únicamente para el propósito que se describe en este manual.
- Sólo personal calificado debe intentar utilizar o realizar el mantenimiento de este equipo. Por "personal calificado" se entiende:

*...una persona o personas que, por el hecho de poseer un título o certificado de capacitación profesional reconocido o que, por sus amplios conocimientos o experiencia, han demostrado con éxito estar capacitados para resolver problemas relacionados con el tema y el trabajo en cuestión  
—ANSI B30.2-1983*

*...una persona que posee habilidades y conocimientos relacionados con la construcción y uso de equipos e instalaciones eléctricas y que ha recibido capacitación en seguridad sobre los riesgos posibles—NEC 2002 Handbook*

### Seguridad personal

- Use siempre anteojos de seguridad y protección auditiva en un entorno industrial.
- Utilice una máscara protectora cuando trabaje cerca de aserrín.
- Utilice ropa adecuada y equipo de protección personal apropiado (por ejemplo, anteojos de seguridad y protección auditiva.) No use ropa suelta ni joyas. Si tiene el cabello largo, áteselo para atrás.
- Proceda con precaución cuando levante piezas o materiales pesados.

## Instalación del equipo

- Siga las instrucciones de instalación al pie de la letra.

## Procedimientos de Bloqueo/Etiquetado

- Antes de realizar el mantenimiento de los sistemas neumáticos o hidráulicos, purgue las líneas para eliminar la presión.
- Bloquee y etiquete todos los sistemas energizados antes de realizar tareas de mantenimiento en ellos. Refiérase a la sección *Pautas de bloqueo/etiquetado* en la página xxv.

## Cómo mantener un entorno seguro

- Mantenga alejados a los niños. Todos los visitantes deben mantenerse a una distancia segura del área de trabajo. Los riesgos pueden no ser evidentes a las personas no familiarizadas con la máquina.
- Mantenga las áreas de trabajo bien iluminadas.
- Mantenga el área de trabajo limpia y libre de cualquier riesgo de tropiezo o resbalamiento.
- No utilice el equipo en lugares húmedos o mojados y no lo exponga a la lluvia o a la nieve.

## Uso y mantenimiento del equipo

- Asegúrese de que no haya personas, herramientas y objetos extraños en las zonas restringidas antes de utilizar este equipo. Las zonas restringidas se indican en la página xxxi.
- Realice las pruebas de seguridad recomendadas en la sección Prueba de seguridad en la página xxxii antes de utilizar el equipo por primera vez, después de cualquier tarea de mantenimiento y conforme a la frecuencia de mantenimiento establecida.
- En caso de que la máquina no funcione correctamente, deténgala inmediatamente utilizando un freno de emergencia e informe el problema a un supervisor.
- No deje nunca la máquina encendida si no está junto a ella. ¡Apáguela!. No abandone la máquina hasta que todas las piezas se detengan completamente y hasta que se haya apagado la alimentación eléctrica.
- Verifique periódicamente que no haya piezas gastadas o dañadas. Repárelas o cámbielas inmediatamente.
- Mantenga los sistemas hidráulicos, neumáticos y eléctricos en buen funcionamiento en todo momento. Repare las fugas y las conexiones sueltas inmediatamente. No exceda nunca la presión ni potencia eléctrica recomendadas.
- Verifique que todos los dispositivos de seguridad estén en buen funcionamiento al comienzo de cada turno. Todos los dispositivos protectores y de seguridad deben

estar en su lugar antes y durante el uso de la máquina. No desconecte ni evite nunca ningún dispositivo de seguridad ni interbloqueo eléctrico.

- Inspeccione periódicamente la calidad del producto terminado.

### **Seguridad eléctrica**

- No utilice líquidos en el interior de los gabinetes eléctricos.
- Cuando utilice disolventes sobre o alrededor de la máquina, desconecte la alimentación para eliminar las probabilidades de chispas, que pueden producir una explosión o incendio. Use un respirador aprobado para el uso con disolventes. Use ropa protectora, guantes y anteojos de seguridad.

## Bloqueo/Etiquetado

### Pautas de bloqueo/etiquetado

**Deben cumplir con todas las pautas de bloqueo/etiquetado conforme a la norma OSHA 29 CFR 1910.147.** El programa de control de energía de la compañía debe incluir un procedimiento específico. El objetivo de este manual no es reemplazar el procedimiento de desenergización o bloqueo/etiquetado requerido por la OSHA, sino proporcionar pautas orientativas generales.

El término "bloqueo", según se utiliza en este manual, se refiere a la colocación de un dispositivo de bloqueo en las fuentes de energía para asegurar que el dispositivo aislador de energía y el equipo controlado por éste no puedan reenergizarse o utilizarse hasta que se retire dicho dispositivo.

Las fotos de la página siguiente muestran los lugares en los que se encuentran los interruptores de desconexión eléctrica de esta máquina.



- Las fuentes de energía incluyen energía eléctrica, mecánica, hidráulica, neumática, química, térmica y otras.
- En el caso de fuentes de energía eléctrica, la alimentación principal y la alimentación de control a la maquinaria deben apagarse y bloquearse físicamente en la posición "off" (apagado).
- Por lo general, como dispositivo de bloqueo se utiliza un candado con llave.
- Si hay más de una persona trabajando en una zona restringida, utilice un dispositivo de bloqueo grupal que permita a cada persona utilizar un candado que sólo pueda ser retirado por la persona que realiza el mantenimiento.

"Etiquetado" significa que debe colocarse una advertencia fácil de ver en un dispositivo aislador de energía que indique que el equipo no debe utilizarse.

## Procedimientos de bloqueo/etiquetado eléctricos

### Cuando trabaja en una máquina fuera del gabinete eléctrico principal de la máquina



Si trabaja en la línea de transmisión eléctrica a la máquina, siga el procedimiento de la página xxviii.

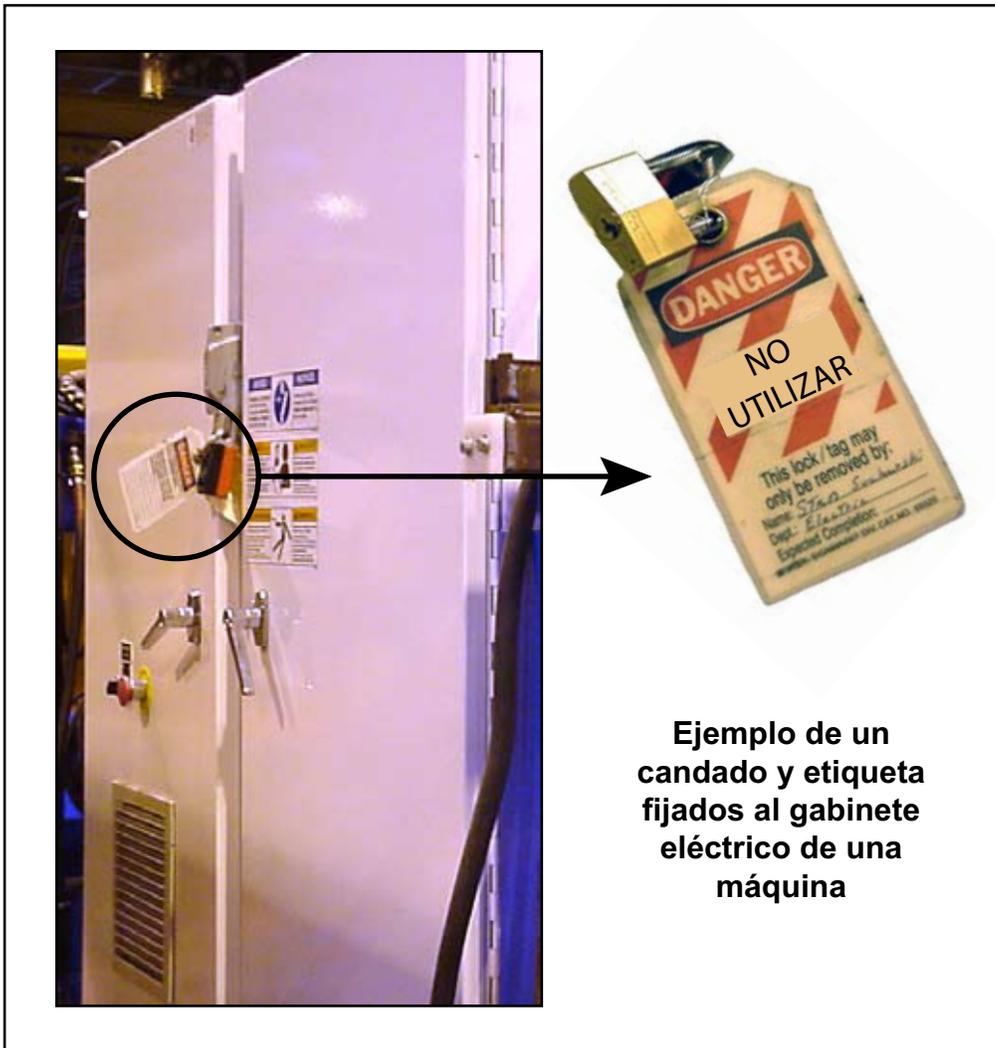
Antes de realizar el mantenimiento de cualquier máquina con alimentación eléctrica, bloquee y etiquete la máquina de forma adecuada. Cuando trabaje en una máquina fuera del gabinete eléctrico principal de la máquina, salvo en el caso de trabajos en la línea de transmisión eléctrica a la máquina, siga los procedimientos de bloqueo/etiquetado aprobados por la compañía, los cuales deberían incluir, entre otros, los pasos aquí indicados.

1. Coloque un freno de emergencia sobre la máquina.
2. Coloque el mango del interruptor con fusibles del gabinete eléctrico principal de la máquina en la posición "apagado/apagada". Vea la figura 2-1.

	<p><b>RIESGO DE ELECTROCUCIÓN.</b></p> <p><b>Cuando el interruptor con fusibles está apagado, sigue habiendo energía dentro del gabinete del interruptor. ¡Apague siempre la alimentación en la fuente de alimentación del edificio antes de abrir este gabinete eléctrico!</b></p>

3. Coloque un candado y una etiqueta que cumplan con los requisitos de bloqueo/etiquetado de la OSHA.
4. Trabe o desenergice todos los componentes hidráulicos y otras piezas que tengan alimentación directa o almacenada.

**Figura 5-1: Bloqueo/etiquetado en el gabinete eléctrico principal**



## **Cuando trabaje en una máquina dentro del gabinete eléctrico principal de la máquina o en la línea de transmisión eléctrica a la máquina**

Antes de abrir el gabinete eléctrico principal o intentar reparar o reemplazar una línea de transmisión eléctrica a la máquina, bloquee y etiqueta la máquina en forma adecuada. Siga los procedimientos de bloqueo/etiquetado aprobados por la compañía, los cuales deberían incluir, entre otros, los pasos aquí indicados.

1. Coloque un freno de emergencia sobre la máquina.
2. Apague la alimentación a la máquina en la fuente de alimentación, que, por lo general, es un panel de entrada de suministro eléctrico que se encuentra en una pared de las instalaciones. En la figura 2-2 se muestra un ejemplo de panel de fuente de alimentación bloqueado.
3. Coloque un candado y una etiqueta que cumplan con los requisitos de bloqueo/etiquetado de la OSHA.
4. Abra la puerta del gabinete al que necesita acceder y usando un multímetro verifique que la alimentación esté apagada.

**Figura 5-2: Bloqueo/Etiquetado del panel de fuente de alimentación**



## Procedimiento de bloqueo/etiquetado de sistema hidráulico

### Cuando no se requiere bloqueo/etiquetado

Si trabaja con componentes que no son del sistema hidráulico pero que requieren su presencia en la proximidad de componentes hidráulicos móviles, debe, como mínimo, trabar físicamente estos componentes para que no se muevan. Si no es posible, bloquee/etiquete todo el sistema hidráulico.

### Cuando se requiere bloqueo/etiquetado

Antes de intentar reparar o realizar el mantenimiento de una línea o componente hidráulico, bloquee y etiquete la máquina en forma apropiada. Siga los procedimientos de bloqueo/etiquetado aprobados por la compañía, los cuales deberían incluir, entre otros, los pasos aquí indicados.

1. Siga las instrucciones de las secciones de bloqueo/etiquetado eléctrico y neumático para bloquear y etiquetar o evitar el movimiento de estos componentes.
2. Coloque un candado y una etiqueta que cumplan con los requisitos de bloqueo/etiquetado de la OSHA en la gabinete eléctrico principal de la máquina.
3. Purgue la presión de todas las líneas hidráulicas.
4. Proceda con precaución cuando desconecte las líneas o componentes hidráulicos ya que puede haber presión almacenada. Use el equipo de protección personal adecuado.

## **Solución de problemas con una máquina energizada**

Sólo un electricista calificado que utilice el equipo de protección personal y siga los procedimientos recomendados en la norma NFPA 70E debe intentar realizar tareas de reparación o mantenimiento en un área o componente energizados de la máquina o en su proximidad.

Cada vez que se realizan tareas de mantenimiento mientras el equipo está eléctricamente energizado, existe un riesgo potencial de formación de un arco eléctrico. Consulte en la norma NFPA 70E el equipo de protección personal requerido para trabajar con componentes eléctricamente energizados. Los componentes neumáticos e hidráulicos pueden moverse de manera imprevista si no se desenergizan. Trabe físicamente cualquier componente que pueda moverse cuando deba trabajar en ellos o en su proximidad.

## Zonas restringida

	<p><b>Manténgase afuera de la zona restringida cuando el equipo esté en uso. Pueden producirse lesiones graves o incluso la muerte si el personal está en la zona restringida.</b></p>
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## Prueba de seguridad

	<p><b>RIESGO DE APLASTAMIENTO.</b></p> <p><b>Realice las pruebas de seguridad que se describen antes de utilizar el equipo por primera vez, después de cualquier tarea de mantenimiento y conforme con la frecuencia de mantenimiento establecida.</b></p>

Los procedimientos de prueba DEBEN ser realizados por personal calificado al poner en marcha el equipo y después de realizar CUALQUIER tarea de mantenimiento, ajuste o modificación. Las pruebas permiten verificar que los sistemas de seguridad estén funcionando correctamente y que la unidad de base principal *LSR* esté recibiendo señales de los dispositivos de seguridad.

### Prueba de las cortinas de luz

1. Asegúrese de que el interruptor con fusibles esté en la posición ENCENDIDO.
2. Presione el botón INICIO en el control del operador.
3. Mientras el *LSR* está inmóvil, pase una tabla a través del travesaño entre el juego de barras de luz derecho.
4. Mueva joystick en la dirección de avance. El *LSR* no debería moverse.
5. Repita los pasos 2 a 4 para todas las barras de luz.
6. Si alguna de las barras no pasa la prueba, refiérase al manual de las barras de luz para solucionar el problema y luego repita la prueba.

## Prueba de los sensores ópticos del protector perimetral

1. Asegúrese de que el interruptor con fusibles esté en la posición ACTIVADO.
2. Presione el botón INICIO en el control del operador.
3. Mientras el *LSR* está inmóvil, pase una tabla delante de uno de los sensores ópticos del protector perimetral.

