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STRUCTURES

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# HIGH MAST AND SPORTS LIGHTING STRUCTURES

## ASSEMBLY AND INSTALATION OF VALMONT STRUCTURES

## Contents



**Document Revisions**

| Number | REV | DATE REVISED | PREPARED BY |
|---|---|---|---|
| M002 | | | DM |

The following information is intended to be a helpful guide to the installing contractor. This information cannot be comprehensive enough to cover all situations or the details of all structures. Therefore it is essential that the owner and contractor carefully plan all aspects of the installation process, not relying only on these guidelines to determine the steps to be followed. This is general information about standard Valmont products. Special features required by individual owners may require unique installation methods. For these the Contractor must be familiar with the owner's plans and specifications and the Valmont submittal drawings (if any). Due to the varied methods used by contractors in actual field operations, Valmont Industries, Inc. cannot be liable for structural damage occurring during erection.

## A. ANCHORAGE

1. An evaluation of local soil conditions should be made by a competent foundation designer. The foundation size and reinforcing must be adequate to withstand the maximum reactions which might be applied by the pole base.
2. Concrete foundations should be installed well ahead of the installation of the poles. Standard concrete requires about 28 days to develop its full design strength.
3. In designing and installing the foundation, consideration should be given to the need for underground wiring and grounding.
4. Projection of the anchor bolts should allow for the thickness of the base plate, nuts (including leveling nuts), and raking if required.
5. Orientation of the anchor bolts in relation to the direction of the lighting must be checked carefully using data from the Valmont drawings and the owner's plans and specifications. The anchor bolts must also be vertical.
6. Reinforcing steel must not be welded to the anchor bolts.
7. Care must be taken not to disturb the position of the anchor bolts while pouring concrete.
8. Leveling nuts should be adjusted before installing the pole. They should be in a horizontal plane.
9. In the case of structures which utilize embedded base installation, typically the bottom (embedded) section of the pole is installed in the ground first. Care should be taken to assure that the bottom section is vertical before

proceeding with the erection of the rest of the pole since there is no adjustment to this type installation as there is with the leveling nuts on anchor bolt type foundations.

## B. ASSEMBLY (See Figure 1)

### 1. General

a. Where space near the foundation and lifting capabilities permit, it is preferable to assemble the complete structure on the ground and erect it as a unit (except see "Anchorage--Item 9" concerning embedded base poles). The sections of the pole should be aligned on the ground and supported, typically with wood blocks, in such a manner that they will readily fit together. Care should be taken to prevent dirt, stones, etc. from getting trapped between the mating surfaces.

b. If the structure is assembled vertically, extra care may be needed to assure that all joints are properly assembled as indicated in the following paragraphs.

c. pole sections can be aligned using the climbing device stand-off plates and/or the pole step lugs.

### 2. Slipover Joints

a. To facilitate the assembly, mating surfaces may be lubricated. Care should be taken not to use a lubricant that will later leak from the joint and stain the pole. Soapy water has been used successfully for this purpose.

b. To visually inspect for minimum splice, it is required to mark up on male section minimum splice length, measured from the edge of section. When the drawn line (or any other indicator) is not visible, the minimum amount of splice has been reached. Minimum splice is always provided on Valmont Poland fabrication drawings or in Splice Requirements Sheet that are attached to the Assembly and Installation Manual.

c. A number of methods may be considered for applying the necessary force to achieve a tight joint. The method selected may depend upon the size of the pole sections, the type of pole design, and the equipment available to the contractor. The two most common methods are:

1. Use of two ratchet chain hoists or similar devices on opposite sides of the pole tube (See Figure 2). These may pull on cables secured to the pole sections with a choker type hitch or attached to M24 bolts installed in the

jacking nuts. Equal forces should be applied by the two hoists simultaneously. If the jacking nuts are used, forces must be applied no more than 40 mm from the surface of the pole tube and the forces must be distributed equally to all the nuts at each joint. Most high mast and sports lighting poles can be assembled with pulling devices of 6-ton capacity.

