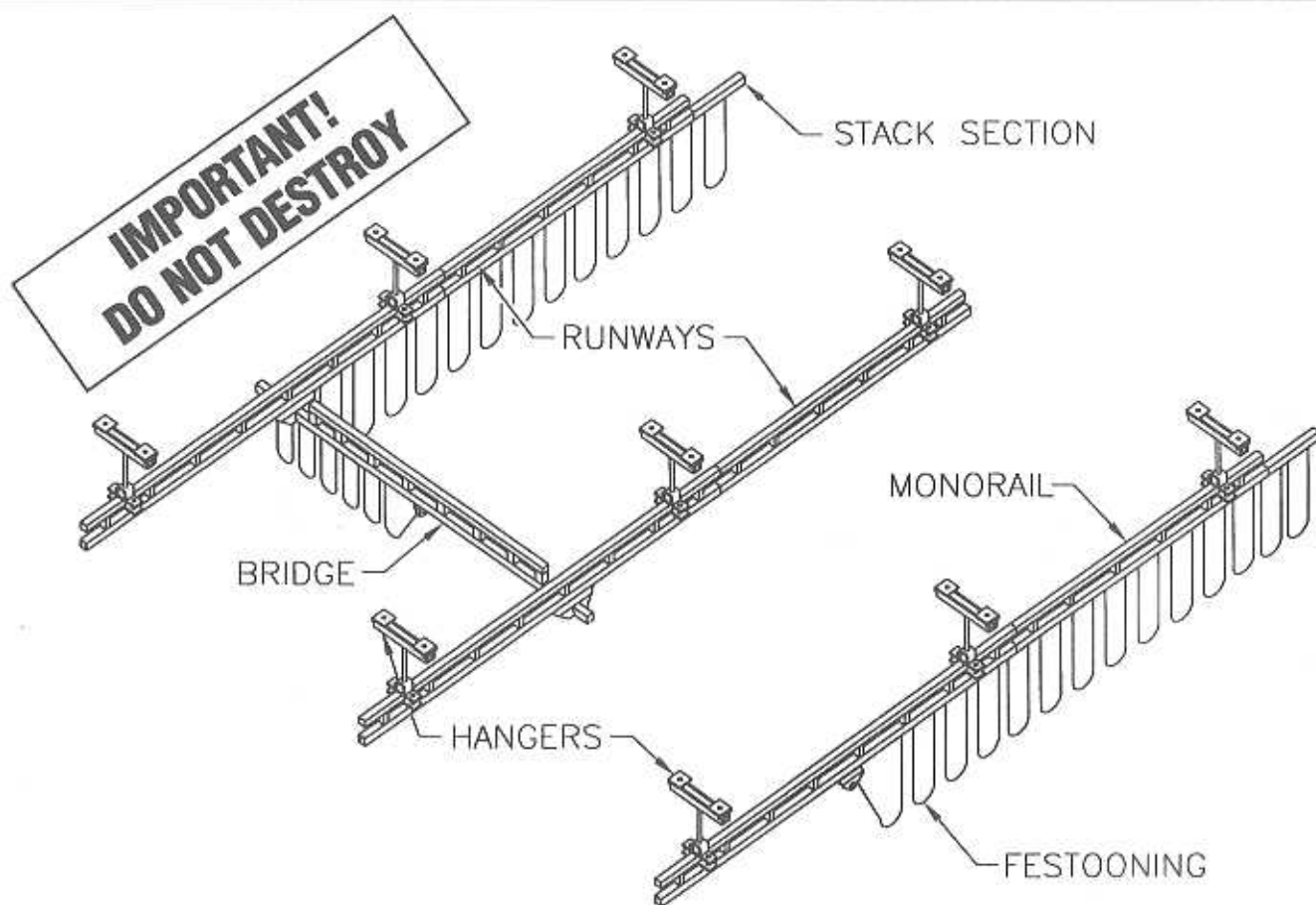


Installation, Operation, & Maintenance Manual



Ceiling Mounted Steel Work Station Bridge Crane and Monorail

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Questions? Concerns? Comments? Please call (800) 821-0086 (US and Canada) or (585) 924-6262 (outside US).

INTRODUCTION

Thank you for choosing Gorbel® Ceiling Mounted Work Station Cranes to solve your material handling needs. The innovative design and heavy-duty construction of the Gorbel® Work Station Cranes will provide a superior quality product that will offer years of long term value. All Gorbel® 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. Gorbel® 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 31.

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. Gorbel, Inc. 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 23.

WARNING

Reference the American Institute of Steel Construction (AISC) Manual of Steel Construction (9th edition), Part 5, Specification for Structural Joints using ASTM A325 or A490 Bolts (section 8.d.2) for the proper procedures to follow when using any torque-tightening method.

INSTALLATION

STEP 1 - PRE-ASSEMBLY

➡ **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.

- 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

➡ **TIP:** 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 29.

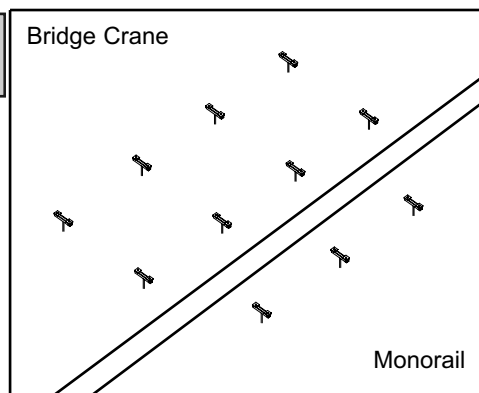
If you have standard hangers, go to Step 2.2.

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 hexnut.



TORQUE CHART

Bolt Diameter	Torque
1/2"	50 ft.-lb.
5/8"	95 ft.-lb.
3/4"	150 ft.-lb.

Chart 2A. Torque Chart.

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

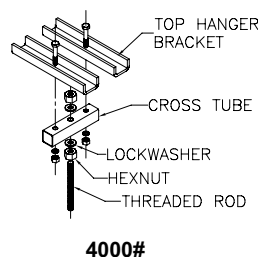
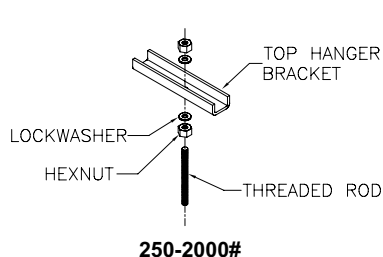


Diagram 2A. Attaching threaded rod to top hanger bracket.

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 but torque. Insert threaded rod into clevis (**diagram 2D**, page 3).

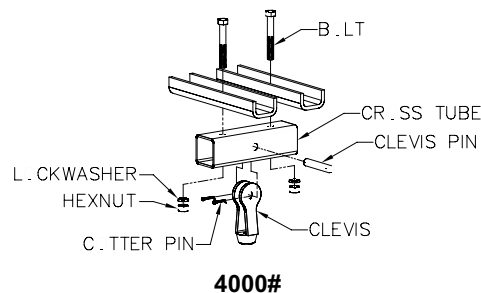
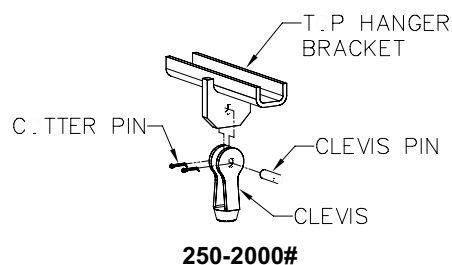


Diagram 2B. Attaching clevis to top hanger bracket.

STEP 2 - HANGER INSTALLATION (CONTINUED)

2.3 To attach clevis to top hanger bracket (continued):

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

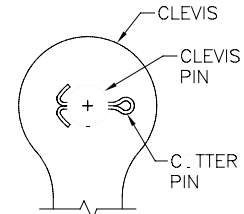


Diagram 2C. Installing cotter pin through clevis pin.

WARNING

Threaded rod must have a minimum of two threads beyond the clevis.

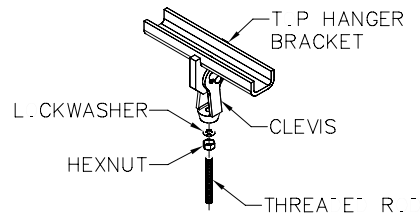
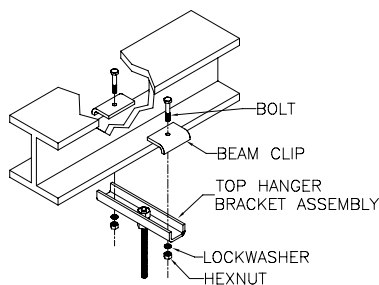


Diagram 2D. Attaching threaded rod to clevis.

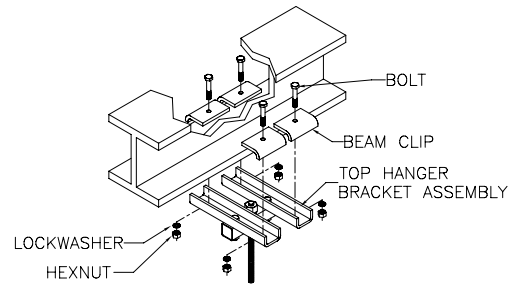
2.4 Bolt top hanger bracket assembly and beam clips to building support beam (*diagram 2E* or *2F*). **Note:** Flange thickness may vary and require shimming. Shimming may be needed to assure that the beam clip hardware is vertical.

WARNING

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

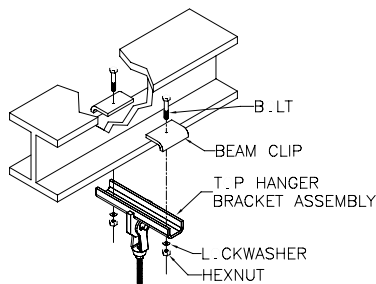


250-2000#

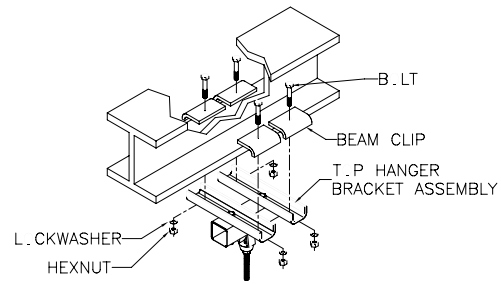


4000#

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



250-2000#



4000#

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

STEP 2 - HANGER INSTALLATION (CONTINUED)

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 6) on the Perpendicular Flush Mount Hanger 250-2000# (**diagram 2G**), before sliding it on the track.