<b>ADVERTENCIA</b>	
	<p><b>RIESGO DE APLASTAMIENTO.</b></p> <p><b>La tabla debe estar suelta. No debe haber personal presente en la zona restringida mientras la máquina esté en condiciones de moverse.</b></p> <p><b>Si no se procede con precaución, podrían producirse lesiones personales graves e incluso la muerte.</b></p>

4. Mueva joystick en la dirección de avance. El *LSR* no debería moverse.
5. Presione y suelte el botón INICIO para resetear los indicadores de seguridad.
6. Repita esta prueba con el otro sensor óptico.

## Prueba de las ubicaciones del tope y reducción de velocidad

1. Asegúrese de que el interruptor con fusibles esté en la posición ENCENDIDO.
2. Presione el botón INICIO en el control del operador.
3. Mueva joystick en la dirección AVANZAR o RETROCEDER para colocar el *LSR* en el centro de la guía.
4. Presione y mantenga presionado el botón direccional AVANZAR del control del operador para mover el *LSR* hacia adelante hasta que pase sobre la barra sensora ubicada aproximadamente a 10 pies respecto del extremo de la guía. El *LSR* debería reducir su velocidad en forma considerable.
5. Continúe moviendo el *LSR* hacia adelante hasta que pase sobre la barra sensora que se encuentra en el punto de descarga. El motor hidráulico debería reducir su velocidad y el *LSR* debería desacelerar hasta detenerse.
6. Presione y mantenga presionado el botón direccional RETROCEDER del control del operador para mover el *LSR* en dirección inversa hasta que pase sobre la barra sensora ubicada aproximadamente a 10 pies respecto del otro extremo de la guía. El *LSR* debería reducir su velocidad en forma considerable.
7. Continúe moviendo el *LSR* en sentido inverso hasta que pase sobre la barra sensora ubicada cerca del extremo de la guía. El motor hidráulico debería reducir su velocidad y el *LSR* debería desacelerar hasta detenerse.

# Introduction

## Chapter 1

### Purpose of Chapter

This chapter explains how to navigate through the equipment manual and how to contact MiTek.

## Introduction to the Manual

<b>WARNING</b>	
	<p><b>Read this manual completely before using this equipment!</b></p> <p><b>Do not operate this machine until you have a thorough understanding of all controls, safety devices, emergency stops, and operating procedures outlined in this manual.</b></p> <p><b>All hazard instructions must be read and observed. Failure to do so may result in economic loss, property damage, and/or personal injury.</b></p> <p><b>This manual must always be available to personnel operating and maintaining this equipment.</b></p>

### Purpose and Scope of This Equipment Manual

In order for this equipment manual to be useful, it must be kept in a location where operators and maintenance personnel have easy access to it.

This manual addresses the most recent versions of the equipment as of the creation or revision date on the title page. For earlier revisions, contact MiTek Machinery Division Customer Service. The part number is listed on the title page, but the revision you require depends on the date your equipment was manufactured.

This manual can be a valuable training tool.

- The Introduction and *General Information* chapter contains information on truss terminology and provides basic information about the equipment.
- The *Operation* chapter teaches operators how to efficiently operate the machine.
- The *Maintenance* chapter is written specifically for maintenance personnel.
- The appendices provide valuable technical and training information to keep your equipment running.

## Navigation

The graphics in Table 1-1 are used throughout the manual to quickly communicate a specific type of information.

**Table 1-1: Navigational Tools Used Throughout the Manual**

Graphic	Explanation
	<p>Important safety note!</p> <p>Indicates that you must lockout/tagout at the disconnect switch located on the equipment using approved methods described in OSHA 29 CFR 1910.147 before continuing with the procedure.</p>
	<p>Indicates tools required before beginning a procedure.</p>
	<p>Gives additional information to the steps or text.</p>
	<p>Refers reader to another section, table, graphic, or drawing for further explanation.</p>

## Additional Resources

### Supplemental Documentation

In addition to the equipment manual, refer to the manufacturer's documentation when you need more detailed information on these components than the MiTek manual provides. The supplemental documentation is provided at the time of installation, or it may be found inside an electrical enclosure. Refer to these documents

### Web Site

Visit the MiTek Web site at [www.mii.com](http://www.mii.com) for up-to-date information on all MiTek equipment. View the latest revision of this manual and all Service Bulletins, or order parts on-line through our eStore.

## Contacting MiTek

For technical assistance or to order parts, contact the Machinery Division Customer Service Department using one of the methods listed in Figure 1-1.

**Figure 1-1: Contacting MiTek**

<p><b>MiTek Machinery Division</b> Customer Service Department 301 Fountain Lakes Industrial Drive St. Charles, MO 63301</p> <p><b>Parts Orders (with part number)</b> E-mail: <a href="mailto:mitekparts@mii.com">mitekparts@mii.com</a></p> <p><b>Technical Assistance</b> Phone: 800-523-3380 Fax: 636-328-9218 <a href="mailto:machinerysupport@mii.com">machinerysupport@mii.com</a></p> <p><b>Web Site</b> <a href="http://www.mitek-us.com">www.mitek-us.com</a></p>	 The MiTek logo, consisting of the letters 'MII' in a bold, black, sans-serif font with three horizontal blue lines through the 'I', and the word 'MiTek' in a blue, sans-serif font below it.
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# General Information

## Chapter 2

### Purpose of Chapter

This chapter provides an overview of the equipment and the means to identify it.

## Introduction to the Equipment

### Purpose of the Equipment

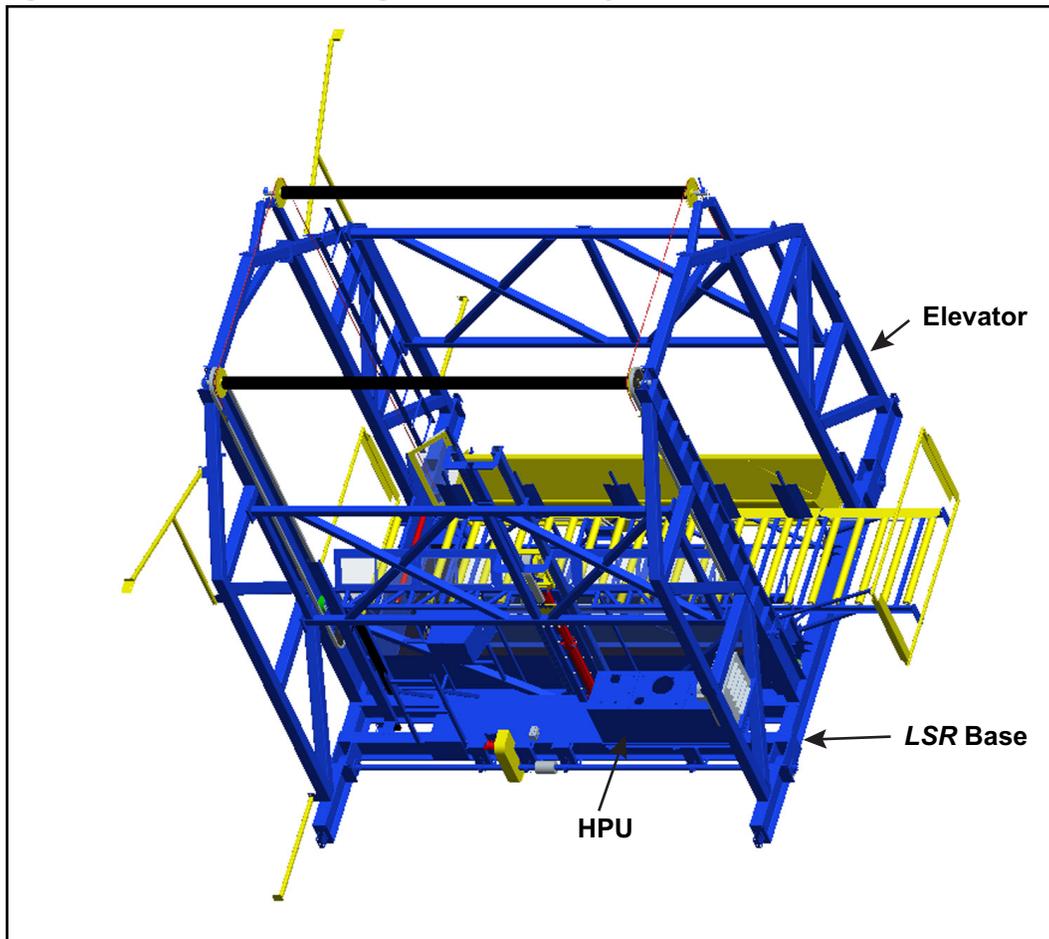
The *LSR* lumber storage and retrieval system is a revolutionary approach to material handling and inventory management that allows operators to load and retrieve full bunks of lumber from indoor mass storage. Efficiency numbers show that one person on a *LSR* system can do the same amount of work as at least three people and two forklifts.

### Description of the Equipment

The *LSR* lumber storage and retrieval system is a material handling system consisting of an operator platform and lumber bins that runs on a track next to a series of indoor *Auto-Stak*<sup>®</sup> lumber storage racks. The operator controls the forward, reverse, up and down movements of the *LSR* to travel to the correct bin and pull the required lumber to feed the saws.

Figure 2-1 shows a standard *LSR*. Refer to the *Maintenance* chapter for more detailed graphics.

**Figure 2-1: LSR Lumber Storage and Retrieval System**



## Main Components and Optional Equipment

Table 2-1 lists the main components that comprise this system.

**Table 2-1: Main Components**

Component	Description	Part #
<i>LSR</i> main base	Moves to lumber bins and saw loading area to transfer lumber from storage to saws; capable of moving a 16'-long bunk of lumber	59600-501
Hydraulic power unit	Provides power to the <i>LSR</i> main base	59605-501
Track	<i>LSR</i> main base rides forward and backward on the track	59602

Table 2-2 lists the options available with this system.

**Table 2-2: Optional Components and Features**

Component	Description	Part #
Rear unload kit	Allows lumber to be unloaded from the side opposite the lumber bins	90558-601
Rear hydraulic unload	Provide power to the rear unload kit	59605-501
<i>LSR</i> wide base	Moves to lumber bins and saw loading area to transfer lumber from storage to saws; capable of moving a 20'-long bunk of lumber	59600-801

## General Specifications

**Table 2-3: General Specifications**

<b>General</b>	
Lumber capacity	48" wide by 16' long
Maximum height of <i>LSR</i> base unit	262" (21' 10")
Maximum working height (height of rollers)	118-1/4" (9' 10-1/4")
Minimum working height (height of rollers)	38-1/4" (3' 2-1/4")
Maximum floor travel of <i>LSR</i> base unit	Varies based on track length
Maximum speed of <i>LSR</i>	3 mph
<b>Hydraulics</b>	
Horsepower, main hydraulic unit	30 hp
Horsepower, cooling fan	1 hp
Reservoir capacity	190 gal.
<b>Dimensions of System Components</b>	
See Table 3-2	
<b>Weight of System Components</b>	
See Table 3-4	

## Truss Terminology

Table 2-4: Truss Terminology

Length Types	Height Types	
Overall length	H1	Board height
Centerline length	H2	Centerline height
Top length	H3	Centerline height
Bottom length	H4	Centerline height

Figure 2-2: Terminology Diagram

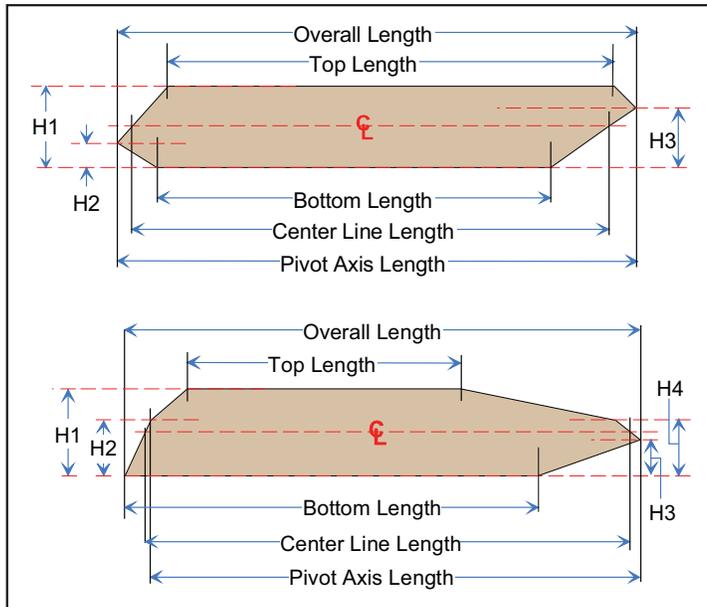
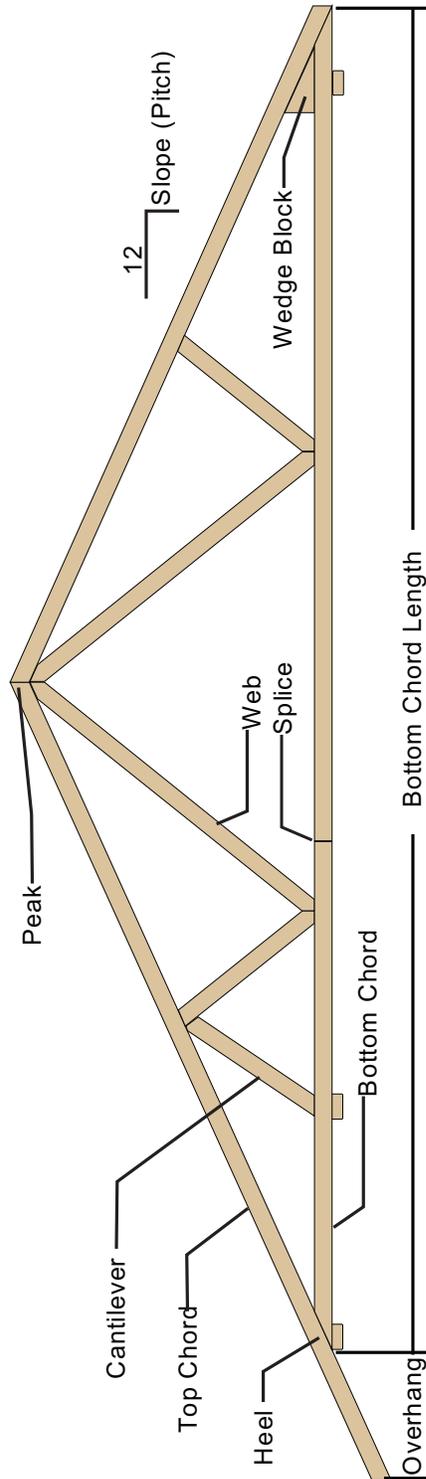


Figure 2-3: Parts of a Truss



# Prior to Installation

## Chapter 3

### Purpose of Chapter

This chapter covers what you must consider or complete before this equipment can be installed.

## MiTek's Responsibilities

### Prior to Installation

MiTek will provide the following items and information prior to the installation date:

1. A Prior to Installation package that:
  - Outlines this chapter and requests your signature of agreement.
  - Gives dates to expect shipment, delivery, and installation.
  - Explains the number of people required to help with installation.
  - Provides guidelines on providing an electrician, welder, and other specialists.
  - Describes payment information.
2. Upon request, a layout showing how you have indicated that you wish the equipment to be arranged within your building.

