Installation, Operation, & Maintenance Manual

Ceiling Mounted Steel Work Station Bridge Crane and Monorail

CM® LodeRail Customer Order No. / Serial No. __________________________

CM® LodeRail Dealer __________________________

Date __________________________

Month __________________________

Year __________________________

IMPORTANT! DO NOT DESTROY
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INTRODUCTION

Thank you for choosing CM® LodeRail Ceiling Mounted Work Station Cranes to solve your material handling needs. The innovative design and heavy-duty construction of the CM® LodeRail Work Station Cranes will provide a superior quality product that will offer years of long term value. All CM® LodeRail cranes are pre-engineered for powered hoist operation. The hoist weight allowance is 15% of the crane’s capacity (for example, a crane rated for 1000 pounds, allows for a 1000-pound live load plus 150 pounds for the weight of the hoist). There is also an allowance of 25% of the crane capacity for impact caused by hoist use. CM® LodeRail Work Station Cranes will provide many years of dependable service by following the installation and maintenance procedures described herein.

Dimensions contained in this installation manual are for reference only and may differ for your particular application. Please refer to the enclosed General Arrangement Drawing for actual dimensions.

Normal safety precautions: These include, but are not limited to:
• Checking for obstructions in crane travel
• Checking that all bolts and threaded rods are tight and have lockwashers
• Making sure that end stops are in place
• Making sure that festooning cannot be snagged or pinched, whether it is electric or pneumatic

For additional safety precautions, see page 20.

WARNING
Equipment described herein is not designed for, and should not be used for, lifting, supporting or transporting humans. Failure to comply with any one of the limitations noted herein can result in serious bodily injury and/or property damage. Check State and Local regulations for any additional requirements.

WARNING
Crane cannot be utilized as a ground: A separate ground wire is required. For example, systems with 3-phase power require three conductors plus one ground wire.

WARNING
Before installing any crane system, it is critical you determine that your building will safely support the loads. CM® LodeRail assumes no responsibility for adequacy or integrity of the mounting surface.

WARNING
Sway bracing is required (except when using flush mounted hangers). For more information see page 19.

WARNING

INSTALLATION

TIP: Packing list can be found in plastic pocket attached to the hardware box: General Arrangement Drawing and additional inserts can be found enclosed in this installation manual.

STEP 1 - PRE-ASSEMBLY
1.1 Read entire installation manual before you begin installing your crane.
1.2 Check packing list to make sure correct quantity of parts is included.
1.3 Tools and materials typically needed to assemble crane are as follows:
   • Hand tools
   • Leveling tools
   • Ladders/man lifts
   • Powered metal-cutting saw
   • Steel shims (for flush mounted hangers)
   • Torque wrench (able to torque up to 200-ft. lb.)
STEP 2 - HANGER INSTALLATION

NOTE: Standard top hanger brackets are designed for flange widths from 1"-3", 3-1/4"-5-1/4", 5-1/2"-7-1/2", 8"-10".

Top Hanger Assemblies

2.1 Mark top hanger placement on the building support beams and runway/monorail track (refer to the General Arrangement Drawing, inserted in this manual, for hanger placement). Installation parameters can be found on page 18.

If you have standard hangers, go to Step 2.2.
If you have sloped hangers, go to Step 2.3.

2.2 To attach threaded rod to top hanger bracket:

WARNING
Threaded rod must have a minimum of two threads beyond the hex nut.

Assemble top hanger assembly (diagram 2A). Refer to Chart 2A for proper nut torque.

Go to Step 2.4, on page 3.

2.3 To attach clevis to top hanger bracket:

WARNING
Sloped ceiling hangers must not be installed on beams more than 15 degrees from horizontal.

Assemble top hanger assembly (diagram 2B). Refer to chart 2A for proper nut torque.

Insert threaded rod into clevis (diagram 2D).

Bend both legs of all cotter pins (diagram 2C).

WARNING
Fully bend both legs of cotter pin (diagram 2C). If cotter pin is cracked or fatigued it must be replaced.

WARNING
Threaded rod must have a minimum of two threads beyond the clevis.
STEP 2 - HANGER INSTALLATION (CONTINUED)

2.4 Bolt top hanger bracket assembly and beam clips to building support beam (diagram 2E or 2F). 
**Note:** Flange thickness may vary and require shimming. Shimming may be needed to assure that the beam clip hardware is vertical.

### WARNING
“Center hole” of the top hanger bracket assembly must be centered on building support beam.

![Diagram 2E](image)

**Diagram 2E.** Bolting standard top hanger bracket and beam clips to existing support beam.

![Diagram 2F](image)

**Diagram 2F.** Bolting sloped top hanger bracket and beam clips to existing support beam.

**Lower Hanger Assemblies**

2.5 For untrussed (plain) track:

### WARNING
Do not over-tighten clamping bolts on the lower hanger assemblies: this will cause permanent damage to the runway track.

Slide lower hanger assembly over the runway track and bolt into place with clamping bolts (diagram 2G).

**Note:** Install the vertical bolts for beam clips (Step 3.2, on page 5) on the Perpendicular Flush Mount Hanger 250-2000# (diagram 2G), before sliding it on the track.

![Diagram 2G](image)

**Diagram 2G.** Installing lower hanger assemblies on untrussed (plain) track.
STEP 2 - HANGER INSTALLATION (CONTINUED)

For trussed track:

**WARNING**

Bolts must have a minimum of two threads beyond hexnut.

Bolt the lower hanger assembly and lower spine clamp plate to the top truss tube of runway (diagram 2H).

Tighten nuts until lockwashers are fully compressed.

**Note:** Sway brace brackets should be installed at this time (see page 19).

**Perpendicular Flush Mount**

2.6 For trussed track:

**WARNING**

Threaded rod must have a minimum of two threads beyond hexnut.

Position spine clamp angles (or plates) so they are centered under top tube of runway at hanger locations. Bolt spine clamp angle (or plate) and top hanger brackets together leaving maximum amount of threaded rod available above top hanger bracket for installation of beam clips (diagram 2I).

**WARNING**

“Center hole” of top hanger brackets should be centered on building support beam but may be offset to prevent vertical interference.

Position runway top tube flush and perpendicular to building support beam. Bolt top hanger brackets and beam clips to support beam. Torque nuts (chart 2A, page 2, for proper torque rating).

