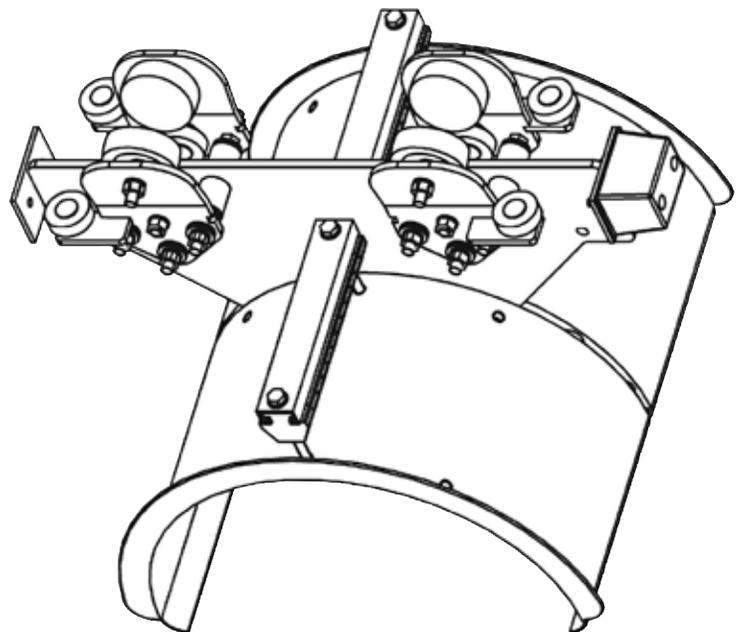


Festoon Heavy Duty



Conductix Incorporated

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1.0 Safety

1.1 Electrical Warnings

- 1.1.1 Properly ground all electrical connections in accordance with the National Electric Code and local codes and ordinances.
- 1.1.2 Disconnect the electrical power from the system before any service is performed.
- 1.1.3 Do not use cable for loads greater than the voltage and current rating. The ampacity rating of the cable should be in accordance with the National Electric Code.

1.2 Operational Warnings

- 1.2.1 Exercise care when handling the festoon system during normal operation.
- 1.2.2 Do not use cable different from that for which the system is intended. Changes in diameter, weight per foot, length of cable or flexibility will affect the operation of the system.
- 1.2.3 Mounting hardware and fasteners should be installed to maintain tightness under vibration and checked periodically to insure tightness. (See Torque Specifications Table, page 11.)

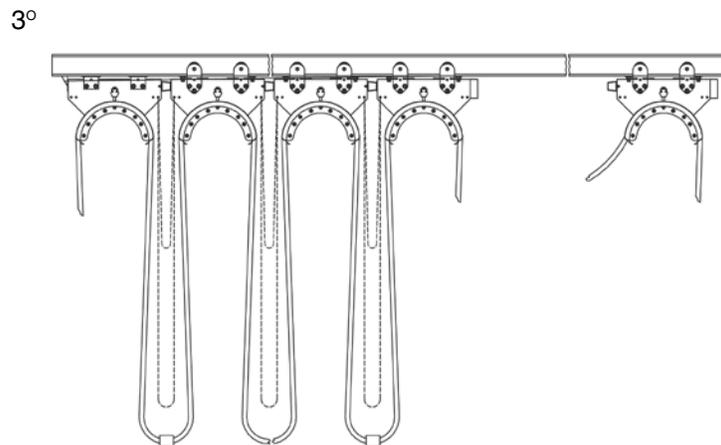
1.3 Maintenance Warnings

- 1.3.1 **WARNING:** Modification of this equipment may cause excessive wear and will void the warranty.
Contact the manufacturer regarding changes or modifications of equipment which could affect reliability or safety.

2.0 Installation

2.1 I-Beam

- 2.1.1 Festoon trolleys are designed to run on most standard S and W shaped I-beams. The type and size of beam must be adequate for the application.
- 2.1.2 For uniformity and dimensional tolerances, purchase I-beams from the same production runs.
- 2.1.3 Weld and grind smooth all beam joints, especially around the lower flange where the rollers run. Avoid splice plates and bolts since they can interfere with trolley movement during operation.
- 2.1.4 We recommend elevating, approximately 3 degrees, the section of the system I-beam where the festoon system is stored, as shown in the diagram. This facilitates movement of the system out of the stored position.
- 2.1.5 The support structure for the I-beam must be adequately designed for the system loads. Install the system I-beam parallel to the crane runway with sufficient clearance to avoid any interference with the moving trolleys and/or possible cable sway.