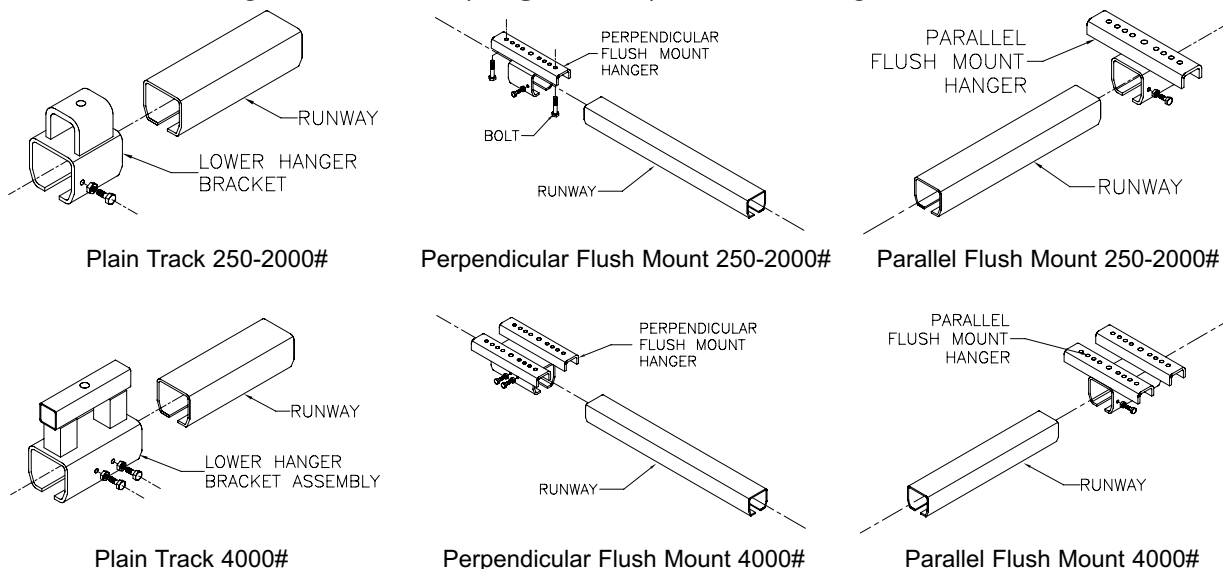


Diagram 2G. Installing lower hanger assemblies on untrussed (plain) track.

For trussed track:

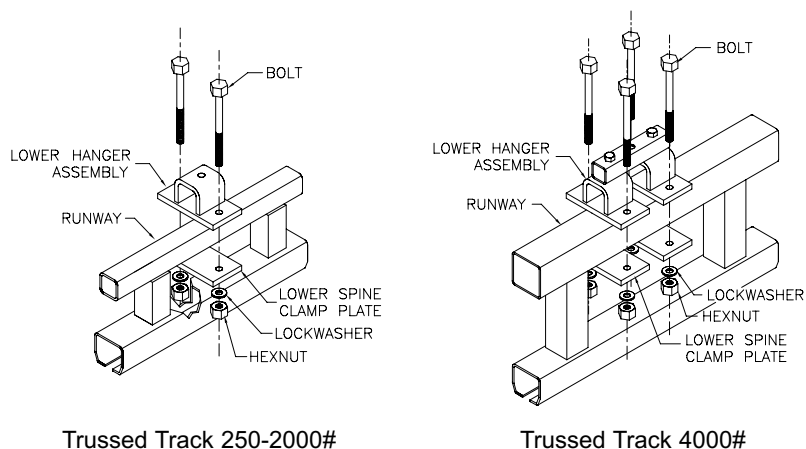
WARNING

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 30).



Trussed Track 250-2000#

Trussed Track 4000#

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

STEP 2 - HANGER INSTALLATION (CONTINUED)

Perpendicular Flush Mount

2.6 For trussed track:

WARNING

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

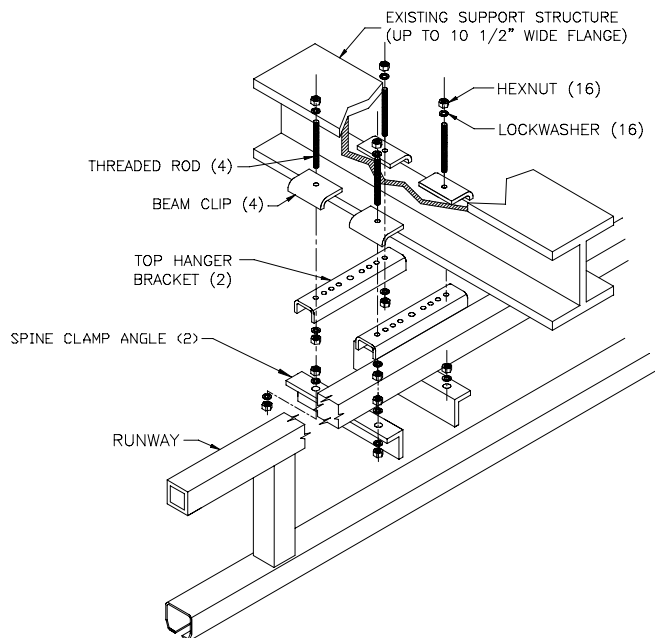
Position spine clamp angles (or plates) so they are centered under top tube of runway at hanger locations. Bolt spine clamp angle (or plate) and top hanger brackets together leaving maximum amount of threaded rod available above top hanger bracket for installation of beam clips (**diagram 2I**).

WARNING

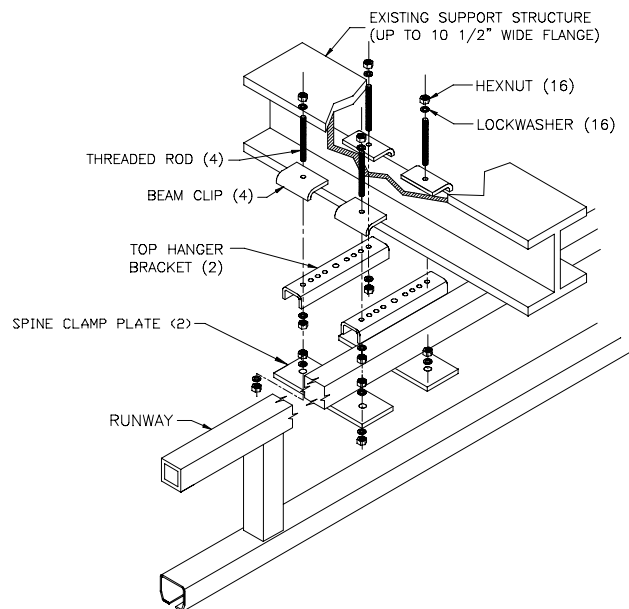
“Center hole” of top hanger brackets must be centered on building support beam.

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 6, for further runway installation instructions.



Trussed track with 1-1/2" to 2-1/2" top tube.



Trussed track with 3" to 6" top tube.

Diagram 2I. *Installing Perpendicular Flush Mounted Hangers on trussed track.*

STEP 3 - RUNWAY INSTALLATION

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

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).

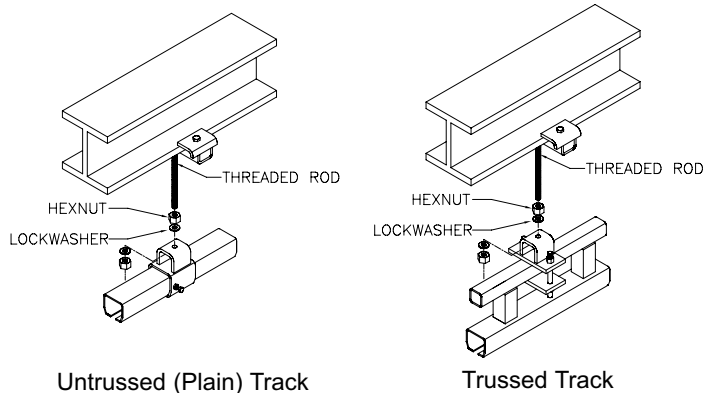
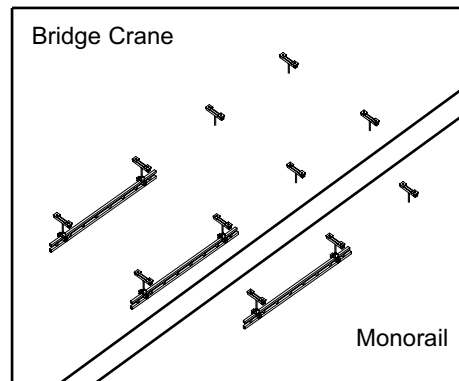


Diagram 3A. Attaching lower hanger assembly to top hanger assembly.

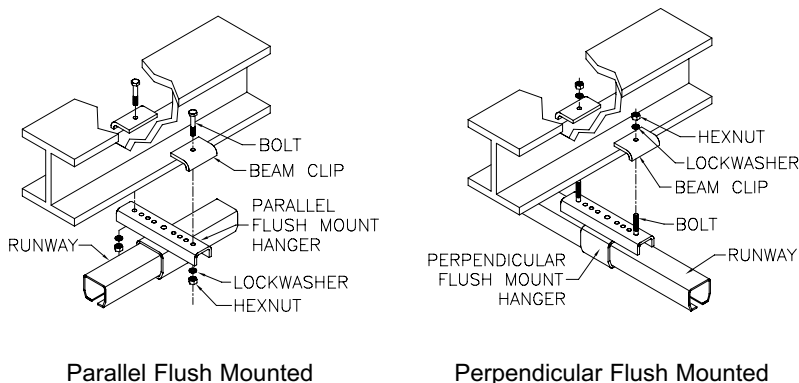


Diagram 3B. Attaching flush mounted hangers to building support beam.

STEP 3 - RUNWAY INSTALLATION (CONTINUED)

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).

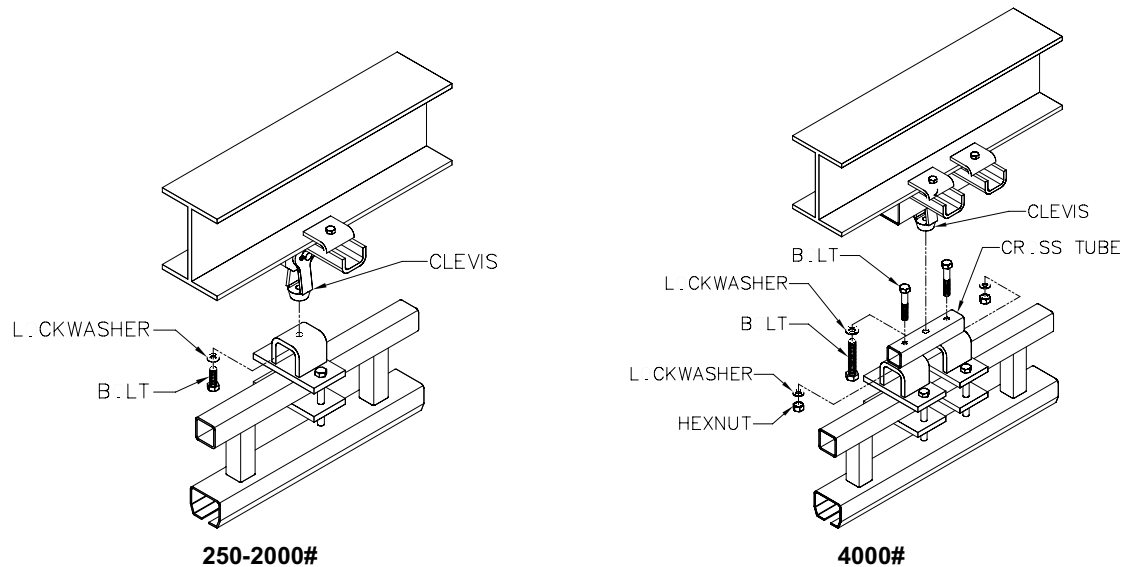


Diagram 3C. Attaching flush mounted sloped ceiling hangers to top hanger assembly.

WARNING

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

For sloped ceiling hangers:

Beam clips must be welded to support beam to prevent clips from shifting (**diagram 3D**).

