CALCULATION PACKAGE

STRUCTURAL DESIGN

Mulnite-1P
North America

PREPARED BY

FTC SOLAR

PREPARED FOR

AUI Partners

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Important Notice

This report is a confidential calculation package which includes structural analysis and design of a tracker prepared for AUI Partners.

All prior proposals or interim reports dated before this report, whether written or presented verbally, are superseded.

Issue Register

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EXECUTIVE SUMMARY

Project Overview

This package is provided as the justification of the structural design for the ground mounted single axis 1P Pioneer H Tracker corresponding to the Mulnite-1P solar farm located in North America. The site specific design parameters such as wind speed and snow load are defined as per ASCE 7-16. Other parameters such as module size, GCR and Tracker height, are defined in consultation with the customer, AUI Partners. This document includes verifications of the superstructure of the single axis Pioneer H Tracker.

The structural elements verified are the torque tubes. The structural design of the tracker and components is based on the project information and relevant standards, and meets the performance requirements of the tracker.

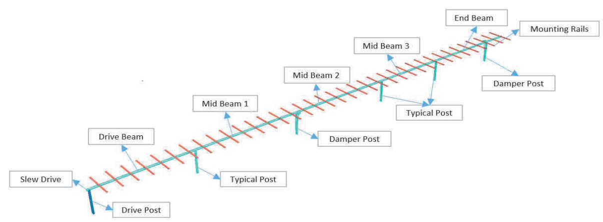


Fig. 1 - Typical 11-Post Tracker (Right-half wing)

Tracker Configuration

The Pioneer H - 1P tracker array consists of 78 modules per row. The trackers are designed as per ASCE 7-16 for a wind speed of 108mph, a snow load of 30 psf and a ground coverage ratio (GCR) of 47%. The tracker rotates to an angle of +/- 52 degree. During a wind event, the tracker goes to a safety stow position (0 deg).

Torque Tubes

Table 1 - Design Results

Hexagon Torque tubes of grade 80 ksi with G90 coating			
ROWS		EXTERIOR	INTERIOR
FULL ROW	Drive Beam (mm)	2.75	2.75
	Mid Beam (mm)	2.75	2.00
	Mid Beam 2 (mm)	2.75	2.00
	End Beam (mm)	2.00	2.00
	End Beam 2 (mm)	2.00	2.00
	Damper/ Row	4	2
PARTIAL 1/2 ROW	Drive Beam (mm)	2.75	2.75
	Mid Beam (mm)	2.75	2.00
	Mid Beam 2 (mm)	2.75	2.00
	End Beam (mm)	2.00	2.00
	Damper Count	4	2

1. PROJECT INFORMATION

The following are the project specifications and design inputs used to prepare this calculation package.

Location

County, State	=	North America		
Design life	=	35	yrs.	

Module Specification:

Capacity (Wp)	=	540		
Manufacturers	=	Heliene		
Variant	=	Heliene 144HC M10 SL Bifacial 540W		
Panel Length (mm)	=	2279		
Panel Width (mm)	=	1134		
Panel thickness (mm)	=	35		
Panel Weight (kg)	=	29.2		

Site parameters:

Design Wind speed	=	108	mph	(As per ASCE 7-16)
Snow	=	30	psf	(As per ASCE 7-16)
Seismic coefficient	=	0.078		(As per ASCE 7-16)

System Configuration:

No. of modules per row	=	78		
String size	=	26		
Ground Cover Ratio (GCR)	=	47.00	%	
Grade to centre of TT	=	1.742	m	(Refer Mechanical GA in Appendix)

Tracker Configuration

Range of motion	=	+/-52	deg	
Operational wind speed	=	45	mph	
Stow angle	=	0	deg	
Snow shedding	=	7.5	psf	

Tolerances:

Ground undulation tolerance	=	152	mm	
Ground clearance	=	915	mm	

Slope details:

NS Slope	=	3%		

2. PRODUCT OVERVIEW

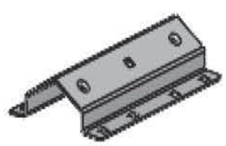
2.1 Pioneer H - 1P - Product Features

Pioneer is a Single Axis Tracker system which allows the mounting of framed or frameless, monofacial or bifacial and thin-film PV modules. Maximum wing length of Pioneer tracker can 115m. The distance between rows is variable and is determined by the desired ground coverage ratio (GCR).

Pioneer has the capability to adjust to uneven site grading conditions and can be installed on terrains with varying east-west and north-south slopes. Pioneer can be mounted on slopes of up to 10 degrees in the north-south direction and has no limits in the east-west direction.

The base Pioneer system is designed to support up to 7.5 psf design snow loads. A snow sensor detects both overall snow depth and the rate of accumulation. The net snow depth impacts the Pioneer systems range of motion (ROM). As snow accumulates on the ground, the Pioneer system actively reduces the tracking ROM to prevent unintended mechanical interferences with potential snowbanks. The reduced ROM can be reset anytime by a maintenance technician once they've verified it is safe to operate to the full ROM.

2.2 Components

Coupler,Half-Clamp	Journal - Lower	Journal - Top	Slew Drive
			

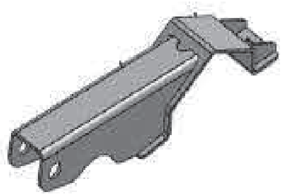
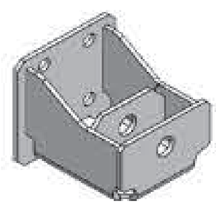
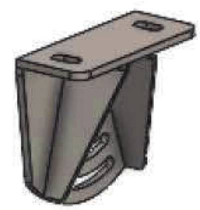
Damper	Damper Arm	Damper Mount Lower	Slew Drive Bracket
			

Fig. 2: Components of a tracker

The components shown above are representative. Refer to the installation manual for the actual project components.