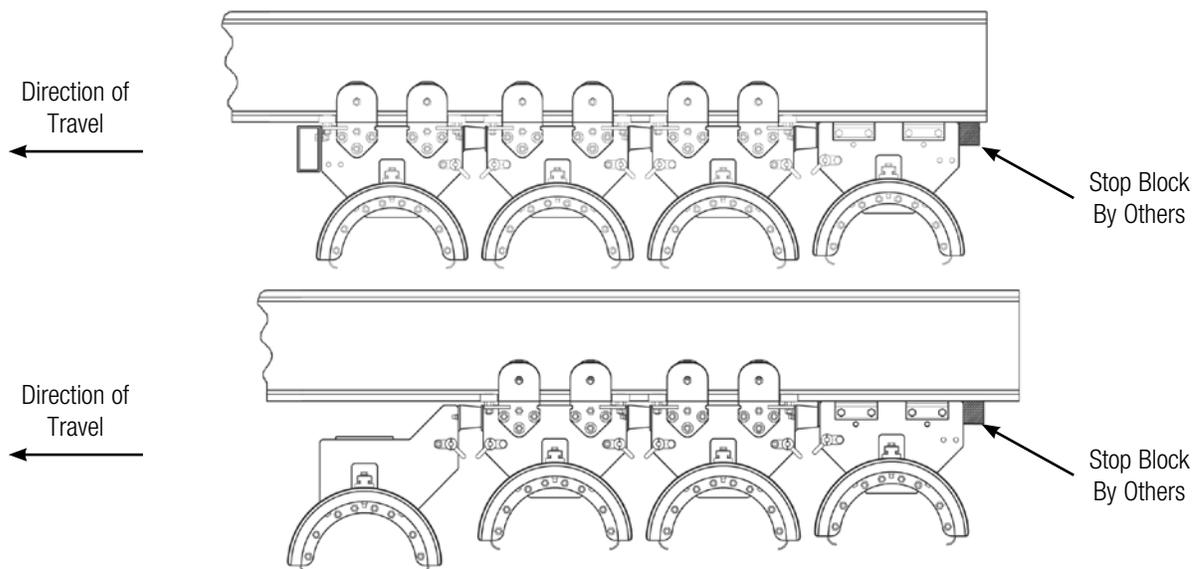


2.0 Installation

2.2 Installation of System on I-Beam

2.2.1 A typical festoon system is comprised of one tow trolley or tow clamp, several trolleys and one end clamp.

Install on the I-beam as shown in the following diagrams:



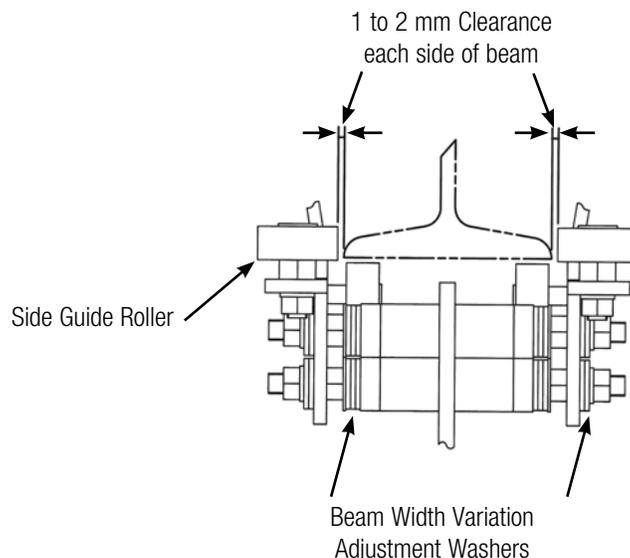
2.2.2 **Tow Trolley:** Connect to the crane via customer supplied tow arm. The end of the tow arm must fit centrally into the rectangular opening of the tow trolley and protrude through the opening such that it will not become disengaged during operation. Note: The tow arm should never be physically attached to the tow trolley. The tow trolley is set from the factory for the beam size specified when ordered. See trolley section below if adjustment is required.

2.2.3 **Tow Clamp** (if required): Use in place of a tow trolley and connect to the crane via a customer supplied tow arm made of channel iron. Bolt the tow clamp to the tow arm using 1/2" diameter high strength (Grade 8) bolts. Torque nuts to 85 ft-lbs. (115.2 N*m). (Make sure bolt threads are clean and dry.)