### During Installation

Upon request, a MiTek Customer Service Technician (CST) will be present to oversee the installation of your equipment.

## Customer Responsibilities

Before the installation of your equipment, the items and procedures in this chapter must be arranged, purchased, or assembled. Table 3-1 provides an overview of these items. Each topic listed in the table is explained in detail in the text following the table.

If these requirements are not satisfied before the scheduled installation date, it may be necessary to reschedule the installation. Any additional cost may be the customer's responsibility.

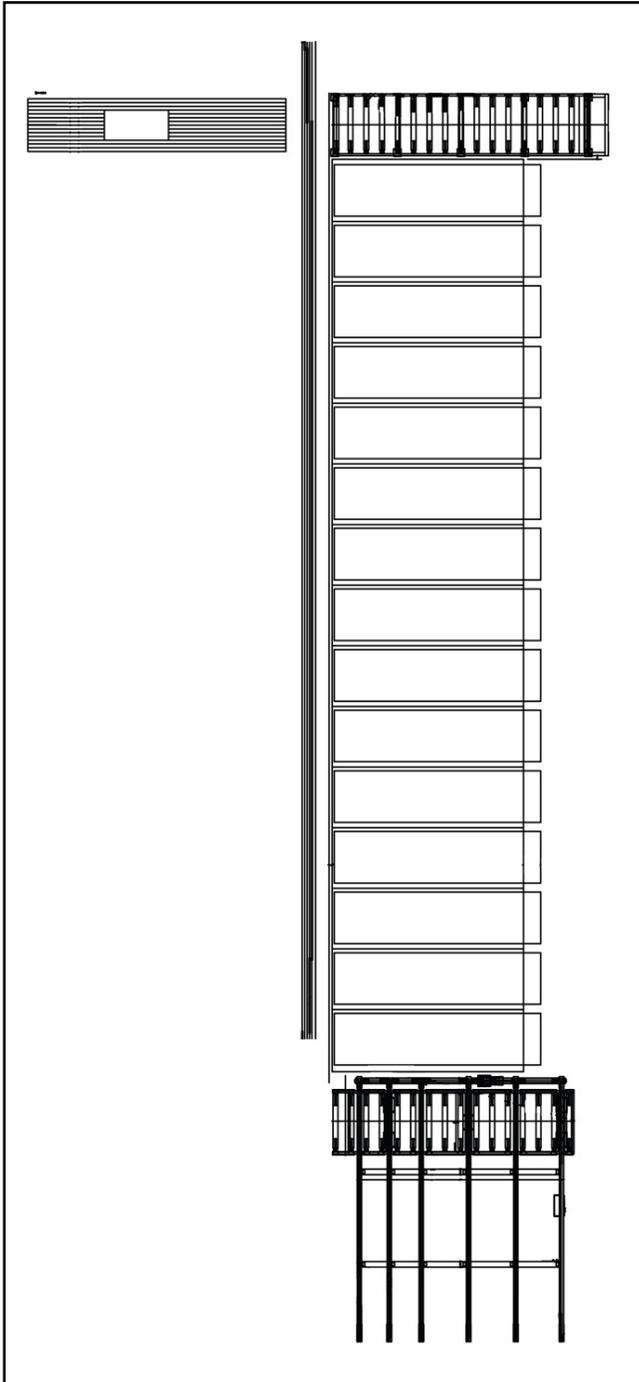
**Table 3-1: Summary of Customer Responsibilities**

Space Requirements	This equipment requires enough space to allow for the machine dimensions listed in Table 3-2, plus additional working space for operation and maintenance. Space should have adequate lighting.
Location Requirements	Reinforced concrete, a minimum of 6 in. thick 3,500 psi, is required to support the weight of the <i>LSR</i> and <i>AutoStak</i> racks. The floor must be level.  The equipment discussed in this manual must be used in dry conditions under a roofed area according to Type 1 electrical enclosure requirements.
Electrical Requirements	The standard electrical requirements are shown in Table 3-3. Contact your MiTek representative immediately if custom power specifications need to be accommodated.  The customer is responsible for supplying the disconnect and all wiring from the bus bar to the disconnect.
Hydraulic System Requirements	Hydraulic fluid that meets the requirements in Table 7-1 on page 48 must be on-hand during the installation process.
Shipping Requirements	See Table 3-4 for shipping weights.
Customer-Supplied Items	The customer is responsible for having the supplies listed in Table 3-5 available at the time of installation. The customer is also responsible for supplying and installing perimeter guarding necessary around the <i>LSR</i> operating area.

## Space Requirements

Space required for a *LSR* system varies. Refer to your individual layout when planning your space allocation.

**Figure 3-1: Sample of a Layout for a Complete System**



## Space for the Equipment

It is the customer’s responsibility to provide adequate space for the installation, operation, and protection of the equipment. Refer to Table 3-2 and your individual layout for dimensions. Additional space is required for operation, maintenance, and optional equipment.

**Table 3-2: Equipment Dimensions**

<b>Part Description</b>	<b>Dimensions</b>
<i>LSR main base</i>	22' tall, 23' long, 20' wide
<i>LSR wide base (option)</i>	22' tall, 23' long, 24-1/2' wide
Track	Refer to layout

## Space for Operation and Maintenance

Additional space must be allocated for operation and maintenance. Space should allow for safe operation, freedom of movement, storage space, and free flow of raw and finished materials.

## Location Requirements

### Floor Structure

A level and structurally sound concrete slab must be provided for the installation of the equipment. This slab should be designed and installed in accordance with local building code requirements. Reinforced concrete should be a minimum of 6 in. thick. Three thousand five hundred (3,500) psi concrete is recommended. Refer to your layout drawing.

### Environment

The equipment must be used in dry conditions under a roofed area according to Type 1 electrical enclosure requirements.

Lighting should be adequate for safe operation and maintenance.

## Electrical Requirements

<b>WARNING</b>	
	<p><b>ELECTRICAL HAZARD!</b></p> <p>All electrical work must be performed by a licensed electrician.</p> <p>Follow approved lockout/tagout procedures (OSHA 29 CFR 1910.147).</p>

The standard electrical requirements are shown in Table 3-3.

The power supply must have a fused disconnect switch, separate from the disconnect switch on the machine. The power supply line must reach the disconnect enclosure on the machine.

You must indicate what voltage is available at the machine’s proposed location when placing the order. This information must be correct. Depending on the voltage available, revisions to the electrical system or a transformer may be necessary.

**Table 3-3: Minimum Electrical Requirements for This Equipment**

Voltage	460 VAC
FLA Plus Control Amperage	37.1 amps
Equipment Disconnect Protection	60 amps
Cycles (Frequency)	60 Hz
Phases	3

## Hydraulic System Requirements



220 gallons of hydraulic fluid must be available for the initial charge of the machine prior to startup.

<b>WARNING</b>	
	<p><b>HIGH PRESSURE HAZARD.</b></p> <p><b>Compressed air and hydraulic lines should be installed only by qualified personnel familiar with all governing regulations. Failure to use proper materials and installation practices can result in ruptured lines leading to personal injury, equipment damage, and equipment failure.</b></p>

You must have 220 gallons of hydraulic fluid on-site during the installation of this equipment. It can not operate without the proper hydraulic fluid.

Refer to Table 7-1 on page 48 for hydraulic fluid specifications.

## Shipping Information

When the equipment arrives, you must have the proper transport and lifting equipment available to remove it from the truck and place it in your facility. Table 3-4 lists the weight of the individual components of a typical system.

<b>DANGER</b>	
	<p><b>Transport and lifting equipment such as forklifts and cranes must be designed and rated for the load and application. The weight of each major component is given in Table 3-4.</b></p> <p><b>Inadequate transport equipment may result in property damage, personal injury, or death.</b></p>

**Table 3-4: Shipping Information**

Contents of Shipment	Approximate Weight
LSR base	30,000 lb
Tower units	3,000 lb each
Torque tubes	500 lb each
Dump bin	800 lb
Cross braces	2,000 lb each

## Customer-Supplied Parts

The customer must supply the parts shown in Table 3-5. Some must be installed before installation of the equipment and some must be available for use at the time of installation.

**Table 3-5: Customer-Supplied Parts**

Item	Description
Electrical Equipment	All electrical requirements to provide power to the disconnect enclosure on the LSR are the customer's responsibility
Transport Equipment	A crane and chains capable of lifting 30,000 lb are required to move the equipment during unloading and placement of the machine All transport and lifting equipment must meet the requirements given in the <i>Shipping Information</i> section
Tools That May Need to be Rented	Transit with measuring stick
	Industrial hammer-drill
	Hydraulic jack
	Welding equipment
General Tools	Reach fork with a 24' lifting height capacity, capable of lifting 3,000 lb.
	Large hex driver
	Set of large standard sockets
	Ratchet
	Set of large wrenches
	1/2" concrete drill bit

## Training Provided

If MiTek is overseeing the installation of your equipment, the MiTek representative trains your operators and maintenance personnel on the equipment's proper operation and maintenance. The representative explains the warranty policy, gives an overview of the equipment manual, and requests your signature that the manual was received.

# Installation

## Chapter 4

### Purpose of Chapter

This chapter describes the entire installation process in detail. The instructions assume that the prior-to-installation requirements are satisfied.

## Responsibilities During Installation

Upon request, MiTek can provide installation supervision to ensure that the system is installed properly and operates correctly. We will also provide operating and maintenance training at the time the equipment is installed. The customer is responsible for providing all labor and equipment needed to complete the installation. These requirements are explained in the *Prior to Installation* chapter.



All customer responsibilities before and during installation are described in the *Prior to Installation* chapter!

## Delivery

### Checking for Damage

All shipments from MiTek are covered with tarps. When your shipment arrives, check to ensure that the tarps are in place. Displaced tarps may indicate a potential problem.

After removing the tarps, inspect the shipment for water/moisture, debris, and damage. Report any findings as required by the transport company. Document any findings by taking photographs or a video. Note any and all damage to the equipment on the bill of lading to ensure proper documentation for insurance claims. Without this note, any damage in transit is the responsibility of the customer to repair.

Notify MiTek Machinery Division Customer Service of any unacceptable findings discovered during the receipt inspection. Although your findings may not appear to be a

problem, they may cause premature failure of components, poor performance, or erratic performance.



**Refer to...**  
Table 3-4 on page 15 for the weight of each component

## Unloading

Refer to the *Prior to Installation* chapter for information regarding preparing for the delivery.

Even if a MiTek representative is present, it is the customer’s responsibility to provide equipment and labor for unloading, placement, and wiring of the equipment. A crane and chains are required to move the equipment during unloading and placement of the machine. The lifting equipment must be rated appropriately for the weights shown in Table 3-4 on page 15.

Exercise extreme caution to avoid damage or misalignment during unloading. Do not apply pressure on any moving parts or fittings. Figure 4-1 shows how to lift and move the equipment safely.

<b>WARNING</b>	
	<p><b>CRUSH HAZARD.</b></p> <p>Failure to lift the equipment in the prescribed manner may cause serious injury, including death, or equipment damage.</p> <p>Personnel not involved in the off-loading from the truck shall remain clear of the area.</p> <p>Transport and lifting equipment such as forklifts and cranes must be designed and rated for the load and application.</p>

Figure 4-1: Lift Points for LSR Base Unit



## Unpacking

After successful unloading, remove the protective crating material from the pallets. Detach and set aside all loose parts. Move the equipment to the desired location using a crane appropriate to the weight of each unit. Lift the equipment to remove the pallet, and gently place each unit in its new location.

## Equipment Layout

Each component must be located in specific locations. A sample layout is shown in Figure 3-1 on page 12, but refer to your own layout during installation. Your MiTek representative will provide your layout to you before the equipment is installed.

## Installing the LSR

### Installing the Lumber Racks

Obtaining the lumber racks is the responsibility of the customer. The lumber racks should be installed according to your individual layout.

### Installing the Track

Follow the procedure below to determine the location of each *LSR* system component. Refer to your individual layout during the procedure.

#### Marking Track Locations

1. Mark the location of the end of the track on the opposite end from the offload area.
2. Mark the location of the edge of the track on the side closest to the lumber storage racks.
  - a) Measure from the edge of the lumber racks the distance indicated on **your** layout.
  - b) Measure and mark in several spots along the length of the track.
  - c) Use a chalk line to mark a straight line the complete length of the track.
3. Mark the location of the edge of the track on the side farthest to the lumber storage racks.

- a) Measure from the edge of the lumber racks the distance indicated on **your** layout.
- b) Measure and mark in several spots along the length of the track.
- c) Use a chalk line to mark a straight line the complete length of the track.

### Placing and Anchoring the Track

1. Put the first section of track in place per your specific layout.
2. Double-check the factors below:
  - a) Adequate space between walls and the equipment for maintenance purposes.
  - b) Local safety regulations regarding the clear space in front of electrical enclosures.
3. Install the first section of track on the side closest to the lumber storage racks.
  - a) Locate the hardware.
    - Concrete anchors (1/2 in. x 4-1/2 in. are supplied).
    - Additional boxes can be ordered if needed.
  - b) Install the concrete anchors.
    - 1) Using an industrial hammer drill and a 1/2-in. drill bit, drill a hole at least 6 in. deep. For best results, drill the hole completely through the concrete pad.



If you do not drill completely through the concrete, you must vacuum out the concrete dust before proceeding with the next steps.

- 2) Place the anchor in the hole, flanged end first.
  - 3) Use a mallet or hammer to pound the anchor into the hole.
4. Install the remaining track sections EXCEPT the end pieces on one end of both tracks using the same procedure as for the first one. Refer to your individual layout for track locations.

### Welding the Track and Placing the Guide Angle

1. Before welding the track, measure all sections of track again to make sure they comply with your individual layout and are exactly parallel.

2. Weld the track sections together.
3. Grind the welds flat so that the *LSR* can glide over them smoothly and without damage to the wheels.
4. Place the guide angle as shown on your individual layout.
5. Anchor the guide angle to the floor. The guide angle should be parallel to the track.
6. After ensuring the guide angle is straight, weld the angle to the track as shown on your layout.

### Placing the *LSR* Onto the Track

The *LSR* should glide easily onto the tracks. Make sure the *LSR* is properly oriented for lumber ejection before placing it onto the track.

### Placing the Track End Pieces After the *LSR* is on the Track

1. Put the last section of each track in place per your specific layout.
2. Install the last section of each track.
  - a) Locate the hardware.
    - Concrete anchors (1/2 in. x 4-1/2 in. are supplied).
    - Additional boxes can be ordered if needed.
  - b) Install the concrete anchors.
    - 1) Using an industrial hammer drill and a 1/2-in. drill bit, drill a hole at least 6 in. deep. For best results, drill the hole completely through the concrete pad.



If you do not drill completely through the concrete, you must vacuum out the concrete dust before proceeding with the next steps.

- 2) Place the anchor in the hole, flanged end first.
- 3) Use a mallet or hammer to pound the anchor into the hole.
3. Before welding the track, measure the sections of track again to make sure they comply with your individual layout and are exactly parallel.
4. Weld the track sections together.

