

1			2			3			4			5			6			7			8		
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			REV.	DESCRIPTION												DATE		APPROVED					
			A	initial release												9/20/16		MGC					
			B	Revised Specs and moment capacities												8/16/17		MGC					
C																							

A

B

C

D

E

F

ARE Telecom & Wind

(AFS-1100)

Above/ Below-Grade Ballasted Foundation Manual

ARE

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CAD-generated drawing  
do not manually update

APPROVALS

DATE

DRAWN MGC

CHECKED

RESP ENG

MFG ENG

QUAL ENG

8/16/17

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sheet 1 of 4

**Design Codes**

- ANSI/ TIA-222-G, Structural Standard for Antenna Supporting Structures and Antennas
- ASCE/ SEI 7-05, Minimum Design Loads for Building and Other Structures
- IBC 2009, International Building Code
- AISC and RCSC, Specification for Structural Joints using ASTM A325-A490 Bolts or equivalent

**Design Loadings**

- Design Wind Speed - **120 mph (53.6 m/s)**
- Deflection based on - **60 mph (27 m/s)**
- Basic wind speed w/ 1" (25.4 mm) ice - **40 mph (18 m/s)**
- Classification of Structure - **Class II**
- Exposure- **C**
- Topographic - **Catagory 1**

**Ballast**

- Backfill / Ballast Material – Bulk Dry Density shall be **2700 lb/ yd3 (16 kN/m3)**
- Ballast Volume - **35.5 yd3 (27 m3)**
- Minimum allowable soil bearing pressure shall be no less than **3000 psf (144 kPa) (see Table 1.)**
- Steel Structure Self Weight
  - Foundation - **6808 lb ( 3095 kg)**
  - Sidewalls -**2376 lb (1080 kg)**

**Design Load Combinations.**

- Dead: Tower Self Weight + Steel Structure Self Weight + Backfill Material Self Wt
- Wind: Tower Horizontal Reaction + Tower Moment Reaction
- Service: 0.9 Dead + 1.35 Wind
- Ultimate: 0.9 Dead +1.35 Wind

**Geotechnical Investigation**

- It is recommended that a site study be conducted to verify that the soil parameters equal or exceed the requirements shown above.

**Important Note:**  
Please contact ARE directly with questions or concerns, or if just unsure about the aforementioned details and requirements.

**Table 1.**

Soil Class	Minimum Ultimate Bearing Capacity	Maximum Base Moment
Class 5	3000 psf (144 kPa)	335 ft-kip (454.2 kN-m)
Class 4	4000 psf (192 kPa)	355 ft-kip (481.3 kN-m)
Class 3	6000 psf (287 kPa)	375 ft-kip (508.4 kN-m)
Class 2	10,000 psf (479 kPa)	395 ft-kip (535.5 kN-m)


