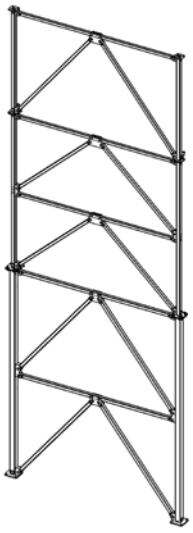

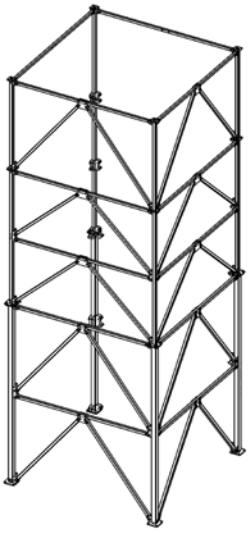

# 2-Leg and 4-Leg QuickBolt™ Towers

Installation Manual

## PNEG-2115

**Version 2.0**

**Date: 10-15-19**

PNEG-2115

**All information, illustrations, photos, and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.**

# Contents

# NOTES

# 1 Safety Precautions

**Topics Covered in this Chapter**

- Safety Guidelines
- Cautionary Symbol Definitions
- Safety Precautions
- Safety Sign-off Sheet

## Safety Guidelines

Safety guidelines are general-to-specific safety rules that must be followed at all times. This manual is written to help you understand safe operating procedures and problems that can be encountered by the operator and other personnel when using this equipment. Read and save these instructions.

As owner or operator, you are responsible for understanding the requirements, hazards, and precautions that exist and to inform others as required. Unqualified persons must stay out of the work area at all times.

Alterations must not be made to the equipment. Alterations can produce dangerous situations resulting in SERIOUS INJURY or DEATH.

This equipment must be installed in accordance with the current installation codes and applicable regulations, which must be carefully followed in all cases. Authorities having jurisdiction must be consulted before installations are made.

When necessary, you must consider the installation location relative to electrical, fuel and water utilities.

Personnel operating or working around equipment must read this manual. This manual must be delivered with equipment to its owner. Failure to read this manual and its safety instructions is a misuse of the equipment.

ST-0001–4

# Cautionary Symbol Definitions

Cautionary symbols appear in this manual and on product decals. The symbols alert the user of potential safety hazards, prohibited activities and mandatory actions. To help you recognize this information, we use the symbols that are defined below.

**Table 1-1** *Description of the different cautionary symbols*

| Symbol | Description |
|---|---|
|  | This symbol indicates an imminently hazardous situation which, if not avoided, **will result in serious injury or death.** |
|  | This symbol indicates a potentially hazardous situation which, if not avoided, **can result in serious injury or death.** |
|  | This symbol indicates a potentially hazardous situation which, if not avoided, **can result in minor or moderate injury.** |
|  | This symbol is used to address practices not related to personal injury. |
|  | This symbol indicates a general hazard. |
|  | This symbol indicates a prohibited activity. |
|  | This symbol indicates a mandatory action. |

ST-0005–2

# Safety Precautions

This is all the topics contained in the Master Safety Reference File. Mainly used to verify formatting before releasing the topic.

**Use Personal Protective Equipment**

- Use appropriate personal protective equipment:

**Eye Protection**

**Respiratory Protection**

**Foot Protection**

**Hearing Protection**

**Head Protection**

**Fall Protection**

**Hand Protection**

- Wear clothing appropriate to the job.
- Remove all jewelry.
- Tie long hair up and back.

ST-0004–1

**Follow Safety Instructions**

- Carefully read all safety messages in this manual and safety signs on your machine. Keep signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from the manufacturer.
- Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.
- If you do not understand any part of this manual or need assistance, contact your dealer.

ST-0002–1

**Sharp Edge Hazard**

- This product has sharp edges, which can cause serious injury.
- To avoid injury, handle sharp edges with caution and always use proper protective clothing and equipment.

ST-0036–2

**Toxic Fume and Dust Hazard**

- Do all work outside or in a well-ventilated area. Dispose of paint and solvent properly.
- Remove paint before welding or heating:
  - — Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.
  - — If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
  - — If you use solvent or paint-stripper, remove stripper with soap and water before welding.
  - — Remove solvent or stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating

ST-0043–2

**Stay Clear of Hoisted Equipment**

- Always use proper lifting or hoisting equipment when assembling or disassembling equipment
- Do not walk or stand under hoisted equipment.
- Always use sturdy and stable supports when needed for installation. Not following these safety precautions creates the risk of falling equipment, which can crush personnel and cause serious injury or death.

ST-0047–1

**Avoid Falls During Service and Installation**

- Use proper fall protection equipment.
- Anchor the bottom of any ladder being used in a bin or silo to prevent it from slipping.
- Use rubber pads or other anti-slip devices to prevent the ladder from slipping on the bin floor.
- Exercise caution when using a ladder to perform work in a partially filled grain bin. The ladder can sink into the grain and cause a fall.
- Because the equipment is suspended from chains in the center, be cautious of positioning the ladder against the equipment. The equipment can move or swing from the weight of a person climbing on the ladder.
- When setting a ladder against the equipment, a vise grip or other type of tie down must be used in the front and back of the track drive unit. This keeps the equipment from rolling or sliding around the bin while service work is being performed.
- During heavy service work, such as removing the auger drive, electric motors, or replacing electrical swivel, tying the ladder to the main frame or other solid component is advised.
- Never climb out on the main beam or augers from the ladder or roof manhole. The equipment can swing, causing a fall.
- Do not climb Stir-Ator down augers to make adjustments or repairs. Slipping can cause falling, bodily injury, or both.
- If an unusual amount of service work needs to be performed, consider lowering the unit onto sawhorses.

ST-0010–2

**Fall Hazard**

- Ladders, stairways and platforms are for use by competent and trained personnel only. Do not allow children or other unauthorized persons to have access to the equipment.
- Access to the equipment must be restricted by the use of security fencing and lockable gates.
- Lower sections of ladders must be fitted with a lockable safety gate to prevent unauthorized access.
- Make sure that hot surfaces have had adequate time to cool before working on or in the equipment.
- Lock out and tag out power supplies and fuel supplies to all equipment.
- Do not attach lifting equipment to ladders or platforms.
- Do not go outside of the safety rails provided on elevated platforms.
- Do not work at heights during high winds, rain, snow, or ice storms.

ST-0056–1

**Fall Hazard**

- Keep access door closed while on a platform to avoid falls.
- Always use proper personal protective equipment and proper clothing when using equipment. Failure to follow safety precautions can result in severe injury or death.

ST-0042–2

**Platform Load Limit**

- The platform load limit is 500 LBS (2.25 kN). Do not exceed this weight.
- Excessive load will damage the platform and cause platform to fall. Severe injury or death will result.


ST-0044–2

**Ladder Load Limit**

- The ladder load limit is 300 LBS (1.34 kN). Do not exceed this weight.
- Excessive load will damage the ladder and severe injury or death will result.
- Ladders, stairways and platforms are for use by competent and trained personnel only. Do not allow children or other unauthorized persons to have access to the equipment.
- Access to the equipment must be restricted by the use of security fencing and lockable gates.
- Lower sections of ladders must be fitted with a lockable safety gate to prevent unauthorized access.
- Lock out and tag out power supplies to all equipment.
- Do not attach lifting equipment to ladders .
- Do not work at heights during high winds, rain, snow, or ice storms.


ST-0059–2

## Safety Sign-off Sheet

Below is a sign-off sheet that can be used to verify that all personnel have read and understood the safety instructions. This sign-off sheet is provided for your convenience and personal record keeping.

| Date | Employee Name | Supervisor Name |
|---|---|---|
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ST-0007

# 2 General Information

**Topics Covered in this Chapter**

- Overview
- Required Specifications
- Hole Preparation
- Anchor Washers
- Top Tower Beams
- Bin Guy Kit for 2-Leg Towers
- Seal Plate Kit
- Tower Erection

## Overview

1. All A325 bolts in splice connections are to be tightened by the turn-of-the-nut method. Bracing bolts are to be “snug-tight” only.
2. All GSI provided steel is hot dipped galvanized per ASTM-123A/123M.
3. No bridge members can be removed at any time unless it was designed for it. Drawings will show exact layout of members and how they are to be installed.
4. No tower members can be removed at any time unless it was designed for it. Drawings will show exact layout of members and how they are to be installed.

## Required Specifications

1. Steel W sections are ASTM A992, A709 or A572 Grade 50.
2. Steel channels, angles and S sections are ASTM A36.
3. Steel HSS is ASTM A500 GR B, 46 KSI.
4. All structural bolts are A325 unless otherwise specified.
5. All field welds are 3/16 in. (0.48 cm) min. size fillet weld E60XX or E70XX.
6. All grade 8 bolts are to be installed in snug-tight condition.

## Hole Preparation

1. Since GSI steels are galvanized, bolt holes may be smaller than the requirement due to the build up of galvanizing around the holes.
2. The bolt holes are usually 1/16” greater than the bolts in diameter.
3. The holes may be deburred so that the bolt can be inserted through the holes.

# Anchor Washers

1. GSI specifies a diameter and grade of anchor rod.
2. GSI provides anchor washers corresponding to the recommended sizes.

| Recommended Maximum Sizes for Anchor-Rod Holes in Base Plates (AISC 360–10) | | | |
|---|---|---|---|
| **Anchor Rod Diameter (in.)** | **Maximum Hole Diameter (in.)** | **Minimum Washer Size (in.)** | **Minimum Washer Thickness (in.)** |
| 3/4 | 1-5/16 | 2 | 1/4 |
| 7/8 | 1-9/16 | 2-1/2 | 5/16 |
| 1 | 1-13/16 | 3 | 3/8 |
| 1-1/4 | 2-1/16 | 3 | 1/2 |
| 1-1/2 | 2-5/16 | 3-1/2 | 1/2 |
| 1-3/4 | 2-3/4 | 4 | 5/8 |
| 2 | 3-1/4 | 5 | 3/4 |
| 2-1/2 | 3-3/4 | 5-1/2 | 7/8 |