2. Use of a hydraulic jacking device which is available for rent or purchase from Valmont Poland (See Figure 3). Where the forces are applied as a slow steady pull, joint tightening will be facilitated by oscillating the advancing section with the supporting crane or by striking the pole in the joint area with a hammer using a cushioning block of wood. These forces should be applied until the joint is tight with no more than small gaps (which can sometimes be caused by a slight mismatch in the shapes of the mating sections). A final check should be made to assure that the specified minimum overlap has been achieved. Anywhere beyond minimum splice is considered an acceptable joint provided the joint is tight.

## 3. Electrical wiring

a. Prior to the attachment of the high mast top assembly or the sports lighting cages, wiring should be strung through the pole

b. Sports lighting poles incorporate one or more internal wiring guides. These are accessible through handholes opposite each guide.

## 4. Attachment of high mast top assemblies and sports lighting cages.

a. The bolts for these connections should be tightened in accordance with EN-1090-2 guidelines, excerpts of which are attached. Threads may need to be lubricated in the field in order to achieve bolt. Hardware suppliers use beeswax and various commercial waxes as lubricants. They indicate that products like "WD-40" are commonly used in the field.

b. Top mounted sports lighting cage and tilted head frame should be attached prior to pole installation.

## 5. Pole ladders

a. Mount ladder brackets (including starting bracket) onto pole using 2 No. M16 Bolts.

b. Insert ladder sections into brackets and merge them together using 2 No. ladder connector & M12 bolts per each connection. CAUTION: Do not over-tighten to the point of damaging ladder handrails.

c. Connect bottom section of ladder with starting bracket using 2 No. M12 bolts.

d. Connect ladder with ladder brackets using ladder locking plate and 1 No. M12 bolts per each end.

e. If ladder with built-in safety climbing device is used, this paragraph is to be omitted.

### 6. Safety climbing device (if ordered)

a. Safety climbing device is to be assembled in accordance to technical specification furnished by the supplier of the device.

b. Safety climbing device may be assembled only by installer authorized by the supplier of the device.

## C. CORROSION PROTECTION and STORAGE:

1. After assembly, any damage to the protective coating on the structure should be repaired.

## D. ERECTION:

1. Prior to lifting the structure, any slipover joint below the crane attachment point should be securely lashed to prevent any possibility of separation during lifting. For additional safety, a hook capable of supporting the entire weight can be attached to the handhole opening and connected to the crane attachment point.

2. The lifting crane must be attached:

   a. to the main pole member, not to appurtenances such as pole ladder brackets, the top flange, etc.

   b. above the center of gravity of the entire assembly including the weight of all equipment mounted on the structure before erection.

   c. as high as possible since higher attachment will result in more nearly vertical alignment of the assembly while suspended above the foundations.

3. Care should be taken to operate the crane very smoothly since jerkiness will cause impact loads which could damage some portion of the assembly.

4. At least a few anchor bolt nuts should be installed as quickly as possible after the base plate is in place. If the pole is eccentrically loaded, the nuts on the side opposite the direction of eccentricity should be installed first.

5. The structure should be checked after erection to make sure it is plumb. If there is some curvature, make sure it is not due to wind or heating of one side of the structure by the sun before trying to correct alignment. Ideally, the top of the structure should be directly over the bottom with any curvature being toward the middle of the structure. The leveling nuts can be adjusted to accomplish this alignment by raising the leveling nuts on the side the structure is leaning toward. Note that a small amount of rotation of the leveling nuts can result in a number of centimetres of movement at the top of the structure. The taller the structure, the more sensitive it will be to adjustment of the leveling nuts. If, at this point, the curvature is objectionable contact Valmont. After plumbing the structure, all remaining leveling nuts should be uniformly snugged against the base plate. Next the top nuts should be tightened and some provision should be made to prevent unauthorized loosening. The two most common methods are:

   a. A slight amount of additional tightening of each top nut.

   b. Peening of a thread just above the nut (considered permanent).

## E. ATTACHMENT OF EQUIPMENT:

1. Lighting structure components may be affected by vibrations induced aerodynamically or from other sources. Although rare, these vibrations can be severe enough to cause damage. This is believed to be more likely to happen when a structure is installed without the equipment which it is intended to support. All such equipment contributes damping to the system. It is considered good practice for installers to attach at least some equipment at the time of installation of the structure.