**Note:** Flange thickness may vary and require shimming. Shimming may be needed to assure that the beam clip hardware is vertical. Refer to Step 3, on page 5, for further runway installation instructions.

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**Diagram 2H.** Bolting lower hanger assembly and spine clamp plate to trussed track.

**Diagram 2I.** Installing Perpendicular Flush Mounted Hangers on trussed track.
STEP 3 - RUNWAY INSTALLATION

3.1 Lift the runway/monorail into place for installation.

3.2 Hangers

**WARNING**
Threaded rod must have a minimum of two threads beyond the hexnut.

**WARNING**
Threaded rod must be allowed to hang “plumb” and should not be bent to accommodate sloped ceilings.

For standard and sloped ceiling hangers with threaded rod drop:
Insert threaded rod into bolt hole on the lower hanger assembly and bolt into place (diagram 3A).
Torque nuts (chart 2A, page 2, for proper torque rating).

For flush mounted standard hangers:
Bolt flush mounted hanger and beam clips to building support beam (diagram 3B).
Torque nuts (chart 2A, page 2, for proper torque rating).

For flush mounted sloped ceiling hangers:
Insert bolt, with lockwasher, into bolt hole on the lower hanger assembly and fasten to clevis (diagram 3C).
Torque hardware (chart 2A, page 2, for proper torque rating).

**WARNING**
Bolt must have a minimum of two threads beyond the clevis.

NOTE: The closer the runways/monorails are to level and parallel, the better the crane will perform.

NOTE: Track running-surface misalignment at joints shall be adjusted to within 1/32” (1mm) when installed.

Bridge Crane
Monorail

Diagram 3A. Attaching lower hanger assembly to top hanger assembly.

Diagram 3B. Attaching flush mounted hangers to building support beam.

Diagram 3C. Attaching flush mounted sloped ceiling hangers to top hanger assembly.
STEP 3 - RUNWAY INSTALLATION (CONTINUED)

For sloped ceiling hangers:
Beam clips must be welded to support beam to prevent clips from shifting (diagram 3D).

For 3-hole hangers:

**WARNING**
Do not deviate from the dimensions specified in the General Arrangement Drawing for the maximum spacing of the runway hangers.

Insert threaded rod into bolt on the lower hanger assembly and through the pre-drilled holes in the runway top tube (diagram 3E).

Torque nuts (chart 2A, page 2, for proper torque rating).

**IMPORTANT:** Note the placement of the threaded rod hardware in diagram 3E. The lower hanger assembly and the truss top tube must be properly clamped to provide adequate support.

3.3 Level track:
Check to make sure that the lower flange of track is level and parallel to opposite runway (within +/-1/32”) at joints.

**WARNING**
Do not deviate from the bridge “span” dimension shown on the General Arrangement drawing. Bridge “span” is the distance between runways (centerline to centerline).

3.4 If you do have additional runways/monorail sections proceed to Step 4, on page 7.
If you do not have additional runways/monorail sections:
Install end stops (diagram 3F) (molded bumper with thru bolt), in runway end opposite festooning end. For more information on festooning, refer to Step 8, on page 13.

Tighten nut on thru bolt until lockwasher is flat.
If you have a bridge crane, go to Step 5, on page 8.
If you have a monorail, go to Step 6, on page 10.
STEP 4 - SPLICING JOINT INSTALLATION

**IMPORTANT:** If using trussed track, use both the splice joint and the splice plate.

**IMPORTANT:** Suitable splices shall be provided at all track joints.

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**WARNING**

Do not deviate from the dimensions specified in the General Arrangement Drawing for maximum space from hanger point to splice joint. Installation parameters can be found on page 18.

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4.1 Attach hardware to splice joint. Slide splice joint over track of installed runway/monorail.

4.2 The maximum gap between ends of the load carrying flange shall not exceed 1/16” (1.5mm).

4.3 Slide next runway/monorail section into splice joint, bringing runway/monorail ends as close as possible (*diagram 4A* or *4B*).

Center the splice joint over the track ends.

4.4 **For trussed track:** Place a truss splice plate on each side of runway truss tube and bolt into place (*diagram 4B*). Tighten hexnuts, but do not torque until you have completed Steps 4.4 and 4.5.

4.5 Refer to Step 2.5, on pages 3 and 4, for lower hanger installation. Attach runway to upper hanger by repeating Steps 3.2, on page 5 and 3.4, on page 6.

4.6 Adjust track for smooth transition:

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**WARNING**

Do not “over-tighten” clamping bolts on splice joints: this will cause permanent damage to the runway track. Clamping bolts are utilized for alignment purposes.

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Tighten clamping bolts along the **top of splice joint** to force track down onto lower flanges of splice. Check to see that the transition from one track to the other is smooth: no raised areas to inhibit trolley or end truck operation.

Tighten clamping bolts along the **sides of splice joint** to align track laterally. Check to see that track portion of runway/monorail is horizontally and vertically flush.

Tighten jam nuts, on both the top and sides of the splice joint, to lock clamping bolts in place (*diagram 4A* or *4B*).

4.7 **For trussed track:** After you have adjusted the track for smooth transition, torque the truss splice plate hexnuts (*chart 2A*, on page 2).

4.8 For additional runways repeat Steps 4.1 through 4.6.

4.9 Install end stops (Step 3.4, on page 6).
STEP 5 - BRIDGE AND END TRUCK INSTALLATION

**IMPORTANT:** Only one end truck is clamped to the bridge; the other is not. The clamping end truck must be oriented with the festooning side of the track (refer to Step 8, on page 13 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.

**IMPORTANT:** Extended end truck should be assembled before attaching to bridge.

5.1 Make sure end stops have been installed in the runway end opposite the festooning (leaving festooning end open for bridge installation).

5.2 Prior to adding bridge, clean inside flanges of track with clean, dry cloth (do not use any kind of cleaning solution) to remove grit or debris that may have collected during shipping, storage, or installation.

5.3 If your end trucks look like:

![Standard End Trucks](Shipped Assembled) (go to Step 5.4)

![Extended End Trucks](Shipped Unassembled) (go to Step 5.7)

**Standard End Trucks**

5.4 Slide an end truck over festooning end of bridge (refer to the General Arrangement Drawing for exact end truck location, end truck sleeve must be 1” (+/- 1/4”) from first vertical) and clamp into place with hardware provided (diagram 5A).