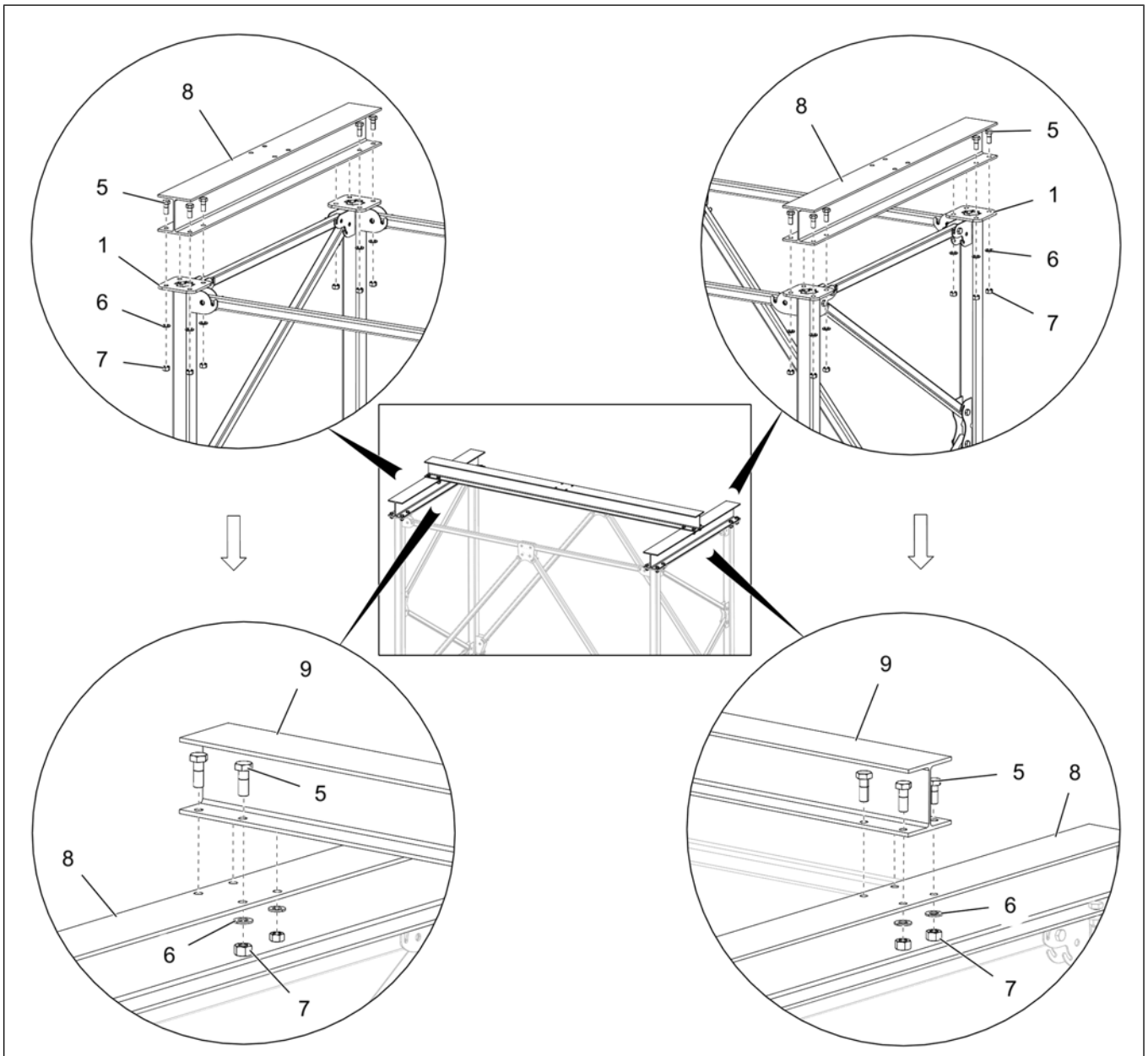
| Column Base Plate Standards | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Column Size (in.)** | **Column Dimension (in.)** | **Plate Dimension (in.)** | **Thickness (in.)** | **Spacing (in.)** | **Grade 105 Size/ Anchor Rod (in.)** | **Hole Size (in.)** | **Washer Hole Size (in.)** | **Washer Thickness (in.)** | **Washer part #** |
| HSS 4 x 4 x 1/4 | 4 | 12 | 1 & 3/4 | 8 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |
| HSS 4 x 4 x 3/16 | 4 | 12 | 3/4 | 8 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |
| HSS 3.5 x 3.5 x 1/4 | 3-1/2 | 11-1/2 | 3/4 | 7-1/2 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |
| HSS 3.5 x 3.5 x 3/16 | 3-1/2 | 11-1/2 | 3/4 | 7-1/2 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |
| HSS 3 x 3 x 1/4 | 3 | 11 | 3/4 | 7 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |
| HSS 3 x 3 x 3/16 | 3 | 11 | 3/4 | 7 | 3/4 | 1 | 7/8 | 1/4 | S2N4 |

# Top Tower Beams

**NOTE:** *The top tower beams are an accessory that may not be included in the tower. It can be either in a 2-beam or 3-beam configuration.*

1. If it is a 3-beam configuration, the beams will appear as shown below.

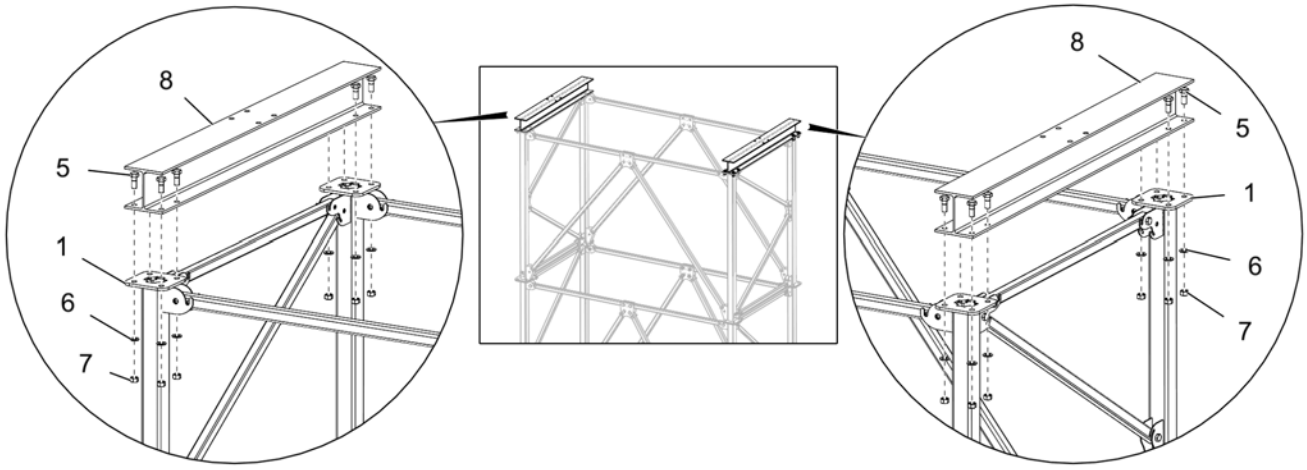
**Figure 2-1** *Top tower 3-beam configuration*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 7 | Nut |
| 5 | Bolt | 8 | Beam (installed on top of tower) |
| 6 | Washer | 9 | Beam (installed on top of beams) |

2. If it is a 2-beam configuration, the beams will be one on each pair of legs as shown below.

**Figure 2-2** *Top tower 2-beam configuration*



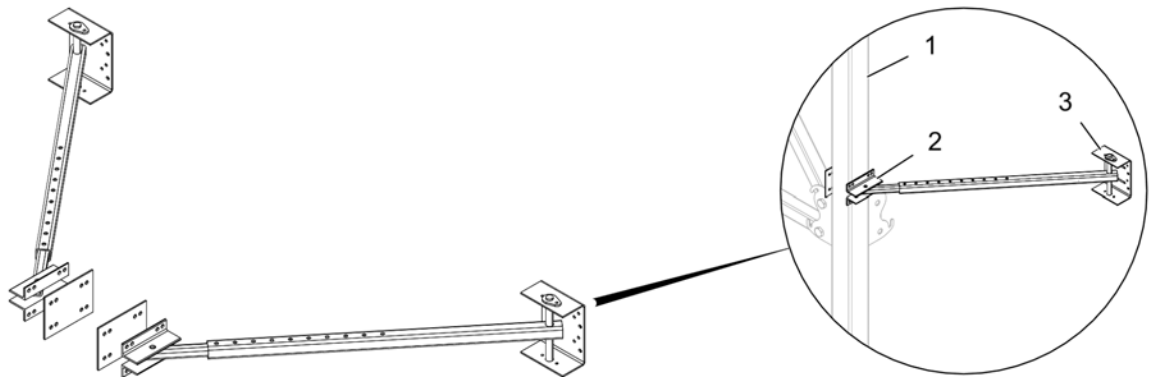

| | | | |
|---|---|---|---|
| 1 | Column weldment | 7 | Nut |
| 5 | Bolt | 8 | Beam |
| 6 | Washer | | |

## Bin Guy Kit for 2-Leg Towers

**NOTE:** *The bin guy kit is an accessory and may not be included with the tower.*

1. The bin guy kit has a clamp (2) that will fit around the column weldment (1) and a guy bracket (3) that will require field drilling to the nearest bin stiffeners.
2. The clamp (2) should be attached close to a shear plate.
3. The guy bracket (3) should not be attached at the stiffener splice.

**Figure 2-3** *Bin guy kit for 2-leg towers*



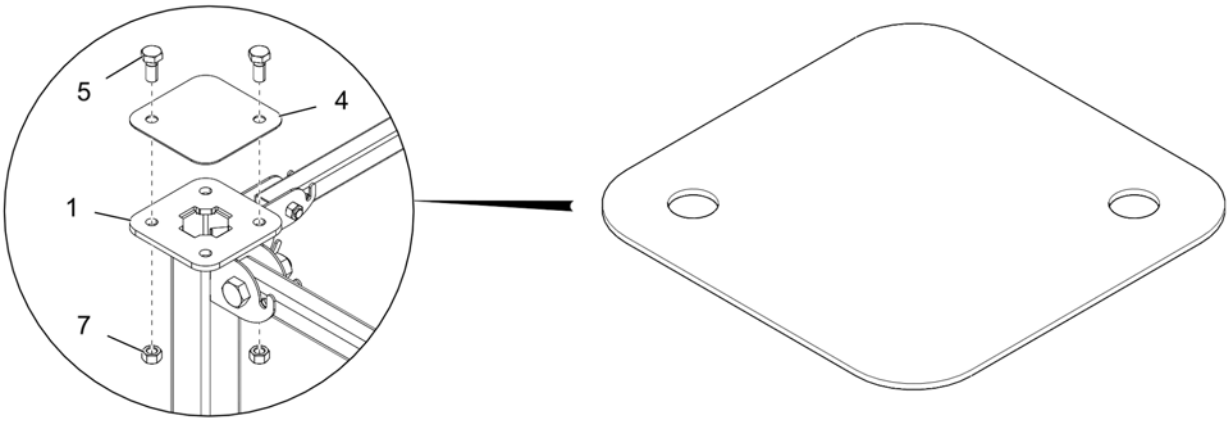

| | | | |
|---|---|---|---|
| 1 | Column weldment | 3 | Guy bracket |
| 2 | Clamp | | |

## Seal Plate Kit

**NOTE:** *The seal plate kits (4) may not be shipped with every tower.*

If needed, it is installed on top of each column weldment (1) of a 2-leg or 4-leg tower to prevent water or trash build up inside of the column weldment (1).

**Figure 2-4** *Seal plate kits*

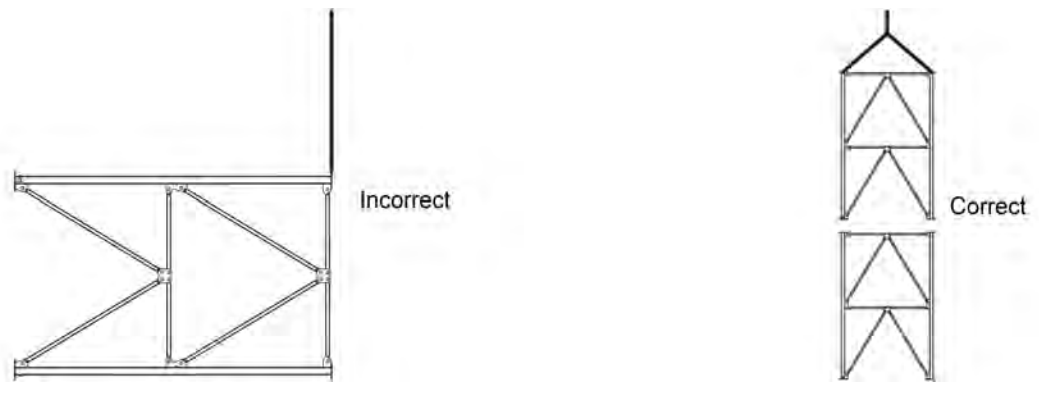



| | | | |
|---|---|---|---|
| 1 | Column weldment | 5 | Bolt |
| 4 | Seal plate | 7 | Nut |

## Tower Erection

1. The tower is assembled vertically with various sections depending on the required height.
2. The tower sections should not be assembled by lifting on the sides.
3. The tower is designed with each section in a specific location, it is critical to assemble the tower with the correct members in each section.
4. Square each section and then tighten the hardware before stacking the next section.
5. The shipping bolts should not be used in the tower assembly.

**Figure 2-5** *Stacking the sections – tower erection*



# NOTES

# 3 Hardware Requirements

## Overview

Installation of all bolts should be in accordance to AISC Specifications for structural joints using ASTM A325 bolts. No other bolts should be substituted for those supplied by GSI. The following is adapted from AISC J3.