## F. INSTALLATION:

Prior to installation, the fastener components shall be protected from dirt and moisture in closed containers at the site of installation. Fastener components shall not be cleaned or modified from the as-delivered condition. Fastener components that accumulate rust or dirt shall not be incorporated into the work. For joints that are designated as snug-tightened joints, the bolts shall

be installed in accordance with Section F.1. For joints that are designated as pretensioned or slip critical, the bolts shall be installed in accordance with Section F.2 in the All joints are designed as a snug-tightened joints.

## 1. Snug-tightened Joints

All bolt holes shall be aligned to permit insertion of the bolts without undue damage to the threads. Compacting the joint to the snug-tight condition shall progress systematically from the most rigid part of the joint. The snug-tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the nut and connection plate into firm contact.

## 2. Pretensioned Joints

1. EN 1090-2, Section 8.5 permits three methods of tightening for preloaded bolts – torque control, torque control followed by part-turn of the nut, and direct tension indicators.

   a. In the **torque control** method, the torque is applied in two steps. The first step, after bedding of the joint, is to apply a torque of up to 75% of the required torque value to all the bolts. The second step is to apply an additional torque to each bolt such that the total applied to the bolt is up to 110% of the required nominal torque value. The extra 10% is to offset the subsequent torsional relaxation of preload in the connection when tightening wrench is removed.

   b. The **combined method** is a combination of torque control and the traditional part-turn method. After the joint is bedded, the preloading takes places in two steps. The first step is to apply a torque of up to 75% of the required torque value to all bolts. The second step is to apply to each bolt a predetermined rotation or part-turn to a specified angle, depending on the bolt length.

   c. The **direct tension indicator (DTI)** method relies on protrusions on direct tension indicators previously known as load indicating washers. These protrusions create a gap prior to preloading in the installed assembly. After the joint is bedded down, the DTI is initially tightened until the protrusions start to deform, at this stage approximately 50% of the preload has been applied. When the gap is closed to the specified value, the bolt force will not be less than the specified preload.

2. Reuse

Retighting previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as a reuse.

## Excerpts from EN 1090-2

**Table 19 – $F_{p,C}$ [kN] (where $F_{p,C} = 0.7\ f_{ub}A_s$)**

| | Bolt diameter [mm] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Bolt Grade** | **12** | **16** | **20** | **22** | **24** | **27** | **30** | **36** |
| 8.8 | 47 | 88 | 137 | 170 | 198 | 257 | 314 | 458 |
| 10.9 | 59 | 110 | 172 | 212 | 247 | 321 | 393 | 572 |

**Table 21 – Combined method: additional rotation**
**(Bolt Grade 8.8, 10.9)**

| **Total nominal thickness "t" of connected parts (including all spacers and washers)**<br><br>**d = bolt diameter** | **Additional rotation, at second step during tightening** | |
|---|---|---|
| **Bolt Grade** | **Degree** | **Nut rotation** |
| t < 2d | 60 | 1/6 turn |
| 2d ≤ t < 6d | 90 | 1/4 turn |
| 6d ≤ t < 10d | 120 | 1/3 turn |

# Recommended values for Pretensioned Joints

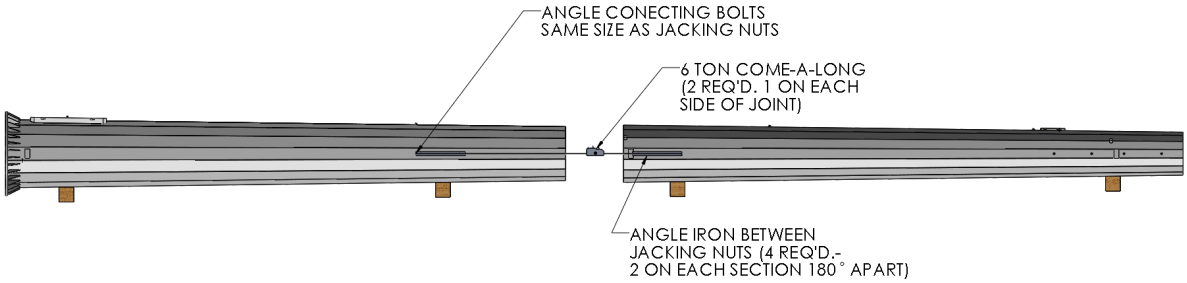
**Recommended Torque Values for Anchor Bolts**