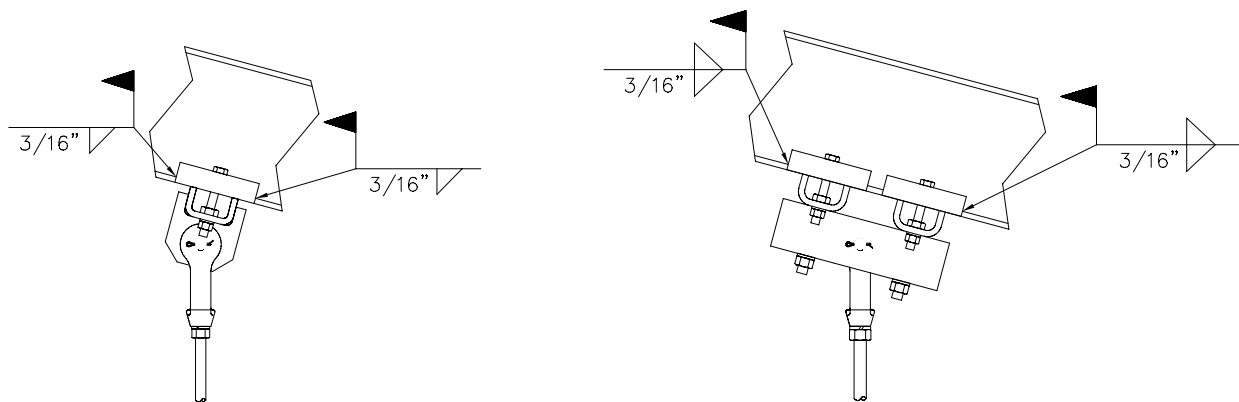


Diagram 3D. Welding beam clips to support beams.

RUNWAY INSTALLATION (CONTINUED)

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).

➡ **TIP:** 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.

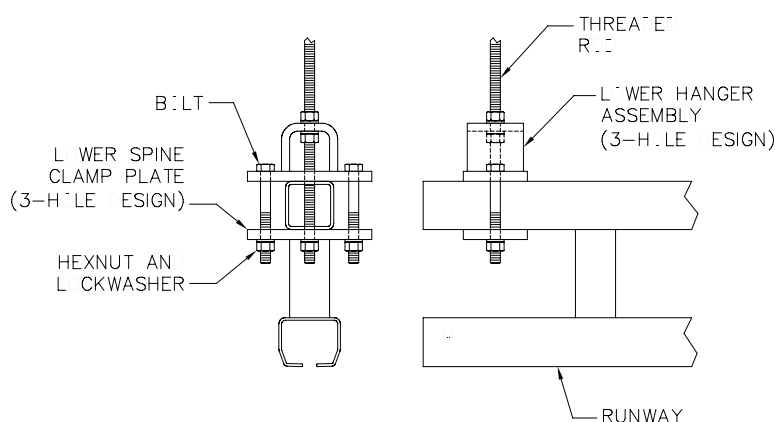


Diagram 3E. 3-Hole Hanger, 250#-2000#.

3.3 Level track:

Check to make sure that the lower flange of track is level (within $\pm 1/8"$) and parallel to opposite runway (within $\pm 1/8"$) over a 20'-0" distance.

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 9.

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 20.

Tighten nut on thru bolt until lockwasher is flat.

If you have a bridge crane, go to Step 5, on page 10.

If you have a monorail, go to Step 6, on page 16.

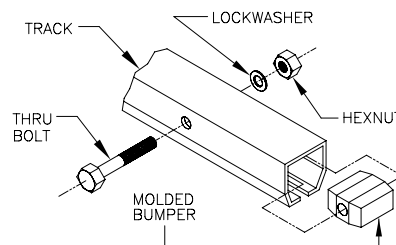


Diagram 3F. Installing end stop.

STEP 4 - SPLICE JOINT INSTALLATION

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

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 29.

- 4.1 Attach hardware to splice joint. Slide splice joint over track of installed runway/monorail.
- 4.2 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.
- 4.3 **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.
- 4.4 Refer to Step 2.5, on page 4, for lower hanger installation.

Attach runway to upper hanger by repeating Steps 3.2, on page 6 and 3.4, on page 8.

- 4.5 **Adjust track for smooth transition:**

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.

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*).

- 4.6 **For trussed track:** After you have adjusted the track for smooth transition, torque the truss splice plate hexnuts (*chart 2A*, on page 2).
- 4.7 For additional runways repeat Steps 4.1 through 4.6.
- 4.8 Install end stops (Step 3.5, on page 8).

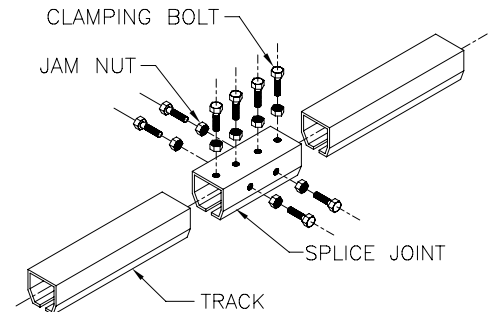
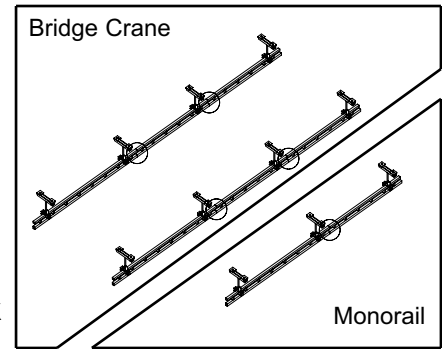


Diagram 4A. Splicing untrussed track.

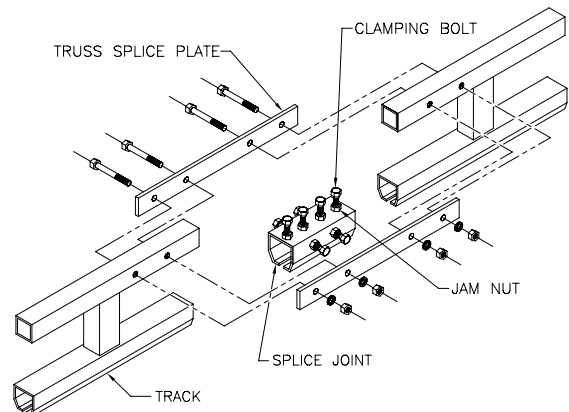
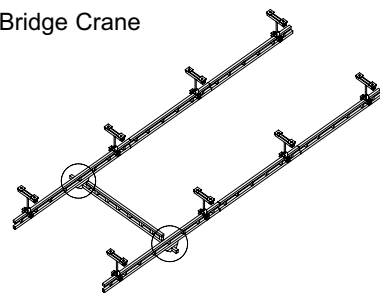


Diagram 4B. Splicing trussed track.

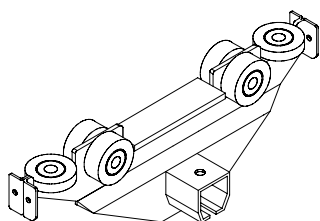
STEP 5 - BRIDGE AND END TRUCK INSTALLATION

➡ **TIP: 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.

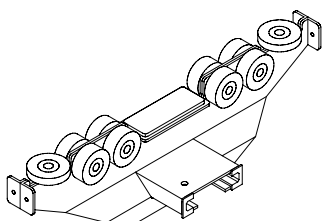
Bridge Crane



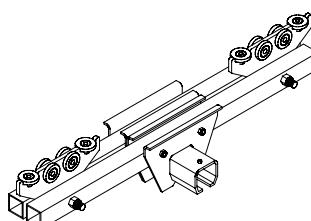
- 5.1 Make sure end stops have been installed in the runway end opposite the festooning (leaving festooning end open for bridge installation).
- 5.2 Prior to adding bridge, clean inside flanges of track with clean, dry cloth (**do not use any kind of cleaning solution**) to remove grit or debris that may have collected during shipping, storage, or installation.
- 5.3 If your end trucks look like:



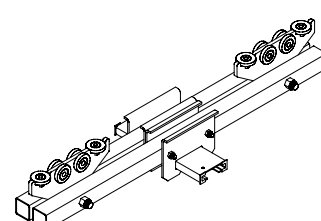
(Shipped Assembled)
go to Step 5.4



(Shipped Assembled)
go to Step 5.7



(Shipped Unassembled)
go to Step 5.19



(Shipped Unassembled)
go to Step 5.29

Standard End Trucks

➡ For Steel Bridges

- 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 should be 1" 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 should be 1" from first vertical).
- 5.6 Go to Step 5.40, on page 15.

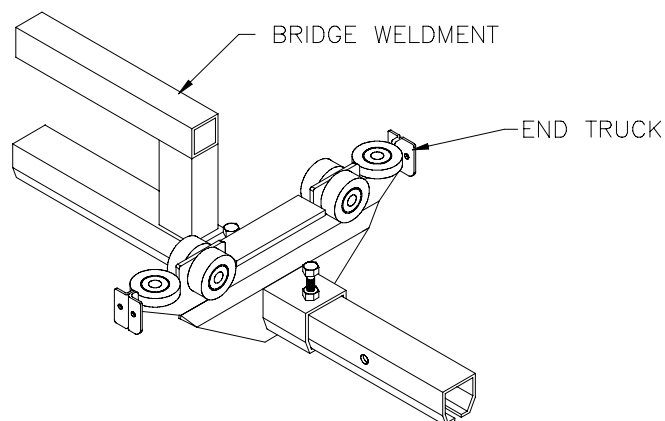


Diagram 5A. Installing standard clamping end truck. See **TIP**.

STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

➡ **TIP:** 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.

Standard End Trucks (continued)

➡ For Non-Coped Aluminum Bridges

- 5.7 Make sure nylon spacers are attached to end truck before installing end truck on bridge.
- 5.8 Slide an end truck over festooning end of bridge (refer to the **General Arrangement Drawing** for exact end truck location) and clamp into place (**diagram 5B**).

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.

- 5.9 Slide and position the non-clamping end truck on the other end of bridge (refer to the **General Arrangement Drawing** for exact location).
- 5.10 Go to Step 5.14.

➡ For Coped Aluminum Bridges

- 5.11 Make sure nylon spacers are attached to end truck before installing end truck on bridge.
- 5.12 Slide an end truck over coped brackets on the festooning end of bridge (refer to the **General Arrangement Drawing** for exact end truck location) and clamp into place (**diagram 5C**).

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

- 5.13 Slide and position the non-clamping end truck on the other end of bridge (refer to the **General Arrangement Drawing** for exact location).
- 5.14 At both ends of bridge, install a shear lug bolt in hole at top of bridge (or in the coped brackets) to prevent bridge from sliding out of end trucks (**diagrams 5B & 5C**).

Note: Install bolts with head of bolt on underside of top flange with threads pointing up.

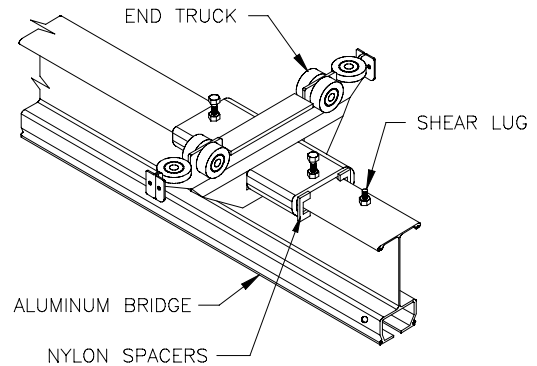


Diagram 5B. Installing clamping end truck on aluminum bridge. See **TIP**.