2.2.4 **Trolley:** Set from the factory for the beam size specified when ordered. The rollers are set for the nominal dimensions of the beam, however, if required, adjust to fit the beam properly. The side guide rollers should have a maximum clearance of 0.08" (2 mm) on each side of beam. As needed, increase or decrease this space by adding or removing adjustment washers as shown in the diagram.

2.2.5 **End Clamp:** Bolt to the underside of the I-beam using 1/2" diameter high strength (Grade 8) bolts. Torque nuts to 85 ft-lbs. (115.2 N*m). (Make sure bolt threads are clean and dry.) Drill a minimum of four 9/16" diameter holes in the lower flange for mounting of the end clamp. After mounting, verify that the bumper of the adjacent trolley contacts the end clamp bumper plate. If required, add shims between the beam and the end clamp so that the bumper makes proper contact. Minimum contact is approximately one half of bumper height.

2.2.6 After installing and positioning the system properly, weld a stop block to the underside of the I-beam adjacent to the back of the end clamp to help resist the impact on the mounting bolts during operation (see diagram for 2.2.1).



2.0 Installation

2.3 Installation of Cables

2.3.1 Before beginning the installation of cables, remove the cable clamping pad assemblies from the tow trolley, trolleys, and end clamp.

2.3.2 Install cables on the equipment per the pre-designed arrangement or the following rules:

2.3.2.1 Round Cables

2.3.2.1.1 Keep diameter variation between adjacent cables to a minimum. Large variations in diameters make clamping difficult and cables may not remain secure during operation (see diagram). A maximum of 5/8" height difference between adjacent cables is permissible. For larger differences consult factory.

2.3.2.1.2 Arrange cables in the following order:

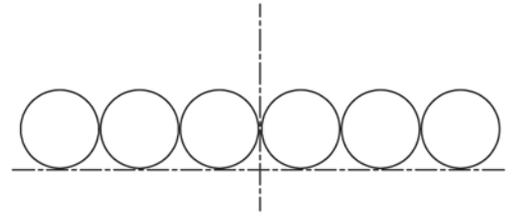
2.3.2.1.2.1 Place the two largest cables in the outer-most positions of the support saddle.

2.3.2.1.2.2 Arrange the remaining cables between these two cables, taking care to place the heaviest cables near the centerline of the trolley and the lighter cables to the outer positions (see diagram). It is important to balance the cable load about the trolley center plates for smooth running and longer bearing life.

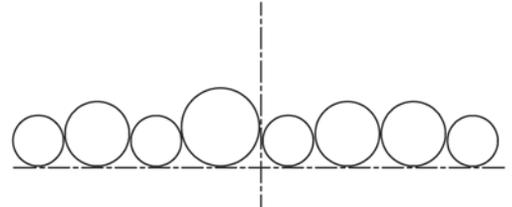
2.3.2.2 Flat Cables

2.3.2.2.1 Arrange cables with the larger cables (power cables) on top of the stack (see diagram below). This provides a larger bending radius as well as improved heat dissipation. Since the top cable also takes more pulling force during operation, the larger conductor is better suited to handle this force.

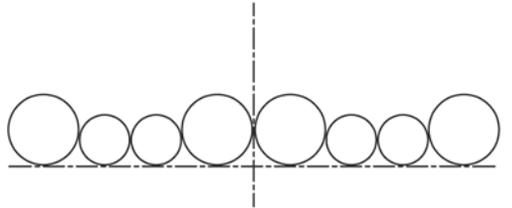
BEST



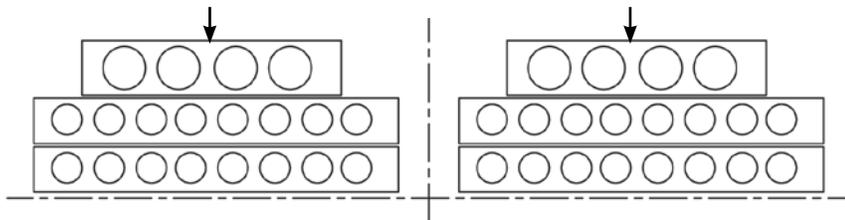
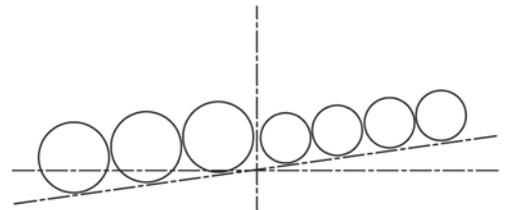
POOR