| Torque [Nm] | Torque [Nm] | | |
|---|---|---|---|
| Bolt diameter [mm] | B500B (BST500S) | S355JR | 6.8 class |
| 30 | 300 | 300 | 350 |
| 36 | 500 | 500 | 600 |
| 42 | 800 | 750 | 950 |
| 48 | 950 | 1150 | 1400 |
| 56 | 1950 | 1800 | 2350 |
| 64 | 2900 | 2700 | 3450 |
| 72 | 4150 | 3900 | 5000 |

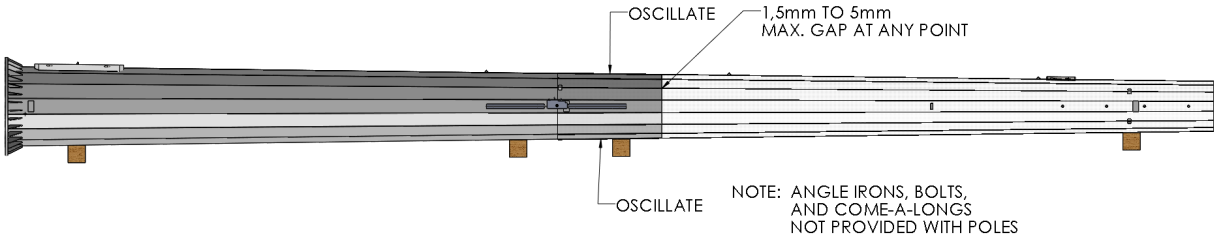
**Torque Values for Joints' Bolts**

| | 10.9 Grade | | | 8.8 Grade | | |
|---|---|---|---|---|---|---|
| Bolt diameter [mm] | Pretensioning Force $F_{p,C}$ [kN] | Torque [Nm] | 0.75*Torque [Nm] | Pretensioning Force $F_{p,C}$ [kN] | Torque [Nm] | 0.75*Torque [Nm] |
| M12 | 59 | 92 | 69 | 47 | 74 | 55 |
| M16 | 110 | 229 | 171 | 88 | 183 | 137 |
| M20 | 172 | 446 | 334 | 137 | 357 | 268 |
| M24 | 247 | 771 | 578 | 198 | 617 | 463 |
| M27 | 321 | 1128 | 846 | 257 | 902 | 677 |
| M30 | 393 | 1532 | 1149 | 314 | 1225 | 919 |