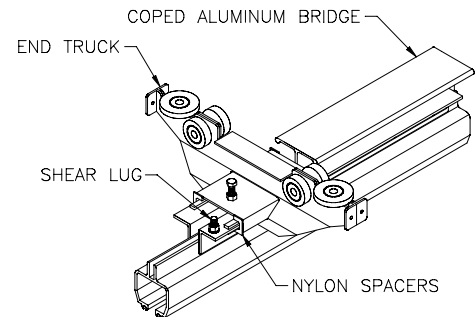


Diagram 5C. Installing clamping end truck on coped aluminum bridge. See **TIP**.

WARNING

Failure to install shear lug bolt assemblies may result in the bridge, hoist, and load falling to the floor.

- 5.15 If a tow arm is not being utilized on the end truck, go to Step 5.40, on page 15.

If a tow arm is being utilized on the end truck, go to Step 5.16, on page 12.

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

STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

- ➔ **TIP:** 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.
- ➔ **TIP:** Extended end truck should be assembled before attaching to bridge.

Standard End Trucks (continued)

- 5.16** Assemble the tow arm weldment on the end truck that will be located on the festooning side of the system (**diagram 5D**). Be sure that the tow arm is located on the festooning side of the end truck itself when installed.
- 5.17** Assemble the tow arm spacer on the end truck located at the opposite end of the bridge (**diagram 5E**). Be sure the spacer is mounted on the same side of the end truck as the tow arm weldment.
- 5.18** After the bridge has been installed, loosen the nuts on the end of the U-bolt enough to thread cable/air hose between the two legs of the U-bolt and the festoon clamp plate. Secure cable/air hose by tightening nuts at the end of the U-bolt, forcing the festoon clamp plate snug against the cable/air hose.

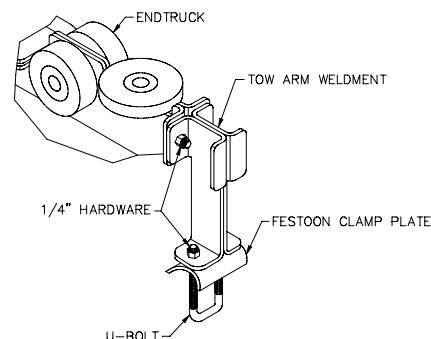


Diagram 5D. Installing tow arm on end truck.

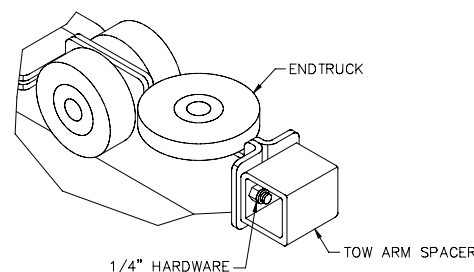


Diagram 5E. Installing tow arm spacer on end truck.

Extended End Trucks

➔ For Steel Bridges

- 5.19** Locate extended end truck tubes, support weldment, wheel plates, and required hardware.
- 5.20** Slide an extended end truck tube halfway through each side of the end truck support weldment (**diagram 5F**). Insert a support bolt in each hole of the support weldment, passing through both end truck tubes and all spacers (if required, **diagram 5G**).
- 5.21** Place nylock nut on end of each bolt and tighten snug against end truck support weldment.

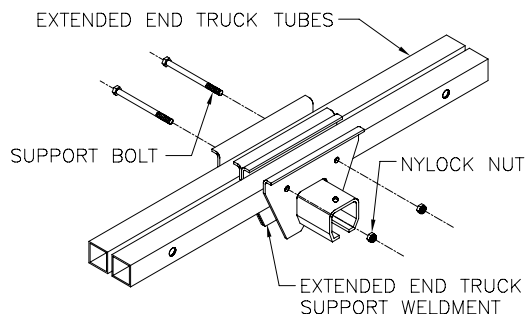


Diagram 5F. Assembling extended end truck.

WARNING

Do not “over-tighten” nylock nut: could cause damage to end trucks. Nylock nut can only be used once. If this item is disassembled, then nut must be replaced.

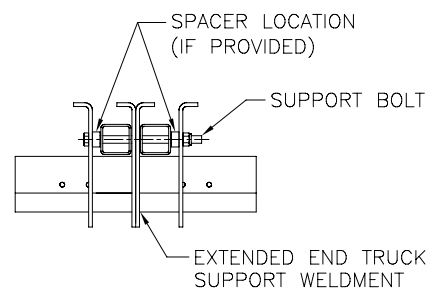


Diagram 5G. Spacer placement (if required)

STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

- ➡ **TIP:** 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.
- ➡ **TIP:** Extended end truck should be assembled before attaching to bridge.

Extended End Trucks (continued)

5.22 Place a wheel plate between the end truck tubes. Insert 1" dia. bolt into first tube, through the wheel plate and out the opposite tube (**diagram 5H**).

5.23 Place nylock nut on end of bolt and tighten snug against extended end truck tube.

Note: Wheel plates should pivot freely.

WARNING

Do not "over-tighten" nylock nut: could cause damage to end trucks. Nylock nut can only be used once. If this item is disassembled, then nut must be replaced.

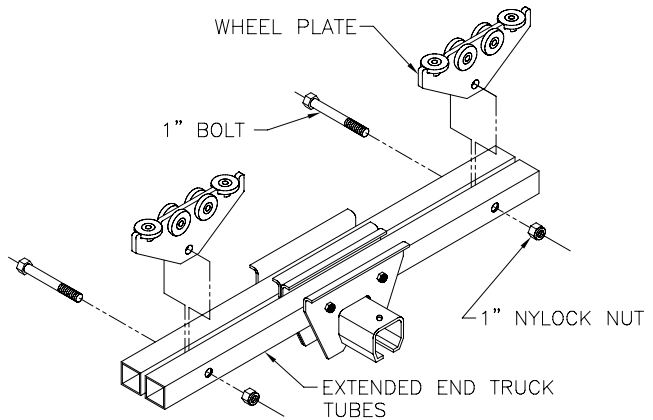


Diagram 5H. Installing wheel plates.

5.24 Repeat steps 5.22 and 5.23 for remaining wheel plate.

5.25 Repeat steps 5.19 to 5.24 for remaining extended end trucks.

5.26 Slide an end truck over festooning end of bridge (refer to the **General Arrangement Drawing** for exact end truck location, end truck sleeve should be 1" from first vertical) and clamp into place (**diagram 5I**).

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.

5.27 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 should be 1" from first vertical).

5.28 Go to Step 5.40, on page 15.

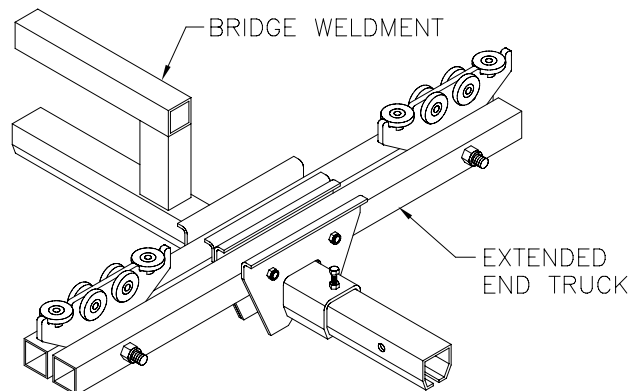


Diagram 5I. Installing extended clamping end truck.
See **TIP**.

STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

- ➔ **TIP:** 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.
- ➔ **TIP:** Extended end truck should be assembled before attaching to bridge.

Extended End Trucks (continued)

➔ For Aluminum Bridges

- 5.29 Make sure nylon spacers are attached to end truck before installing end truck on bridge.
- 5.30 Locate extended end truck tubes, support weldment, wheel plates, and required hardware.
- 5.31 Slide an extended end truck tube halfway through each side of the end truck support weldment (**diagram 5J**). Insert a support bolt in each hole of the support weldment, passing through both end truck tubes and all spacers (if required, **diagram 5K**).
- 5.32 Place nylock nut on end of each bolt and tighten snug against end truck support weldment.

WARNING

Do not “over-tighten” nylock nut: could cause damage to end trucks. Nylock nut can only be used once. If this item is disassembled, then nut must be replaced.

- 5.33 Place a wheel plate between the end truck tubes. Insert 1” dia. bolt into first tube, through the wheel plate and out the opposite tube (**diagram 5L**).
- 5.34 Place nylock nut on end of bolt and tighten snug against extended end truck tube.

Note: Wheel plates should pivot freely.

WARNING

Do not “over-tighten” nylock nut: could cause damage to end trucks. Nylock nut can only be used once. If this item is disassembled, then nut must be replaced.

- 5.35 Repeat steps 5.33 and 5.34 for remaining wheel plate.
- 5.36 Repeat steps 5.29 to 5.35 for remaining extended end trucks.

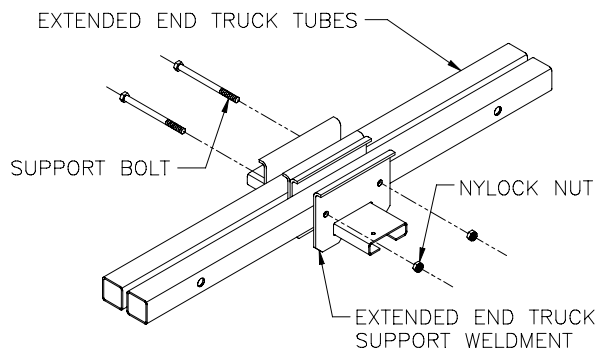


Diagram 5J. Assembling extended end truck.

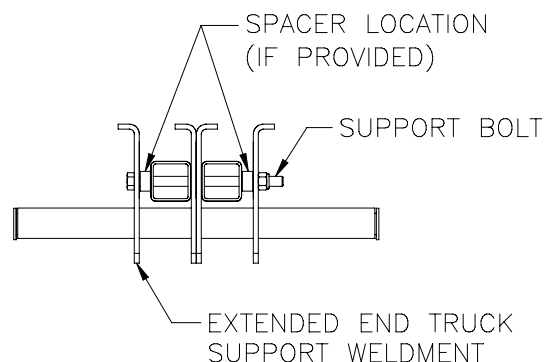


Diagram 5K. Spacer placement (if required)

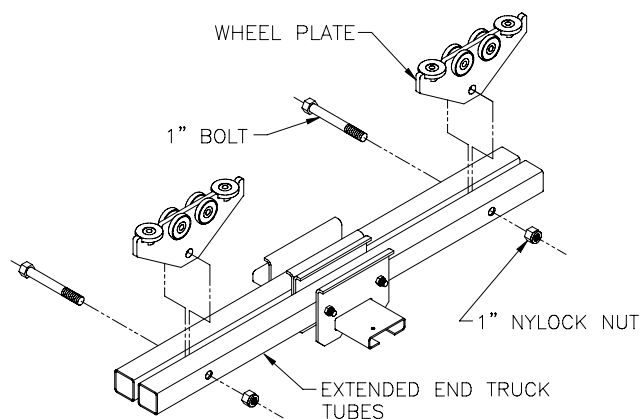


Diagram 5L. Installing wheel plates.