5. Grind the welds flat so that the *LSR* can glide over them smoothly and without damage to the wheels.
6. Place the guide angle as shown on your individual layout.
7. Anchor the guide angle to the floor. The guide angle should be parallel to the track.
8. After ensuring the guide angle is straight, weld the angle to the track as shown on your layout.

## Installing Perimeter Guarding

Obtaining adequate perimeter guarding is the responsibility of the customer. Perimeter guarding must be installed before operating the *LSR*.

<b>DANGER</b>	
	<p><b>CRUSH HAZARD.</b></p> <p><b>Perimeter guarding <i>MUST</i> be in place before the <i>LSR</i> is capable of operation.</b></p> <p><b>Failure to install proper perimeter guarding is likely to result in death or serious injury.</b></p>

## Hydraulic System

### Hydraulic Fluid

See Table 7-1 on page 48 for hydraulic fluid specifications. The indicated amount of hydraulic fluid must be available during installation.

#### **CAUTION**

**Add hydraulic fluid before turning on the system.  
The equipment is shipped with the reservoir empty.**

### Connecting the Hoses

The hydraulic system ships with all hoses connected. Verify that all connections are tight before proceeding with the installation.

### Electrical Connections to the HPU

Electrical connections to the HPU will be connected before shipping. Check connections for tightness and tighten or reconnect wires as necessary. Refer to Drawing 90558.

### Connecting HPU Controls

Connect the two 20-pin cables from the main electrical enclosure on the rear of the machine to the proportional directional and throttle valves.

## Installing the Bus Bar System

### Overview of the Bus Bar System

To install the bus bar system, mount a junction box to the mast and the conductor bars that are attached to the storage racks. The trolleys in the bus bar assembly ride along the conductor bars and provide constant power to the machine without the need for a cable. A system overview is shown in Figure 4-2 and a close-up look at the components is shown in Figure 4-3.

**Figure 4-2: Bus Bar System Overview**

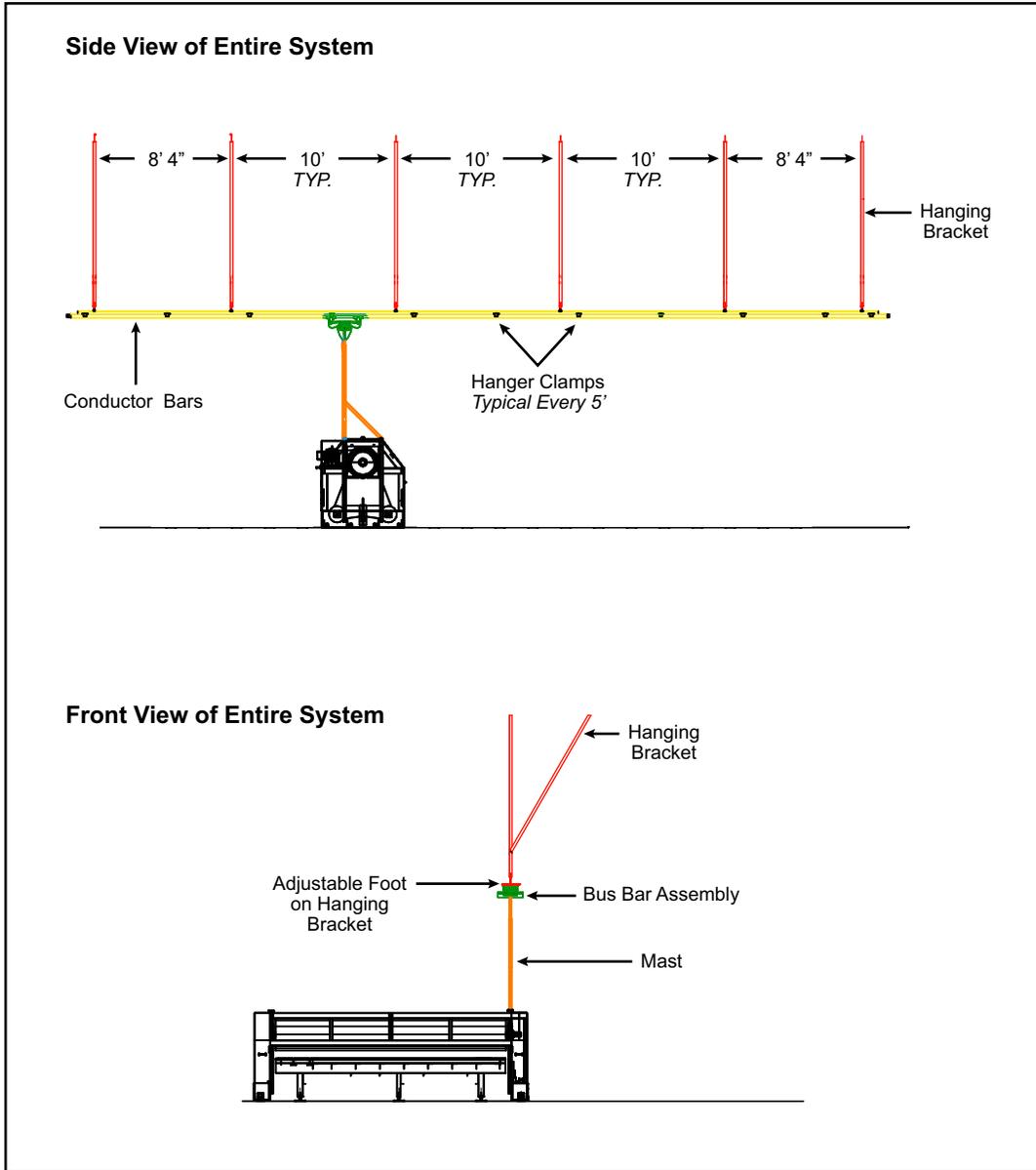
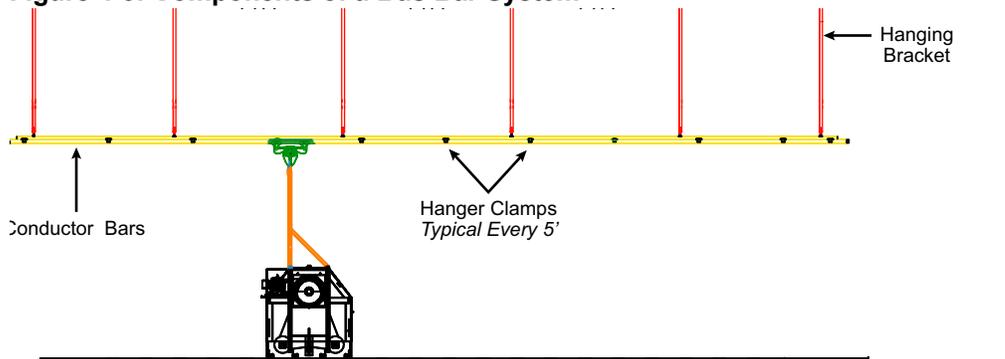
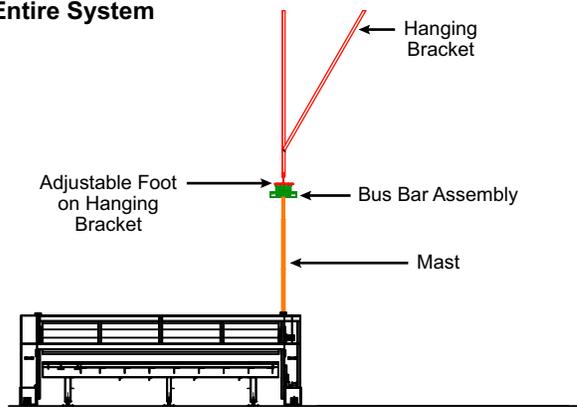


Figure 4-3: Components of a Bus Bar System



Front View of Entire System



## Installing the Bus Bar System

The customer must supply the hanging brackets. MiTek will provide drawings with the requirements for each bracket. The brackets consist of an upright, a gusset, and an adjustable foot. The instructions below address the installation of the components. The electrical needs are addressed in the *Electrical System* section later in this chapter.

1. Once the hanging brackets are ready, determine the exact location of the bus bar system.
2. Hang the brackets from the storage racks at the spaces indicated on your drawing. A typical example is shown in Figure 4-2.
3. Attach the adjustable feet to a 2x6 board. The board is the gang bracket mount labeled in Figure 4-3. The height will be adjusted in a later step.
4. Attach the conductor bars to the gang bracket mount board using the hanger clamps at the intervals specified on your drawings. The typical spacing is 5 ft center-to-center.
5. Mount the trolley assembly to the mast.
6. Adjust the height of the hanging bracket feet so the conductor bars are at the correct height to hold the trolleys in place.

## Electrical System

<b>DANGER</b>	
	<p><b>ELECTRICAL HAZARD!</b></p> <p>All electrical work shall be done by a licensed electrician and shall conform to all regulating codes. In the event that information in this manual conflicts with local code requirements, please contact MiTek Machinery Division Customer Service.</p> <p>Do not turn on electrical power until you have read the startup procedure. Follow approved lockout and tagout procedures in accordance with OSHA 19 CFR 1910.147.</p>

### Checking Existing Wiring

Heavy gauge wire can work loose during shipping and handling. Before power is connected to the machine, conduct a pull test on all pre-wired connections inside the electrical enclosures.

### Connecting Power to the Bus Bar and *LSR*

All electrical work is the customer's responsibility and must be performed by a licensed electrician. The machine design addresses electrical components starting with the disconnect enclosure. Installation and maintenance of all electrical requirements up to the disconnect enclosure are the responsibility of the customer. Your MiTek representative can provide guidance regarding when the electrical will need to be available during the installation.

Wiring from the main disconnect enclosure to the bus bar system is the responsibility of the customer. The bus bar ground bar is green. All work must be performed by a licensed electrician.

The sample of a disconnect on a machine's main electrical enclosure is shown in Figure 4-1 on page xiii.

The trolley assembly mounts to the top of the mast on the gantry head. Run the wires from that assembly down the mast into the machine's main disconnect enclosure.

## Installation Checklist

- Check for damage
- Unload the equipment
- Unpack the equipment
- Review your individual layout
- Install the lumber racks
- Mark the track locations
- Place the track
- Anchor the track
- Weld the track in place
- Grind the welds smooth
- Place the angle
- Anchor the angle
- Weld the angle
- Place the *LSR* onto the track
- Place the track end pieces
- Weld the track end pieces in place
- Grind the welds smooth
- Place the angle
- Anchor the angle
- Weld the angle
- Install the perimeter guarding
- Check hydraulic hose connections
- Fill the hydraulic system with fluid
- Connect power to the HPU
- Connect the HPU controls
- Install the bus bar system
- Check existing wiring
- Connect power to the bus bar system
- Connect power to the *LSR*

<b>WARNING</b>	
	<p><b>ELECTROCUTION, HIGH PRESSURE, CRUSH, CUT, AND CHEMICAL HAZARDS!</b></p> <p><b>Do not attempt to start the system without a MiTek representative present!</b></p> <p><b>Serious injury and/or equipment damage may result.</b></p>

# Startup

## Chapter 5

### Purpose of Chapter

This chapter describes the procedures required before operating your equipment.



The equipment is shipped with the hydraulic fluid reservoir empty. Add fluid before turning equipment on!

## Preparing the Hydraulic System

Fill the hydraulic reservoir with hydraulic fluid that matches the specification listed in Table 7-1 on page 48. Ensure that you have the required amount of hydraulic fluid prior to planning the startup. The reservoir should be filled to within 2 in. from the top. Watch the sight gauge on the reservoir to determine the fill level. Refer to the procedure on page 49 of the *Maintenance* chapter.

CAUTION	
	<p><b>SLIP HAZARD.</b></p> <p><b>Do not overfill. Clean up any spillage immediately to avoid injury.</b></p>

## Checking Motor Rotation

Check the motor rotation of the HPU motor to ensure it is rotating in the same direction as the arrow on its housing. If the motor is rotating in the wrong direction, lockout/tagout the machine and switch any two of the lead wires located on the motor's junction box.

## Safety Tests

Perform the safety tests beginning on page xvii or page xxxii before operating the equipment at the initial startup, after performing any maintenance, and in accordance with the maintenance schedule.

# Operation

## Chapter 6

### Purpose of Chapter

This chapter describes the operating mechanisms on this equipment and the procedure to operate it in most circumstances.

## Before You Begin

### Safety Operating Notes

WARNING	
	<p><b>ELECTROCUTION, HIGH PRESSURE, CRUSH, CUT, AND CHEMICAL HAZARDS!</b></p> <p>Read this section <b>AND</b> the safety section in the preliminary pages before operating or maintaining this equipment.</p> <p>Do not operate this machine until you have a thorough understanding of all controls, safety devices, E-stops, and operating procedures outlined in this manual.</p> <p>Read and observe all warnings. Failure to do so may result in economic loss, property damage, and/or personal injury.</p> <p>This manual must always be available to personnel operating and maintaining this equipment.</p>

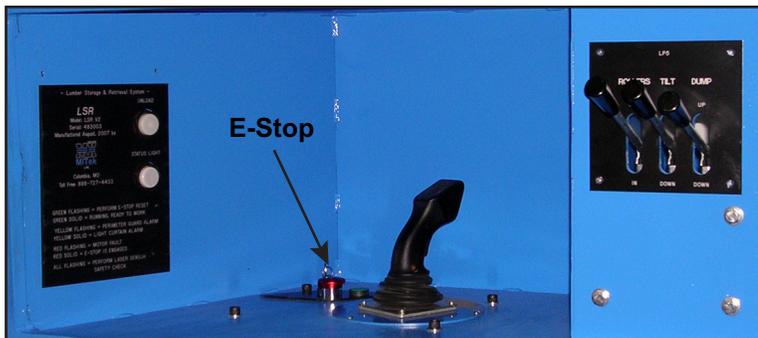
WARNING	
	<p><b>CRUSH AND CUT HAZARD.</b></p> <p>Before turning on the equipment, make sure that all personnel and equipment are out of the restricted zone (see page xvi or page xxxi).</p>

## Stopping the Machine

Emergency stops (E-stops) immediately cease electrical power transmitting to the control circuit. Utilize the E-stop on this machine to cease power to the HPU motor. The E-stop will cause the motor to stop rotating and the machine will come to a controlled stop.

Note the E-stop location shown in Figure 6-1.

**Figure 6-1: E-Stop Location on Operator Controls**



In addition, pressing and holding the START button while the hydraulic motor is on will cause the hydraulic motor to stop.

### E-Stop Pushbutton

The E-stop on the *LSR* is located on the operator control station next to the joystick. A typical E-stop pushbutton is shown in Figure 6-2. To activate a pushbutton, push the entire red button in. To release a pushbutton E-stop, pull the button straight up. It will return to its extended position. Once the START button is pressed, the machine will operate again.

**Figure 6-2: E-Stop Pushbutton**



### Perimeter Access Guarding (Light Bars)

Operation of the light bars is discussed later in this chapter. To stop the machine using the light bars, a solid object must pass through the light beam, interrupting the transmission of the beam between the transmitter bar and receiver bar. Refer to Table 7-1 on page 43 in the *Maintenance* chapter for the location of the light bars.