# ASSEMBLY & INSTALLATION DRAWINGS

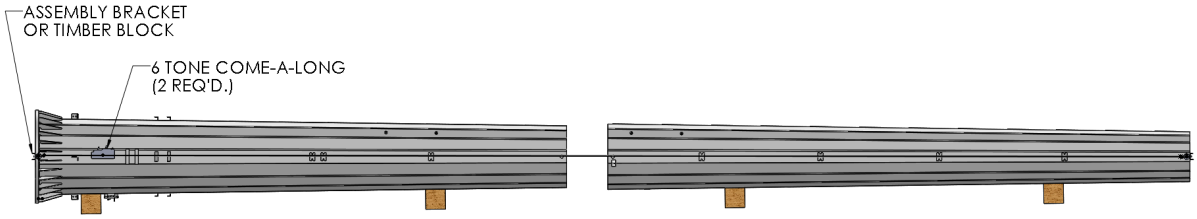



*HOOKUP PRIOR TO SLIPFIT*

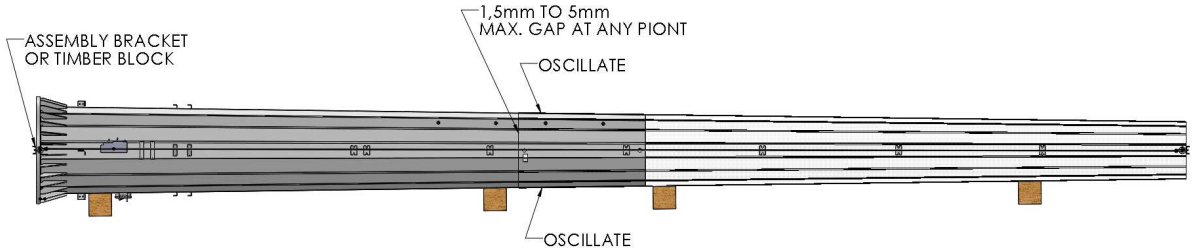



*SLIPFIT COMPLETE*

## FIGURE No. 1

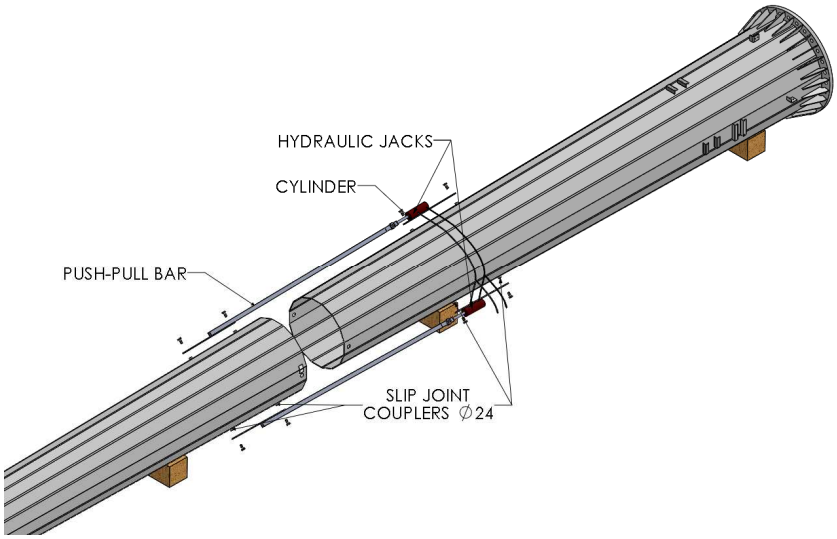