## Hardware Tightening – Splice Connections

Using an impact wrench, or spud wrench, tighten all fasteners until the splices are touching. Using bar on wrench, turn the nut the appropriate turn distance (degree) to achieve the desired pretension. It is critical that the head of the bolt be held with a wrench so that it does not turn during tightening.

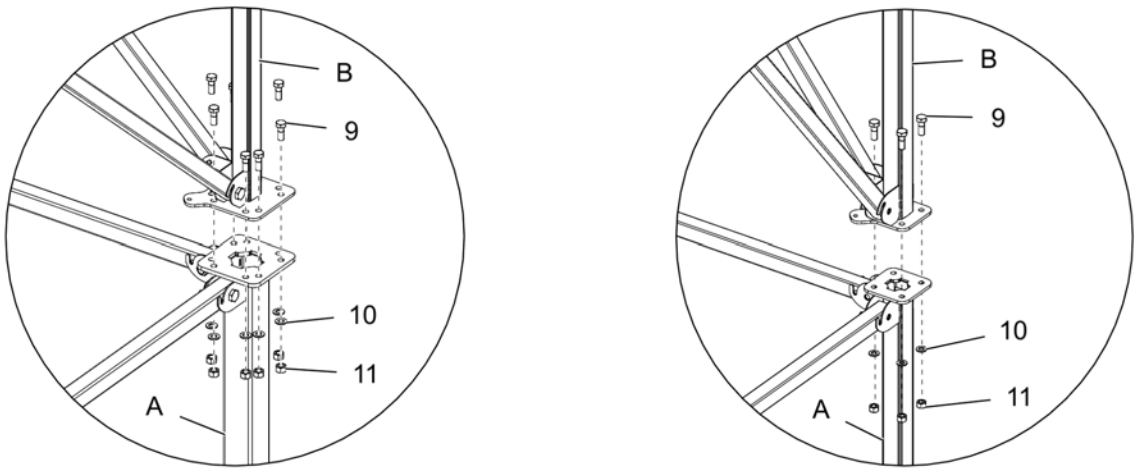
## Bolt Tightening

***Pre-Tensioned Bolts***

1. Pre-tension is required for the bolts that connect the sections of the tower columns.
2. Using a calibrated wrench or the turn-of-the-nut method, this pre-tension can be done using the values in the following table.

| Minimum Bolt Pre-Tension for A325 Bolts | |
|---|---|
| **Bolt Diameter (in.)** | **Pre-Tension (kips)** |
| 5/8 | 19 |
| 3/4 | 28 |
| 7/8 | 39 |
| 1 | 51 |
| 1-1/4 | 71 |
| 1-1/2 | 103 |

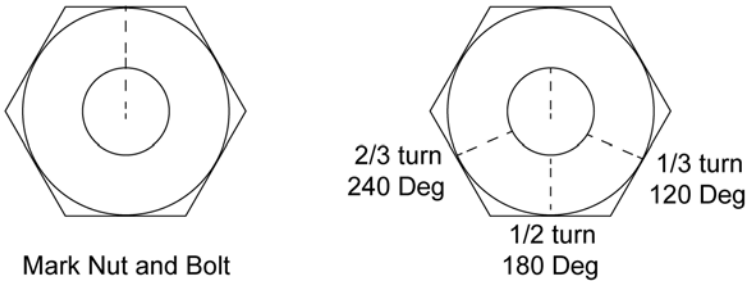
**Figure 3-1** *Connection of tower section columns*




| | | | |
|---|---|---|---|
| A | Lower 4-Leg Section | 10 | Washer |
| B | Upper 4-Leg Section | 11 | Nut |
| 9 | Bolt | | |

3. The turn-of-the-nut method can be done in three steps.
   - Snug tighten the bolts in the joint.
   - Match-mark the nut and protruding end of the bolt.
   - Rotate the nut by the value listed in the below table*.

**Figure 3-2** *Turn-of-the-nut method*




| Bolt Diameter | Bolt Length | Required Turns | Bolt Length | Required Turns | Bolt Length | Required Turns |
|---|---|---|---|---|---|---|
| 5/8" | l ≤ 2-1/2" | 1/3 | 2-1/2" < l ≤ 5" | 1/2 | 5" < l ≤ 7-1/2" | 2/3 |
| 3/4" | l ≤ 3" | 1/3 | 3" < l ≤ 6" | 1/2 | 6" < l ≤ 9" | 2/3 |
| 7/8" | l ≤ 3-1/2" | 1/3 | 3-1/2" < l ≤ 7" | 1/2 | 7" < l ≤ 10-1/2" | 2/3 |
| 1" | l ≤ 4" | 1/3 | 4" < l ≤ 8" | 1/2 | 8" < l ≤ 12" | 2/3 |
| 1-1/4" | l ≤ 5" | 1/3 | 5" < l ≤ 10" | 1/2 | 10" < l ≤ 15" | 2/3 |
| 1-1/2" | l ≤ 6" | 1/3 | 6" < l ≤ 12" | 1/2 | 12" < l ≤ 18" | 2/3 |

– For required turns of 1/3 turn (120 degrees) the rotation tolerance is +/- 30 degrees.
– For required turns of 1/2 turn (180 degrees) the rotation tolerance is +/- 30 degrees.
– For required turns of 2/3 turn (240 degrees) the rotation tolerance is +/- 45 degrees.
*This table is applicable for connections between two flat plates.

***Snug-Tightened Bolts***

1. All hardware in bracing locations is tightened to a “snug-tight” condition.
2. The snug-tight condition is a tightness required to bring the connected plies into firm contact.
3. Snug-tight condition can be attained by a few impacts of an impact wrench or the full effort of a worker with an ordinary spud wrench.
4. Bolts to be tightened to a condition other than snug-tight shall be clearly identified on design drawings.

## Washer Location

1. Washers are used to cover the slotted holes in an outer ply.
2. Washers should be placed under the turning element.

## Reuse of A325 Bolts

A325 bolts and structural hardware should not be reused after it has been tightened.

## Bolt Length

All the bolts used in each installation should have the bolt end extending outside the nut or at least flush with the outer surface of the nut.

## Splice Kit Hardware

| Splice Hardware Usage | Bolt | | Nut | | Washer | |
|---|---|---|---|---|---|---|
| | Part Number | Description | Part Number | Description | Part Number | Description |
| 4" Column, 1/2" Splice Plate | S-8557 | Bolt, HHCS 7/8"-9 x 2-1/4" GV A325 | S-8364 | Nut, Hex 7/8"-9 GV A563 | S-8560 | Washer, Flat 7/8" GV F436 |
| 4"-6" Transition, 1/2"-3/4" Splice Plate | S-10454 | Bolt, HHCS 1"-8 x 2-3/4" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 | S-10496 | Washer, Flat 1" GV F436 |
| 6" Column, 3/4" Splice Plate | S-10455 | Bolt, HHCS 1"-8 x 3" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 | S-10496 | Washer, Flat 1" GV F436 |
| 6" Column, 1" Splice Plate | S-10457 | Bolt, HHCS 1"-8 x 3-1/2" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 | S-10496 | Washer, Flat 1" GV F436 |
| 8" Column, 1" Splice Plate | S-10472 | Bolt, HHCS 1-1/4"-7 x 3-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 | S-10497 | Washer, Flat 1-1/4" GV F436 |
| 10" Column, 1" Splice Plate | S-10508 | Bolt, HHCS 1-1/2"-6 x 3-1/2" GV A325 | S-8624 | Nut, Hex 1-1/2"-6 GV A563 | S-10498 | Washer, Flat 1-1/2" GV F436 |

## Bracing Kit Hardware

| Bracing Hardware usage | Bolt | | Nut | |
|---|---|---|---|---|
| | Part Number | Description | Part Number | Description |
| **Small Towers: 4' - 6' Footprint** | | | | |
| 4" Columns, 2" Bracing | S-10432 | Bolt, HHCS 3/4"-10 x 3-1/2" GV A325 | S-8364 | Nut, Hex 7/8"-9 GV A563 |
| 6" Columns, 2-1/2" Bracing | S-10461 | Bolt, HHCS 1"-8 x 4-1/2" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 |
| 8" Columns, 3" Bracing | S-10477 | Bolt, HHCS 1-1/4"-7 x 5-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| 10" Columns, 3" Bracing | S-10478 | Bolt, HHCS 1-1/4"-7 x 6" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| **Medium Towers: 8' - 14' Footprint** | | | | |
| 4" Columns, 2-1/2" Bracing | S-10461 | Bolt, HHCS 1"-8 x 4-1/2" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 |
| 6" Columns, 3" Bracing | S-10476 | Bolt, HHCS 1-1/4"-7 x 5" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| 8"-10" Columns, 3" Bracing | S-10477 | Bolt, HHCS 1-1/4"-7 x 5-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| **Large Towers: 16' - 20' Footprint** | | | | |
| 4" Columns, 3" Bracing | S-10463 | Bolt, HHCS 1"-8 x 5" GV A325 | S-10488 | Nut, Hex 1"-8 GV A563 |
| 6" Columns, 3-1/2" Bracing | S-10477 | Bolt, HHCS 1-1/4"-7 x 5-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| 8" Columns, 4" Bracing | S-10479 | Bolt, HHCS 1-1/4"-7 x 6-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |
| 10" Columns, 4" Bracing | S-10479 | Bolt, HHCS 1-1/4"-7 x 6-1/2" GV A325 | S-10490 | Nut, Hex 1-1/4"-7 GV A563 |

## Splice Kit Hardware - Angle Braced

| Part number | Description | Quantity |
|---|---|---|
| S-8557 | Bolt, HHCS 7/8"-9 x 2-1/4" GV A325 | 16 |
| S-8364 | Nut, Hex 7/8"-9 GV A563 | 16 |
| S-8560 | Washer, Flat 7/8" GV A325 | 16 |

## Bracing Kit Hardware - Angle Braced

| Part number | Description | Quantity |
|---|---|---|
| S-8607 | Bolt, HHCS 5/8"-11 x 1-1/4" ZN Grade 5 | 60 |
| S-9259 | Nut, Flange 5/8"-11 ZN | 60 |

# 4 2-Leg Towers

**Topics Covered in this Chapter**

- 2-Leg Tower Layout
- Assembling the 2-Leg Tower Section (Chevron Bracing)
- Assembling the 2-Leg Tower Section (Warren Bracing)
- Stacking the 2-Leg Tower Section