*Note:* The festooning end of the bridge will have a hole that is inset the same or greater distance from the end of the bridge than the hole in the opposite end of the bridge.

5.5 Slide and position the non-clamping end truck on the other end of bridge (refer to the General Arrangement Drawing for exact location, end truck sleeve must be 1” (+/- 1/4”) from first vertical).

5.6 Go to Step 5.16, on page 9.

**Extended End Trucks**

5.7 Locate extended end truck tubes, support weldment, wheel plates, and required hardware.

5.8 Slide an extended end truck tube halfway through each side of the end truck support weldment (diagram 5B). Insert a support bolt in each hole of the support weldment.

5.9 Place nylock nut on end of each bolt and tighten snug against end truck support weldment.

**WARNING**

Do not “over-tighten” nylock nut; this could cause damage to end trucks. Nylock nut can only be used once. If this item is disassembled, then nut must be replaced.
STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

**IMPORTANT:** ONLY ONE end truck is clamped to the bridge: the other is not. The clamping end truck must be oriented with the festooning side of the track (refer to Step 8, on page 16 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.

**IMPORTANT:** Extended end truck should be assembled before attaching to bridge.

Extended End Trucks (continued)

5.10 Place a wheel plate between the end truck tubes. Insert 5/8” dia. bolt into first tube, through the wheel plate and out the opposite tube (Diagram 5C).

5.11 Place nylock nut on end of bolt and tighten snug against extended end truck tube. **Note:** When tightening this lock nut make sure that wheel plate pivots freely.

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5.12 Repeat steps 5.10 and 5.11 for remaining wheel plate.

5.13 Repeat steps 5.7 to 5.12 for remaining extended end trucks.

5.14 Slide an end truck over festooning end of bridge (refer to the General Arrangement Drawing for exact end truck location, end truck sleeve must be 1” (+/- 1/4”) from first vertical) and clamp into place (Diagram 5D).

**Note:** The festooning end of the bridge will have a hole that is inset the same or greater distance from the end of the bridge than the hole in the opposite end of the bridge.

5.15 Slide and position the non-clamping end truck on the other end of bridge (refer to the General Arrangement Drawing for exact location, end truck sleeve must be 1” (+/- 1/4”) from first vertical).

5.16 Install an end stop to the end of the bridge opposite the festooning (Diagrams 5E or 5F).

5.17 Lift bridge up to runways and simultaneously insert end trucks into open ends of runways. Make sure festooning end of bridge is oriented with festooning runway. For information on festooning, refer to Step 8, on page 13.

5.18 **Immediately** install end stops in open ends of runways to prevent bridge from exiting runways (Diagrams 5E or 5F).

5.19 Roll bridge down length of runways to check for smooth travel. If travel is not smooth, check track for level and parallel (Step 3.4, page 6) and check to make sure that only one end truck on bridge is clamped.

**Diagram 5C. Installing wheel plates.**

**Diagram 5D. Installing extended clamping end truck. See NOTE.**

**Diagram 5E. Installing end stop.**

**Diagram 5F. Installing end stop.**
STEP 6 - HOIST TROLLEY INSTALLATION

6.1 If your hoist trolley looks like:

250#, 500#, 1000# and 2000# Hoist Trolley

6.2 Clean inside flanges of track with a clean, dry cloth (do not use any kind of cleaning solution) to remove grit or debris that may have collected during shipping, storage, or installation.

6.3 Be sure end stop is installed opposite the festooning end of bridge/monorail.

6.4 Attach hoist to hoist trolley by snapping hoist suspension hook over the trolley saddle clevis pin of hoist trolley.

6.5 If hoist suspension is too large or hoist has a suspension device other than a hook, remove trolley saddle clevis pin and install suspension device (by others). Insert clevis pin back into place. Slide washers on clevis pin and insert cotter pin through trolley saddle clevis pin (diagrams 6A, 6B, and 6C).

6.6 Bend back both legs of cotter pin (diagram 6D).

**WARNING**

Fully bend both legs of cotter pin (diagram 6D). If cotter pin is cracked or fatigued it must be replaced.

6.7 If a tow arm is not being utilized on the trolley, go to Step 6.12, on page 11.

If a tow arm is being utilized on the trolley, go to Step 6.8.

Note: Festoon tow arms are not recommended for use on 4000# systems or systems with extended end trucks. They are not necessary for systems with festoon trolleys.

6.8 Remove wheels from festoon end of trolley (as needed). Keep snap rings.

6.9 Assemble the tow arm weldment on the festooning end of the hoist trolley (diagram 6E).

6.10 Re-assemble wheels and snap rings (as needed).

6.11 After the hoist trolley has been installed, loosen nuts on end of U-bolt enough to thread cable/air hose between the two legs of the U-bolt and festoon clamp plate. Secure cable/air hose by tightening nuts at the end of the U-bolt, forcing the festooning clamp plate snug against the cable/air hose.
**STEP 6 - HOIST TROLLEY INSTALLATION (CONTINUED)**

6.12 Roll hoist trolley into open end of track on bridge/monorail.

6.13 Install end stop on the festooning end of bridge/monorail (*diagram 3F*, on page 6).

6.14 If you have tagline, go to Step 9, on page 15.
   
   If you **do not** have festooning, go to Step 11, on page 17.
   
   If you **do not** have a festoon stack section, go to Step 8, on page 13.
   
   Otherwise go to Step 7, on page 12.

6.15 Clean inside flanges of track with a clean, dry cloth (*do not use any kind of cleaning solution*) to remove grit or debris that may have collected during shipping, storage, or installation.

6.16 Be sure end stop is installed opposite the festooning end of bridge/monorail.

6.17 Bend **both legs** of all cotter pins (*diagram 6F*).

**WARNING**

Fully bend both legs of cotter pin (*diagram 6F*). If cotter pin is cracked or fatigued it must be replaced.

6.18 Attach hoist to hoist trolley by snapping hoist suspension hook over the clevis bolt (center bolt) on hoist trolley loadbar.

**WARNING**

Hang hoist from clevis bolt (center bolt) of hoist trolley only.

6.19 If hoist suspension hook is too large or hoist has a suspension device other than a hook, you will need to remove clevis bolt and install suspension device (by others). Insert clevis bolt back into place. Place nylock nut on end of bolt and tighten (*diagram 6G*).