*HOOKUP PRIOR TO SLIPFIT*




*SLIPFIT COMPLETE*

## FIGURE No. 1A

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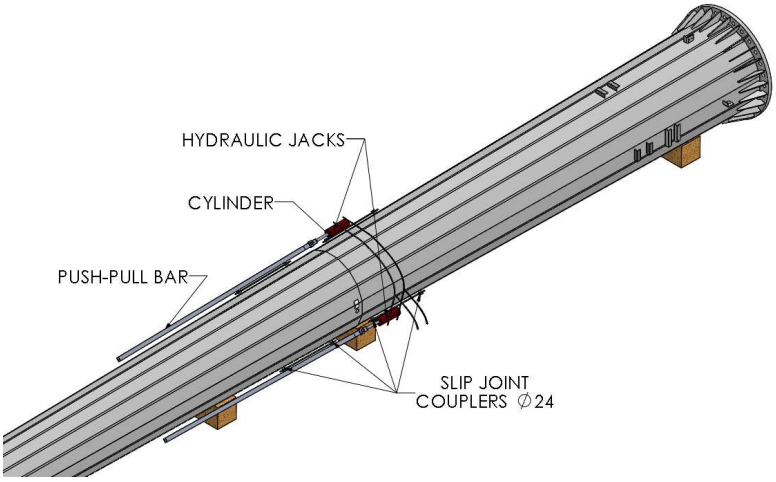
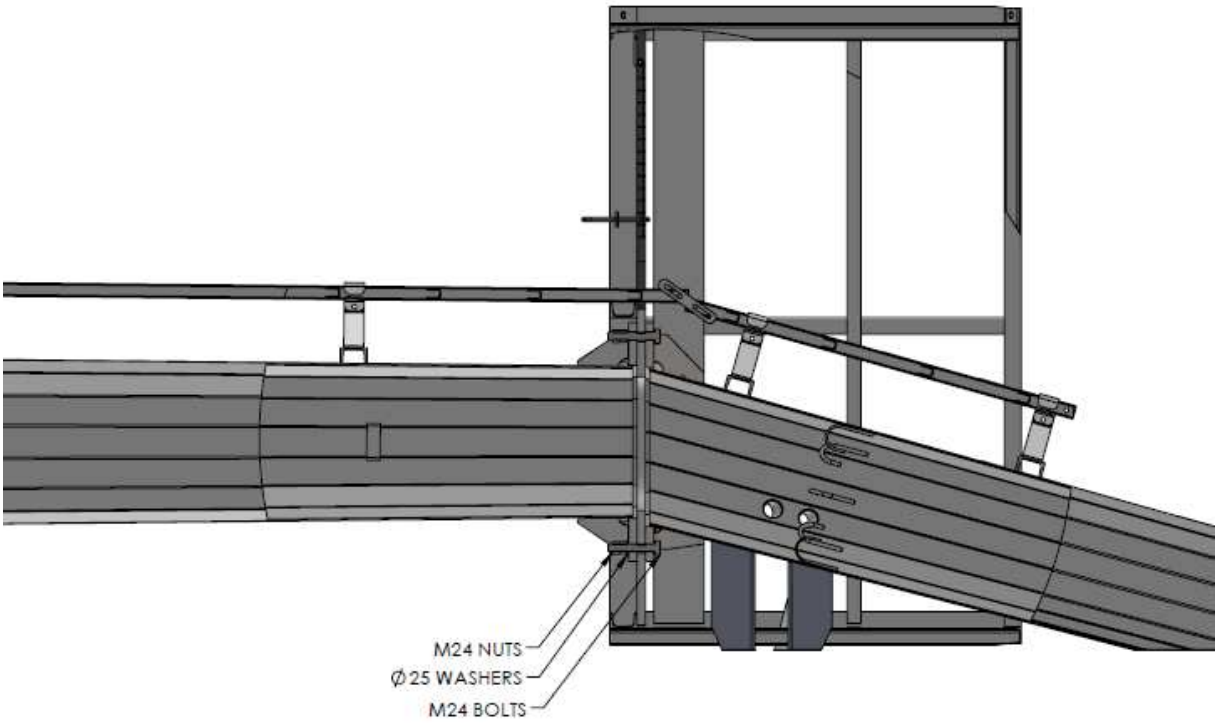