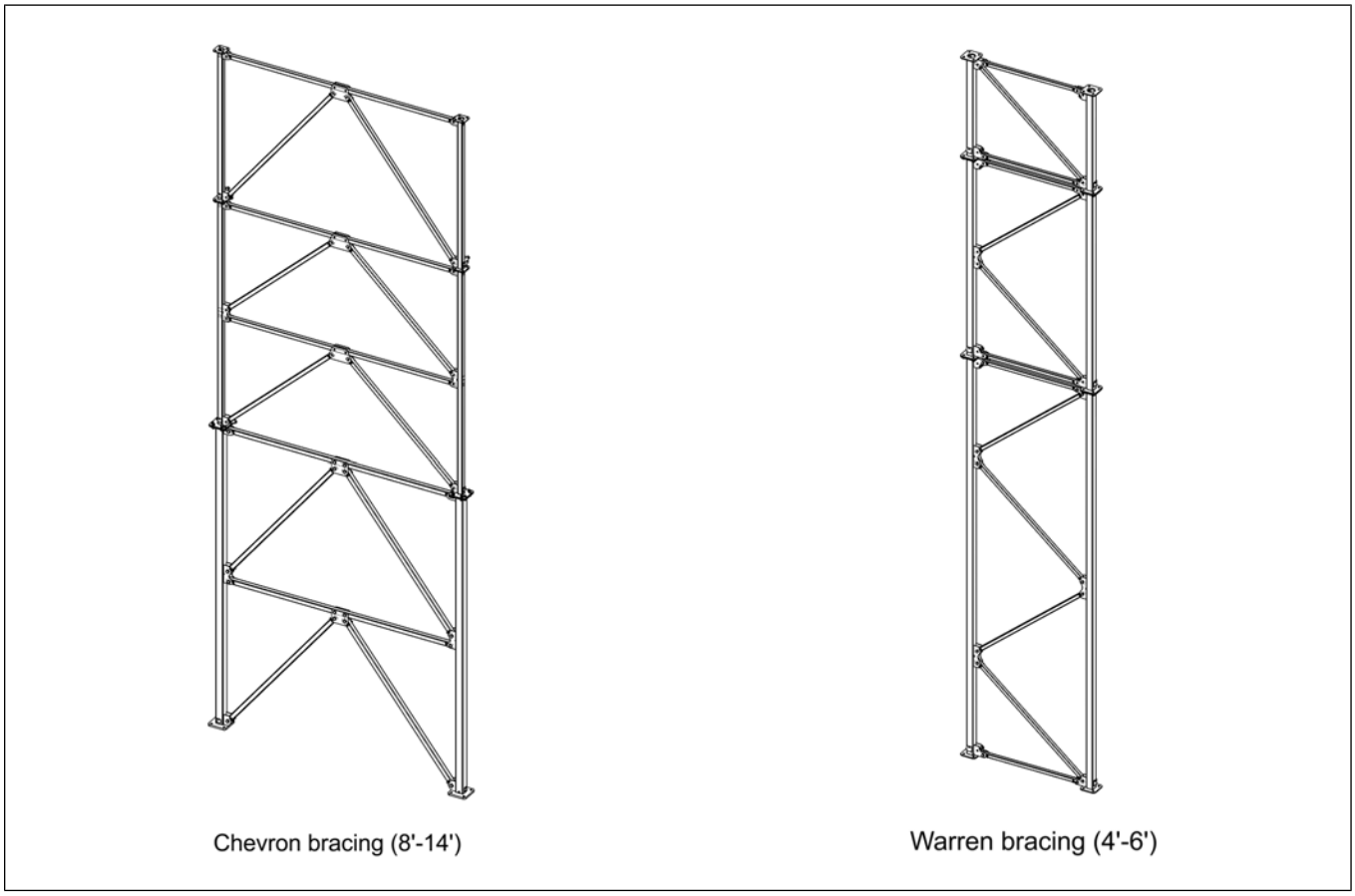
## 2-Leg Tower Layout

Two different bracing styles are used in the 2-leg tower assemblies, dependent on the foot print. Each tower may consist of various section heights to achieve the required overall height.

**NOTE:**

- ***For 4 ft. to 6 ft. towers, use warren bracing.***
- ***For 8 ft. and larger towers, use chevron bracing.***

**Figure 4-1** *2-leg tower layout*



# Assembling the 2-Leg Tower Section (Chevron Bracing)

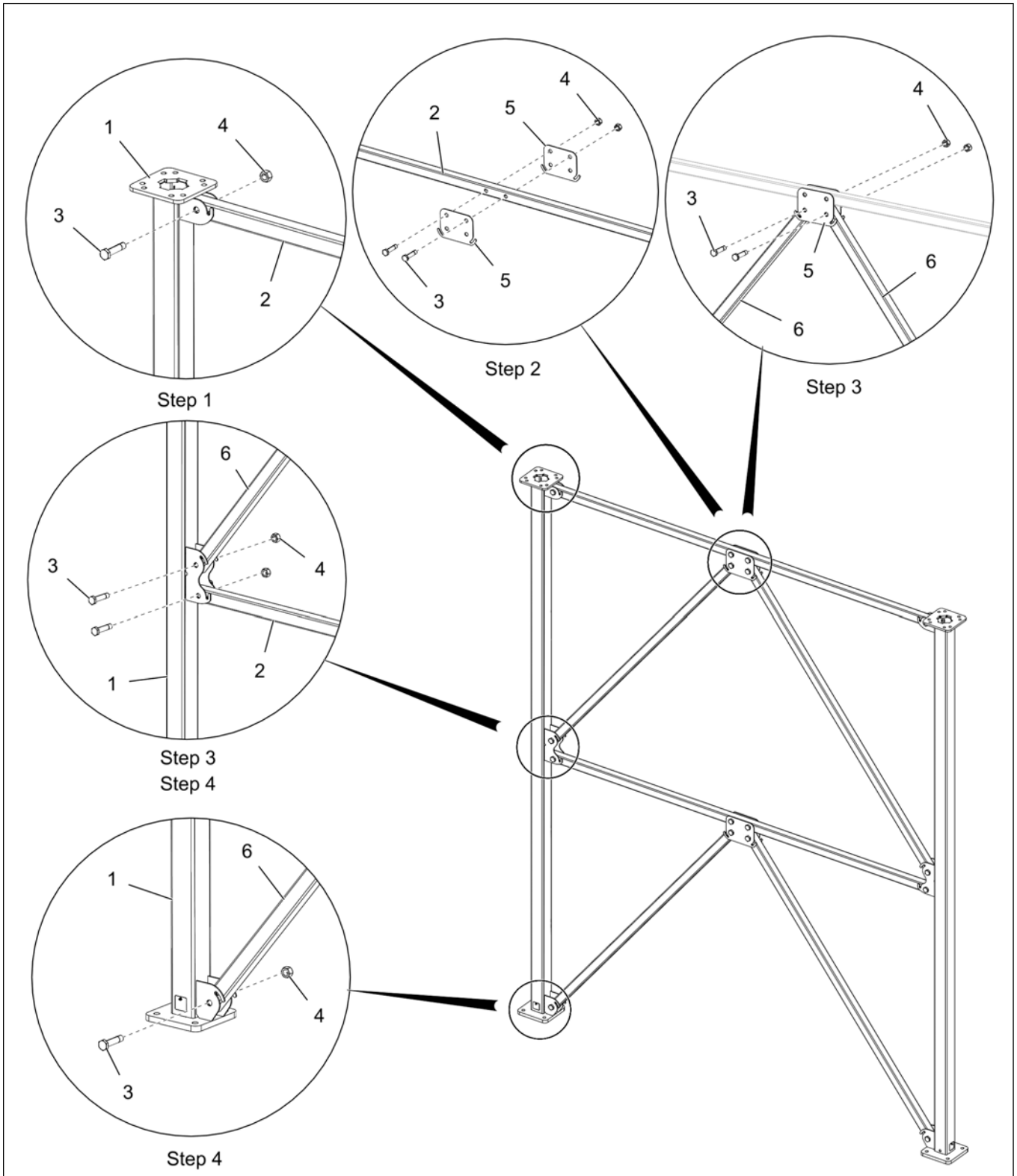
The following assembly procedure can be used for any section with 2-bays of chevron bracing. A similar procedure can be used for assembling the different bay layouts of chevron braced 2-leg tower sections.

**What You Should Know**
Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

1. Insert the strut (2) between the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
3. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottoms to each column weldment (1) using bolts (3) and nuts (4).
4. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the 2-leg tower section.
5. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-4) for assembly.

   **NOTE:** *The small diameter holes in the struts (2) and diagonals (6) are used to align the tubes with the column weldments (1) and do not require a bolt.*

**Figure 4-2** *Assembling the 2-leg tower section (Chevron bracing)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 4 | Nut |
| 2 | Strut | 5 | Gusset plate |
| 3 | Bolt | 6 | Diagonal |

# Assembling the 2-Leg Tower Section (Warren Bracing)

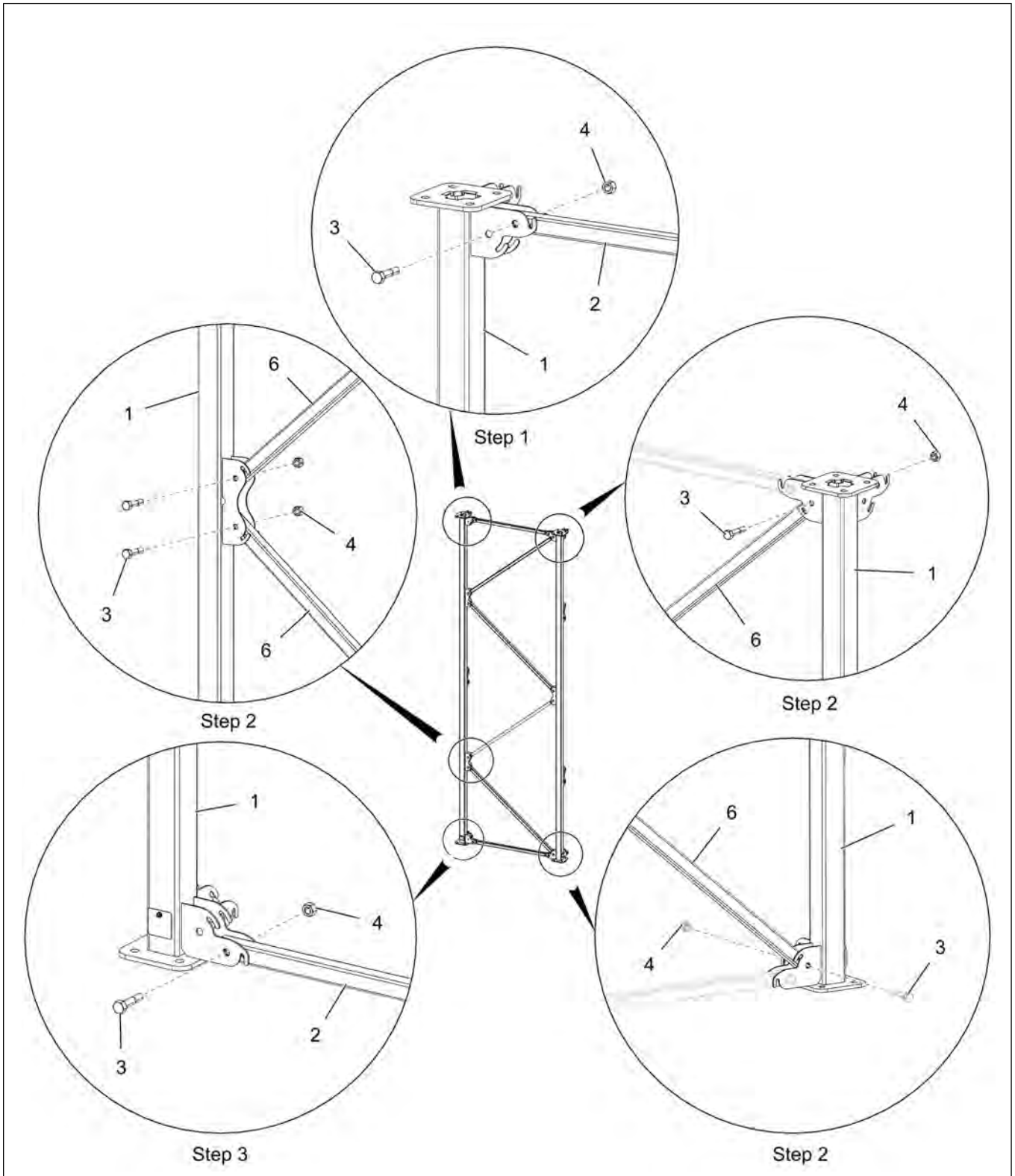
The following assembly procedure can be used for any section with 4-bays of warren bracing. A similar procedure can be used for assembling the different bay layouts of warren braced 2-leg tower sections.

**What You Should Know**
Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

1. Insert the strut (2) between the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the diagonals (6) to the shear plates in alternating directions, from the top to the bottom between the column weldments (1) using bolts (3) and nuts (4).
3. Insert the bottom strut (2) into the shear plates located at the bottom of the column weldments (1) and connect them using bolts (3) and nuts (4) to complete the 2-leg tower section.