STEP 5 - BRIDGE AND END TRUCK INSTALLATION (CONTINUED)

➔ **TIP:** 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 20 for festooning). The non-clamping end truck allows adjustment for any runway misalignment.

Extended End Trucks (continued)

- 5.37** Slide an end truck over festooning end of bridge (refer to the **General Arrangement Drawing** for exact end truck location) and clamp into place (**diagram 5M**).

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.

- 5.38** Slide and position the non-clamping end truck on the other end of bridge (refer to the **General Arrangement Drawing** for exact location).

- 5.39** At both ends of bridge, install a shear lug bolt in the hole in the coped brackets to prevent bridge from sliding out of end trucks (**diagram 5M**).

Note: Install bolts with head of bolt on underside of top flange with threads pointing up.

WARNING

Failure to install shear lug bolt assemblies may result in the bridge, hoist, and load falling to the floor.

- 5.40** Install an end stop to the end of the bridge opposite the festooning (**diagrams 5N or 5O**).

- 5.41** 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 20.

- 5.42** **Immediately** install end stops in open ends of runways to prevent bridge from exiting runways (**diagrams 5N or 5O**).

- 5.43** 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 8) and check to make sure that only one end truck on bridge is clamped.

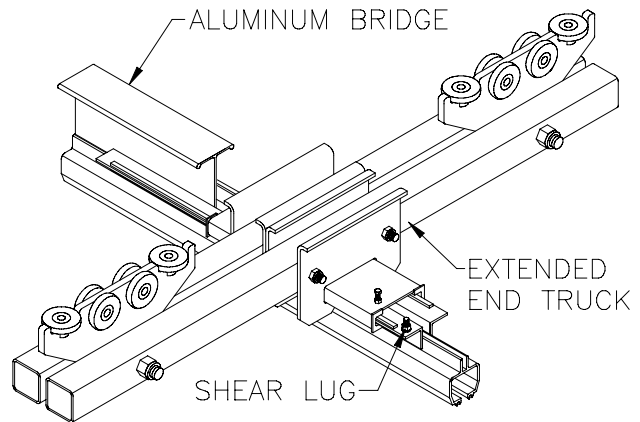


Diagram 5M. Installing extended clamping end truck. See **TIP**.

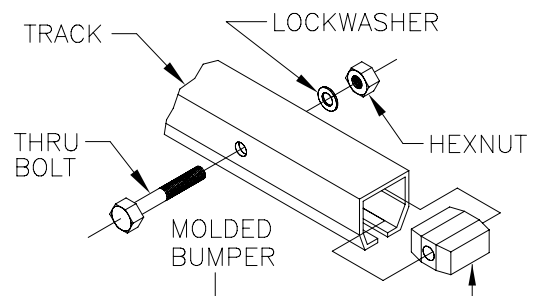


Diagram 5N. Installing end stop.

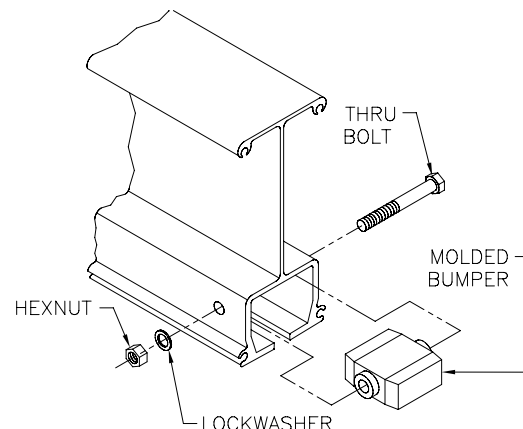
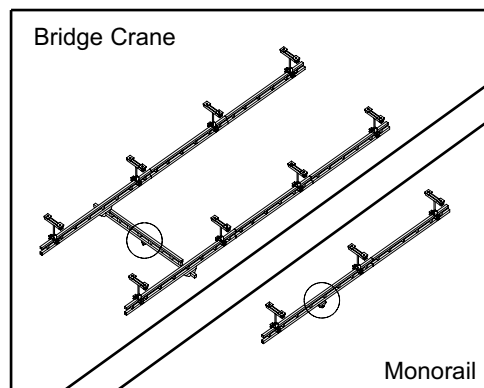
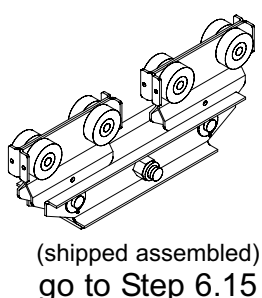
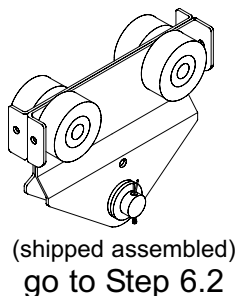


Diagram 5O. Installing end stop.

STEP 6 - HOIST TROLLEY INSTALLATION

6.1 If your hoist trolley looks like:



150#, 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**).

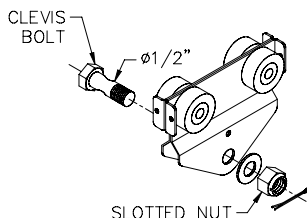


Diagram 6A. Installing hoist on 150-250# hoist trolley.

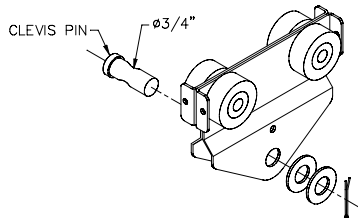


Diagram 6B. Installing hoist on 500# hoist trolley.

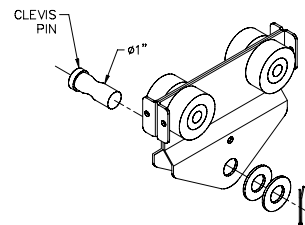


Diagram 6C. Installing hoist on 1000-2000# hoist trolley.

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 17.

If a tow arm **is** being utilized on the trolley, go to Step 6.8, on page 17.

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.

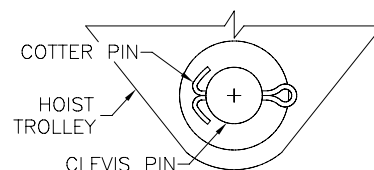


Diagram 6D. Installing cotter pin through trolley saddle clevis pin.

STEP 6 - HOIST TROLLEY INSTALLATION (CONTINUED)

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.

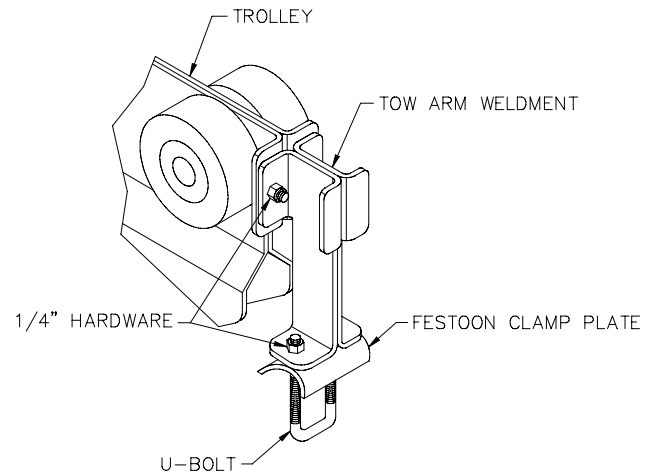


Diagram 6E. Installing tow arm on trolley.

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 3E**, on page 8).

6.14 If you have tagline, go to Step 9, on page 24.

If you **do not** have festooning, go to Step 11, on page 28.

If you **do not** have a festoon stack section, go to Step 8, on page 20.

Otherwise go to Step 7, on page 19.

STEP 6 - HOIST TROLLEY INSTALLATION (CONTINUED)

Loadbar Hoist Trolley, 4000# Steel / 2000# - 4000# Aluminum

- 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**).

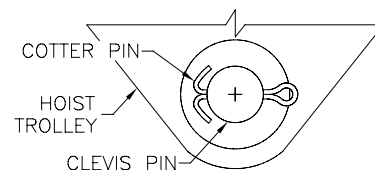


Diagram 6F. Installing cotter pin through trolley saddle clevis pin.

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.

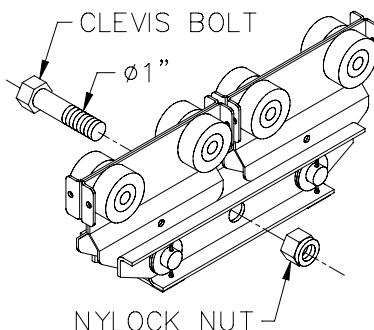


Diagram 6G. Installing hoist on loadbar hoist trolley.

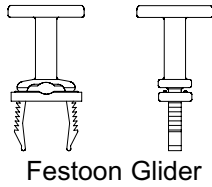
- 6.20 Roll hoist trolley into open end of track on bridge/monorail.
- 6.21 Install end stop on festooning end of bridge/monorail (**diagram 3E**, on page 8).
- 6.22 If you have tagline, go to Step 9, on page 24.
- If you **do not** have festooning, go to Step 11, on page 28.
- If you **do not** have a festoon stack section, go to Step 8, on page 20.
- Otherwise go to Step 7, on page 19.

STEP 7 - FESTOON STACK SECTION INSTALLATION

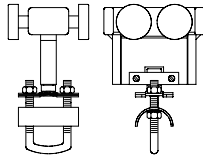
- ➡ **TIP:** Festoon stack section allows festooning to stack up at the end of the system, permitting full use of runway/monorail.

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

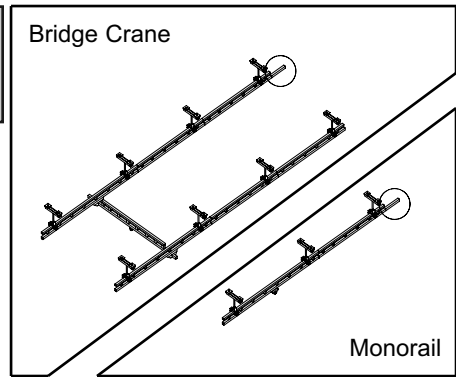
- ➡ **For All Systems With Festoon Gliders, or Systems With Festoon Trolleys and 1000, 2000, or 4000 Series Track (diagram 7A)**



Festoon Glider



Festoon Trolley



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.

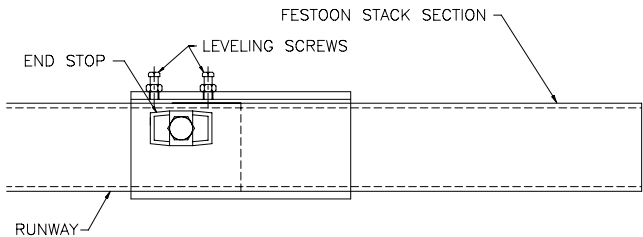


Diagram 7A. Installing festoon stack section.

- ➡ **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.