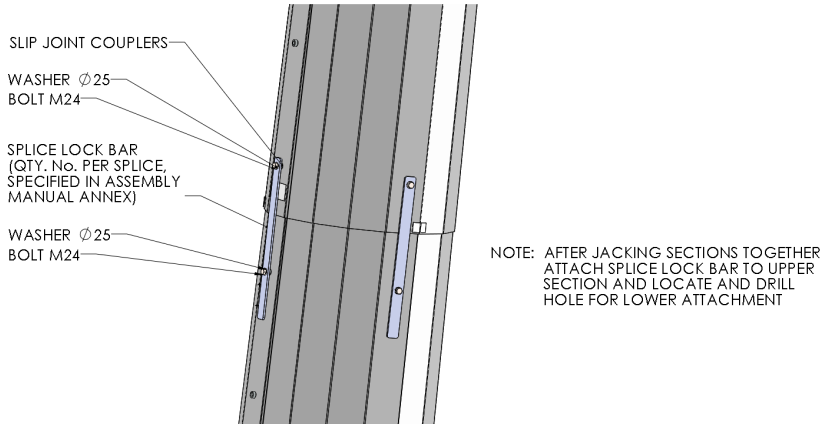

*SLIPFIT COMPLETE*

**FIGURE No. 1B**



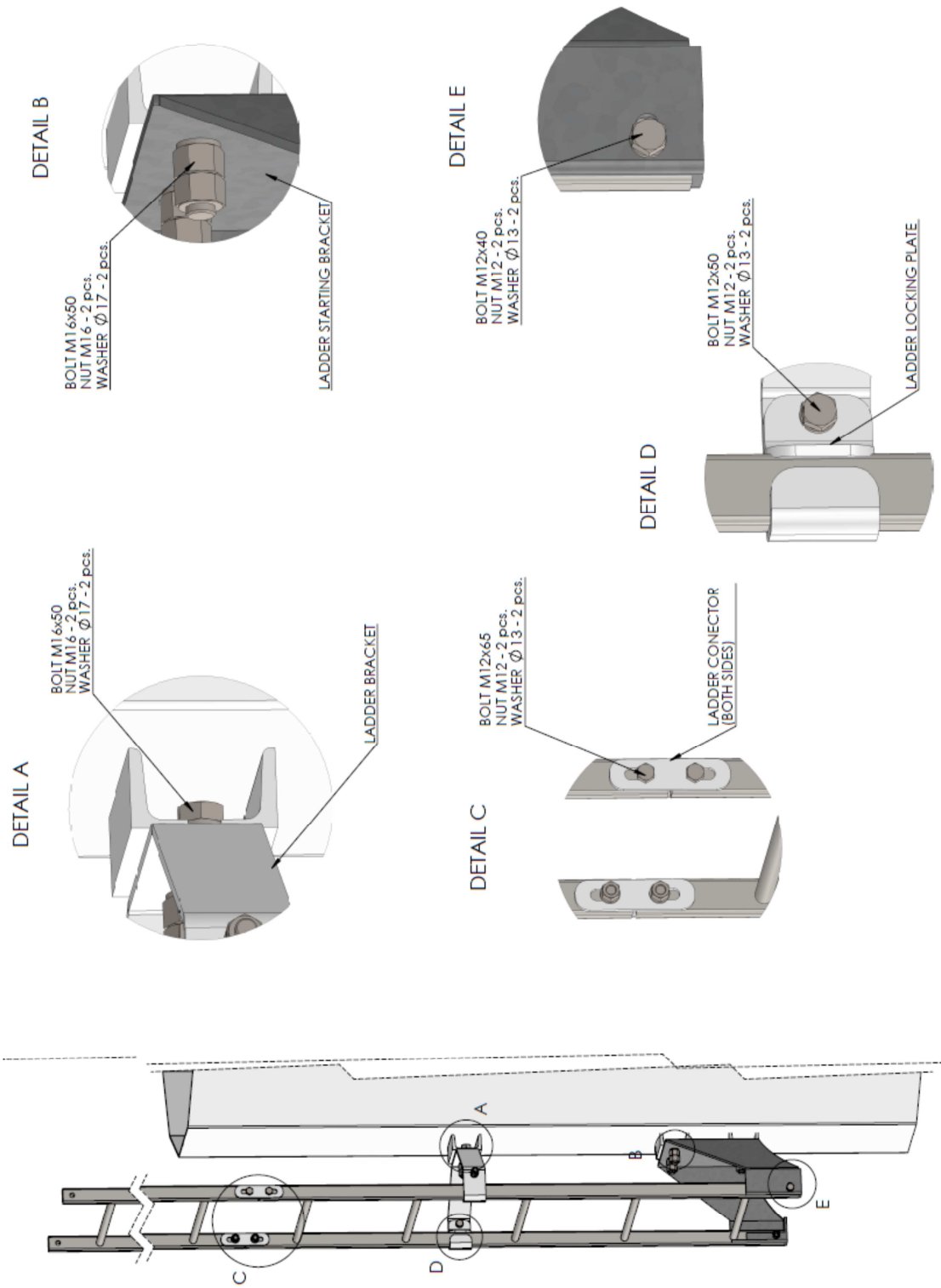

*SHAFT-CAGE-TILTED HEAD CONNECTION COMPLETE*

**FIGURE No. 2**



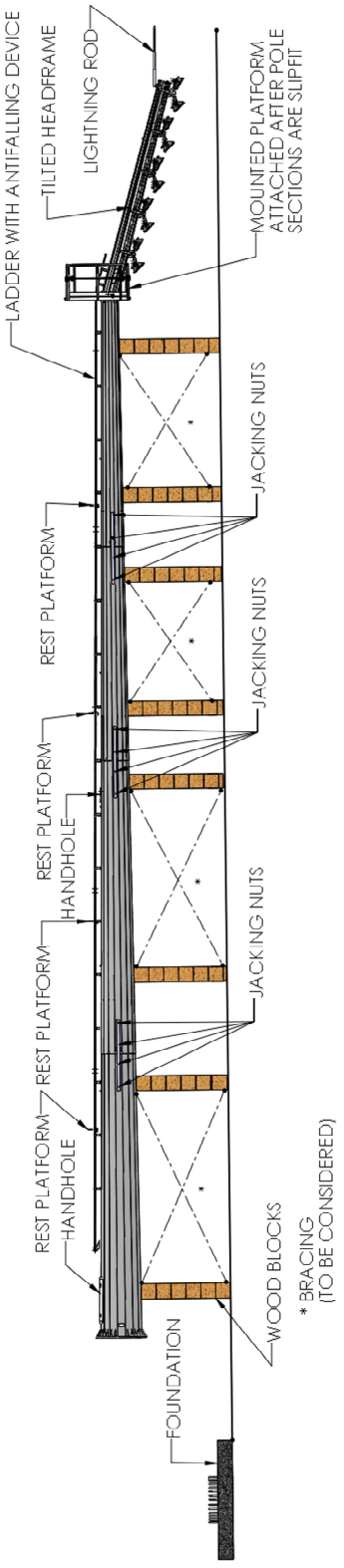