   **NOTE:** *The small diameter holes in the struts (2) and diagonals (6) are used to align the tubes with the column weldments (1) and do not require a bolt.*

**Figure 4-3** *Assembling the 2-leg tower section (Warren bracing)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 4 | Nut |
| 2 | Strut | 6 | Diagonal |
| 3 | Bolt | | |

# Stacking the 2-Leg Tower Section

The following is the general procedure for stacking sections of a 2-leg tower.

**Before You Begin**
Assemble all the required 2-leg tower sections on the ground. Square each section and tighten all hardware before stacking.


***Follow all safety procedures when hoisting equipment. Wear hard hats and make sure everyone is clear of the working area.***

1. Hoist the first 2-leg section (A) and place on the foundation anchors.

   **NOTE:** *After the section has been anchored to the foundation, tighten all the anchor hardware.*

2. Hoist the next 2-leg section (B) onto the previous 2-leg section (A) and install using bolts (9), washers (10) and nuts (11).

   **NOTE:** *After the section has been stacked to the previous section, tighten all the splice hardware.*

3. Repeat the previous step to continue installing the remaining 2-leg tower sections until the correct elevation is reached.

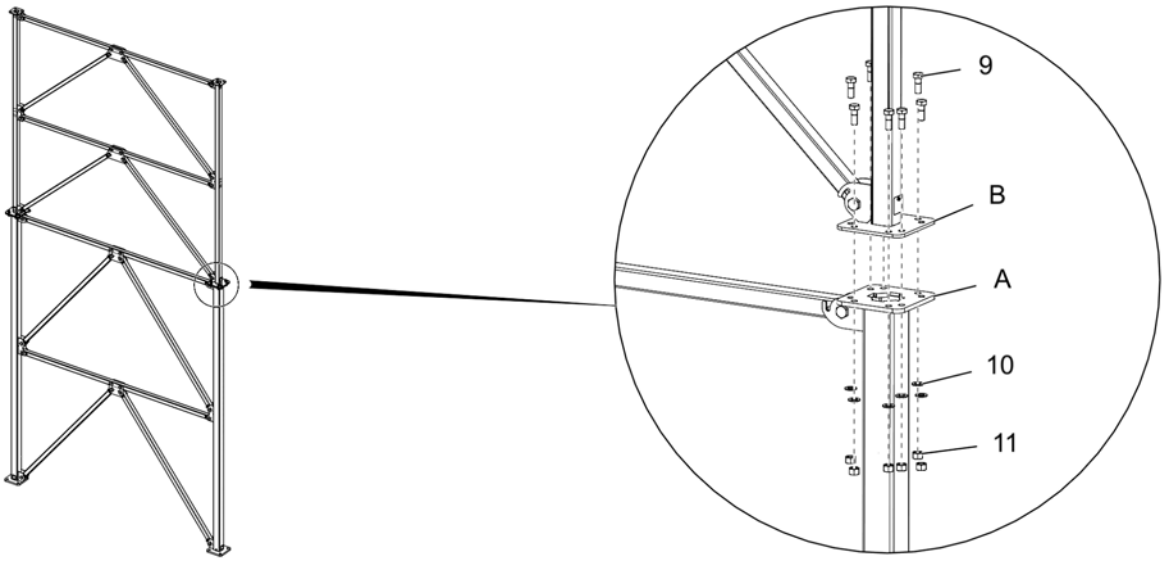
4. If required, attach sealing plates or top tower beams on the top of the columns of the last 2-leg section and tighten all the splice hardware. See *Seal Plate Kit, page 17* for sealing plates or *Top Tower Beams, page 15* for top tower beams.

   **NOTE:** *Seal plate kits are not included in the column bundle and may not be required.*

   **IMPORTANT:** *When stacking a 2-leg warren braced tower, it is critical that the sections be stacked so the bracing appears continuous. It means that the diagonal should always connect where another diagonal comes in right above or below.*

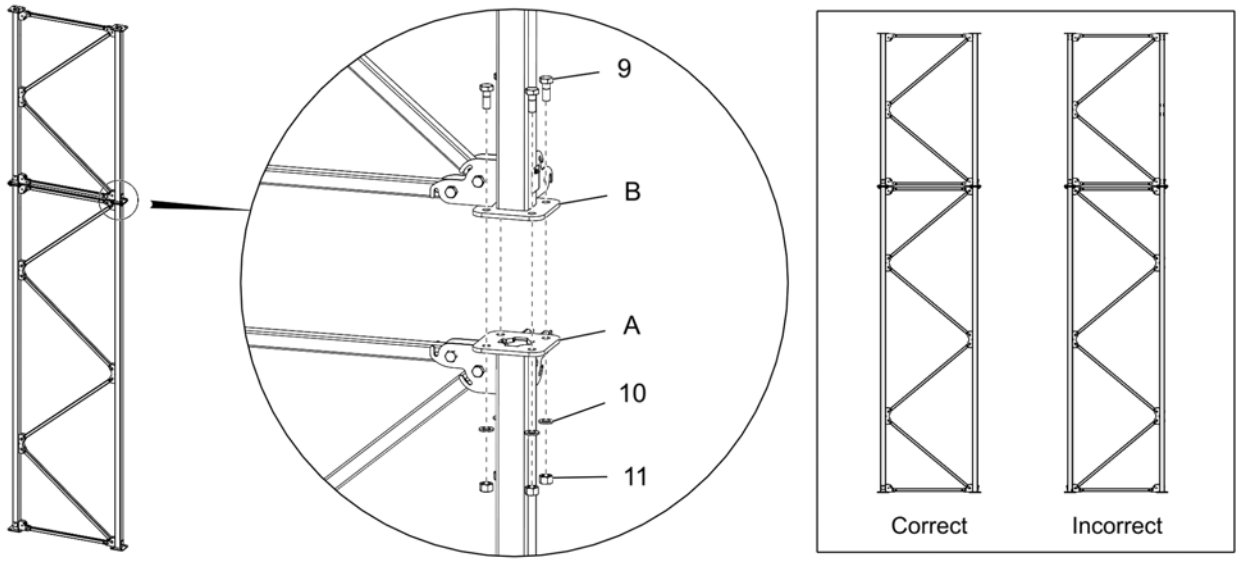
   **NOTE:** *2-Leg towers are not self-supporting and must be guyed to a structure capable of supporting the horizontal loads from the tower. Guying locations and spacing on the tower depends on the tower and is specified in order-specific drawings. Typically, the 2-Leg tower should be supported every 20 ft. and within 20 ft. from the top of the tower unless otherwise noted.*

**Figure 4-4** *Stacking the 2-leg tower sections (Chevron bracing)*




| | | | |
|---|---|---|---|
| A | Lower 2-leg Section | 10 | Washer |
| B | Upper 2-leg Section | 11 | Nut |
| 9 | Bolt | | |

**Figure 4-5** *Stacking the 2-leg tower sections (Warren bracing)*




| | | | |
|---|---|---|---|
| A | Lower 2-leg Section | 10 | Washer |
| B | Upper 2-leg Section | 11 | Nut |
| 9 | Bolt | | |

# NOTES

# 5 4-Leg Towers

**Topics Covered in this Chapter**

- 4-Leg Tower Layout
- Assembling the 4-Leg Tower Section (Chevron Bracing)
- Assembling the 4-Leg Tower Section (Angle Braced)
- Assembling the 4-Leg Tower Section (Warren Bracing)
- Assembling the 4-Leg Tower Section (Chevron and Warren Bracing)
- Stacking the 4-Leg Tower Section

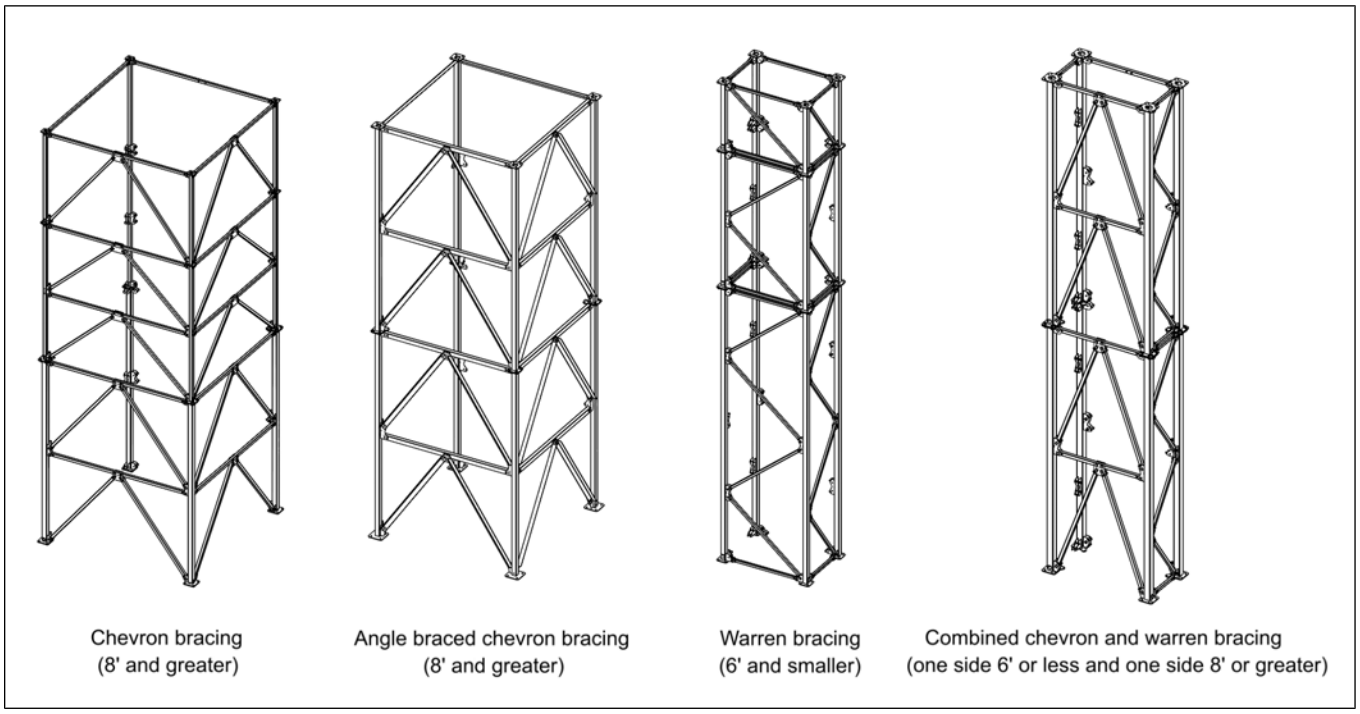
## 4-Leg Tower Layout

Four different bracing styles are used in 4-leg tower assemblies, dependent on the foot print. Each tower may consist of various section heights to achieve the required overall height.