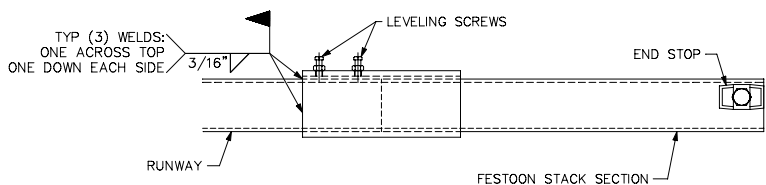
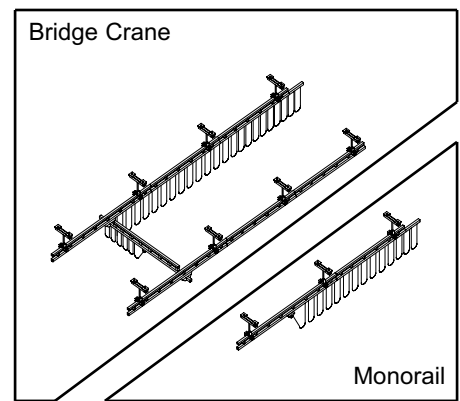


Diagram 7B. Welding festoon stack section on 250-500# series track.

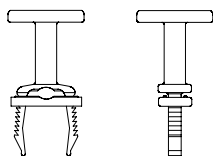
7.8 Install end stop (removed in step 7.1) in end of festoon stack section (**diagram 7B**).

STEP 8 - FESTOONING INSTALLATION

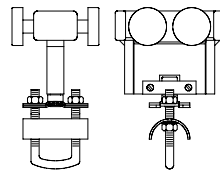
- ➔ **TIP:** Festoon gliders are comprised of a glider body (with upper saddle) and lower saddle (a separate piece that clips onto the glider body).
- ➔ **TIP:** Enough carriers (festoon gliders or festoon trolleys) are supplied to support festoon conductor every 6' on runway/monorail and every 3' on bridges.
- Note:** Every 6' on vacuum hose trolley.



8.1 If you are using:



festoon gliders, go to Step 8.2



festoon trolleys, go to Step 8.7

Festoon Gliders (Steel Bridges / Runways only)

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 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 22.

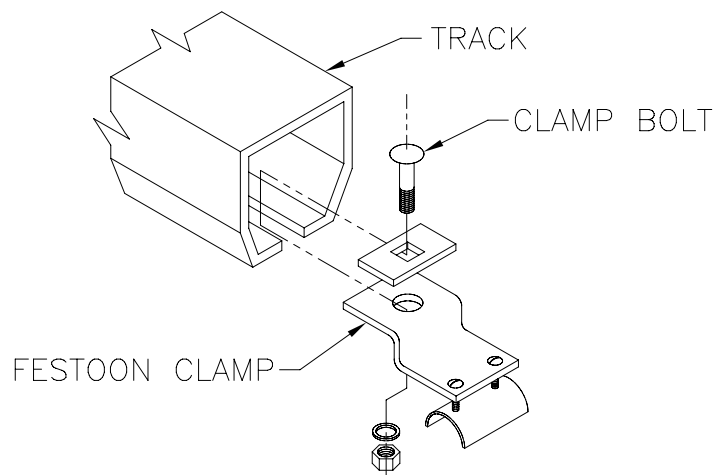


Diagram 8A. Installing festoon clamp on runway or bridge.

STEP 8 - FESTOONING INSTALLATION (CONTINUED)

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

Festoon Trolleys

If you have a monorail go to Step 8.11.

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**, page 20, or **8B**).

8.10 Re-install end stop (molded bumper with through bolt) in festooning end of bridge (**diagram 8C**).

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**, page 20, or **8B**).

8.14 For 250 or 500 series track:

Re-install end stop in runway/monorail/festoon stack section (**diagram 8C**).

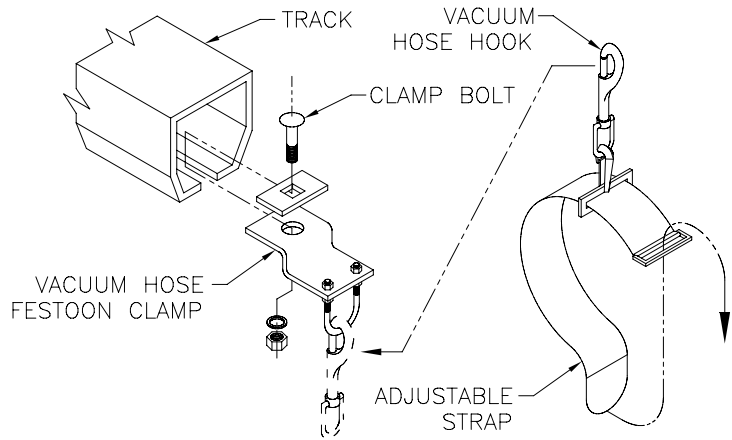


Diagram 8B. Installing vacuum hose clamp on runway or bridge.

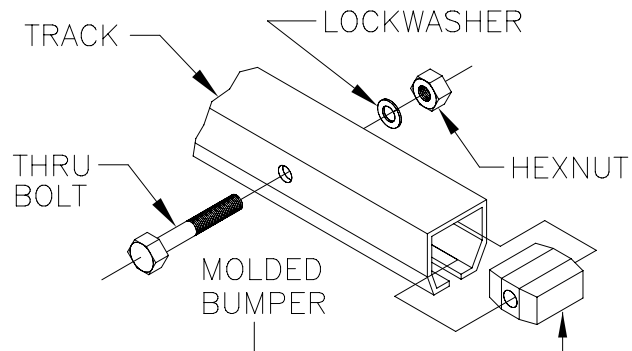


Diagram 8C. Installing end stop on runway/monorail/festoon stack section.

STEP 8 - FESTOONING INSTALLATION (CONTINUED)

8.15 Installing Festoon Electric Cable/Air Hose/Vacuum Hose:

Gliders are designed to accept 4-conductor, electric flat cable (#12 or #14 gauge).

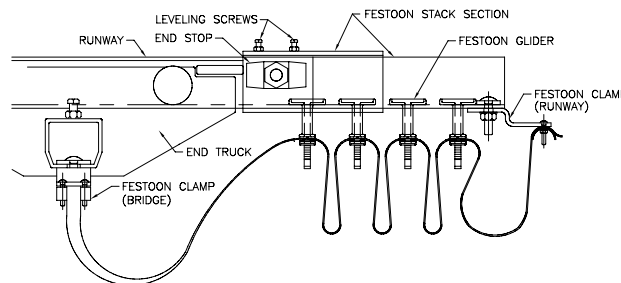
Festoon trolleys are designed to accept 4-conductor, electric flat or round cable (#12 or #14 gauge) or air hose (maximum: 7/8" outside diameter).

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.

Diagram 8D. Installing electric cable on festoon glider.

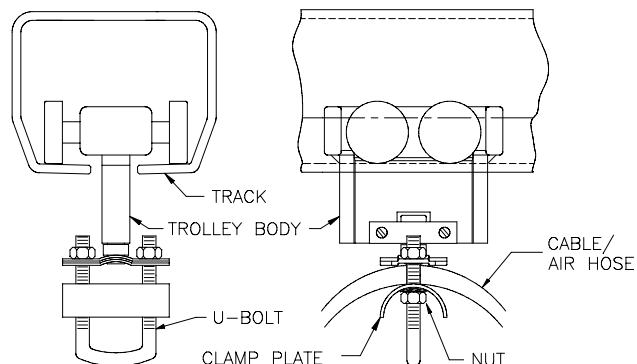


Diagram 8E. Installing electric cable or air hose on festoon trolley.

➡ **Cable/Air Hose Installation Tips:** 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.

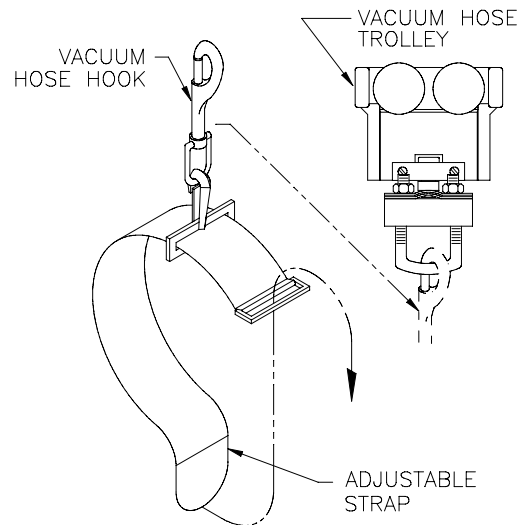


Diagram 8F. Installing vacuum hose on vacuum hose trolley.

STEP 9 - BRIDGE AND RUNWAY TAGLINE INSTALLATION

➡ Steel Track (Bridges and Runways)

- 9.1 Slide tagline brackets onto each end of bridge and/or runway and tighten clamp hardware (**diagrams 9A** and **9B**).

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

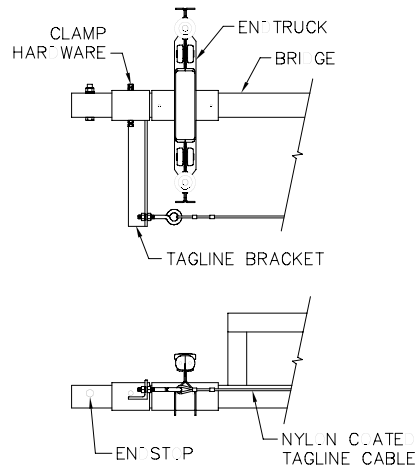


Diagram 9A. Tagline on steel bridge.

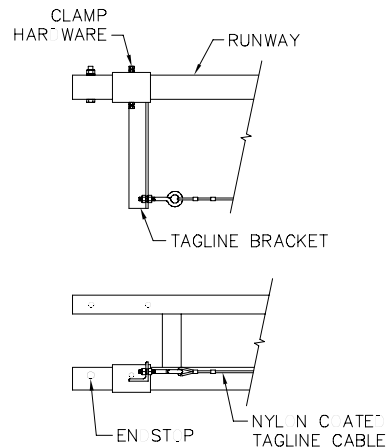


Diagram 9B. Tagline on steel runway.

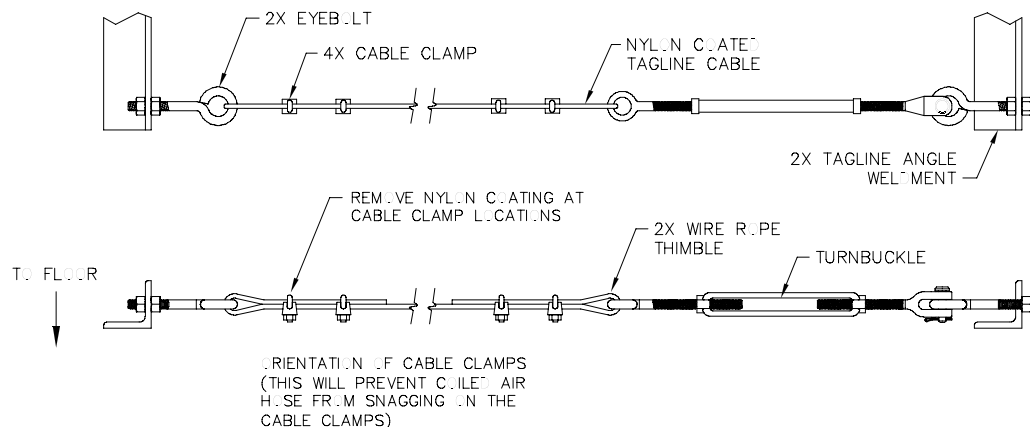


Diagram 9C. Tagline cable assembly.

- 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.