**WARNING**

Be sure to tighten nut on the clevis bolt (center bolt) of hoist trolley. **Do not** “over-tighten” nylock nut: could cause damage to trolleys. Nylock nut on clevis bolt should only be used once. If this item is disassembled, then nut must be replaced.

6.20 Roll hoist trolley into open end of track on bridge/monorail.

6.21 Install end stop on festooning end of bridge/monorail (*diagram 3F*, on page 6).

6.22 If you have tagline, go to Step 9, on page 15.
   
   If you **do not** have festooning, go to Step 11, on page 17.
   
   If you **do not** have a festoon stack section, go to Step 8, on page 13.
   
   Otherwise go to Step 7, on page 12.
**STEP 7 - FESTOON STACK SECTION INSTALLATION**

**TIP:** Festoon stack section allows festooning to stack up at the end of the system, permitting full use of runway/monorail.

7.1 Remove end stop on festooning end of runway/monorail.

*For All Systems With Festoon Gliders, or Systems With Festoon Trolleys and 1000, 2000, or 4000 Series Track (diagram 7A)*

7.2 Slide festoon stack section over open runway/monorail end.

7.3 Re-install end stop (diagram 7A).

7.4 Use leveling screws located at top of festoon stack section to align it with the runway/monorail.

*For Systems With Festoon Trolleys and 250 or 500 Series Track (diagram 7B)*

**Note:** Welding is required to attach festoon stack section to runway/monorail when using festoon trolleys with 250 or 500 series track.

7.5 Slide festoon stack section over open runway/monorail end.

**WARNING**

Do not “over tighten” leveling screws: this will cause permanent damage to the track.

7.6 Use leveling screws located at top of festoon stack section to align it with runway/monorail.

7.7 Weld festoon stack section to runway/monorail at locations (diagram 7B).

**WARNING**

All welds must meet American Welding Society (AWS) specification D1.1 using E70xx electrodes.

**Note:** Because trolleys are too large to roll under the end stop on the 250 and 500 series track, the end stop and accompanying hardware (which held the festoon stack section to the runway/monorail) is positioned at the end of the festoon stack section. To prevent festoon stack section from sliding off the runway/monorail, the festoon stack section is welded.

7.8 Install end stop (removed in step 7.1) in end of festoon stack section (diagram 7B).
STEP 8 - FESTOONING INSTALLATION

**TIP:** Festoon gliders are comprised of a glider body (with upper saddle) and lower saddle (a separate piece that clips onto the glider body).

**TIP:** Enough carriers (festoon gliders or festoon trolleys) are supplied to support festoon conductor every 6’ on runway/monorail and every 3’ on bridges.

*Note:* Every 6’ on vacuum hose trolley.

8.1 If you are using:

![](image1.png)

- festoon gliders, go to Step 8.2
- festoon trolleys, go to Step 8.7

**Festoon Gliders**

If you have a monorail go to Step 8.4.

8.2 Slide festoon gliders through end of bridge that corresponds with festooning on runway. Space festoon gliders every 3'-0" along bridge.

8.3 Slide festoon clamp into place at festooning end of bridge and tighten clamp bolt (*diagram 8A*).

8.4 Slide festoon gliders into festoon stack section end of runway/monorail track (on festooning side of runway/monorail). Space festoon gliders every 6'-0" along runway/monorail, between bridge and festoon stack section.

8.5 Slide festoon clamp into end of runway/monorail/festoon stack section (*diagram 8A*). Tighten clamp bolt until lockwasher is flat.

8.6 Proceed to Step 8.15, on page 14.

**Festoon Trolleys**

**IMPORTANT:** Before installing festoon trolleys in 250 and 500 series track, the molded bumper (on festooning end of bridge runway) must first be removed.

If you have a monorail go to Step 8.11, on page 14.

8.7 For 250-500 series track:

Remove end stop on festooning end of bridge.

8.8 Roll festoon trolleys through open end of bridge that corresponds with festooning on runway. Space festoon trolleys every 3'-0" along bridge.

*Note:* Every 6'-0" for vacuum hose festooning.

8.9 Slide festoon clamp/vacuum hose clamp into place at festooning end of bridge and tighten clamp bolt (*diagrams 8A or 8B*).

8.10 Re-install end stop (molded bumper with through bolt) in festooning end of bridge (*diagram 8C*, page 14).
STEP 8 - FESTOONING INSTALLATION (CONTINUED)

8.11 For 250-500 series track:
Remove end stop from festoon stack section/festooning end of runway/monorail.

8.12 Roll festoon trolleys into end of runway/monorail/festoon stack section track (on festooning side of runway/monorail). Space festoon trolleys every 6’0” along runway/monorail, between bridge and festoon stack section.

8.13 Slide festoon clamp into end of runway/monorail/festoon stack section and tighten clamp bolt (diagram 8A or 8B, on page 13).

8.14 For 250 or 500 series track:
Re-install end stop in runway/monorail/festoon stack section (diagram 8C).

8.15 Installing Festoon Electric Cable/Air Hose/Vacuum Hose:
Gliders are designed to accept 4-conductor, electric flat cable (#12 or #14 gauge). Festoon trolleys are designed to accept 4-conductor, electric flat or round cable (#12 or #14 gauge) or air hose (maximum: 7/8” outside diameter).

WARNING
Crane cannot be utilized as a ground: A separate ground wire is required. For example, systems with 3-phase power require 3 conductors plus one ground wire.

Electric Cable with Festoon Gliders
Thread electric cable between upper and lower saddles of glider. Secure electric cable by pushing lower saddle up glider legs, clamping electric cable into place (diagram 8D).

Electric Cable/Air Hose with Festoon Trolleys
Loosen nuts and clamp-plate enough to thread electric cable/air hose between the U-bolt legs and clamp plate on festoon trolley. Secure cable by tightening nuts on festoon trolley, forcing clamp plate snug against electric cable/air hose (diagram 8E).

Note: Be careful not to tighten nuts too tight; will cause damage to electric cable/air hose.

Note: Be sure that U-bolt does not interfere with trolley body.