**NOTE:**

- ***If all sides of the tower are 8 ft. or greater, chevron bracing will be used.***
- ***If all sides of the tower are 6 ft. or smaller, warren bracing will be used.***
- ***If one side is 6 ft. or smaller and the other side is 8 ft. or greater, then a combination of warren and chevron bracing will be used.***
- ***In certain applications, angle braced sections will be used (Chevron Bracing).***

**Figure 5-1** *4-leg tower layouts*



# Assembling the 4-Leg Tower Section (Chevron Bracing)

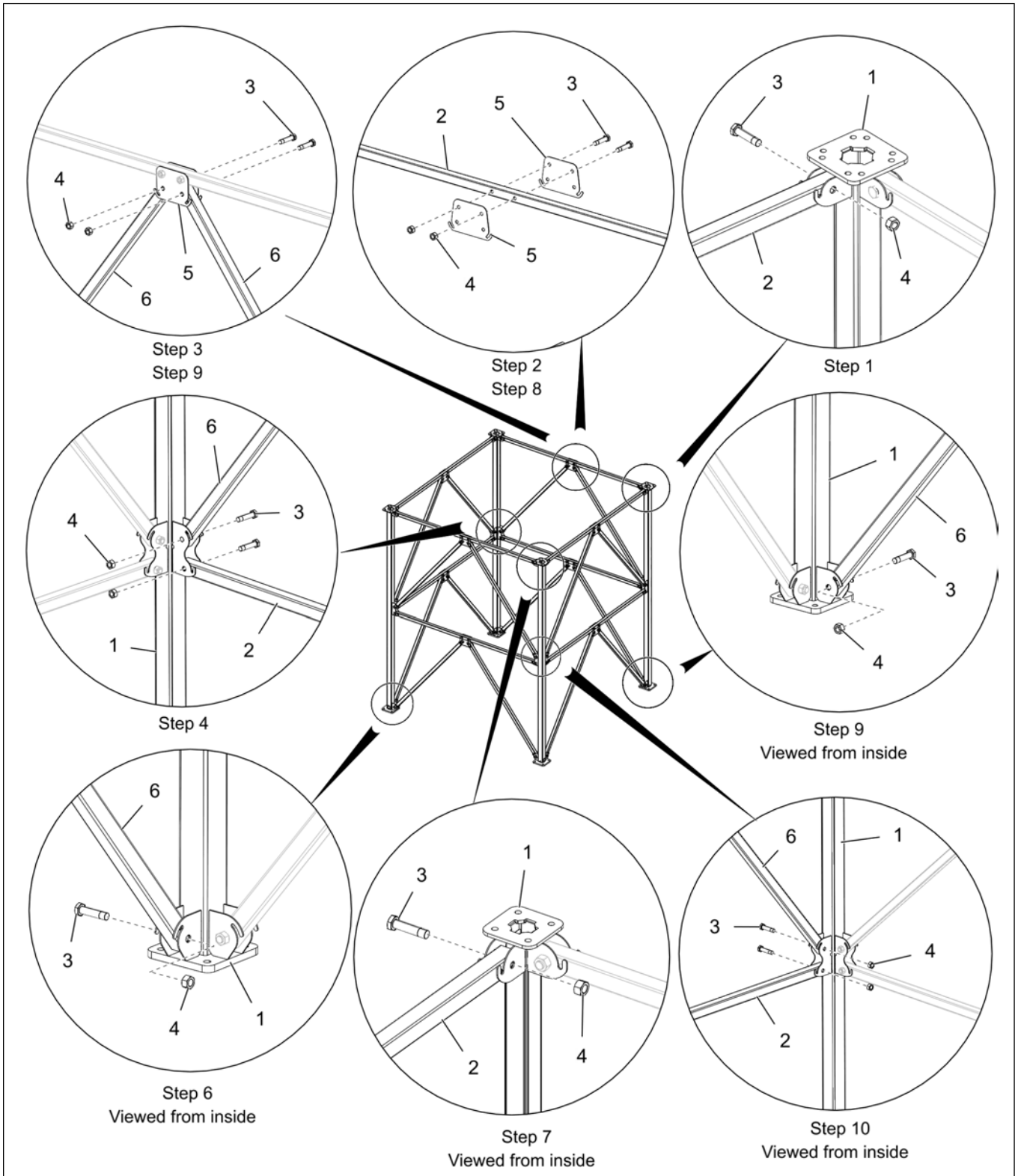
The following assembly procedure can be used for any section with 2-bays of chevron bracing. A similar procedure can be used for assembling the different bay layouts of chevron braced 4-leg tower sections.

**What You Should Know**
You will assemble two completed sides (front and rear) and connect them together to complete the 4-leg section. Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

1. Insert the strut (2) between the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
3. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottom to each column weldment (1) using bolts (3) and nuts (4).
4. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the front side of the 4-leg tower section.
5. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-4) for assembly.
6. Repeat the previous steps to assemble the rear side of the 4-leg tower section.
7. Connect the front and rear sides together by inserting the strut (2) between the shear plates located at the top of the column weldments (1) and connecting them using bolts (3) and nuts (4).
8. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
9. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottoms to each column weldment (1) using bolts (3) and nuts (4).
10. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the 4-leg tower section.
11. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-10) for assembly.

**NOTE:** *The small diameter holes in the struts (2) and diagonals (6) are used to align the tubes with the column weldments (1) and do not require a bolt.*

**Figure 5-2** *Assembling the 4-leg tower section (Chevron bracing)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 4 | Nut |
| 2 | Strut | 5 | Gusset plate |
| 3 | Bolt | 6 | Diagonal |

# Assembling the 4-Leg Tower Section (Angle Braced)

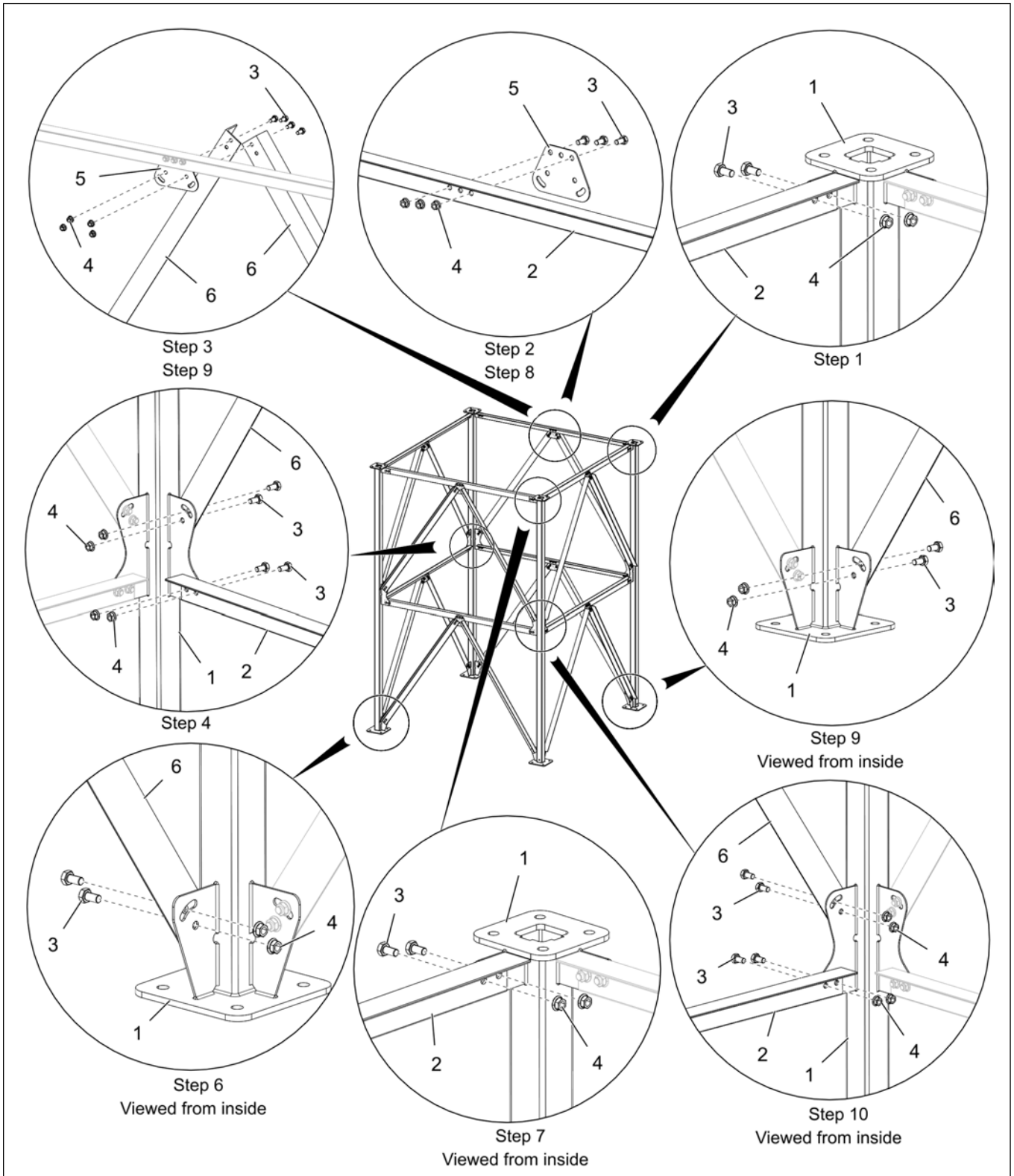
The following assembly procedure can be used for any section with 2-bays of angle braced towers. A similar procedure can be used for assembling the different bay layouts of angle braced 4-leg tower sections.

**What You Should Know**
You will assemble two completed sides (front and rear) and connect them together to complete the 4-leg section. Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

1. Assemble the strut (2) to the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
3. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottom to each column weldment (1) using bolts (3) and nuts (4).
4. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the front side of the 4-leg tower section.
5. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-4) for assembly.
6. Repeat the previous steps to assemble the rear side of the 4-leg tower section.
7. Connect the front and rear sides together by installing the strut (2) to the shear plates located at the top of the column weldments (1) and connecting them using bolts (3) and nuts (4).
8. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
9. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottoms to each column weldment (1) using bolts (3) and nuts (4).
10. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the 4-leg tower section.
11. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-10) for assembly.

**NOTE:** *Always assemble the struts (2) and diagonals (6) to the outside of the shear plates in the column weldments (1).*

**Figure 5-3** *Assembling the 4-leg tower section (Angle braced)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 4 | Nut |
| 2 | Strut | 5 | Gusset plate |
| 3 | Bolt | 6 | Diagonal |

# Assembling the 4-Leg Tower Section (Warren Bracing)

The following assembly procedure can be used for any section with warren bracing that may have 1, 2 or 4-bays. A similar procedure can be used for assembling the different bay layouts of warren braced 4-leg tower sections.

**What You Should Know**
You will assemble two completed sides (front and rear) and connect them together to complete the 4-leg section. Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

1. Insert the strut (2) between the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the diagonals (6) to the shear plates in alternating directions, from the top to the bottom between the column weldments (1) using bolts (3) and nuts (4).
3. Insert the bottom strut (2) into the shear plates located at the bottom of the column weldments (1) and connect them using bolts (3) and nuts (4) to complete the front side of 4-leg tower section.
4. Repeat the previous steps to assemble the rear side of 4-leg tower section.