*SPLICE LOCK BAR*

**FIGURE No. 3 (alternatively)**



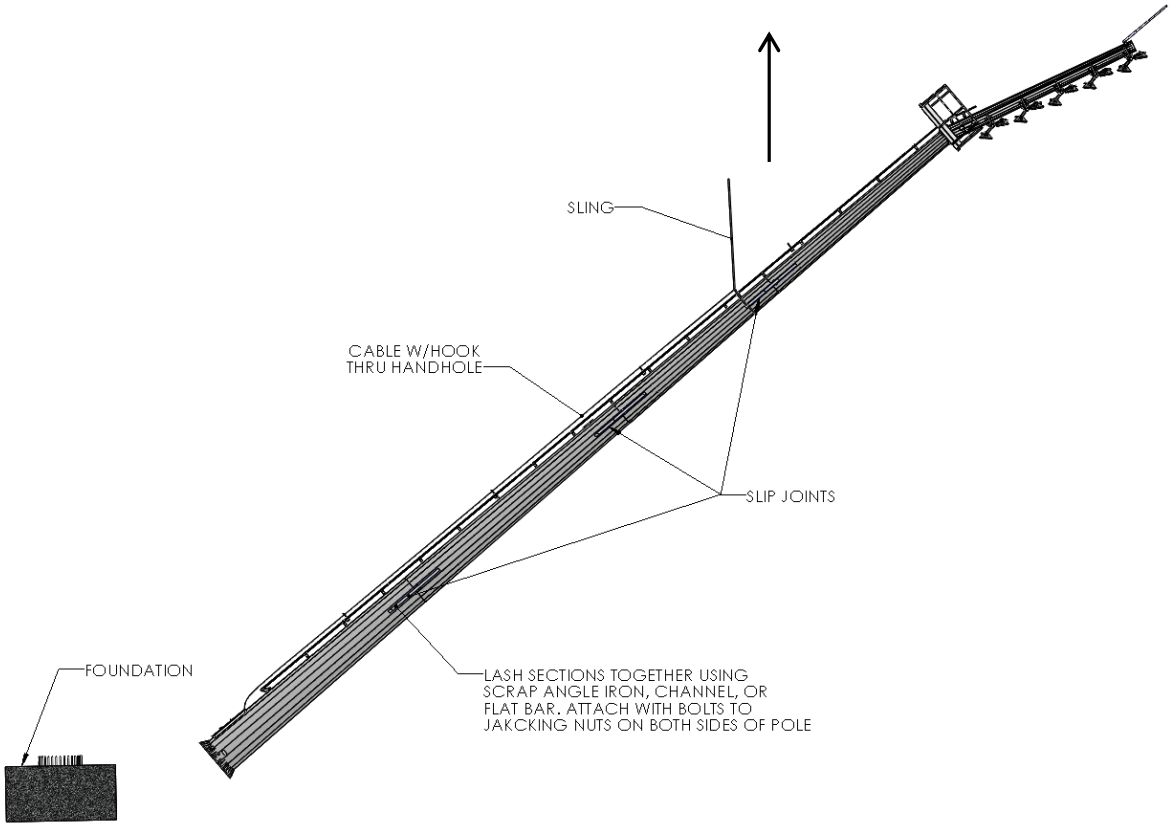

*LADDER ASSEMBLY*

**FIGURE No. 4**




***STRUCTURE ASSEMBLY COMPLETE***

**FIGURE No. 5**




***ERECTION***

**FIGURE No. 6**