IMPORTANT: Cable/Air Hose Installation: It is important that as much twist as possible be taken out of the hose before it is hung. To take the twist out follow the steps below:

1. Lay the cable or hose out on the floor flat.
2. Mark the cable or hose where the first end clamp will be and then make marks for trolley and bridge end clamp locations at 6-7 foot intervals. If cable or hose twist still exists, increase intervals.
3. Recoil the cable or hose so that the marks are all lined up on the top of the coiled cable or hose.
4. Lay the large coil on the floor with the marks lined up. At each mark, attach a trolley or end clamp. When installing the festoon, pick up the whole coil and run the trolleys in without disturbing the coil.

Suggestion: Air Swivels should be used at either end of cable or hose to reduce twist.
STEP 8 - FESTOONING INSTALLATION (CONTINUED)

Vacuum Hose Trolleys

Place strap around vacuum hose (by others). Secure Velcro sides together and be sure vacuum hose is held snugly in place (diagram 8F).

**Note:** Strap will fit vacuum hoses with outside diameters ranging from 1-1/2" to 2-3/4".

Clip vacuum hose hook (with vacuum hose attached) onto vacuum hose trolley (diagram 8F).

**Note:** If Velcro strap does not hold vacuum hose securely, engage vacuum device so a vacuum is present in the hose and retighten Velcro straps so the vacuum hose is held tightly.

STEP 9 - BRIDGE AND RUNWAY TAGLINE INSTALLATION

9.1 Slide tagline brackets onto each end of bridge (diagram 9A). Attach tagline mounting angles to vertical tube using hardware provided (diagram 9B).

**Note:** This will require removal of endstop hardware. This hardware must be re-installed immediately after tagline bracket is installed.

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Diagram 8F. Installing vacuum hose on vacuum hose trolley.

Diagram 9A. Tagline on bridge.

Diagram 9B. Tagline on runway.

Diagram 9C. Tagline cable assembly.
STEP 9 - BRIDGE AND RUNWAY TAGLINE INSTALLATION (CONTINUED)

9.2 Attach eyebolts onto tagline brackets. Attach turnbuckle to one eyebolt. Loop cable through eyebolt or turnbuckle and turn back 4-3/4” of cable on a thimble. Apply first clamp 1” from the dead end of the cable and tighten U-bolt to 15 ft.-lbs. or torque. Apply the second clamp as close to thimble as possible. Tighten U-bolt to 15 ft.-lbs. of torque (diagram 9D).

9.3 Add any S-hooks, wire rope trolleys, or coiled air hose to the cable prior to attaching the other end.

9.4 Secure other end of the cable as in Step 9.2.

STEP 10 - OPTIONAL ACCESSORIES

Safety Cable Installation

A) The safety cable is provided as a single piece and must be cut in the field as necessary. Each connection requires 5 ft. of cable.

B) After cutting the cable down to required length, one end of each cable must be properly saddled using the thimble and U-bolt cable clamps provided (diagram 10A).

C) Turn back 4-3/4” of cable on a thimble or loop. Apply the first clamp 1” from the dead end of the cable and tighten U-bolt to 15 ft.-lbs. of torque. Apply the second clamp as close to thimble or loop as possible. Tighten U-bolt to 15 ft.-lbs. of torque (diagram 10A).

D) Pass the free end of cable through support points of each connection in which safety cabling is required.

E) After the free end of cable has passed through all required support points, it should be passed through the saddled end of cable.

F) Saddle the free end of cable while making sure both ends are interlocked. Complete the connection using the instructions from Step C above (diagram 10B).

WARNING

The cable and termination should be inspected periodically for wear, abuse, and general adequacy.
STEP 10 - OPTIONAL ACCESSORIES (CONTINUED)

Coiled Air Hose Installation
A) Assemble female fittings to the coiled air hose according to diagram 10D. The coiled air hose is inserted through the spring guard, nut, ferrule, and over the tube insert as far as possible. Note the orientation of the ferrule: the bevel is pointing towards the female fitting.

B) Assemble the remainder of the components per diagram 10E.

Double Wired Endstop Installation
A) Install end stop bumper with hardware provided (diagram 10F).

B) Install additional hardware with bolt facing the same direction as the end stop hardware.

C) Insert safety wire through the holes in each end stop bolt and twist ends together to secure wire in place (diagram 10G).

STEP 11 - FINAL STEPS

11.1 Check to make sure all bolts are tightened to specifications and lockwashers are flat.
11.2 Be sure to sway brace the crane, except when using flush mounted hangers.
11.3 If necessary, touch up crane with paint provided.
11.4 Install yellow rubber tracdoms on open ends of steel track.
11.5 Keep Packing List, Installation Manual, General Arrangement Drawing, and any other inserts filed together in a safe place.

WARNING
End stop bumper must be placed on the “inside” bolt so that the endtruck or trolley contacts the bumper and not the secondary bolt.

TIP: Do not throw away this manual: the maintenance schedule is on the back cover.
INSTALLATION PARAMETERS AND APPLIED FORCES TO THE SUPPORTING STRUCTURE

The applied forces drawing in diagram 1, details the relative position and the direction of forces that the work station bridge crane applies to the supporting structure.

Loads applied to the support structure can be determined by the following formulas:

\[ P = \text{Live Load} \]
\[ R_1 = \text{Vertical Load applied by support hanger (lb.)} \]
\[ R_2 = \text{Longitudinal load applied by movement of the crane to each runway (lb.)} \]
\[ R_3 = \text{Lateral load applied by movement of the trolley and load to each runway (lb.)} \]
\[ L_1 = \text{Maximum distance between hanger centerlines (support centers) (ft)} \]
\[ L_2 = \text{Maximum splice joint centerline to hanger centerline (support center) (in)} \]
\[ L_5 = \text{Maximum bridge cantilever (in)} \]
\[ L_9 = \text{Maximum runway cantilever (in)} \]
\[ L_4 = \text{Bridge span (distance between runway centerlines) (ft)} \]
\[ 1.4 = \text{Design factor which includes 25% for impact and 15% for hoist weight} \]
\[ W = \text{Weight per foot of runway (lb./ft)} \]
\[ w = \text{Weight per foot of bridge (lb./ft)} \]

**Note:** If there are only 2 hangers per runway substitute "(L1)/2" for "L1" in the R1 formula.

**Note:** For bridge lengths greater than 23 ft., up to 28 ft., use GLCSL weights. Greater than 28 ft. lengths, up to 34 ft., use GLCSLX weights.

\[ R_1 = \frac{(1.4 \times P) + (W \times L_1) + (w \times L_4)}{2} \]
\[ R_2 = \frac{(1.15 \times P) + [(w \times L_4) \times 0.10]}{2} \]
\[ R_3 = 1.15 \times P \times 0.20 \]

<table>
<thead>
<tr>
<th>CAPACITY</th>
<th>SERIES</th>
<th>WEIGHT PER FOOT</th>
<th>MAX. L1</th>
<th>MAX. L2</th>
<th>MAX. L5</th>
<th>MAX. L9</th>
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Sway bracing must be located at or near each support location. It is required that each sway brace point shall not exceed the smaller of 10% of the spacing between supports or 24 inches from a support point. Maximum spacing shall not exceed 30 feet or as determined by structural analysis involving maximum unbraced length of the compression flange, and the horizontal length and horizontal deflection limit of the track.