   **NOTE:** *Make sure to assemble the diagonals (6) in the rear side at the opposite direction to the first side.*

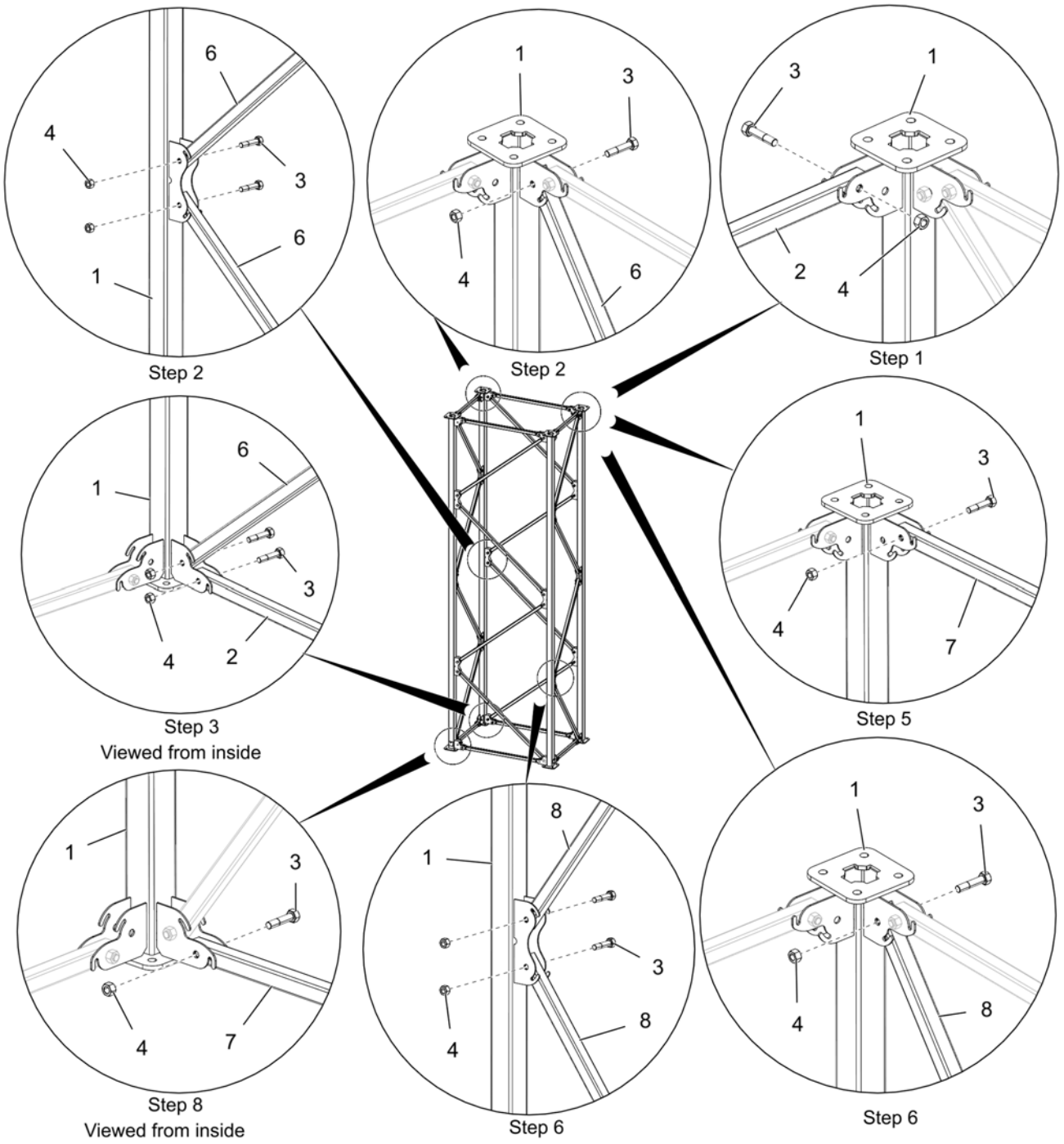
5. Connect the front and rear side sections by inserting the strut (7) between the shear plates located at the top of the column weldments (1) and connecting them using bolts (3) and nuts (4).
6. Assemble the diagonals (8) to the shear plates in alternating directions, from the top to the bottom between the column weldments (1) using bolts (3) and nuts (4).
7. Insert the bottom strut (7) into the shear plates located at the bottom of the column weldments (1) and connect them using bolts (3) and nuts (4) to complete the third side of the 4-leg tower section.
8. Repeat the previous steps for assembling the last side to complete the 4-leg tower section.

   **NOTE:**

   a. *Make sure to assemble the diagonals (8) in the last side at the opposite direction to the third side.*

   b. *The small diameter holes in the struts (2 and 7) and diagonals (6 and 8) are used to align the tubes with the column weldments (1) and do not require a bolt.*

**Figure 5-4** *Assembling the 4-leg tower section (Warren bracing)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 6 | Diagonal |
| 2 | Strut | 7 | Strut |
| 3 | Bolt | 8 | Diagonal |
| 4 | Nut | | |

# Assembling the 4-Leg Tower Section (Chevron and Warren Bracing)

The following assembly procedure can be used for any section with 2-bays of chevron and 4-bays of warren bracing. A similar procedure can be used for assembling the different bay layouts of chevron and warren bracing 4-leg tower sections.

**What You Should Know**
You will assemble two completed sides (front and rear) and connect them together to complete the 4-leg section. Assemble the struts and diagonals from the top to the bottom of each section. Square the tower section and tighten all hardware before stacking.

**Assembling the Chevron Braced Sides**

1. Insert the strut (2) between the shear plates located at the top of the column weldments (1) and connect them using bolts (3) and nuts (4).
2. Assemble the two gusset plates (5) to the strut (2) using bolts (3) and nuts (4).
3. Assemble the two diagonals (6), aligning the top of each diagonal to the gusset plates (5) and the bottom to each column weldment (1) using bolts (3) and nuts (4).
4. Repeat the previous steps to assemble the remaining strut (2), gusset plates (5) and diagonals (6) to complete the front side of the 4-leg tower section.
5. If the section has only 1-bay (10 ft. or shorter), ignore the above step (step-4) for assembly.
6. Repeat the previous steps to assemble the rear side of the 4-leg tower section.

**Assembling the Warren Braced Sides**

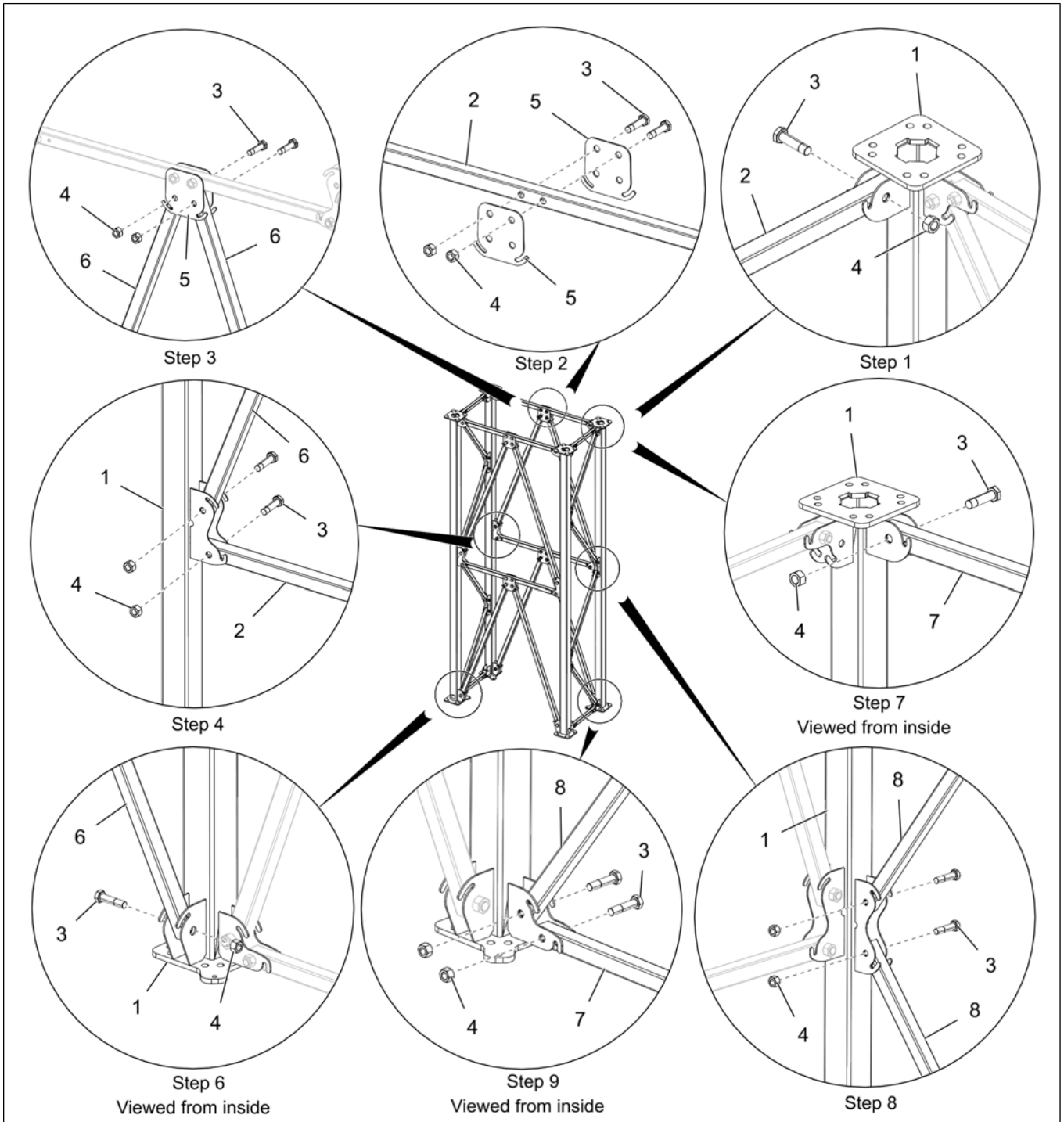
7. Connect the front and rear sides by inserting the strut (7) between the shear plates located at the top of the column weldments (1) and connecting them using bolts (3) and nuts (4).
8. Assemble the diagonals (8) to the shear plates in alternating directions, from the top to the bottom between the column weldments (1) using bolts (3) and nuts (4).
9. Insert the bottom strut (7) into the shear plates located at the bottom of the column weldments (1) and connect them using bolts (3) and nuts (4) to complete the third side of 4-leg tower section.
10. Repeat the above steps for assembling the last side to complete the 4-leg tower section.

**NOTE:**

a. *Make sure to assemble the diagonals (6) in the last side at the opposite direction to the third side.*

b. *The small diameter holes in the struts (2 and 7) and diagonals (6 and 8) are used to align the tubes with the column weldments (1) and do not require a bolt.*

**Figure 5-5** *Assembling the 4-leg tower section (Chevron and Warren bracing)*




| | | | |
|---|---|---|---|
| 1 | Column weldment | 5 | Gusset plate |
| 2 | Strut (Chevron braced side) | 6 | Diagonal (Chevron braced side) |
| 3 | Bolt | 7 | Strut (Warren braced side) |
| 4 | Nut | 8 | Diagonal (Warren braced side) |

# Stacking the 4-Leg Tower Section

The following is a general procedure for stacking sections of a 4-leg tower.

**Before You Begin**
Assemble all the required 4-leg tower sections on the ground. Square each section and tighten all hardware before stacking.


***Follow all safety procedures when hoisting equipment. Wear hard hats and make sure everyone is clear of the working area.***

1. Hoist the first 4-leg section (A) and place on the foundation anchors.

   **NOTE:** *After the section has been anchored to the foundation, tighten all the anchor hardware.*

2. Hoist the next 4-leg section (B) onto the previous 4-leg section (A) and install using bolts (9), washers (10) and nuts (11).

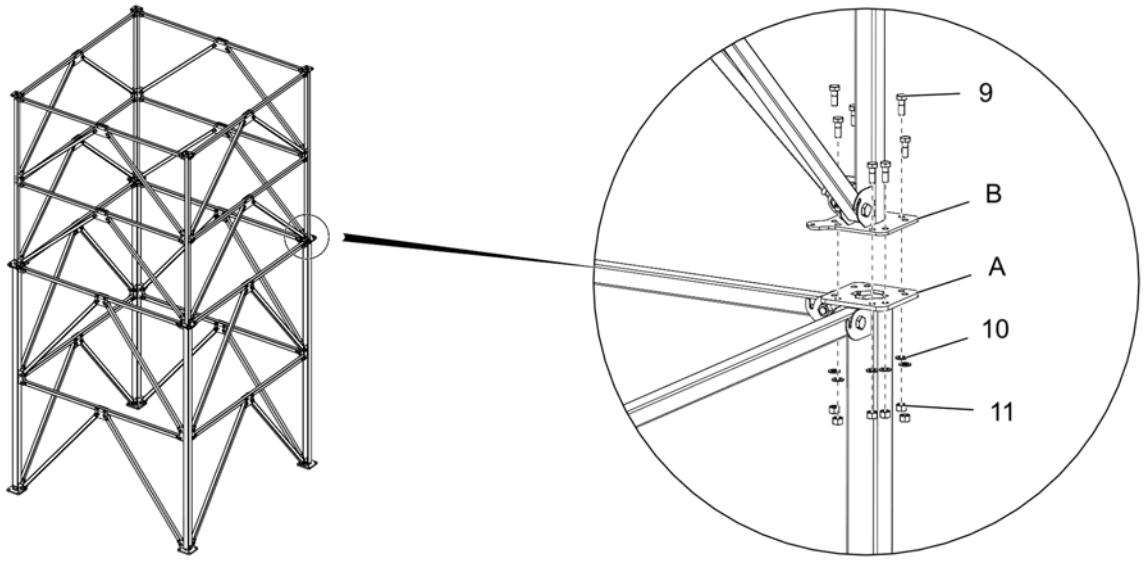
   **NOTE:** *After the section has been stacked to the previous section, tighten all the splice hardware.*

3. Repeat the previous step to continue installing the remaining 4-leg tower sections until the correct elevation is reached.