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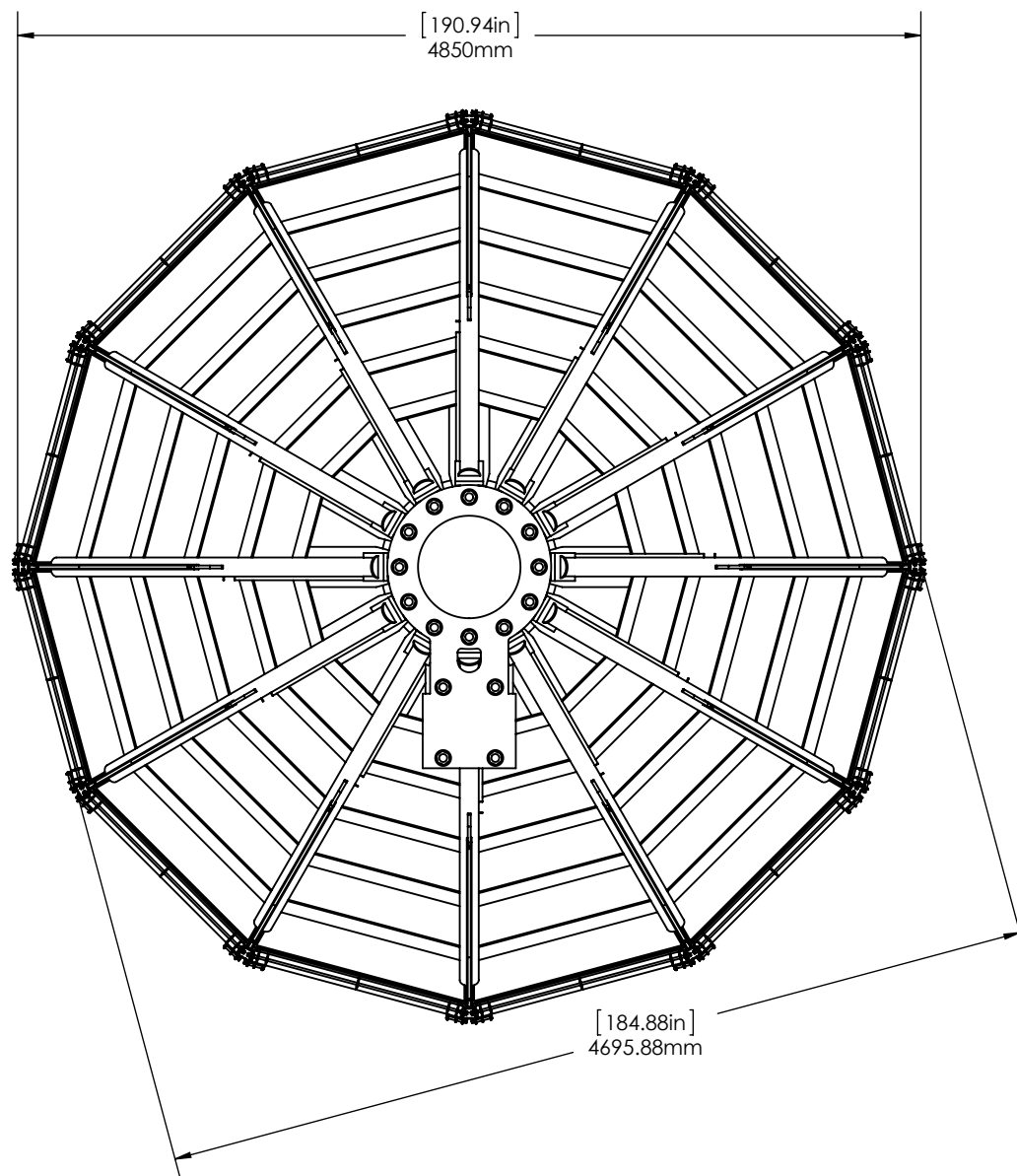
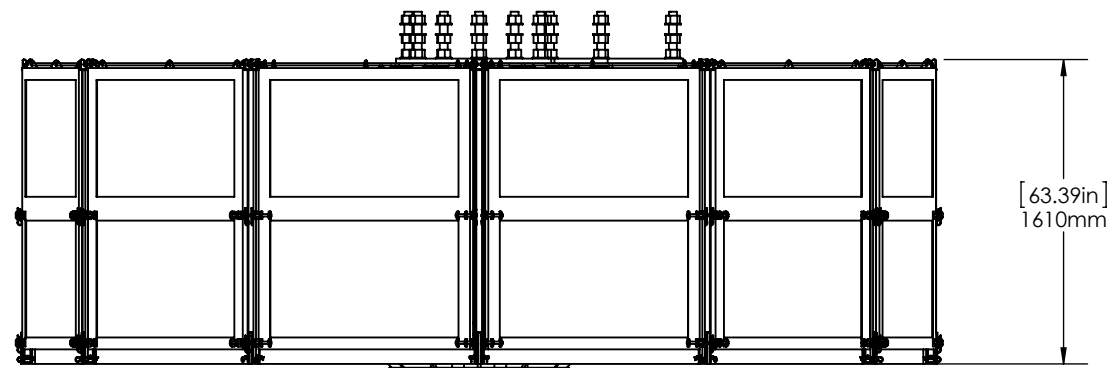