### Perimeter Guard Photo Eyes

The two perimeter guard photo eyes are located on the bottom corners of the *LSR* main base unit on the side next to the lumber storage racks. The photo eyes will sense lumber that is protruding from the racks into the *LSR* travel area. If an object is protruding into the travel area, the photo eyes will stop the hydraulic motor and the motion of the machine before it collides with the object.

### Disconnect Switch

Figure 4-1 on page xiii shows a sample photo of a disconnect switch that controls the power supplied from that switch to the rest of the machine. Turning the disconnect handle to the ON position supplies electrical power to the entire machine. To remove power to the machine, turn the disconnect handle to the OFF position. The disconnect handle should be turned off when the machine is not in use

<b>WARNING</b>	
	<p><b>When the disconnect switch is off, there is still live power to the disconnect switch’s enclosure. Always turn off power at the main power source before opening electrical enclosure!</b></p>

### Starting the Machine

Refer to the *Operating Procedure* section on page 36 for the operating procedure.

### Indicators

#### Indicator Lights

The *LSR* has a multi-colored banner status light on the legend plate located next to the joystick. The indicator lights listed in Table 6-1 provide the operator with information about the status of the machine.

**Table 6-1: Functions of Indicators**

Light	Meaning
Green, flashing	Reset E-stop
Green, solid	Running, ready to operate
Yellow, flashing	Perimeter guard photo eye alarm
Yellow, solid	Light curtain alarm
Red, flashing	Motor fault
Red, solid	E-stop is engaged

**Table 6-1: Functions of Indicators (Continued)**

Light	Meaning
All colors, flashing	Perform laser sensor safety check

**Indication of Movement (Beacon and Horn)**

When the joystick is moved in the forward or reverse direction, the *LSR* will begin motion. The beacons will begin blinking and the horns will sound in one-second increments. The beacon remains blinking and the horn continues to pulse while the *LSR* is moving.

The *LSR* has two beacon and horn units. They are located on the front and rear of the *LSR*, halfway up the side away from the lumber bins on the left- and right-hand cage assemblies.

## Operator Control Interface

### Control Mechanisms

Figure 6-3: Overview of Control Mechanisms

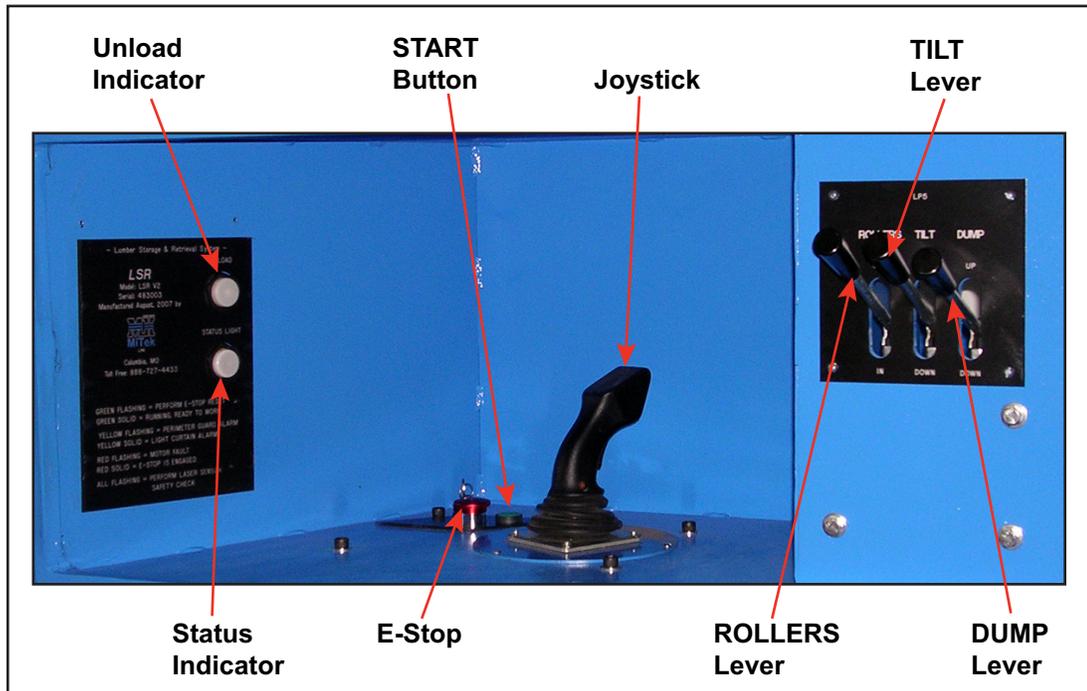


Table 6-2: Functions of Control Mechanisms

Control Mechanism	Function
START button	Starts hydraulic motor
ROLLERS lever	Controls lumber rollers on <i>LSR</i>
TILT lever	Controls the up and down movement of the tilt arms
DUMP lever	Controls dump bin
Joystick	Controls left, right, up and down motion of the <i>LSR</i>
Joystick trigger button	Activates joystick; must be held down while using joystick

## Using the Joystick

The *LSR* can be moved left and right on the track, and the elevator can be moved up and down using the joystick control. See Table 6-3 for an explanation of the joystick direction and the corresponding direction of movement.

**Table 6-3: Joystick Functions**

Joystick Direction	Direction of Movement
Forward (Away from operator)	Down
Back (Toward operator)	Up
Left	Left
Right	Right

## Operating Procedure

<b>WARNING</b>	
	<p><b>CRUSH AND CUT HAZARD.</b></p> <p>Before turning on the equipment, make sure that all personnel and equipment are clear.</p>

### Procedure Under Normal Conditions

1. Perform safety tests described beginning on page xvii or page xxxii.
2. Turn on the main power switch at the control box on the rear of the machine.
3. Walk around the machine and board the lifting platform.
4. Pull out the E-stop button.
5. Exit the lifting platform and activate the perimeter guard photo eyes by passing a piece of paper or cardboard over each one.
6. Board the lifting platform.
7. Push the START button.
  - The status light should flash green, indicating the machine is ready to start.
  - There should be a solid green status light on the display panel, indicating the hydraulic motor is running.

<b>CAUTION</b>
<p><b>The hydraulic motor should only be started a few times a day to prevent overheating and wear.</b></p> <p><b>Excessive starts may cause damage to the equipment.</b></p>

8. Hold down the joystick trigger button and drive the *LSR* to the correct lumber locations using the joystick control. See *Using the Joystick* on page 35 for information on using the joystick.
9. Load the lumber into the *LSR*. Sort bad lumber into the dump bin.
10. When lumber is ready for delivery to the outfeed conveyor, drive the *LSR* to the dropoff location.

11. Using the ROLLERS lever, slide the lumber out of the *LSR* and onto the outfeed conveyor.
12. If more lumber is needed, repeat steps 8 through 11.
13. If finished using the *LSR* for an extended period of time, use the DUMP lever to empty the dump bin.
14. If finished using the *LSR* for an extended period of time, push the E-stop button. Ensure the elevator is in the down position before pushing the E-stop.
15. Exit the lifting platform.
16. Turn off power at the control box at the rear of the machine.

## Restart Procedure

If the machine has stopped because an E-stop has been depressed:

1. Reset the E-stop by pulling the button straight out.
2. Exit the lifting platform and activate the perimeter guard photo eyes by passing a hand over each one.
3. Board the lifting platform.
4. Push the START button.

If the machine has stopped because an object has passed through the light beam or triggered a perimeter guard photo eye:

1. Remove the object that has tripped the light beam or perimeter guard photo eye.
2. Exit the lifting platform and activate the perimeter guard photo eyes by passing a piece of paper or cardboard over each one.
3. Board the lifting platform.
4. Push the START button.

If the machine has stopped because it has triggered the sensor strip at the end of the track, move the joystick in the forward or reverse direction to move the machine in the opposite direction, toward the other end of the track.

## Hydraulic System Operation

### Operating Overview

The hydraulic system powers many functions on the *LSR*. A 30 hp electric motor powers a variable displacement pump. This pump senses the pressure in the output line and reduces displacement when pressure requirements have been met. A 1 hp motor operates the cooling circuit.

The joystick sends an electrical signal to the PLC to initiate a position or speed changes. The PLC analyzes the position of the *LSR* as indicated by proximity sensors, then provides an appropriate speed change by signalling the hydraulic valves to change the hydraulic flow to the drive motor or hydraulic mast.

### Starting the Hydraulic System

To start the hydraulic system, push the START button on the operator controls. This will start the electric motor and the variable displacement pump. It is not necessary to prime the hydraulic pump.

## Perimeter Access Guarding Operation

<b>WARNING</b>	
	<p><b>CRUSH AND CUT HAZARD.</b></p> <p>This safety device is intended for detection of personnel and equipment entering a hazardous area and not for the detection of hands and fingers.</p> <p><b>Tampering with or modifying the light bars or safety bumpers can result in property damage, serious injury, or death.</b></p>



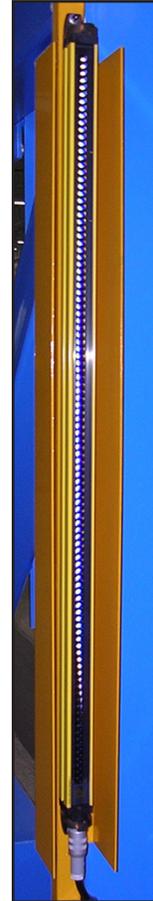
**Refer to...**

Maintenance chapter for more information.

The *LSR* uses two forms of perimeter access guarding. The photo eyes detect when lumber or other objects are protruding from the lumber racks into the path of the *LSR*.

The light bars prevent the *LSR* from moving while objects are protruding from the *LSR*. This equipment uses a continuous-beam light bar set. A light bar is shown in Figure 6-4.

Figure 6-4: Light Bar



# Maintenance

## Chapter 7

### Purpose of Chapter

This chapter provides step-by-step instructions as well as information to help you understand how your equipment works to enable you to make repairs and perform preventive maintenance.

## Introduction to Maintaining Your Equipment

This manual contains sufficient information for proper maintenance under most conditions. Certain operating environments may necessitate preventive maintenance at more frequent intervals. Because consistent preventive maintenance is so important for keeping mechanical equipment in good operating condition, MiTek recommends that you stock certain replacement parts to minimize downtime.

Review the table of contents and utilize the index to locate the information you need. The following appendices will also assist in maintaining and repairing your equipment:

- Troubleshooting
- Parts List
- Maintenance Checklists
- Drawing Set

Refer to Figure 7-1 for an overview of component locations that may require maintenance during the life of your equipment.

Read the *Performing Maintenance Safely* section before beginning maintenance on this equipment.

## Performing Maintenance Safely

Read the safety pages in the preliminary pages and adhere to all rules and guidelines. This section provides additional safety information specific to maintenance topics.

### Before Operating This Equipment

Adhere to these warnings before operating this equipment:

<b>WARNING</b>	
	<p><b>ELECTROCUTION, HIGH PRESSURE, CRUSH, CUT, AND CHEMICAL HAZARDS!</b></p> <p>Read this section <b>AND</b> the safety section in the preliminary pages before operating or maintaining this equipment.</p> <p>Do not operate this machine until you have a thorough understanding of all controls, safety devices, E-stops, and operating procedures outlined in this manual.</p> <p>Read and observe all hazard instructions. Failure to do so may result in economic loss, property damage, and/or personal injury.</p> <p>This manual must always be available to personnel operating and maintaining this equipment.</p>



### Lockout/Tagout

The lock and tag symbol shown here indicates that proper lockout/tagout procedures must be used prior to starting the procedure where the symbol occurs.

<b>WARNING</b>	
	<p><b>ELECTROCUTION AND HIGH PRESSURE HAZARDS.</b></p> <p>Always turn the power off by activating an E-stop when the equipment is not in operation.</p> <p>Always verify that all power to the machine has been turned off and follow approved lockout/tagout safety procedures (OSHA 29 CFR 1910.147) before performing any maintenance on this equipment.</p> <p>If it is absolutely necessary to troubleshoot an energized machine, follow NFPA 70E for proper procedures and personal protective equipment.</p> <p>Turn off the shutoff valve if appropriate.</p> <p>Bleed hydraulic lines if appropriate.</p>

## Making Adjustments

Be careful when making mechanical adjustments. Untrained personnel may damage the machine or cause harm to themselves and others.

<b>WARNING</b>	
	<p><b>The components on this machine can cause severe injury if adjusted improperly. Follow all procedures in this manual thoroughly and do not make adjustments to the machine without guidance from MiTek or MiTek documentation.</b></p> <p><b>Only trained personnel should make mechanical adjustments to this machine.</b></p>

## Replacing Parts

Special materials have been used for some of the components of this equipment. It is critical to the future performance of this machine that only specified replacement parts are used. Order all replacement parts through MiTek. Do not substitute parts without first consulting MiTek to determine if it is safe and effective. No electrical system component, cable, connector, or device should be modified, removed, disconnected, changed without specific approval and guidance from MiTek.

## Wearing Personal Protective Equipment

Follow OSHA guidelines regarding the proper personal protective equipment (PPE) while performing maintenance. The most common guidelines are in regards to eye protection, hearing protection, dust masks while blowing off sawdust, gloves while working with solvents, and fire- retardant clothing when troubleshooting an energized machine.

## Conducting Safety Tests

Ensure safety devices are always operating properly. Perform the safety tests described on page xvii or page xxxii before operating the equipment at the initial startup, after performing any maintenance, and in accordance with the maintenance schedule.

## Overview Graphics

Figure 7-1 provides an important overview of the equipment to help you better understand the procedures in the *Maintenance* chapter.

**Figure 7-1: Components Discussed in the *Maintenance* Chapter**



## Operating Procedures for Maintenance Personnel

Maintenance personnel must make sure the elevator is fully lowered before proceeding with any maintenance procedure.

<b>WARNING</b>	
	<p><b>CRUSH AND CUT HAZARD.</b></p> <p>Before turning on the equipment, make sure that all personnel and equipment are clear.</p>

## Adjustments

### Adjusting the Elevator Tilt



1. Lower the elevator completely.
2. Lockout/tagout the machine.
3. Loosen fasteners and jam nuts.
4. Adjust the chains at the turnbuckles.



The chain should have approximately 1 in. of deflection when measured 5 ft up from the bottom sprocket.

5. Retighten the fasteners and jam nuts.
6. Remove the lockout/tagout device and start the machine.
7. Raise the elevator approximately 1 ft from its lowered position.
8. Check the tension. If the front of one chain is tight, the back of the opposite chain should be tight.
9. Check the distance from the top of the elevator car to the main vertical beam of the frame on both the front and back sides of the car.



The distance from the front and back of the elevator to the frame should not differ by more than 1/8 in. If the difference is greater than 1/8 in., you must re-tension the chains.

## Adjusting the Auxiliary Pull Cable System



14-ft ladder

50-lb pull scale  
clamps

yardstick

standard wrench  
set



The cable system consists of two wire ropes attached to the leveling chain at one end and the elevator car at the other. These cables provide a 1,000-lb force to decrease the load on the guide wheels. The cables will stretch over time and require periodic adjustment.