Thrust bracing must be located at or near end hanger locations. It is required that each thrust brace point shall not exceed the smaller of the 10% of the spacing between supports or 24 inches from a support point. At a minimum, there should be two thrust braces per enclosed track runway. At curved locations (used with monorails) bracing shall be provided at ends and midpoints of curves, but the maximum spacing shall not exceed three feet. On monorail systems, track switches shall be braced in both directions.

Sway or thrust bracing must not be directly attached to hanger rods. All new bracing connecting to the flange of the track and flanges of building beams shall use sway brackets or equal as shown in diagram 1. When attaching bracing to steel truss or steel beams, the bracing member shall be attached to the top chord or top flange and located as close to the bridging members as possible.

Angle of bracing from vertical preferably should be equal to or greater than 45 degrees, but in no case be less than 30 degrees.

Generally, bracing is placed either parallel or perpendicular to track. However, skewed bracing is also permissible to accommodate difficult connections, such as the presence of ducts or pipes. Design of skewed bracing should use the same criteria for parallel/perpendicular bracing. For skewed thrust bracing, two pieces, symmetrical to the track, should be used if the skewed angle is greater than 10 degrees.

### ANGLE AND PIPE BRACE TYPES

Based on (KL/r = 300) Design Criteria

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<thead>
<tr>
<th>Size</th>
<th>Area (in²)</th>
<th>r (in)</th>
<th>Max. Length (ft)</th>
<th>Allowable Force (kips)</th>
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<td>0.421</td>
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K = Effective Length Factor for a Prismatic Member (see AISC manual)
L = Length of Brace
r = Radius of Gyration

Diagram 1. Typical Connection detail.
CRANE OPERATOR INSTRUCTIONS

Overhead cranes and jib cranes generally handle materials over working areas where there are personnel. Therefore, it is important for the Crane Operator to be instructed in the use of the crane and to understand the severe consequences of careless operation. It is not intended that these suggestions take precedence over existing plant safety rules and regulations or OSHA regulations. However, a thorough study of the following information should provide a better understanding of safe operation and afford a greater margin of safety for people and machinery on the plant floor. It must be recognized that these are suggestions for the Crane Operator’s use. It is the responsibility of the owner to make personnel aware of all federal, state and local rules and codes, and to make certain operators are properly trained.

Qualifications

Cranes operate, to be safe and efficient, requires skill: the exercise of extreme care and good judgment, alertness and concentration, and rigid adherence to proven safety rules and practices as outlined in applicable and current ANSI and OSHA safety standards. In general practice, no person should be permitted to operate a crane:

- Who cannot speak the appropriate language or read and understand the printed instructions.
- Who is not of legal age to operate this type of equipment.
- Whose hearing or eyesight is impaired (unless suitably corrected with good depth perception).
- Who may be suffering from heart or other ailments which might interfere with the operator’s safe performance.
- Unless the operator has carefully read and studied this operation manual.
- Unless the operator has been properly instructed.
- Unless the operator has demonstrated his instructions through practical operation.
- Unless the operator is familiar with hitching equipment and safe hitching equipment practices.

Handling the Bridge Travel Motion

Before using the bridge of the crane, the operator should be sure the hook is high enough to clear any obstruction. Before a load is handled by the crane, the bridge should be brought into position so that it is directly over the load. Start the bridge slowly and bring it up to speed gradually. Approaching the place where it is desired to stop the bridge, reduce the bridge speed.

Handling the Trolley Motion

Before a load is handled, the hoist should be positioned directly over the load that is to be handled. When the slack is taken out of the slings, if the hoist is not directly over the load, bring it directly over the load before hoisting is continued. Failure to center the hoist over the load may cause the load to swing upon lifting. Always start the trolley motion slowly and reduce the trolley speed gradually.

Handling the Hoist Motion

Refer to the lifting (hoist) equipment’s operating instructions.

GENERAL SUGGESTIONS

Know Your Crane

Cranes operators should be familiar with the principal parts of a crane and have a thorough knowledge of crane control functions and movements. The crane operator should be required to know the location and proper operation of the main conductor disconnecting means for all power to the attachments on the crane.

Responsibility

Each crane operator should be held directly responsible for the safe operation of the crane. Whenever there is any doubt as to SAFETY, the crane operator should stop the crane and refuse to handle loads until: (1) safety has been assured or (2) the operator has been ordered to proceed by the supervisor, who then assumes all responsibility for the SAFETY of the lift.

Do not permit ANYONE to ride on the hook or a load.

Inspection

Test the crane movement and any attachments on the crane at the beginning of each shift. Whenever the operator finds anything wrong or apparently wrong, the problem should be reported immediately to the proper supervisor and appropriate corrective action taken.

Operating Suggestions

One measure of a good crane operator is the smoothness of the crane operation. The good crane operator should know and follow these proven suggestions for safe, efficient crane handling.