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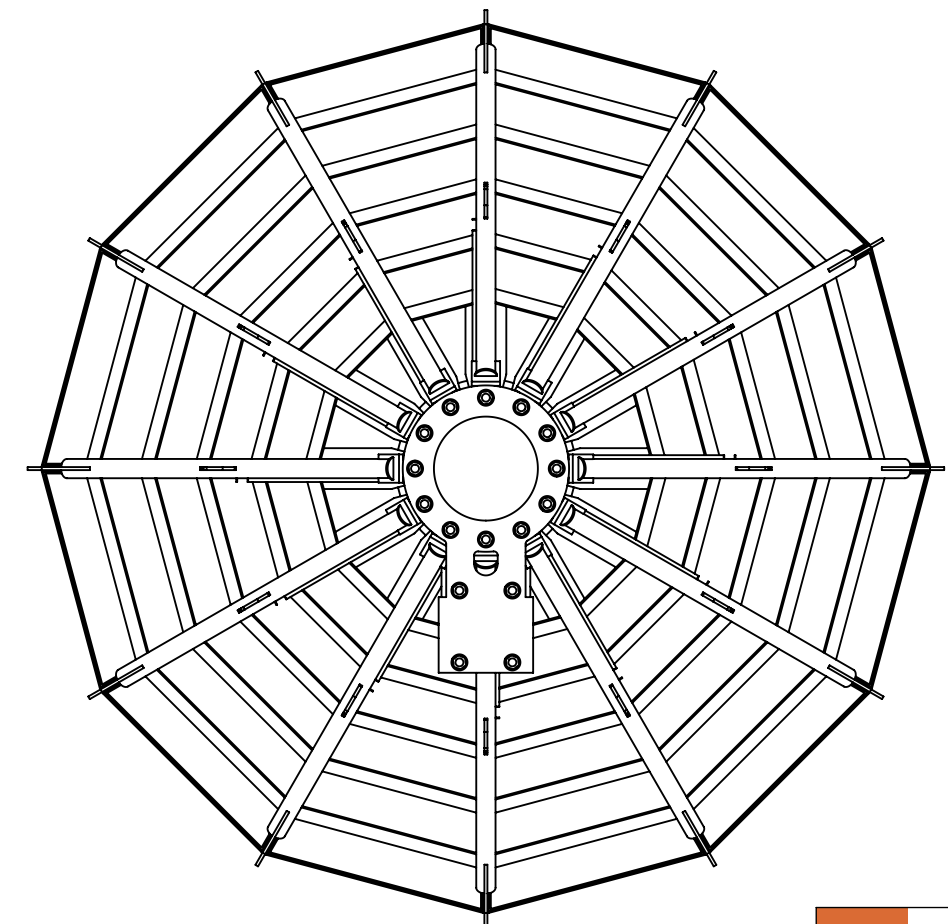
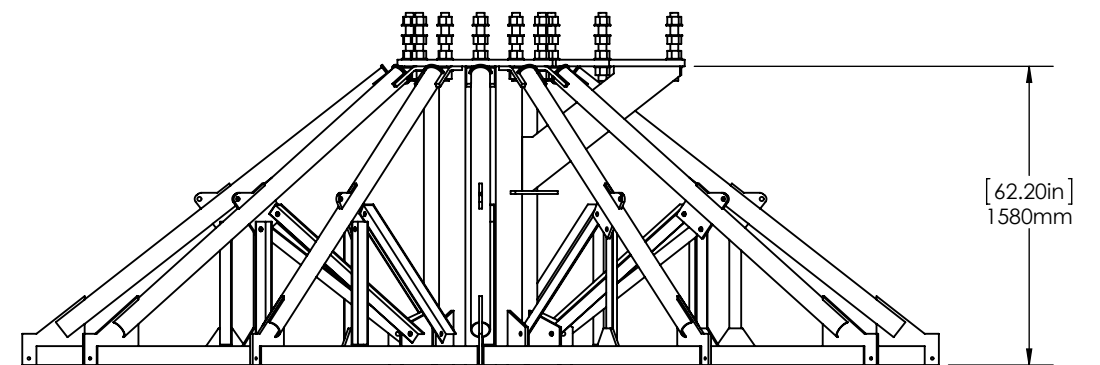
scale NA rev. B size NA sheet 2 of 6