Ensure the elevator tilt is properly adjusted before adjusting the auxiliary pull cable system. See page 44.

1. Raise the elevator car approximately 1 ft from its lowered position.
2. Press the E-stop and lockout/tagout the machine.
3. Locate the center of the cable between the base and the first pulley.
4. Clamp the yardstick onto the ladder so that it is perpendicular to the wire and parallel to the pullscale
5. Measure the pull force at the center of the cable. The ideal pull force is 20 lb at 1.5 in. deflection.
  - If the pull force is more than 20 lb at 1.5 in. deflection, lengthen the cable by adjusting the cable end stud and jam nut.
  - If the pull force is less than 20 lb at 1.5 in. deflection, shorten the cable by adjusting the cable end stud and jam nut.
6. If a large adjustment was necessary, check the opposite cable and adjust as necessary.
7. If you adjusted the opposite cable, recheck the first cable and adjust as necessary.
8. Ensure the jam nuts are fully retightened.
9. Remove the lockout/tagout device and restart the machine.

## Cleaning, Lubricating, and Inspecting

### Cleaning

<b>DANGER</b>	
	<p><b>CRUSH AND CUT HAZARD</b></p> <p>Guards must always be in place during operation to avoid serious injury and possibly death.</p> <p>Always replace guards after maintenance is complete and before removing the lockout/tagout device.</p>

The track should be cleaned every day before the first use of the *LSR*. The track may be cleaned with compressed air or by vacuuming.

The dump bin should be emptied daily.

Debris on the *LSR* platform must be removed daily with compressed air or by vacuuming.

Electrical enclosures must be vacuumed daily.

<b>CAUTION</b>
<p>Do not use compressed air inside the electrical enclosures! It may force contaminants into the electrical connections.</p>

**Figure 7-2: Never Use Compressed Air Inside an Electrical Enclosure**



### Lubricating

Proper amounts of motor oil and grease must be maintained at all times. The type of lubrication used, frequency of application, oxidation, and contamination of the lubricant affect service life and parts efficiency of gears and bearings. Improved performance will be obtained by following the guidelines in this manual. Lubrication guidelines are given in this chapter for each part or system that requires lubrication. The information is also in the *Maintenance Checklist* appendix.

There are synthetic fluids, synthetic blends, and hydrocarbon fluids (mineral). The synthetic fluids and synthetic blends are usually phosphate esters, chlorinated hydrocarbons, or a blend, sometimes including a small amount of hydrocarbon based oils. With these lubricants, special consideration must be given to the seals, pump performance,

paints and any plastics in the system. In addition, the viscosity of synthetic fluids and synthetic blends is usually much lower than the viscosity of hydrocarbon (mineral) based fluids.

**CAUTION**

Mixing synthetic lubricants with mineral lubricants is not recommended. Check with your lubricant supplier.



## Lubricating With Grease

Grease the bearings every 300 working hours. Refer to the *Bearings* section for bearing locations and the procedure for lubricating them.

## Lubricating With Oil

Instructions and specifications for oil are described in the section for each specific component requiring oil.



Use 90W gear oil to lubricate the motor drive chain daily and the mast chain and torque tube chains weekly. Refer to the *Chains* section for chain locations and the procedure for lubricating them.

## Hydraulic System

<b>CAUTION</b>	
	<p><b>HIGH PRESSURE HAZARD.</b></p> <p><b>Bleed all pressure from the lines before performing any maintenance on the hydraulic components.</b></p>

## Hydraulic Fluid Specifications

Refer to Table 7-1 for hydraulic fluid specifications. See the footnotes if operating outside the recommended temperature range.

**Table 7-1: Recommended Hydraulic Fluid**

Recommended Operating Viscosity Range	60-245 SUS	
Temperature	At Startup	>68°F
	During Operation	86° to 120°F
ISO Grade <sup>a</sup>	32	
Reservoir Capacity	190 gallons	
Brand and Type	Mobile Oil Company	DTE 26

a. If operating outside of the recommended temperature range, select a hydraulic fluid that will operate at the proper SUS range for your temperatures.

## Adjusting the Hydraulic Pressure

1. Locate the main pressure relief valve located on the main manifold block.
2. Set the main pressure relief to a maximum of 2,200 psi.
3. Locate the remote compensator adjustment screw.
4. Loosen the jam nut and turn the screw in.
  - a) If no tone change is heard in the motor, begin turning the screw out.
  - b) Adjust the screw until the tone changes and the motor becomes quieter, indicating the displacement compensator has been enabled and the pressure is high enough.

## Adjusting the Dual Crossover Relief Valve

1. Drive the machine at full speed at ground level.
2. While driving the machine, pass an object between the light bars to cause the machine to stop.
3. Monitor the pressure on the gauge of the DCR valve. The pressure must be above 2,200 psi (110% of system pressure) but below 3,000 psi.
4. Adjust the relief valve on the DCR until optimum pressure is achieved.
5. Reset the E-stop and push the START button.
6. Drive the machine at full speed at ground level in the opposite direction.
7. While driving the machine, pass a piece of paper or cardboard between the light bars to cause the machine to stop.
8. Monitor the pressure on the gauge of the DCR valve. The pressure must be above 2,200 psi (110% of system pressure) but below 3,000 psi.
9. Adjust the relief valve on the DCR until optimum pressure is achieved.



## Checking and Adding Hydraulic Fluid

Check the level of the hydraulic fluid in the reservoir weekly by viewing the sight gauge on the rear of the hydraulic tank.

To fill the reservoir, unscrew the reservoir cap and pour a recommended oil into the reservoir until the oil is within two (2) in. from the top of the reservoir. If pumping oil into the reservoir, you must remove the collar and screen underneath the cap.

Always replace the screen and cap immediately to prevent debris from falling into the reservoir

**Figure 7-3: Hydraulic Fluid Sight Gauge**



**Figure 7-4: Hydraulic Fluid Fill Cap**



## Replacing the Filter Element



### Replacing the Cooling Circuit Filter

Refer to Figure 7-5 for the location of the cooling circuit filter element.

Replace the cooling circuit filter element every 6 months or when the pressure gauge is red.

To replace the filter element:

1. Unscrew and dispose of the old filter.
2. Fill the new filter with hydraulic fluid.
3. Screw the new filter into place.

Figure 7-5: Cooling Circuit Filter



### Replacing the Power Circuit Filter



Refer to Figure 7-6 for the location of the power circuit filter element.

Replace the power circuit filter element every 6 months.

To replace the filter element:

1. Unscrew the cap.
2. Remove and dispose of the old filter.
3. Insert the new filter.
4. Fill the chamber with hydraulic fluid.
5. Reinstall the cap.

Figure 7-6: Power Circuit Filter



## Replacing the Hydraulic Fluid

The acceptable time between hydraulic oil changes depends on both the fluid used and the operating conditions involved.



In general, fluid should be changed when contaminated with water or dirt. Periodic laboratory analysis is the most accurate method to determine when and how often fluid should be changed. The supplier can often run these tests, or check the condition of the used oil. A trained maintenance mechanic can quickly determine the fluid level in the reservoir sight gauge and possible water contamination. Dirt and discolored oil both indicate that the oil should be changed. Additional indicators that the fluid must be changed are unusual noises, excessive temperatures, excessive vibration, leaking lines and fittings, and oil deposits on or around the machine.

Completely drain and refill the reservoir if you change the type of hydraulic oil in use.

At a minimum, it is recommended to completely drain and replace the hydraulic fluid every year. Always use a hydraulic fluid that matches the specifications described in Table 7-1 on page 48.

### Tips for Replacing Hydraulic Fluid

- It is best to change hydraulic fluid when the system is at operating temperature. This will drain off as much of the impurities in suspension as possible.
- To eliminate the possibility of spillage, use a suction pump to remove the fluid from the reservoir. Some suppliers offer this service.
- Always replace the return line filter when changing the fluid, and again shortly thereafter.
- Completely drain and refill the reservoir if you change the type of hydraulic fluid in use.

### Procedure for Replacing Hydraulic Fluid



New hydraulic fluid is not always filtered and may wear out the return line filters quickly. Ensure that you have a filter to be used as a replacement part shortly after replacing hydraulic fluid.

1. Remove the drain plug at the bottom of the oil tank.
2. Allow the hydraulic fluid to completely drain out of the oil tank.
3. Remove the two steel panels on the back of the oil tank.

4. Wipe the entire inside of the tank clean with paper towels or clean rags.



The hydraulic valves are sensitive to debris. It is important to clean the tank completely by hand.

5. Reinstall the two steel panels. If the gaskets appear to be damaged, replace them using RTV silicon gasket maker.
6. Reinstall the drain plug.
7. Fill the tank with the recommended hydraulic oil to 2 in. from the top. See Table 7-1 on page 48 for hydraulic fluid specifications.
8. Dispose of the used hydraulic fluid.

### **ENVIRONMENTAL**

**Always dispose of used hydraulic fluid in accordance with local, state, and federal laws.**

## **Hydraulic Components**

All hydraulic hose connections should be checked quarterly for tightness.

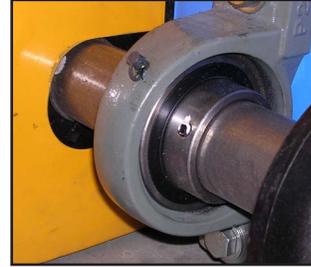
## Bearings

The *LSR* has four (4) drive wheel bearings, four (4) idle wheel bearings, and eight (8) elevator car wheel bearings. All bearings should be greased every 300 working hours.

### **CAUTION**

**Do not overgrease the bearings. Excess grease may rupture the seals and cause damage to the machine.**

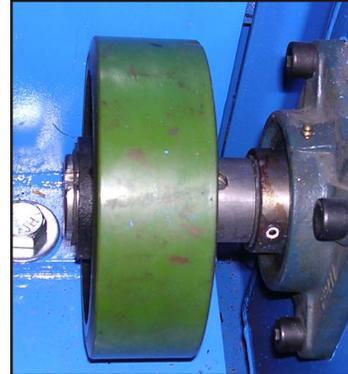
**Figure 7-7: Bearing**



## Wheels

The wheels should be checked weekly for signs of wear and cracking. Damaged wheels should be replaced immediately. Wheel bearings must be lubricated as scheduled.

**Figure 7-8: Wheel**



## Chains



### Lubricating Chains

The roller chain should be lubricated every day. The lubricant used should be a high-grade, non-detergent, petroleum-base oil. Anti-foam, anti-rust, and film-strength improving additives are often beneficial. 90W gear oil is recommended.

To apply the oil, brush it on the inside surface of the chain. Apply it to the upper edges of the link plates in the lower span of the chain at a point close to where the chain engages a sprocket. Gravity and centrifugal force will aid in carrying the lubricant to the critical pin and bushing surfaces.

Do not be concerned about surplus lubricant spilling over the link plate edges as it will lubricate the roller and bushing surfaces.

Figure 7-9: Chain



### Adjusting the Chain Tension

You can adjust the chain tension on the roller chain by performing the procedure below. The chain should be tensioned so that the elevator assembly moves up and down smoothly, with no hesitation and without any rattling.



1. Remove the chain guard from the *LSR*.
2. Loosen the four (4) mounting bolts on the motor drive chain tension sprocket take-up mechanism.
3. Tighten the tension bolts to push the tension sprocket forward and increase tension or back-out the tension screws to decrease the tension.
4. Re-tighten the mounting bolts on the tension sprocket take-up mechanism.

### Replacing a Chain

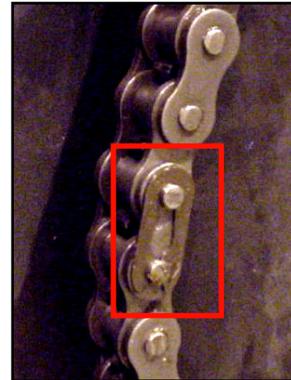
The roller chain can be replaced using the following procedure.

1. Move the elevator to the down position. The master link should be clear of the sprockets so it can easily be reached. The master link is shown in Figure 7-10.



2. Lockout/tagout at the disconnect switch located on the equipment.
3. Remove the chain guard from the *LSR*.
4. Note how the chain is threaded around the sprockets.
5. Loosen the tension sprocket per the *Adjusting the Chain Tension* section.
6. Remove the master link on the chain by pulling out the two (2) pins using pliers. The chain will come apart and can be removed from the sprockets.
7. Thread the new chain around the sprockets.
8. Connect the chain to itself by placing the master link between two links and pressing together with pliers.
9. Adjust the tension sprocket. The chain should be tensioned so that the elevator assembly moves up and down smoothly, with no hesitation and without any rattling.
10. Replace the chain guard and remove the lockout/tagout equipment.

**Figure 7-10: Master Link on a Chain**



## Wear Strips

The *LSR* has wear strips on the tilt to ensure that lumber is square on the conveyors. The wear strips should be checked annually for cracking, wear and damage.

To replaced the wear strips:

1. Remove the bolts holding the wear strips in place. Save the hardware for re-use.
2. Remove the wear strips.
3. Put new wear strips in place.
4. Bolt the new wear strips in place using the old hardware.

## Light Bars

### Components

The *LSR* is equipped with one set of light bars, on the side closest to the lumber racks. Machines with the rear unload kit have a second set of light bars on the rear. One set consists of a transmitter bar and a receiver bar. The transmitter bar transmits the signal for the light beam and the receiver bar receives the signal.

### Realigning and Inspecting

Inspect the light bars prior to starting the machine. An LED display area is located on the light bars to notify the operator if an error occurs. Refer to Table 7-2 and Table 7-3 for information on the indicators on the light bars.



When a set of light bars is out of alignment, the light bars assume there is an object blocking the beam. A diagnostic code of 0, 1, or 2 displays on the receiver bar.

Each light beam mount has clamping bolts to allow for adjustment. Loosen the clamping bolts, move the sender bar until the orange light on the receiver bar turns off. Tighten the clamping bolts. Turn the power supply off and back on again. The 7-segment display should show no display or “r” to indicate that the light bars are properly aligned.

## Light Bar Diagnostic and Test Features

<b>DANGER</b>	
	<p><b>Electrocution hazard.</b></p> <p><b>Disconnect power before opening end caps!</b></p>

The sender and receiver each have a four-color set of status indicator lights and a 7-segment display. The displays are visible from the front of each bar. The diagnostic codes indicate operating modes and faults. See Table 7-2 for sender bar indicator codes and Table 7-3 for receiver bar indicator codes.

**Table 7-2: Diagnostic Codes for the Sender Bar**

Display	Meaning of Display
Yellow light	Supply voltage OK
E	System error. Disconnect the supply voltage for at least 3 sec. If the problem persists, replace the light bars.
a	The device is in test mode
U	None-coded operation (only after switching on)
-	Operation with code 1 (only after switching on)
-	Operation with code 2 (only after switching on)
Other displays	All other displays are error displays. Refer to your light bar manual for explanations of these codes.