1. The crane should be moved smoothly and gradually to avoid abrupt, jerky movements of the load. Slack must be removed from the sling and hoisting ropes before the load is lifted.
2. Center the crane over the load before starting the hoist to avoid swinging the load as the lift is started. Loads should not be swung by the crane to reach areas not under the crane.
3. Crane-hoisting ropes should be kept vertical. Cranes shall not be used for side pulls.
4. Be sure everyone in the immediate area is clear of the load and aware that a load is being moved.
5. Do not make lifts beyond the rated load capacity of the crane, sling chains, rope slings, etc.
6. Make certain that before moving the load, load slings, load chains, or other lifting devices are fully seated in the saddle of the hook with hook latch closed (if equipped with hook latch)
7. Check to be sure that the load and/or bottom block is lifted high enough to clear all obstructions when moving boom or trolley.
8. At no time should a load be left suspended from the crane unless the operator has the push button with the power on, and under this condition keep the load as close as possible to the floor to minimize the possibility of an injury if the load should drop. When the crane is holding a load, the crane operator should remain at the push button.
9. Do not lift loads with sling hooks hanging loose. If all sling hooks are not needed, they should be properly stored, or use a different sling.
10. All slings or cables should be removed from the crane hooks when not in use (dangling cables or hooks hung in sling rings can inadvertently snag other objects when the crane is moving).
11. Operators shall not carry loads and/or empty bottom blocks over personnel. Particular additional caution should be practiced when using magnet or vacuum devices. Loads, or parts of loads, held magnetically could drop. Failure of power to magnets or vacuum devices can result in dropping the load. Extra precaution should be exercised when handling molten metal in the proximity of personnel.
12. Whenever the operator leaves the crane the following procedure should be followed:
   - Raise all hoists to an intermediate position
   - Spot the crane at an approved designated location.
   - Place all controls in the “off” position.
   - Open the main switch to the “off” position.
   - Make visual check before leaving the crane.
13. In the case of emergency or during inspection, repairing, cleaning or lubrication, a warning sign or signal should be displayed and the main switch should be blocked in the “off” position. This should be done whether the work is being done by the crane operator or by others.
14. Contact with rotation stops or trolley end stops shall be made with extreme caution. The operator should do so with particular care for the safety or persons below the crane, and only after making certain that any persons on the other cranes are aware of what is being done.
15. ANY SAFETY FEATURES AND MECHANISMS BUILT-IN OR OTHERWISE PROVIDED WITH THE CRANE BY CM® LODERAIL ARE REQUIRED FOR THE SAFE OPERATION OF THE CRANE. DO NOT UNDER ANY CIRCUMSTANCES REMOVE OR OTHERWISE IMPAIR OR DISABLE THE PROPER FUNCTIONING OF ANY CRANE SAFETY MECHANISMS OR FEATURES BUILT-IN OR OTHERWISE PROVIDED BY CM® LODERAIL FOR SAFE OPERATION OF THE CRANE. ANY REMOVAL, IMPAIRMENT OR DISABLING OF ANY SUCH SAFETY MECHANISMS OR FEATURES OR OTHER USE OR OPERATION OF THE CRANE WITHOUT THE COMPLETE AND PROPER FUNCTIONING OF ANY SUCH SAFETY MECHANISMS OR FEATURES AUTOMATICALLY AND IMMEDIATELY voids ANY AND ALL EXPRESS AND IMPLIED WARRANTIES OF ANY KIND OR NATURE.
LIMITED WARRANTY

It is agreed that the equipment purchased hereunder is subject to the following LIMITED warranty and no other. Columbus McKinnon Corporation ("CM® LodeRail") warrants the manual push-pull Work Station Cranes and Jib Crane products to be free from defects in material or workmanship for a period of five years or 10,000 hours use from date of shipment. CM® LodeRail warrants the Motorized Work Station Crane products to be free from defects in material or workmanship for a period of two years or 4,000 hours use from the date of shipment. This warranty shall not cover failure or defective operation caused by operation in excess of recommended capacities, misuse, negligence or accident, and alteration or repair not authorized by CM® LodeRail. No system shall be modified after manufacture without the written authorization of CM® LodeRail. Any field modification made to the system without the written authorization of CM® LodeRail shall void CM® LodeRail’s warranty obligation. OTHER THAN AS SET FORTH HEREIN, NO OTHER EXPRESS WARRANTIES, AND NO IMPLIED WARRANTIES, ORAL OR WRITTEN, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE BY CM® LODERAIL WITH RESPECT TO ITS PRODUCTS AND ALL SUCH WARRANTIES ARE HEREBY SPECIFICALLY DISCLAIMED. CM® LODERAIL SHALL NOT BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, SPECIAL, AND/OR CONSEQUENTIAL DAMAGES WHATSOEVER, WHETHER OR NOT FORESEEABLE. INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOST PROFITS AND ALL SUCH INCIDENTAL, SPECIAL AND/OR CONSEQUENTIAL DAMAGES ARE HEREBY ALSO SPECIFICALLY DISCLAIMED. CM® LodeRail’s obligation and Purchaser’s or end user’s sole remedy under this warranty is limited to the replacement or repair of CM® LodeRail’s products at the factory, or at the discretion of CM® LodeRail, at a location designated by CM® LodeRail. Purchaser or end user shall be solely responsible for all freight and transportation costs incurred in connection with any warranty work provided by CM® LodeRail hereunder. CM® LodeRail will not be liable for any loss, injury or damage to persons or property, nor for damages of any kind resulting from failure or defective operation of any materials or equipment furnished hereunder. Components and accessories not manufactured by CM® LodeRail are not included in this warranty. Purchaser’s or end user’s remedy for components and accessories not manufactured by CM® LodeRail is limited to and determined by the terms and conditions of the warranty provided by the respective manufacturers of such components and accessories.

A) DISCLAIMER OF IMPLIED WARRANTY OF MERCHANTABILITY
CM® LodeRail and Purchaser agree that the implied warranty of merchantability is excluded from this transaction and shall not apply to the goods involved in this transaction.

B) DISCLAIMER OF IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE
CM® LodeRail and Purchaser agree that the implied warranty of fitness for particular purpose is excluded from this transaction and shall not apply to the goods involved in this transaction.

C) DISCLAIMER OF EXPRESS WARRANTY
CM® LodeRail and Purchaser agree that the implied warranty of fitness is excluded from this transaction and shall not apply to the goods involved in this transaction.

D) DISCLAIMER OF SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES
CM® LodeRail and Purchaser agree that any claim made by Purchaser which is inconsistent with CM® LodeRail’s obligations and the warranty remedies provided with CM® LodeRail’s products, and in particular, special, incidental and consequential damages, are expressly excluded.