BEST

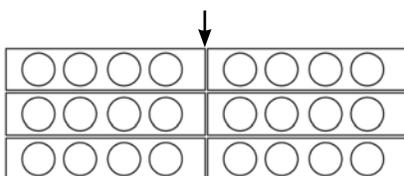


POOR

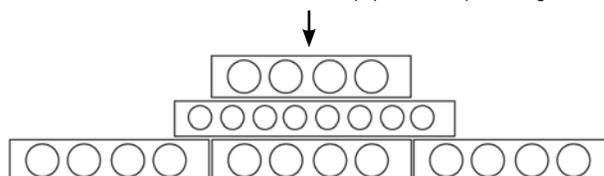


2.3.2.2.2 Arrange cable packages with a width to height ratio of 3 or 4 to 1. Tall narrow cable stacks can be unstable during operation.

2.3.2.2.3 Arrange cables with a minimum of 50% of each cable surface under clamp pressure (see diagram below).



BEST

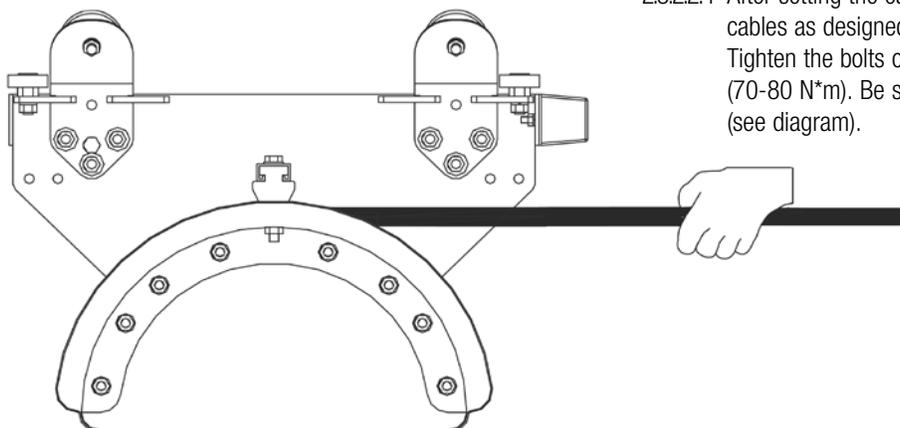


POOR

2.0 Installation

2.3 Installation of Cables Cont.

2.3.2.2.4 After setting the cables to their proper loop depth and arranging the cables as designed, re-install the cable clamping pad assemblies. Tighten the bolts on the clamping pad assemblies to 52-59 ft-lbs. (70-80 N*m). Be sure the smallest cables do not move when pulled (see diagram).



2.4 Installation of Cable Organizers

2.4.1 We recommend cable organizers for systems in order to prevent adjacent cables within each loop from becoming tangled during operation. Depending on the loop depth, either one or two per loop may be required. The recommended guidelines are:

2.4.1.1 For flat cable, always use two organizers per loop (see Figure 2).

2.4.1.2 For loop depths up to seven feet, use one organizer per loop. Position the organizer in the lower apex of the loop (see Figure 1).

2.4.1.3 For loop depths over seven feet, use two organizers per loop. Position the organizers in the lower third of the loop, making sure to stagger the organizers on each side of the loop (see Figure 2).

2.4.2 Round Cable Organizers

2.4.2.1 Install organizer with the outer-most cables of the loop securely clamped between the end brackets. Position the remaining cables between the organizer rods, thereby permitting free movement of the cables. Note: If the sum of the diameters of two adjacent cables is less than the distance between the two rods of the organizer, install a cable separator to prevent the cables from becoming tangled during operation (see diagram below). Please check the catalog for the proper separator required.

2.4.2.2 Torque bolts of round cable organizer to 15-22 ft-lbs. (20-30 N*m).

Note: Organizer shown with cables.