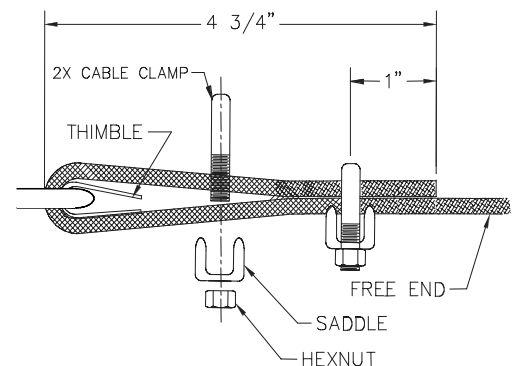


Diagram 9D. Saddling the cable on one end.

STEP 9 - BRIDGE AND RUNWAY TAGLINE INSTALLATION (CONTINUED)

► Aluminum Track (Bridges and Runways)

9.5 Attach tagline brackets to aluminum track web (*diagrams 9E, 9F and 9G*).

Note: Do not forget to install the backing angle on the web opposite to the tagline angle.

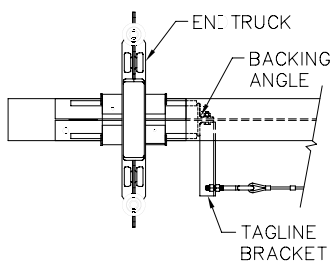


Diagram 9E. Tagline on coped aluminum bridge.

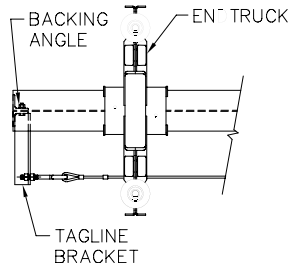


Diagram 9F. Tagline on non-coped aluminum bridge.

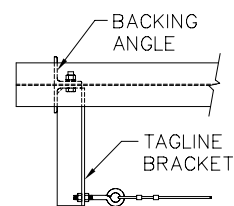
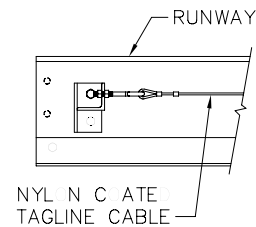
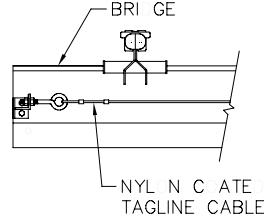
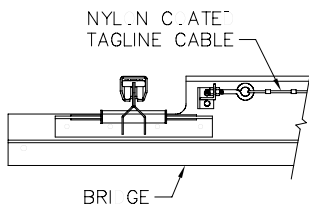


Diagram 9G. Tagline on aluminum runway.



9.6 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. or torque (*diagram 9D*).

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

9.8 Secure other end of the cable as in Step 9.6.

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**).

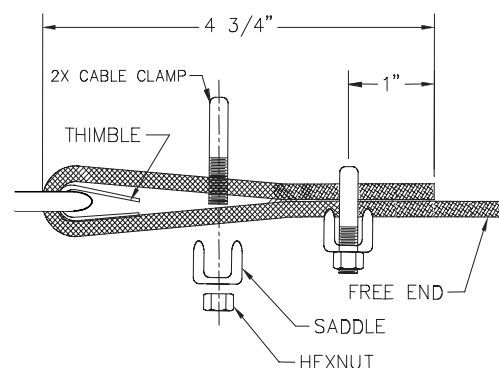


Diagram 10A. Saddling the cable on one end.

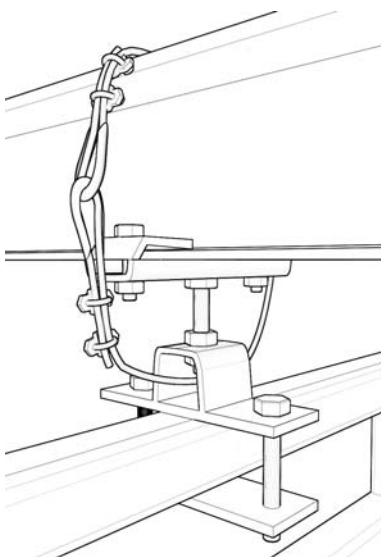


Diagram 10B. Safety cable installed on ceiling mounted hanger connection.

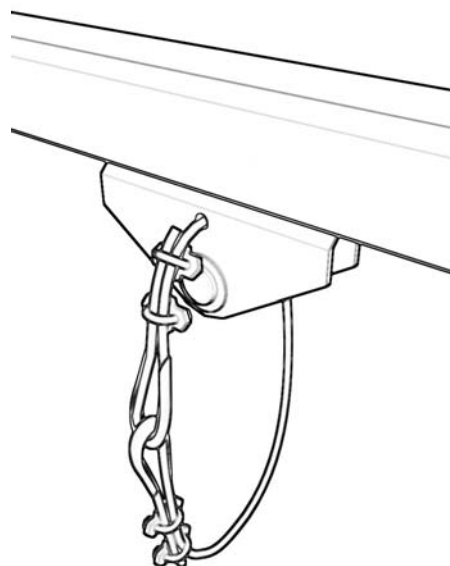


Diagram 10C. Safety cable installed on Gorbel® trolley that will attach to hoist (by others).

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**.

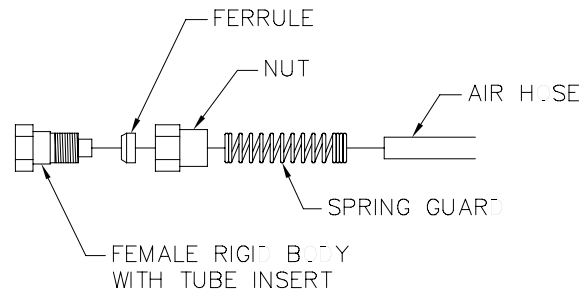


Diagram 10D. Female fitting assembly.

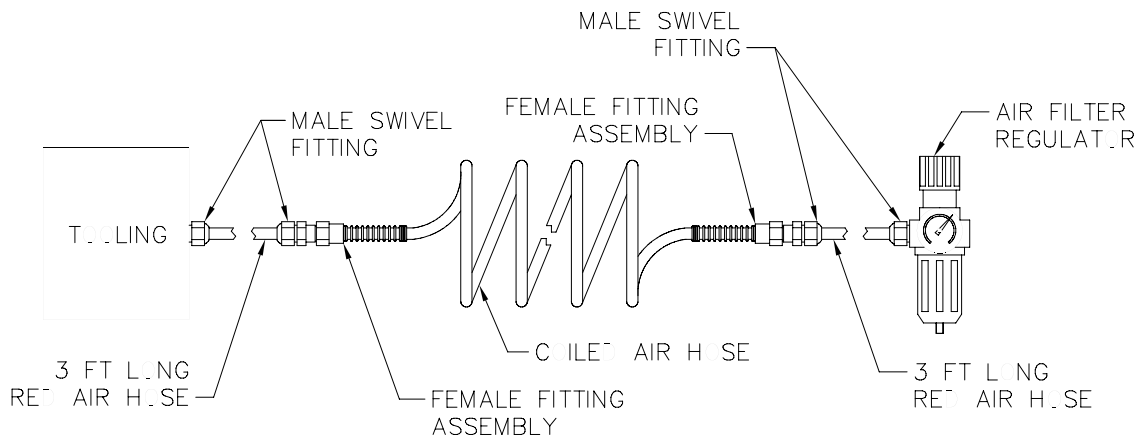


Diagram 10E. Coiled air hose assembly.

STEP 10 - OPTIONAL ACCESSORIES (CONTINUED)

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*).

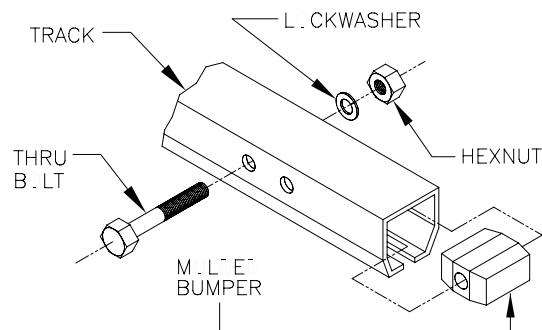


Diagram 10F. Installing endstop.

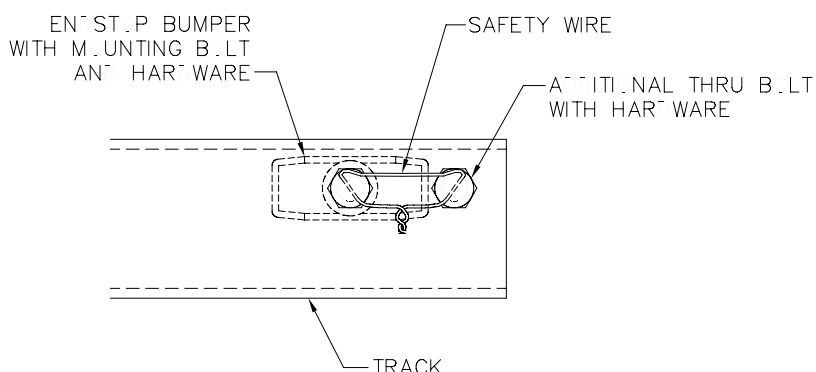


Diagram 10G. Double wired end stop.

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.

STEP 11 - FINAL STEPS

➡ **TIP:** Do not throw away this manual: the maintenance schedule is on the back cover.

- 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.

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 = Live Load
- R1 = Vertical Load applied by support hanger (lb.)
- R2 = Longitudinal load applied by movement of the crane to each runway (lb.)
- R3 = Lateral load applied by movement of the trolley and load to each runway (lb.)
- L1 = Maximum distance between hanger centerlines (support centers) (ft)
- L2 = Maximum splice joint centerline to hanger centerline (support center) (in)
- L5 = Maximum bridge cantilever
- L9 = Maximum runway cantilever
- L4 = Bridge span (distance between runway centerlines) (ft)
- 1.4 = Design factor which includes 25% for impact and 15% for hoist weight
- W = Weight per foot of runway (lb./ft)
- w = 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.

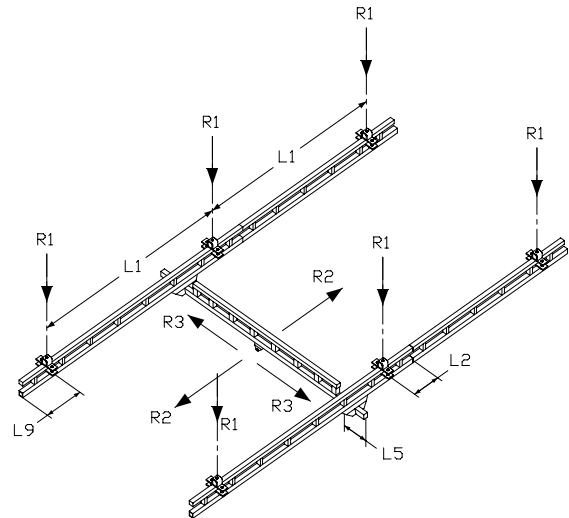


Diagram 1. Applied forces to supporting structure.