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## Above Grade (Sidewalls Hinged)



## Below Grade (Sidewalls not required)



F

(2X) 28 Ton Hydraulic  
Cylinders (Optional)  
See hydraulic manual  
for more details.



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Preloaded High Strength Structural bolts

- The bolts shall be in accordance with **AISC and RCSC (DIN 6914 / ISO 7412)**.
- The bolts shall be installed and preloaded in accordance with **AISC and RCSC (BS EN 1090-2:2008)**
- The slip resistances of the structural bolts were calculated in accordance with **AISC and RCSC (EN 1993-8: 2005)**. It is understood that the steel will be hot dipped galvanized after fabrication and a bitumen coating will be applied on direct burial only. The bitumen coating is not suitable on the surface of these joints and therefore it is necessary to mask the faying areas prior to the application of the bitumen paint.
- The friction coefficient factor is taken as **0.2** which is recommended for hot dipped galvanized surfaces.

Preloaded bolt installation

- The contact surfaces shall be free from all contaminants, such as oil, dirt or paint.
- Burrs that would prevent solid seating of the connecting parts shall be removed.

Torque control method (see Table 2.)

- 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 the tightening wrench is removed.

Table 2.

Bolt Torque and Preload Requirements								
#	Bolt Size - Grade A325, (8.8) or equivalent	Torque Coefficient	Torque ft-lb/ (N-m)	Torque 75% ft-lb/ (N-m)	Torque 110% ft-lb/ (N-m)	Preload lb-kips/ (kN)	QTY	Width Across Flats - in/ (mm)
1	1 3/4-5 x 12"/ (M42x4.5 x 300mm)	0.2	2222/ (3013)	1667/ (2260)	2445/ (3315)	81/ (359)	16	2 5/8 (65)
2	1-8 x 3" (M24x3 x 75mm)	0.2	701/ (950)	525/ (712)	771/ (1045)	44.5/ (198)	60	1 1/2 (36)
3	5/8-11 x 2.5" (M16x2 x 65mm)	0.2	162/ (220)	122/ (165)	179/ (242)	15.5/ (69)	72	15/16 (24)

A technical drawing of a structural steel connection. It shows a vertical column on the right, a horizontal beam at the top, and a diagonal gusset plate. Various bolts are indicated with circled numbers: 1 points to a bolt on the top horizontal beam; 2 points to bolts on the bottom horizontal beam; 3 points to bolts on the diagonal gusset plate. The drawing is a line drawing showing the geometry and bolt locations.

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Part #  
scale NA rev. A size NA sheet 5 of 6



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# Direct Burial AFS-1100

## Site Control

(A) - Earth material shall be excavated to a diameter of **191" x 59"/ (4.85m x 1.5m)** deep. Excavation walls shall be properly sloped to avoid cave-in.

(B) - Minimum allowable soil bearing capacity shall meet or exceed **3000 psf/ (144 kPa)**. Subsoil layer (bearing strata) shall be leveled prior to placing foundation structure in excavated hole. A layer of coarse sand may be used to provide good contact between foundation and compacted subsoil layer.

(C) - Backfill using excavated soil. Backfill material shall be free from all organic materials and be mechanically compacted in layers not exceeding **10"/ (250mm)**. Backfill material must be equal to or exceed a dry bulk density of **2700 lb/ yd3/ (16 kN/m3)**.

(D) - Distance from top of kingpost flange to grade shall be **4"/ (100mm)**. A slope gradient of **3% to 5%** is recommended to mitigate soil saturation and to facilitate runoff away from tower.

## Note:

For more details and analysis results, refer to the site specific design review report