E) DEALER OR DISTRIBUTOR NOT AN AGENT
CM® LodeRail and Purchaser agree that Purchaser has been put on notice that dealer or distributor is not CM® LodeRail’s agent in any respect for any reason. CM® LodeRail and Purchaser also agree that Purchaser has been put on notice that dealer or distributor is not authorized to incur any obligations or to make any representations or warranties on CM® LodeRail’s behalf other than those specifically set forth in CM® LodeRail’s warranty provided in connection with its product.

F) MERGER
This warranty agreement constitutes a final and complete written expression of all the terms and conditions of this warranty and is a complete and exclusive statement of those terms.

G) PAINTING
Every crane (excluding components) receives a quality paint job before leaving the factory. Unfortunately, no paint will protect against the abuses received during the transportation process via common carrier. We have included at least one (1) twelve ounce spray can for touchup work each crane ordered (unless special paint was specified). If additional paint is required, contact a CM® LodeRail Customer Service Representative at 1-800-888-0985 or 1-716-689-5400.

Title and Ownership:
Title to the machinery and equipment described in the foregoing proposal shall remain with CM® LodeRail and shall not pass to the Purchaser until the full amount herein agreed to be paid has been fully paid in cash.

Claims and Damages:
Unless expressly stated in writing, goods and equipment shall be at Purchaser’s risk on and after Seller’s delivery in good shipping order to the Carrier. CM® LodeRail shall in no event be held responsible for materials furnished or work performed by any person other than it or its authorized representative or agent.

Cancellations:
If it becomes necessary for the purchaser to cancel this order wholly or in part, he shall at once so advise CM® LodeRail in writing. Upon receipt of such written notice all work will stop immediately. If the order entails only stock items, a flat restocking charge of 15% of the purchase price will be due and payable by Purchaser to CM® LodeRail. Items purchased specifically for the canceled order shall be charged for in accordance with the cancellation charges of our supplier plus 15% for handling in our factory. The cost of material and/or labor expended in general fabrication for the order shall be charged for on the basis of total costs to CM® LodeRail up to the time of cancellation plus 15%.

Returns:
No equipment, materials or parts may be returned to CM® LodeRail without express permission in writing to do so.

Extra Charge Delay: If Purchaser delays or interrupts progress of Seller’s performance, or causes changes to be made, Purchaser agrees to reimburse CM® LodeRail for expense, if any, incident to such delay.

Changes and Alterations:
CM® LodeRail reserves the right to make changes in the details of construction of the equipment, as in its judgment, will be in the interest of the Purchaser; will make any changes in or additions to the equipment which may be agreed upon in writing by the Purchaser; and CM® LodeRail is not obligated to make such changes in products previously sold any customer.

Third Party Action:
Should CM® LodeRail have to resort to third party action to collect any amount due after thirty (30) days from date of invoice, the Purchaser agrees to pay collection costs, reasonable attorney’s fees, court costs and legal interest.

OSHA Responsibilities:
CM® LodeRail agrees to fully cooperate with Purchaser in the design, manufacture or procurement of safety features or devices that comply with OSHA regulations. In the event additional equipment or labor shall be furnished by CM® LodeRail, it will be at prices and standard rates then in effect, or as may be mutually agreed upon at the time of the additional installation.

Equal Employment Opportunity:
CM® LodeRail agrees to take affirmative action to ensure equal employment opportunity for all job applicants and employees without regard to race, color, age, religion, sex, national origin, handicap, veteran, or marital status. CM® LodeRail agrees to maintain non-segregated work facilities and comply to rules and regulations of the Secretary of Labor or as otherwise provided by law or Executive Order.
# Inspection and Maintenance Schedule

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<th>MAINTENANCE</th>
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<td>1</td>
<td>Top Hanger Bracket/Beam Clips/Threaded Rod</td>
<td>Check that lockwashers are compressed and nuts tightened to manufacturer’s specifications.</td>
<td>Every 2,000 hours or yearly</td>
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<td>Check that lockwashers are compressed and nuts tightened to manufacturer’s specifications.</td>
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<td>3</td>
<td>Truss Splice Plate</td>
<td>Check that lockwashers are compressed and nuts tightened to manufacturer’s specifications.</td>
<td>Every 2,000 hours or yearly</td>
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<td>Splice Joint</td>
<td>All bolts should be in contact with track. Check track for alignment and that wheel rolling surface is flush.</td>
<td>Every 2,000 hours or yearly</td>
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<td>5</td>
<td>Hoist Trolley</td>
<td>Check clevis pin. Check cotter pin. (Cotter pin should be fully wrapped around clevis pin.) Check clevis bolt and hardware.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
<tr>
<td>6</td>
<td>End Stops (runway/bridge/monorail)</td>
<td>Check for full compression of lockwasher. If thru-bolt is exposed, replace endstops.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
<tr>
<td>7</td>
<td>Festoon Cable Clamp or Vacuum Hose Clamp</td>
<td>Check for full compression of lockwasher.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
<tr>
<td>8</td>
<td>Wheels</td>
<td>Check for cracks, pits, and/or grooves: all of these increase pull forces. If any of these conditions exist, wheels should be replaced.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
<tr>
<td>9</td>
<td>Aluminum Bridge Assembly Hardware</td>
<td>Check that lockwashers are compressed and nuts tightened to torque specifications (Chart 2A, page 2). Ensure sheer lug hardware is still in required position and tight.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
<tr>
<td>10</td>
<td>End Trucks</td>
<td>Check for proper clamping hardware attachment. Ensure correct position on bridge to match specified cantilevers. Inspect end truck wheels following instructions for wheels above. Standard end truck: Make sure body is free of any bent materials, cracked or broken welds. Extended end truck: Check overall condition of tubes. Examine supports for bent materials, cracked or broken welds. Inspect hardware attaching end truck support to tubes. Check wheel plate attachment bolts for any wear and make sure the nylock nut is still in the correct position.</td>
<td>Every 2,000 hours or yearly</td>
</tr>
</tbody>
</table>

*Federal, state and local codes may require inspection and maintenance checks more often. Please check the federal, state and local code manuals in your area.

## Warning

Any changes in rolling effort or unusual noises must be immediately identified and corrected. It is not necessary to lubricate the track or bearings. Lubricating may attract airborne particles and may increase the rolling resistance. (Do not use such substances as WD-40®, silicone sprays, oil or grease on bearings or on track flanges.)

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