**Table 7-3: Diagnostic Codes for the Receiver Bar**

Display	Meaning of Display
Orange light	Cleaning or realignment required
Yellow light	Reset required
Red light	System providing signals for shutting down the machine (switching output off)
Green light	System enabled (switching output on)
b	Bypass active (only in conjunction with SICK switching amplifier, e.g. UE 402)
E	System error. Disconnect the supply voltage for at least 3 sec. If the problem persists, replace the light bars.
0	Poor alignment to sender. Refer to your light bar manual to correct this problem.
1	
2	
H	Operation with large protective field width (only after switching on)
r	Operation with reduced resolution and/or blanking

**Table 7-3: Diagnostic Codes for the Receiver Bar**

Display	Meaning of Display
U	None-coded operation (only after switching on)
-	Operation with code 1 (only after switching on)
-	Operation with code 2 (only after switching on)
11	Emergency stop active
Other displays	All other displays are error displays. Refer to your light bar manual for explanations of these codes.



## Indicator Lights and Sounding Device

### Beacon

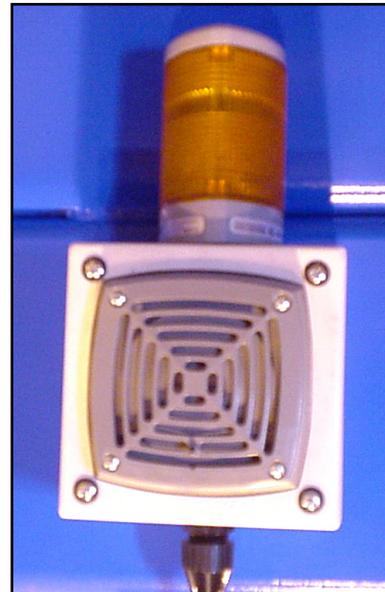
There are two (2) beacons on the *LSR*, one each near the middle of the left- and right-hand cage assembly. To remove the light cover, unscrew the small screw on the top of the light cover. Unscrew the bulb to remove it for replacement.

### Sounding Device

A sounding device is shown in Figure 7-11. For safety reasons, they must be kept in working order. To replace the sounding device, refer to Drawing 90558-505 for part numbers and an electrical schematic.

<b>DANGER</b>	
	<p><b>Do NOT attempt to change the time delay between the horn and movement or the volume of the horn. Without these safety features, serious injury or death could occur.</b></p>

**Figure 7-11: Sounding Device**





## Electrical Components

### Replacing Light Bulbs

To remove the light cover, simply unscrew it. To replace the light bulb under the light cover, gently push in and turn the light bulb counterclockwise. It will come loose within 1/2 turn.

### Circuit Breakers

Circuit breakers are used for certain components as a safety switch.

#### Using the Handle

Manually operate the circuit breaker using the handle and the PUSH-TO-TRIP toggle switch on the circuit breaker. The handle has three (3) positions: on, trip, and off.

#### Manually Tripping the Circuit Breaker to Test

Manually trip the circuit breaker by pushing the PUSH-TO-TRIP toggle switch.

#### Resetting a Tripped Circuit Breaker

Reset the circuit breaker after it has been tripped by moving the handle to the off position, then back to the on position.

## Motor Starters and Overloads

Motor starters turn motors on and off. Overloads are usually mounted to the output side of the motor starter and act as safety switches.

### Cleaning Contacts

To clean the motor starter contacts:

#### CAUTION

**Never use pneumatic air inside electrical cabinets. It will force dust and particles into electrical components causing them to fail.**

1. Activate an E-stop. The starter will release (open) and the dust may be forced out.
2. If the problem continues, activate an E-stop again.
3. Lockout/tagout at the wall before opening the enclosure.
4. Use canned air to blow dust from contacts. **DO NOT USE PNEUMATIC AIR FROM YOUR PLANT!**
5. Cycle the contacts up and down with a small screwdriver.
6. Vacuum the enclosure.



### Environmental Temperature

The air temperature around the *LSR* should never exceed 110°F. In high ambient temperatures, the motors are unable to dissipate heat effectively. When the temperature of the motor windings exceeds a preset value, the motor overload will automatically shutdown the motor to prevent it from burning up.

# Maintenance Checklists

## Appendix A

### Navigating the Maintenance Checklists

These checklists guide you through all preventive maintenance tasks required to keep this equipment in top working condition.

These pages are supplied with the intent that you will photocopy them and leave the original in the manual for future use. Space is provided in each chart to place the date that the work is done and the initials of the person performing the work.

Checklist	Page
Daily Checklist	ii
Weekly Checklist	iii
Monthly Checklist	iv
Checklist by Working Hours	v
Periodic Checklist	vi

### Safety Notes For Maintenance Checklists

WARNING	
	<p><b>CRUSH, CUT, HIGH PRESSURE, ELECTROCUTION AND CHEMICAL HAZARDS.</b></p> <p>Perform the safety tests described in the <i>Safety Test</i> section on page xvii or page xxxii before operating the equipment at the initial startup, after performing any maintenance, and in accordance with the maintenance schedule.</p>
WARNING	
	<p><b>ELECTROCUTION AND HIGH PRESSURE HAZARDS.</b></p> <p>Always turn the power off and activate an E-stop when the equipment is not in operation.</p> <p>Always verify that all power to the machine has been turned off and follow approved lockout/tagout safety procedures (OSHA 29 CFR 1910.147) before performing any maintenance on this equipment.</p> <p>Turn off the shutoff valve if appropriate.</p> <p>Bleed hydraulic lines if appropriate.</p>



# Daily Checklist

Month and Year: \_\_\_\_\_ Week: \_\_\_\_\_

Action		See Page	Dates						
Clean the track with compressed air or by vacuuming	Shift 1								
	Shift 2								
	Shift 3								
Empty the dump bin	Shift 1								
	Shift 2								
	Shift 3								
Remove debris from the elevator platform with compressed air or by vacuuming	Shift 1								
	Shift 2								
	Shift 3								
Vacuum the electrical enclosures	Shift 1								
	Shift 2								
	Shift 3								
Lubricate all chains with 90W gear oil	Shift 1								
	Shift 2								
	Shift 3								

Notes	Date
_____	_____
_____	_____
_____	_____
_____	_____



# Weekly Checklist

Year: \_\_\_\_\_

Month: \_\_\_\_\_

Action	See Page	Dates				
Check the level of hydraulic fluid						
Check wheel bearings for signs of wear and cracking						

Notes	Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



## Monthly Checklist

Year: \_\_\_\_\_

Action	Interval	See Page	JAN	FEB	MAR	APRIL	MAY	JUNE
Check cooling circuit filter	6 months							
Check power circuit filter	6 months							
Replace hydraulic fluid	1 year							
Check wear strips for signs of cracking, wear and damage	1 year							

Action	Interval	See Page	JULY	AUG	SEPT	OCT	NOV	DEC
Check cooling circuit filter	6 months							
Check power circuit filter	6 months							
Replace hydraulic fluid	1 year							
Check wear strips for signs of cracking, wear and damage	1 year							



## Checklist by Working Hours

Year: \_\_\_\_\_

Action	Working Hours	See Page	Sign and Date When Action is Performed				
Grease the drive wheel bearings	300						
Grease the idle wheel bearings	300						
Grease the elevator car wheel bearings	300						



## Periodic Checklist

Year: \_\_\_\_\_

Action		See Page	Sign and Date When Action is Performed				
Check cooling circuit filter	6 months						
Check power circuit filter	6 months						
Replace hydraulic fluid	1 year						
Check wear strips for signs of cracking, wear and damage	1 year						

Notes	Date
_____	
_____	
_____	
_____	
_____	

# Technical Information

## *Appendix B*

This appendix provides general information that will help you better understand how this equipment works.

## Understanding Overloads

### Purpose and Scope

The information below has been collected to help you understand the role of an overload, how an overload works, and how to calculate the overload setting to protect the motor.

### The Importance of Protecting Your Motor

The following statement describes the importance of protecting electric motors and is a good illustration of why we need overloads.

### Proper Motor Protection Safeguards Your Investments

With electric motors driving the majority of today's manufacturing processes, proper motor protection is critical. Not surprisingly, a significant amount of effort and resources have recently been invested in motor protection technology, resulting in cost-effective solutions to many of today's common motor problems.

Motors fail for a number of reasons—moisture and contamination, short circuits, mechanical problems and old age—but the primary reason is excessive heat, caused by excess current (greater than normal motor full load current), high ambient temperatures, and poor ventilation of the motor. If a motor is continuously overheated by only 10 degrees, its life can be reduced by as much as 50%.

Steve Zimmerman  
Control Engineering  
December 1, 1997

## What is an Overload?

So, what is an overload? The term literally means that too much load (what the motor is driving) has been placed on the motor. A motor is designed to run at a certain speed, called its synchronous speed. If the load on the motor increases, the motor draws more current to continue running at its synchronous speed.

It is quite possible to put so much load on a motor that it will draw more and more current without being able to reach synchronous speed. If this happens for a long enough period of time, the motor can melt its insulation and burn out, resulting in damage to the motor windings. This excessive load condition is called an overload.

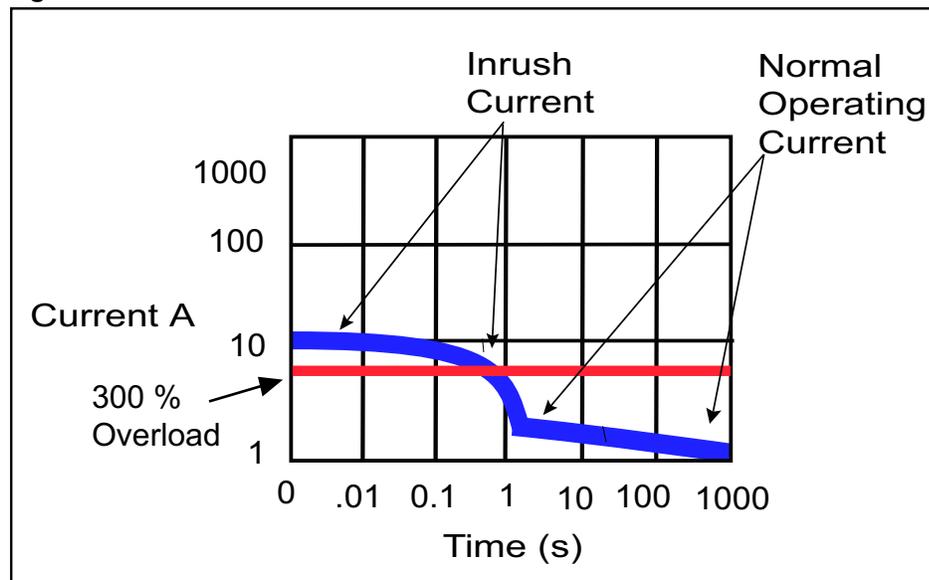
In fact, the motor could stop turning altogether (called a locked rotor) under a large enough load. This is another example of an overload condition. Even though the motor shaft is unable to turn, the motor continues to draw current, attempting to reach its synchronous speed.

Although the running motor may not draw enough current to blow the fuses or trip circuit breakers, it can produce sufficient heat to burn up the motor. This heat, generated by excessive current in the windings, causes the insulation to fail and the motor to burn out. We use the term “locked rotor amps” to describe when the motor is in this state and is drawing the maximum amount of current.

Due to the possibility of excessive current draw, an overload protection device is required that does not open the circuit while the motor is starting, but opens the circuit if the motor gets overloaded.

## Starting Current

When a motor is started, it must perform work to overcome the inertia of the rotating portion of the motor and the attached load. The starting current measured on the incoming line is typically 600% of full-load current when rated voltage and frequency is first applied to a NEMA B motor. The stationary portion of the motor current decreases to its rated value as the rotor comes up to speed.

**Figure B-1: Motor Inrush Curve**


An overload condition will occur when the rotor has difficulty turning and draws more current than it normally would need to keep it turning. When an overload occurs the current being drawn is usually between 2 to 6 times the normal operating current.

For example if a conveyor belt becomes jammed and does not allow the rotor to turn, the motor will draw about as much amperage as it would on startup to try to get the rotor to turn. As long as the rotor does not turn, this increased current will continue to flow. The key thing to remember in an overload condition is that the current flows through the normal circuit path. Continued overload current will cause excess heating in the motor and the motor circuit. If the over current protective device does not operate in a timely manner, the motor could short out a winding, or cause insulation damage to a winding which could lead to a short circuit later.

## Overload Relays

The overload relay is the device used in starters for motor overload protection. It limits the amount of current drawn to protect the motor from overheating.

An overload relay consists of:

- A current sensing unit (connected in the circuit to the motor)
- A mechanism to break the circuit, either directly or indirectly

Overload relays have the following features:

- A time delay which ignores harmless temporary overloads caused by normal motor starting, without breaking the circuit
- A means of resetting the circuit once the overload is removed

- A design that meets the special protective needs of motor control circuits
- Allow harmless temporary overloads, such as motor starting, without disrupting the circuit
- Will trip and open a circuit if current is high enough to cause motor damage over a period of time
- Can be reset once the overload is removed

### Bimetallic Overload Relays

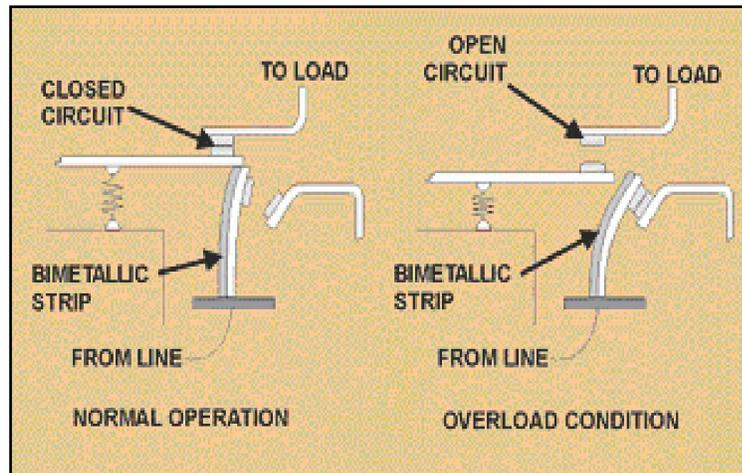
Overload protection is accomplished with the use of a bimetallic strip. This component consists of a small heater element wired in series with the motor and a bimetallic strip that can be used as a trip lever. A bimetallic strip is made of two dissimilar metals bonded together. The two metals have different thermal expansion characteristics, so the bimetallic bends at a given rate when heated.

Under normal operating conditions the heat generated by the heater element will be insufficient to cause the bimetallic strip to bend enough to trip the overload relay.

As current rises, heat also rises. The hotter the bimetallic becomes, the more it bends. In an overload condition the heat generated from the heater will cause the bimetallic strip to bend until the mechanism is tripped, stopping the motor.

If heat begins to rise, the strip bends, and the spring pulls the contacts apart, breaking the circuit, as shown in Figure B-2.

**Figure B-2: The Warping Effect of the Bimetallic Strip**



Once the tripping action has taken place, the bimetallic strip cools and reshapes itself, automatically resetting the circuit. The motor can be restarted even when the overload condition has not been cleared, and will trip and reset itself again and again. (This assumes an automatic reset and can also be equipped with a manual reset.)

## Electronic Overload Relay

Electronic overload relays are another option for motor protection. The features and benefits of electronic overload relays vary but there are a few common traits. One advantage offered by electronic overload relays is heater-less design. This reduces installation cost and the need to stock a variety of heaters to match motor ratings. Electronic overload relays can detect a phase loss and disconnect the motor from the power source. This feature is not available on mechanical types of overload relays.