4. If required, attach sealing plates or top tower beams on the top of the columns of the last 4-leg section and tighten all the splice hardware. See *Seal Plate Kit, page 17* for sealing plates or *Top Tower Beams, page 15* for top tower beams.

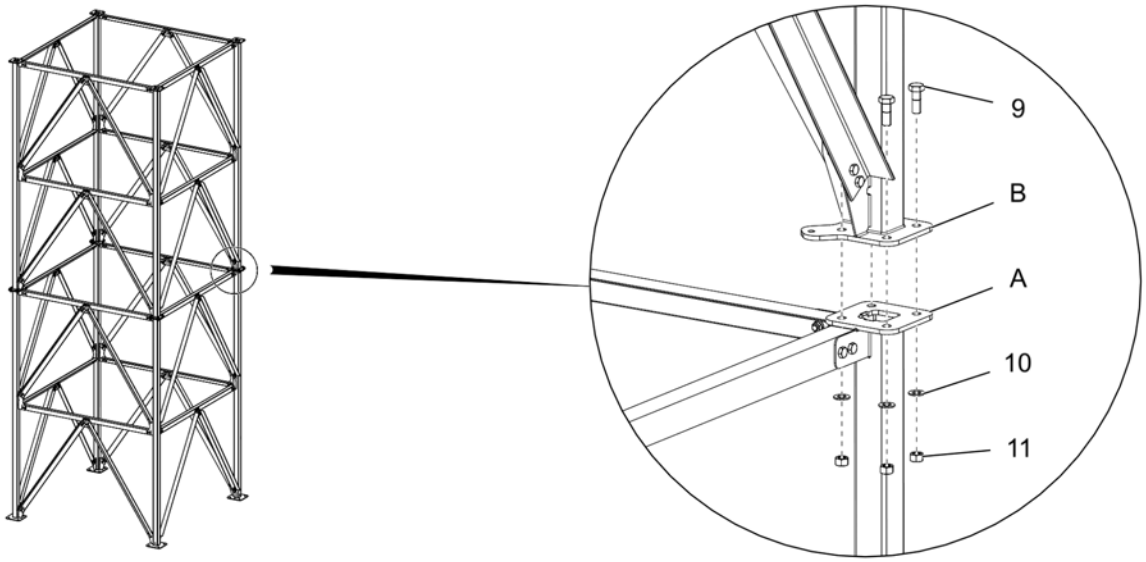
   **NOTE:** *Seal plate kits are not included in the column bundle and may not be required.*

**Figure 5-6** *Stacking the 4-leg tower sections (Chevron bracing)*



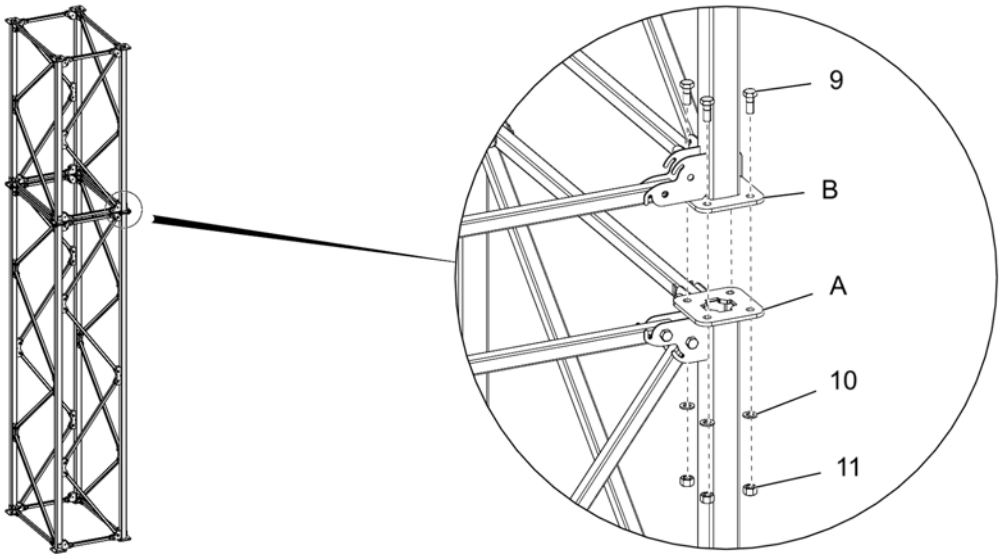

| | | | |
|---|---|---|---|
| A | Lower 4-leg section | 10 | Washer |
| B | Upper 4-leg section | 11 | Nut |
| 9 | Bolt | | |

**Figure 5-7** *Stacking the 4-leg tower sections (Angle braced)*



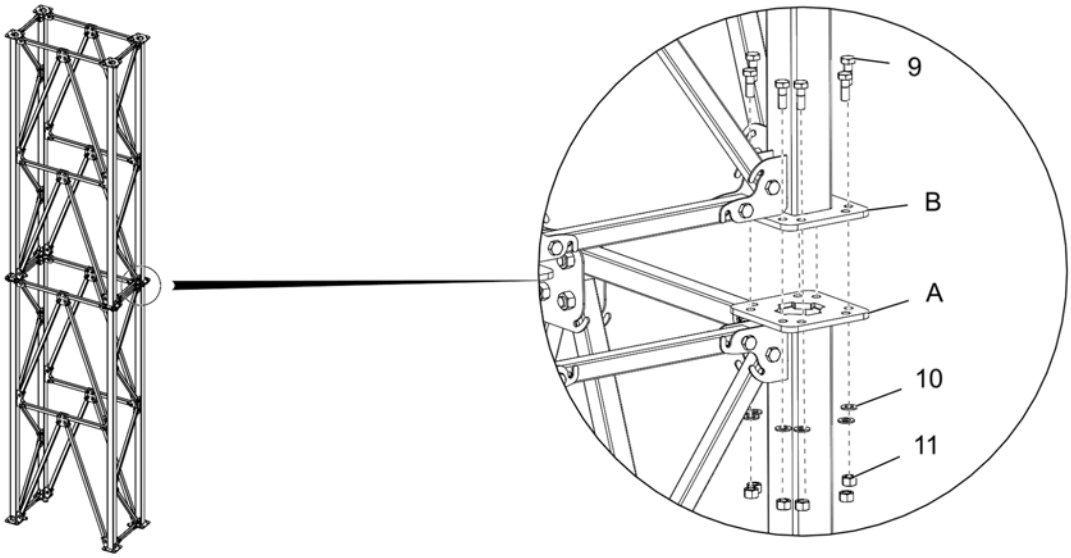

| | | | |
|---|---|---|---|
| A | Lower 4-leg section | 10 | Washer |
| B | Upper 4-leg section | 11 | Nut |
| 9 | Bolt | | |

**Figure 5-8** *Stacking the 4-leg tower sections (Warren bracing)*




| | | | |
|---|---|---|---|
| A | Lower 4-leg section | 10 | Washer |
| B | Upper 4-leg section | 11 | Nut |
| 9 | Bolt | | |

**Figure 5-9** *Stacking the 4-leg tower sections (Chevron and Warren bracing)*




| | | | |
|---|---|---|---|
| A | Lower 4-leg section | 10 | Washer |
| B | Upper 4-leg section | 11 | Nut |
| 9 | Bolt | | |

# Limited Warranty — N.A. Grain Products

The GSI Group, LLC. (“GSI”) warrants products which it manufactures, to be free of defects in materials and workmanship under normal usage and conditions for a period of 12 months from the date of shipment (or, if shipped by vessel, 14 months from the date of arrival at the port of discharge). If, in GSI’s sole judgment, a product is found to have a defect in materials and/or workmanship, GSI will, at its own option and expense, repair or replace the product or refund the purchase price. This Limited Warranty is subject to extension and other terms as set forth below.

**Warranty Enhancements:** The warranty period for the following products is enhanced as shown below and is in lieu of (and not in addition to) the above stated warranty period. (Warranty Period is from date of shipment.)

| | Product | Warranty Period |
|---|---|---|
| **Storage** | Grain Bin Structural Design<br>▪ Roof, doors, platforms and walk arounds<br>▪ Flooring (when installed using GSI specified floor support system for that floor)<br>▪ Hopper tanks | 5 Years |
| **Conditioning** | Dryer Structural Design – (Tower, Portable and TopDry)<br>▪ Includes (frame, portable dryer screens, ladders, access doors and platforms) | 5 Years |
| | All other Dryer parts including:<br>▪ Electrical (controls, sensors, switches & internal wiring) | 2 Years |
| | Bullseye Controllers | 2 Years |
| **Material Handling** | Bucket Elevators Structural Design | 5 Years |
| | Towers Structural Design | 5 Years |
| | Catwalks Structural Design | 5 Years |
| | Accessories (stairs, ladders and platforms) Structural Design | 5 Years |

## Conditions and Limitations:

THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE LIMITED WARRANTY DESCRIPTION SET FORTH HEREIN; SPECIFICALLY, GSI DISCLAIMS ANY AND ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE IN CONNECTION WITH: (I) ANY PRODUCT MANUFACTURED OR SOLD BY GSI, OR (II) ANY ADVICE, INSTRUCTION, RECOMMENDATION OR SUGGESTION PROVIDED BY AN AGENT, REPRESENTATIVE OR EMPLOYEE OF GSI REGARDING OR RELATED TO THE CONFIGURATION, INSTALLATION, LAYOUT, SUITABILITY FOR A PARTICULAR PURPOSE, OR DESIGN OF SUCH PRODUCTS.

The sole and exclusive remedy for any claimant is set forth in this Limited Warranty and shall not exceed the amount paid for the product purchased. This Warranty only covers the value of the warranted parts and equipment, and does not cover labor charges for removing or installing defective parts, shipping charges with respect to such parts, any applicable sales or other taxes, or any other charges or expenses not specified in this Warranty. GSI shall not be liable for any other direct, indirect, incidental or consequential damages, including, without limitation, loss of anticipated profits or benefits. Expenses incurred by or on behalf of a claimant without prior written authorization from the GSI warranty department shall not be reimbursed. This warranty is not transferable and applies only to the original end-user. GSI shall have no obligation or responsibility for any representations or warranties made by or on behalf of any dealer, agent or distributor. Prior to installation, the end-user bears all responsibility to comply with federal, state and local codes which apply to the location and installation of the products.

This Limited Warranty extends solely to products sold by GSI and does not cover any parts, components or materials used in conjunction with the product, that are not sold by GSI. GSI assumes no responsibility for claims resulting from construction defects, unauthorized modifications, corrosion or other cosmetic issues caused by storage, application or environmental conditions. Modifications to products not specifically delineated in the manual accompanying the product at initial sale will void all warranties. This Limited Warranty shall not extend to products or parts which have been damaged by negligent use, misuse, alteration, accident or which have been improperly/inadequately maintained.

**Notice Procedure:**
In order to make a valid warranty claim a written notice of the claim must be submitted, using the RMA form, within 60 days of discovery of a warrantable nonconformance. The RMA form is found on the OneGSI portal.

**Service Parts:**
GSI warrants, subject to all other conditions described in this Warranty, Service Parts which it manufactures for a period of 12 months from the date of purchase unless specified in Enhancements above.

(Limited Warranty - N.A. Grain Products_ revised 19 October 2018)

**This equipment shall be installed in accordance with the current installation codes and applicable regulations which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.**

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**Fax: 1-217-226-4420**
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CN #344605