INSTALLATION PARAMETERS						
CAPACITY	SERIES	WEIGHT PER FOOT	MAX. L1	MAX. L2	MAX. L5	MAX. L9
250#	GLC	2.55#	6'	8"	18"	18"
	GLCS	4.88#	20'	48"	18"	48"
	AL	4.00#	20'	30"	48"	48"
	GLCSL	8.14#	25'	48"	18"	48"
500#	GLC	4.11#	6'	8"	24"	20"
	GLCS	7.23#	20'	48"	24"	48"
	AL	4.70#	20'	30"	48"	48"
	GLCSL	10.94#	25'	48"	24"	48"
	GLCSLX	11.26#	30'	48"	24"	48"
1000#	GLC	6.50#	6'	8"	24"	20"
	GLCS	12.09#	20'	48"	24"	48"
	AL	8.30#	20'	30"	48"	48"
	GLCSL	13.37#	25'	48"	24"	48"
	GLCSLX	15.31#	30'	48"	24"	48"
2000#	GLC	9.00#	6'	8"	24"	24"
	GLCS	14.59#	20'	48"	24"	48"
	AL	10.20#	20'	30"	48"	48"
	GLCSL	20.14#	25'	48"	24"	48"
	GLCSLX	20.95#	30'	48"	24"	48"
4000#	GLC	9.00#	6'	8"	24"	24"
	GLCS	18.42#	20'	48"	24"	48"
	GLCSL	23.83#	25'	48"	24"	48"
	GLCSLX	28.02#	30'	48"	24"	48"

$$R1 = (1.4 * P) + (W * L1) + \frac{(w * L4)}{2}$$

$$R2 = (1.15 * P) + \frac{[(w * L4) * 0.10]}{2}$$

$$R3 = 1.15 * P * 0.20$$

SWAY AND THRUST BRACING GUIDELINES

➔ **TIP:** Sway bracing is not required on systems with flush mounted hangers.

WARNING

Bracing must be installed to resist damaging lateral and longitudinal loads.

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 midpoint 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

Size	Area (in ²)	r (in)	Max. Length (ft)	Allowable Force (kips)
1" Ø pipe SCH 40	0.49	0.421	10.5	0.81
1" Ø pipe SCH 80	0.64	0.407	10.17	1.06
L 2" x 2" x 1/4"	0.94	0.609	9.75	1.56
L 2 1/2" x 2 1/2" x 1/4"	1.19	0.769	12.28	1.98
L 3" x 3" x 1/4"	1.44	0.930	14.80	2.39

K = Effective Length Factor for a Prismatic Member (see AISC manual)

L = Length of Brace

r = Radius of Gyration

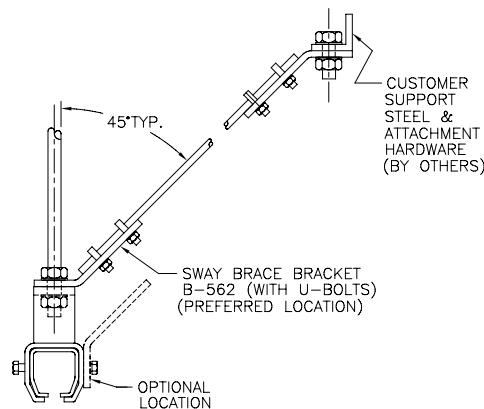
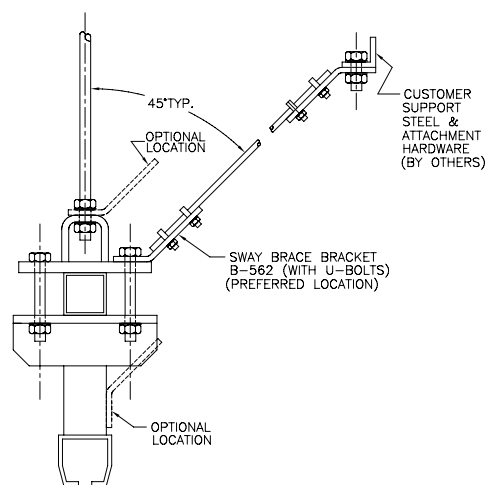
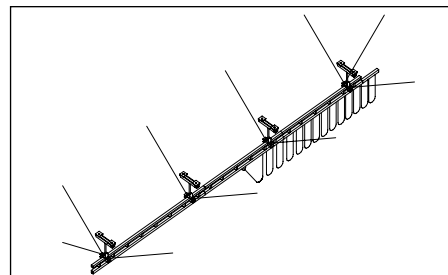
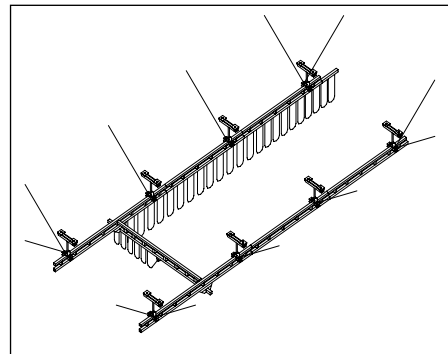


Diagram 1. Typical Connection detail.

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

Crane operation, 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

Crane 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 hooks 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 locked 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 of 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 GORBEL 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 GORBEL 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. Gorbel Incorporated ("Gorbel"), warrants the manual push-pull Work Station Cranes, Jib Crane, and Gantry 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. Gorbel warrants the Motorized Work Station Cranes and Jib 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. Gorbel warrants the G-Force® and Easy Arm™ products to be free from defects in material or workmanship for a period of one year or 2,000 hours use from the date of shipment. This warranty shall not cover failure or defective operation caused by operation in excess of recommended capacities, misuses, negligence or accident, and alteration or repair not authorized by Gorbel. No system shall be modified after manufacture without the written authorization of Gorbel, Inc. Any field modification made to the system without the written authorization of Gorbel, Inc. shall void Gorbel'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 GORBEL WITH RESPECT TO ITS PRODUCTS AND ALL SUCH WARRANTIES ARE HEREBY SPECIFICALLY DISCLAIMED. GORBEL 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. Gorbel's obligation and Purchaser's or end user's sole remedy under this warranty is limited to the replacement or repair of Gorbel's products at the factory, or at the discretion of Gorbel, at a location designated by Gorbel. Purchaser or end user shall be solely responsible for all freight and transportation costs incurred in connection with any warranty work provided by Gorbel hereunder. Gorbel 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 Gorbel are not included in this warranty. Purchaser's or end user's remedy for components and accessories not manufactured by Gorbel 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

Gorbel 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

Gorbel 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

Gorbel's agents, or dealer's agents, or distributor's agents may have made oral statements about the machinery and equipment described in this transaction. Such statements do not constitute warranties, and Purchaser agrees not to rely on such statements. Purchaser also agrees that such statements are not part of this transaction.

D) DISCLAIMER OF SPECIAL, INCIDENTAL AND CONSEQUENTIAL DAMAGES

Gorbel and Purchaser agree that any claim made by Purchaser which is inconsistent with Gorbel's obligations and the warranty remedies provided with Gorbel's products, and in particular, special, incidental and consequential damages, are expressly excluded.

E) DEALER OR DISTRIBUTOR NOT AN AGENT

Gorbel and Purchaser agree that Purchaser has been put on notice that dealer or distributor is not Gorbel's agent in any respect for any reason. Gorbel 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 Gorbel's behalf other than those specifically set forth in Gorbel'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 with each crane ordered (unless special paint was specified). If additional paint is required, contact a Gorbel® Customer Service Representative at 1-800-821-0086 or 1-585-924-6262.

Title and Ownership:

Title to the machinery and equipment described in the foregoing proposal shall remain with Gorbel 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. Gorbel 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 Gorbel 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 become due and payable by Purchaser to Gorbel. 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 Gorbel up to the time of cancellation plus 15%.

Returns:

No equipment, materials or parts may be returned to Gorbel 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 Gorbel for expense, if any, incident to such delay.

Changes and Alterations:

Gorbel 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 Gorbel is not obligated to make such changes in products previously sold any customer.

Third Party Action:

Should Gorbel 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:

Gorbel 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 Gorbel, 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:

Gorbel 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. Gorbel 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

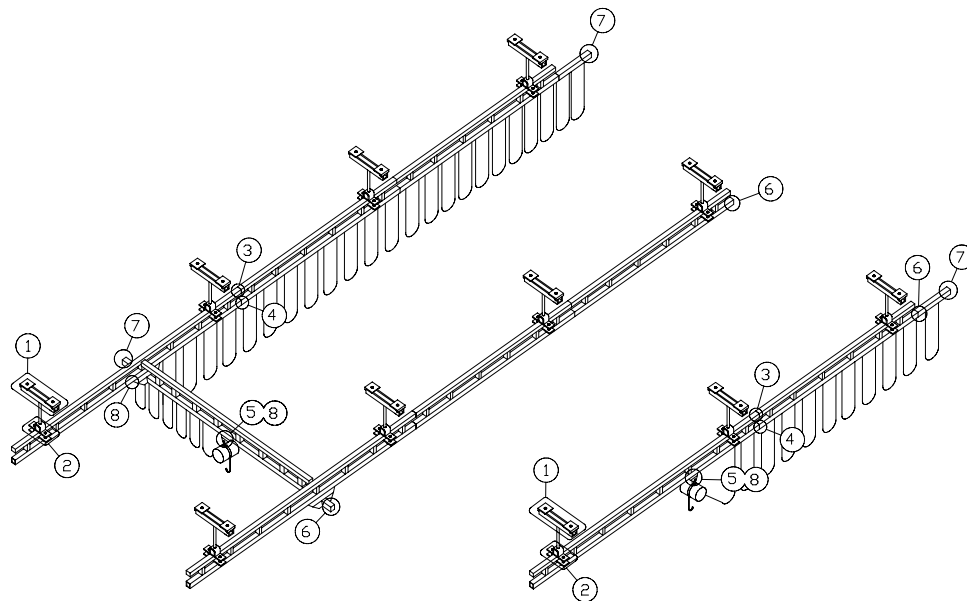
GORBEL® WORK STATION CRANE AND MONORAIL: INSPECTION AND MAINTENANCE SCHEDULE			
ITEM	COMPONENT	MAINTENANCE	FREQUENCY*
1	Top Hanger Bracket/Beam Clips/Threaded Rod	Check that lockwashers are compressed and nuts tightened to manufacturer's specifications.	Every 2,000 hours or yearly
2	Lower Hanger Bracket	Check that lockwashers are compressed and nuts tightened to manufacturer's specifications.	Every 2,000 hours or yearly
3	Truss Splice Plate	Check that lockwashers are compressed and nuts tightened to manufacturer's specifications.	Every 2,000 hours or yearly
4	Splice Joint	All bolts should be in contact with track. Check track for alignment and that wheel rolling surface is flush.	Every 2,000 hours or yearly
5	Hoist Trolley	Check clevis pin. Check cotter pin. (Cotter pin should be fully wrapped around clevis pin.) Check clevis bolt and hardware.	Every 2,000 hours or yearly
6	End Stops (runway/bridge/monorail)	Check for full compression of lockwasher. If thru-bolt is exposed, replace endstops.	Every 2,000 hours or yearly
7	Festoon Cable Clamp or Vacuum Hose Clamp	Check for full compression of lockwasher.	Every 2,000 hours or yearly
8	Wheels	Check for cracks, pits, and/or grooves: all of these increase pull forces. If any of these conditions exist, wheels should be replaced.	Every 2,000 hours or yearly
9	Aluminum Bridge Assembly Hardware	Check that lockwashers are compressed and nuts tightened to torque specifications (Chart 2A, page 2).	Every 2,000 hours or yearly

***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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