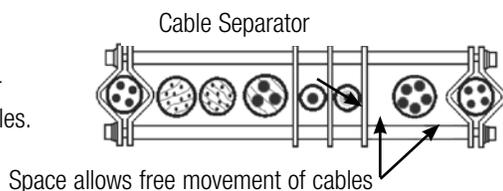


Figure 1

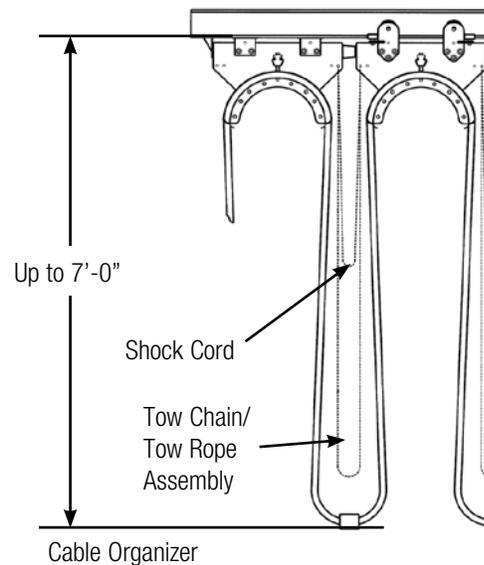
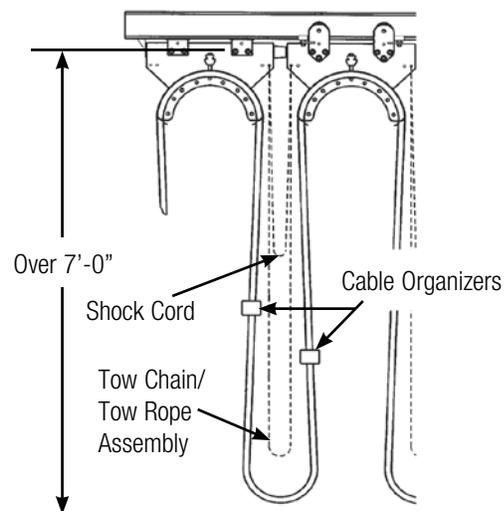


Figure 2



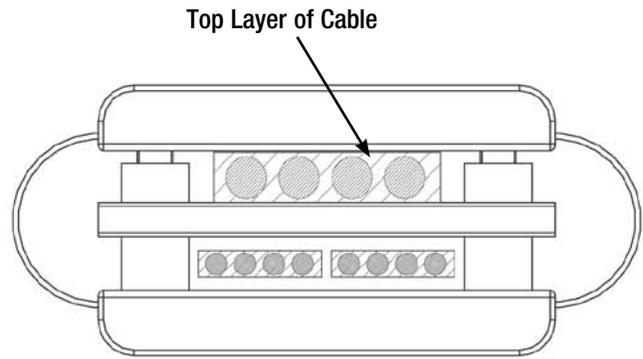
2.0 Installation

2.4 Installation of Cable Organizers Continued

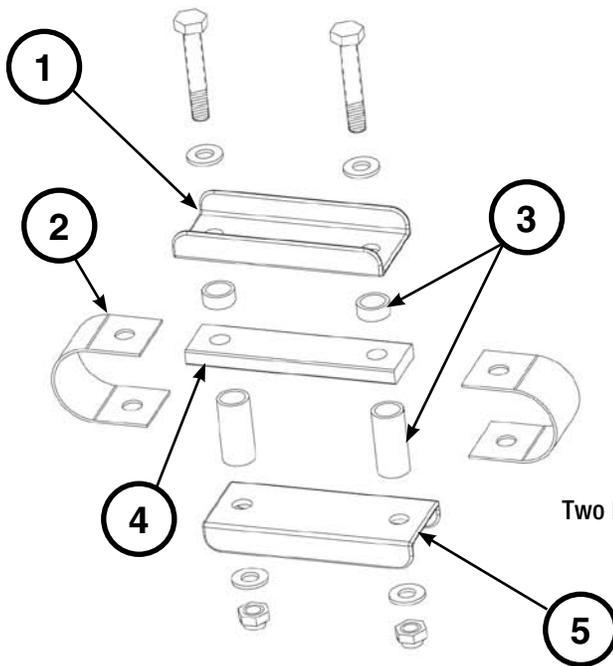
2.4.3 Flat Cable Organizer

2.4.3.1 Install organizer with the top layer of cables securely clamped between the plate and clamping bar (see Sec. 2.3.2.2, page 5; also Figures 1 and 2, page 6). Position the remaining cables between the plate and floating bar, thereby permitting free movement of the cables.
(See diagram.)