## Overload Classifications

Overload relays also have an assigned trip class. The trip class is the maximum time in seconds at which the overload relay will trip when the carrying current is at 600% of its current rating. Bimetallic overload relays can be rated as Class 10, meaning that they can be counted on to break the circuit no more than ten seconds after a locked rotor condition begins. Melting alloy overload relays are generally *Class 20*.

American industry has standardized on Class 20 overload protection. The Europeans have standardized on Class 10.

Class 20 will give a nominal 590-second trip (9.83 minutes) at an overload of 125% of full load amps, a 29-second trip at a 500% overload, and a 20-second trip at a 600% overload. Thus, a motor that is stalled and drawing locked rotor amperage will be taken off-line in 20 to 29 seconds. However, a motor that draws a continuous locked rotor current can be expected to burn out before 20 seconds.

Class 10 will give a nominal 230-second trip (3.83 minutes) at 125% overload, 15 seconds at 500% overload, and 10 seconds at 600% overload.

Class 30 has a longer time delay to be used on high inertia loads that require a long acceleration or have shock loading that causes repetitive motor inrush.



The overload class that *MiTek* normally specifies for equipment is a Class 10. Since it is possible to burn out a motor in less than 20 seconds, we have chosen to protect the motor with the highest degree of protection.

## Codes And Standards

### NFPA 79—Electrical Standard for Industrial Machinery, 2002

**7.3.1.1 Motors.** Motor overload protection shall be provided to each motor in accordance with Article 430, Part III, of NFPA 70, *National Electrical Code*.

### NEC 2002—National Electrical Code

**430.32 (A) (1) Separate Overload Device.** A separate overload device that is responsive to motor current. This device shall be rated at no more than the percentages shown in Table B-1.

**Table B-1: Full Load Current Tolerances**

Nameplate Full Load Current Rating	% Allowed Above Full Load Current Rating
Service Factor of 1.15	125%
Motors with a marked temperature rise of 40°C or less	125%
All other motors	115%

#### Example 1

15 hp, 208V, 3 phase, induction motor, 40°C rise, *design B*, *FLA* 48 amps. Overload Protection = 48 amps times 125% = 60 amps

#### Example 2

25 hp, 208V, 3 phase, induction motor, 1.15 s.f., *design C*, *FLA* 72A. Overload Protection = 72 amps times 125% = 90 amps

### Example 3

40 hp, 208V, 3 phase, wound rotor motor, FLA 118 amps. Overload Protection = 118 amps times 115%=136 amps

The motor overloads must be calculated using the nameplate current and not from Tables 430-148 or 430-150 of the National Electrical Code.



In Example 1, the motor has a 40°C rise, the O.L. unit is sized at 125% of the full load motor current.

In Example 2, the motor has a s.f. (service factor) of 1.15. The O.L. unit is sized at 125% of the full load motor current.

In Example 3, where neither of the two conditions exists, it is sized at 115%.

## Glossary of Overload Terms

### Full Load Amps (FLA)

This is the current flow required by a motor during normal operation under normal loading to produce its designated horsepower. Motors having nothing attached to their shaft will draw less than the FLA current.

### Insulation Class

The National Electrical Manufacturers Association (NEMA) has established insulation classes to meet motor temperature requirements found in different operating environments. The four insulation classes are A, B, F, and H. Class F is commonly used. Class A is seldom used. Before a motor is started, its windings are at the temperature of the surrounding air. This is known as ambient temperature. NEMA has standardized on an ambient temperature of 104°F, or 40°C for all motor classes.

Temperature rises in the motor as soon as it is started. The combination of ambient temperature and allowed temperature rise equals the maximum winding temperature in a motor. A margin is allowed for a point at the center of the motor's windings where the temperature is higher. This is referred to as the motor's hot spot.

The operating temperature of a motor is important to efficient operation and long life. Operating a motor above the limits of the insulation class reduces the motor life expectancy. A 50°F (10°C) increase in the operating temperature can decrease the life expectancy of a motor by as much as 50%.

**Table B-2: Maximum Winding Temperature**

Class A	Class B	Class F	Class H
221°F (105°C)	266°F (130°C)	311°F (155°C)	356°F (180°C)

### Locked Rotor Amps

Also known as inrush current, locked rotor amps is the amount of current the motor can be expected to draw under starting conditions when full voltage is applied. This is the current taken from the supply line at rated voltage and frequency with the rotor at rest.

### Motor Load

A motor provides the conversion of electrical energy to mechanical energy that enables a machine to do work. The energy that a machine requires from a motor is known as the

motor load. The motor load “seen” by a motor is dependant upon how the load is connected to the motor, the dimensions of the load, and the weight of the load.

A load connected to a motor by a gearbox reduces the load by the square of the gear ratio. If a load is attached to a motor through a 3:1 gear ratio, the load is 1/9 of the load the motor would see if the load were attached directly to the motor.

A round object attached to the motor shaft has a load related to the square of the radius of the object. If a 16" saw blade is a load of weight multiplied by the radius squared, the load is  $8^2 \times \text{weight} = 64 \times \text{weight}$ . A 20" saw blade is a load of  $10^2 \times \text{weight} = 100 \times \text{weight}$ . The 20" saw blade is 56% more load than the 16" saw blade due to the dimensions.

A motor load is directly related to the weight of an object. A 16" blade weighs 9.28 pounds. A 20" blade weighs 14.61 pounds, or 5.33 pounds more. The 20" blade is 56% more load than the 16" blade due to weight. Remember, weight is the volume of an object times its density, so weight is also related to the dimensions.

In the example of the saw blades, the combined effect of the longer radius, and longer weight means the 20" saw blade is approximately 125% more load on a motor than a 16" saw blade, which partially explains why motors on quads 1 and 4 are more likely to burn out or trip an overload.

## NEMA Design Ratings

NEMA ratings refer to the torque ratings. The following ratings apply to motors:

### NEMA B

The NEMA B motor's percentage of slip ranges from 2 to 4%. It has medium values for starting or locked rotor torque, and a high value of breakdown torque.

### NEMA A

The NEMA A motor is similar in many ways to the NEMA B motor. It typically has a higher value of locked rotor torque and its slip can be higher.

### NEMA C

The NEMA C motors are well suited to starting high-inertia loads. This is because they have high locked rotor torque capability. Their slip is around 5%, and their starting current requirement is average.

### NEMA D

The NEMA D motor is found in heavy duty, high-inertia applications. It has high values of slip (up to 8%), and very high locked rotor torque capability.

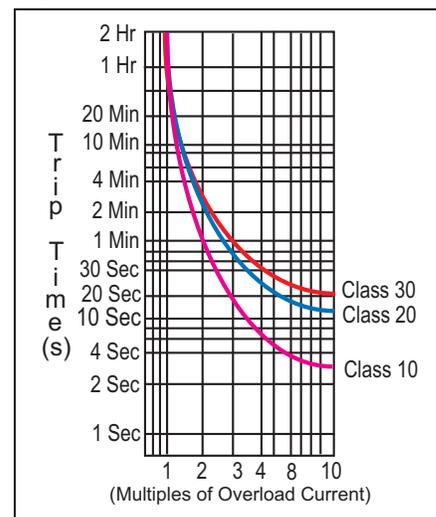
## Service Factor (s.f.)

A motor designed to operate at its nameplate horsepower rating has a service factor of 1.0. Some applications may require a motor to exceed the rated horsepower. In these cases a motor with a service factor of 1.15 can be specified. The service factor is a multiplier that may be applied to the rated power. A 1.15 service factor motor can be operated 15% higher than the motor's nameplate horsepower.

## Trip Class

Overload relays are rated by a trip class, which defines the length of time it will take for the relay to trip in an overload condition. The most common trip classes are Class 10,

Figure B-3: Trip Times for Trip



Class 20, and Class 30. Class 10, for example, has to trip the motor off-line in 10 seconds or less at 600% of the full load amps. This is usually sufficient time for the motor to reach full speed.

## Understanding Motor Starting Problems

There are three major sources of motor starting problems: voltage source problems, control circuit problems, and drive faults. Diagnosing and resolving these problems can be a time-consuming process, but some time can be saved by using an organized process of elimination. The following sections address the most common sources of motor starter problems.

<b>WARNING</b>	
	<p><b>ELECTROCUTION HAZARD.</b></p> <p><b>Always turn the power off by activating an E-stop when the equipment is not in operation.</b></p> <p><b>Always verify that all power to the machine has been turned off and follow approved lockout/tagout safety procedures (OSHA 29 CFR 1910.147) before performing any maintenance on this equipment.</b></p> <p><b>If it is absolutely necessary to troubleshoot an energized machine, follow NFPA 70E for proper procedures and personal protective equipment.</b></p>

### Voltage Source Problems

1. Check the incoming power source. Verify that all three phases of power have the proper voltage using a digital multimeter set to voltage mode. If any of the three phases of incoming power are low or missing, disconnect power at the primary disconnect switch and reset the circuit breaker or replace the fuse.
2. Before restoring power at the primary disconnect, verify that there are no phase-to-phase or phase-to-ground shorts at the motor starter line contactors. If necessary, replace starter contacts to correct shorts.
3. Check that motor thermal overloads have not been tripped. Reset the overloads by pressing the reset pushbutton.
4. Check the motor starter leads for phase-to-phase and phase-to-ground shorts. Check for discoloration, hot spots, melted wire or damaged fuses. Correct the motor lead wiring if necessary.

5. Check the motor leads for phase-to-phase and phase-to-ground shorts. Check for discoloration, hot spots, melted wire or damaged fuses. Replace the motor if necessary.
6. Determine if motor windings are breaking down by testing the motor insulation with an insulation tester or taking the motor to a repair shop for testing.
7. Disconnect the motor from its load. Start the motor. If it runs correctly, the problem is associated with the mechanical drive train. If it does not run correctly, replace the motor bearings.

## Control Circuit Problems

1. If the incoming power source has all three phases of power, check the motor starter overloads. Reset the motor starter overloads by pressing the reset button.
2. Verify that the control voltage transformer fuse is operating correctly using a digital multimeter set to Ohms. The multimeter should have a low reading. If the multimeter registers no reading or an infinite reading, replace the fuse.
3. Disconnect the motor starter contactor coil. Check for a short or ground. If necessary, replace the motor starter coil.
4. Check the control circuit wiring to the contactor coil while the coil is still disconnected. If a short or ground is present, disconnect the field wiring circuit to the motor starter. Determine whether the problem is with the motor contactor overload circuit or the field control wiring.
5. If a ground is found in the motor starter overloads circuit, replace the overloads. Reconnect the starter coil and control field wiring.
6. If a ground is found in the field wiring circuit, clear the ground. Reconnect the starter coil and control field wiring.
7. Check for an open circuit in the motor overloads or control circuit by using a digital multimeter set for Ohms to verify the motor overloads control circuit is working correctly.
8. Check the PLC contact closure, relay contact closure or start/stop pushbutton circuit that supplies the start signal to the motor starter.

## Drive Faults

Before troubleshooting a drive fault, determine whether the fault is a motor, drive, or application fault. Use the fault codes of the drive. If you are unable to locate the source of the fault, contact MiTek Customer Service.

# Drawing Set

## Appendix C

Drawings are inserted at the back of the manual.

**Table C-1: Attached Drawings**

Description	Drawing Number
<i>LSR</i> top level assembly	59600-501
<i>LSR</i> track and sensor bar layout	59602
Conveyor roller assembly	59668-501
Idler conveyor roller assembly	59789-501
Roller extension assembly	59904-501
Electrical schematic	90558
Main enclosure cutouts	90558-102
Joystick enclosure	90558-103
Rear unload enclosure	90558-104
<i>LSR</i> electrical assembly	90558-501
Main enclosure layout	90558-502
Joystick enclosure layout	90558-503
Horn and beacon assembly	90558-505
Rear unload assembly	90558-601
Rear unload enclosure assembly	90558-604

# Document Evaluation

## *Appendix D*

A form is included in this appendix so you can provide MiTek with feedback on the usefulness of this manual. We make an ongoing effort to improve the value of our documentation, and your views are important to us.

Please follow the instructions on the form to provide us with comments or suggestions that will help us improve the quality of our documentation services.



# Document Evaluation Form (cont'd)

Identify any inaccuracies in the document.	
What are the three best features of the document?	
What are the three worst features of the document?	
What did you like/dislike about the illustrations?	
Your Name:	Date:
Company Name:	Address:
Phone:	Email:
<b>Please mail this form to:</b> MiTek Machinery Operations 301 Fountain Lakes Industrial Dr. St. Charles, MO 63301 Attn: Engineering Manager	<b>Or fax this form to:</b> 636-328-9218 Attn: Engineering Manager

*If you do not receive a reply within 45 days, please call our Customer Service Department and ask for the Documentation Specialist or Engineering Manager: 800-523-3380.*

# Glossary

<b>actuate</b>	to activate, put into action
<b>amperage</b>	the strength of an electric current, expressed in amperes
<b>bus bar</b>	an electrical device that allows multiple gantry heads to be used simultaneously
<b>connector plate</b>	the nail-plate that is embedded into the production material to hold it together
<b>cushion</b>	an attribute of a hydraulic cylinder that allows adjustment of the pressure in each cylinder
<b>directional buttons</b>	the 2 black buttons on the pendant control station that tell the gantry head which direction to move
<b>joystick</b>	an option that replaces the pendant control station to control movement of the gantry head
<b>layout</b>	a scaled diagram of the location of components and the space that they occupy
<b>light bar</b>	the perimeter access guarding device that uses multiple light beams to detect when something is in the way of the gantry head and stops the machine to prevent injury or damage; the <i>LSR</i> uses a set of continuous-beam light bars on both sides of the machine
<b>lockout/tagout</b>	a means of isolating a piece of equipment from its energy source so maintenance can safely occur; guidelines provided in OSHA 29 CFR 1910.147
<b>operator control interface</b>	the method in which the operator controls the machine; it may be a touch screen, a control panel, etc.
<b>port</b>	a connection point for a peripheral device
<b>proximity switch</b>	a switch that uses an electromagnetic field to detect when an object is near, there is no physical contact between the object and the switch; inductive proximity switches detect only metal objects, capacitive proximity switches can sense both metallic and non-metallic objects

# Glossary

<b>qualified person</b>	a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training, or experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work—ANSI B30.2-1983; one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved—NEC2002 Handbook
<b>receiver bar</b>	the light bar that receives the signal from the transmitter bar; every light bar set consists of a receiver bar and a transmitter bar
<b>solenoid</b>	an assembly used as a switch consisting of a coil and a metal core free to slide along the coil axis under the influence of the magnetic field
<b>torque</b>	a turning or twisting force
<b>transmitter bar</b>	the light bar that transmits the signal to the receiver bar; every light bar set consists of a receiver bar and a transmitter bar
<b>VFD</b>	Variable Frequency Device; controls the speed of the cycle
<b>voltage</b>	Equal to the difference of electric potential between two point on a conducting wire carrying a constant current of one ampere when the power between the points is one watt

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