2.4.3.2 Torque bolts of flat cable organizer to 52-59 ft-lbs. (70-80 N*m).

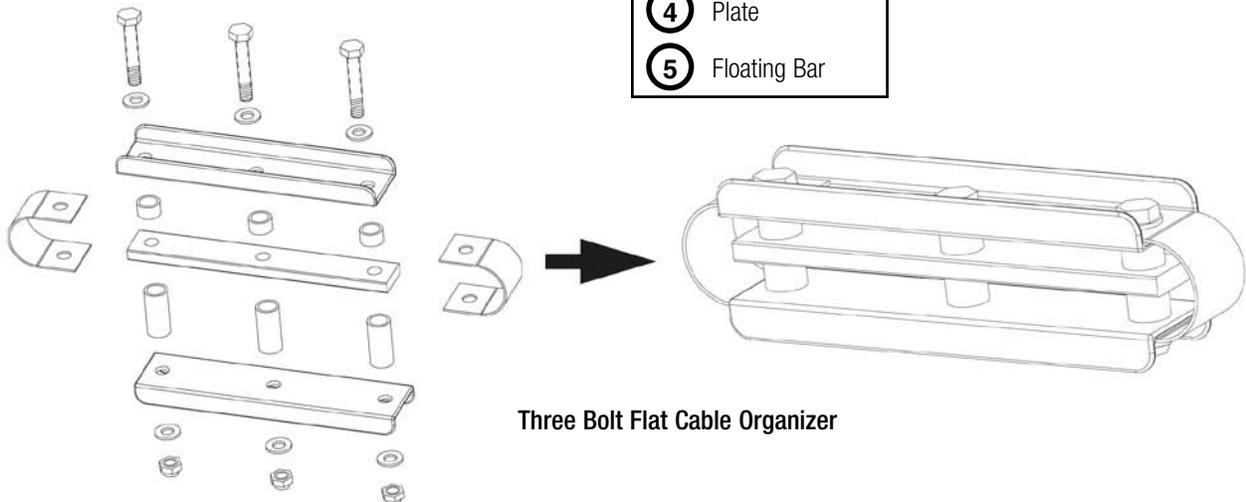


Flat Cable Organizer (Shown with Cables)



Two Bolt Flat Cable Organizer

- | | |
|---|--------------|
| 1 | Clamping Bar |
| 2 | Side Guard |
| 3 | Spacers |
| 4 | Plate |
| 5 | Floating Bar |

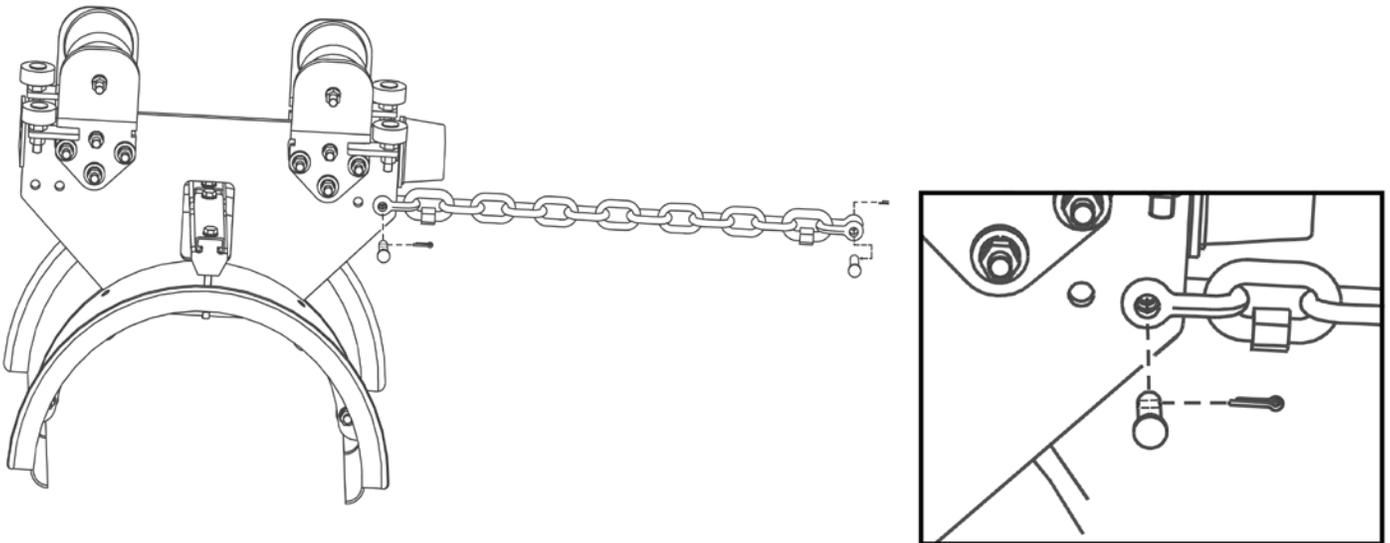


Three Bolt Flat Cable Organizer

2.0 Installation

2.5 Installation of Tow Ropes/Tow Chains

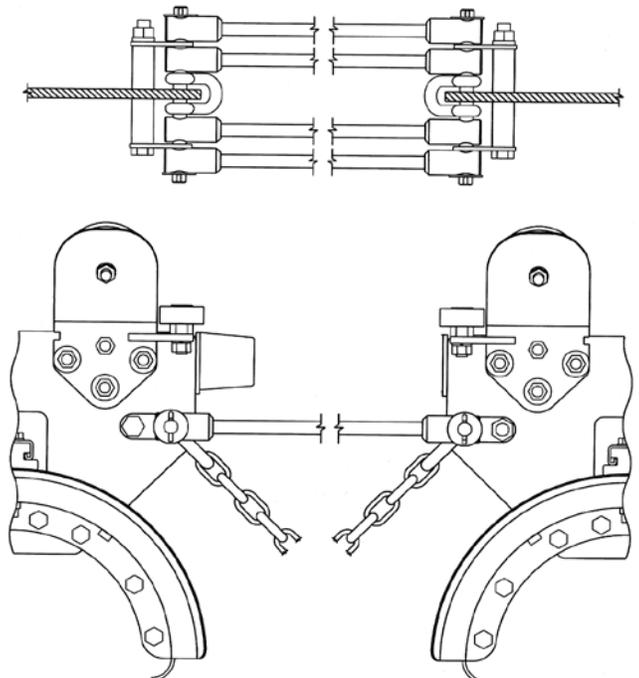
- 2.5.1 Install tow ropes or tow chains in each loop of the system by attaching the steel shackles provided with each rope/chain assembly to the trolleys, tow trolley, or end clamp. During installation of tow rope or tow chains, make sure each rope or chain is not twisted or tangled and hangs freely within the loop (see diagram for 2.4.1.2, page 6).
- 2.5.2 When installing tow rope and chains in conjunction with shock cord assemblies, the shackle pin and cotter pin will not be required (see diagram in Sec. 2.6).



Install cotter pin after inserting pin through center plate and shackle.

2.6 Installation of Shock Cords

- 2.6.1 If required, install shock cords to trolleys, tow trolleys, and end clamps with either the tow rope or tow chain assembly. Install the shock cord bracket per the diagram. Torque the nuts to 77-81 ft-lbs. (105-110 N*m). During installation, make sure the shock cords are not twisted or tangled and hang freely within the loop. Please note that the shock cord loop must be shorter than both the electrical cable and the tow rope/tow chain.
- 2.6.2 To replace a worn or broken shock cord, remove the pin from the shock cord mounting bracket. Remove the worn rope and replace with the new cord. Again, make sure the cord is not twisted or tangled within the loop.
- 2.6.3 **Note:** If one or more cords within a loop are worn or broken, replace all the cords within that loop.



2.0 Installation

2.7 Installation Instructions For Pre-Assembled Festoon System

- 2.7.1 Pre-assembled festoon systems are typically built and shipped on steel shipping frames by Insul-8 Corp. To install the system onto the beam at the joist please follow these steps:
- 2.7.1.1 Upon arrival at the job-site, inspect the festoon system to insure electrical cables and festoon components have not been damaged during transit.
 - 2.7.1.2 To insure easy transfer from shipping frame I-beam onto permanent I-beam, prepare end of beams by eliminating any burrs or rough edges and drill holes in the lower flange at the fixed end to accept end clamp.
 - 2.7.1.3 Attach hoisting cables at each end of the shipping frame (depending on the length of the shipping frame, intermediate hoisting locations may be required) and lift shipping frame into position. I-beam on shipping frame must line-up with permanent festoon I-beam.
 - 2.7.1.4 Caution: Load may shift to the mobile end of the shipping stand while transferring the festoon system onto the permanent I-beam.
 - 2.7.1.5 Once the I-beams are aligned, clamp the beams together to insure that they do not separate while transferring the festoon system from the shipping frame to the permanent I-beam.
 - 2.7.1.6 After the I-beams are clamped together, remove the hardware on the shipping frame so that the tow trolley can be rolled onto the permanent I-beam.
 - 2.7.1.7 Roll the tow trolley and succeeding trolleys onto the permanent I-beam. Remove the end clamp from the shipping stand I-beam and attach it to the permanent I-beam using the holes drilled as specified in Section 2.2.5 of the installation instructions.
 - 2.7.1.8 Make mechanical connection of customer supplied towing arm to crane and festoon system per Section 2.2.2 of the installation instructions.
 - 2.7.1.9 Make electrical connections as required.

3.0 Operation

3.1 Pre-Operation Inspection

- 3.1.1 Check for proper mounting of end-clamp.
- 3.1.2 Check for obstructions of beam joints.
- 3.1.3 Check cable clearances, that cables are hanging properly and are not tangled.
- 3.1.4 Check that tow arm is not disengaged from tow trolley during test operation and remains within the confines of the tow box.

3.2 Operation Instructions

- 3.2.1 Do not exceed the voltage or ampere rating of the cable. Overheating, fire, damage to equipment or personal injury could result.
- 3.2.2 Operate the festoon system within the electrical and mechanical limits for which it was intended.

4.0 Maintenance

4.1 Maintenance Instructions

- 4.1.1 In general, since all trolley rollers are lubricated and sealed for life, no re-greasing is required. However, customer should conduct periodic inspections of the system. Determine the inspection intervals based on severity of duty cycle and environment. We recommend the following checks during inspection:
- 4.1.2 Check all rollers for wear.
- 4.1.3 Check tightness of all hardware. (See Torque Specifications table on page 10.)
- 4.1.4 Check cable clamp of all trolleys, making sure cables remain secure.
- 4.1.5 Inspect cable insulation for any cuts or cracks.
- 4.1.6 Check bumper condition.
- 4.1.7 Check all accessories, tow ropes and tow chains, shock cords and cable organizers.
- 4.1.8 Inspect running beam for wear, clean running surface of any debris.

Part Description	Part Description	Part Description	Part Description
Running Gear Kits		Trolley	
Main Roller	77-81 ft-lbs. / 105-110 N*m	Saddle Assembly	100-106 ft-lbs. / 136-144 N*m
Main Roller (Flanged)	44-48 ft-lbs. / 60-65 N*m	Bumper	20-22 ft-lbs. / 27-30 N*m
Auxiliary Roller	44-48 ft-lbs. / 60-65 N*m	Cable Clamp Pad Assembly	52-59 ft-lbs. / 70-80 N*m
Spacer Kit Assembly	100-106 ft-lbs. / 136-144 N*m	Bumper Extension Kit	15-22 ft-lbs. / 20-30 N*m
Shock Cord Assembly	77-81 ft-lbs. / 105-110 N*m	Round Cable Organizer	15-22 ft-lbs. / 20-30 N*m
		Flat Cable Organizer	52-59 ft-lbs. / 70-80 N*m
<p>Note: Apply anti-seize compound (DISCO 902 or equivalent) to all stainless steel hardware.</p>			

5.0 Troubleshooting

5.1 Troubleshooting Applications

5.1.1 Thoroughly review each installation. The following is a general list of factors to consider:

- 5.1.1.1 The influence of wind and other ambient conditions.
- 5.1.1.2 The alignment of track beams.
- 5.1.1.3 The installation of beam in storage area (2-3 degree slope).
- 5.1.1.4 The types of cables installed.
- 5.1.1.5 The operating conditions, which include:
 - 5.1.1.5.1 Main travelling area of crab.
 - 5.1.1.5.2 Travel cycles.
 - 5.1.1.5.3 Approximate cycle speeds.
 - 5.1.1.5.4 Various crab positions during operation.
 - 5.1.1.5.5 Influence of the crane operator.

5.1.2 The main step necessary is to observe the system in operation and to record and measure the reaction of the loops and trolleys. The following table is a list of typical problems and possible solutions:

PROBLEM	POSSIBLE CAUSE	SOLUTION
Loops at end clamp are whipping.	1) Cable reserve length is insufficient. 2) Cable loop weight. 3) Speed is too fast.	Installation of shock cords in the last 2 to 3 loops.
Loops at tow trolley/tow clamp end are whipping.	1) Very high acceleration. 2) Very high speed. 3) Weight of cable trolleys is too heavy compared to weight of cable loop.	Installation of shock cords in the first 2 to 3 loops. Verify length of tow rope/chain per calculations in Heavy-Duty Festoon Catalog.
Loops in middle are whipping.	1) Operation cycle varies (e.g. bulk handling crane).	Install shock cords in every loop.
All loops are whipping (Typically on high-speed systems with either light cable loops or short loop depth.)	1) Cable loops impart only small force components for the acceleration of the trolleys 2) Towing rope/chains are too short.	Install shock cords in every loop to assist in the acceleration of the trolleys.

Notes

Notes

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