2.3. Damper

The Pioneer system during wind events relies on damping to control the natural frequencies of the structure. System damping is provided through dampers mounted on foundation posts on both sides of the tracker rows.

2.3.1 Wind Effect on tracker:

Stalled airflow may create a natural harmonics situation where the modules flutter, which could damage the modules and steel structure. Additionally, the inertial state of the single axis tracker (SAT) may cause the wind to catch the resonant frequency, causing it to vibrate and stress. In its inertial state, the SAT may also undergo non-oscillatory instability leading to torque tube twists. The combined effects of resonant vibration, flutter and torsional divergence, were studied in the wind tunnel test, discussed in section 3.2 of this document. Proprietary tools were used to size dampers to remove dynamic energy in the torque tube and further reduce the possibility of the above three dynamic stress conditions on the pioneer system.

2.3.2 Damper System

The damper apparatus includes the arm to attach the damper to the torque tube and a bracket that connects the spherical rod to the foundation post. The damper is a piston-style damper filled with damper XSD oil to steadily cushion the movement of the tracker along the east-west plane.

The Pioneer system during wind events relies on damping to control the natural frequencies of the structure. System damping is provided through dampers mounted on foundation posts on both sides of the tracker rows.

2.4 Connections

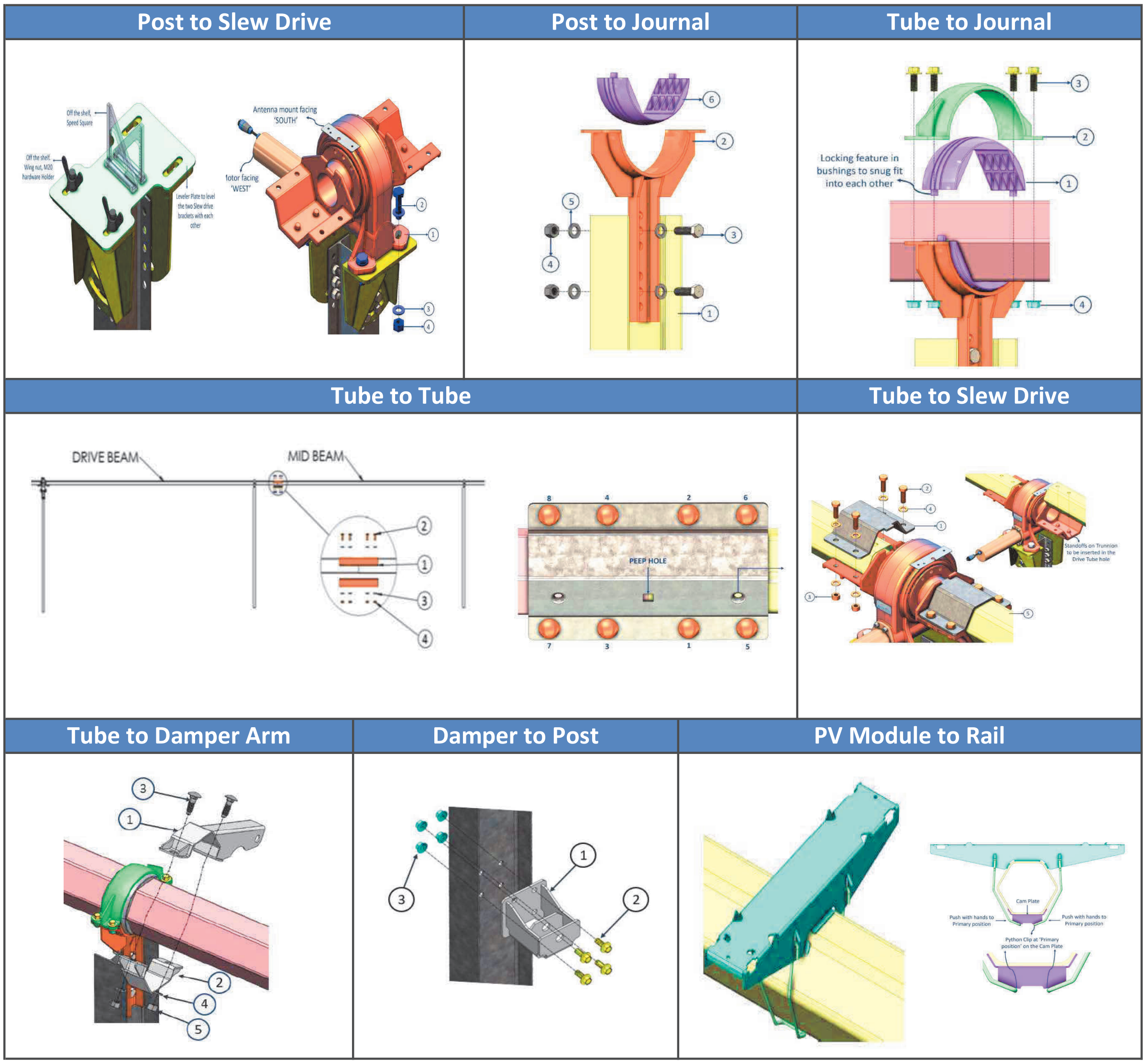


Fig. 3: Connections in Pioneer

The Connections shown above are only as representative. Please refer Installation Manual for the sizes and other details

2.4.1 Connection Description

Following are the connection description indicating restraints and constraints assumed in Finite Element Analysis

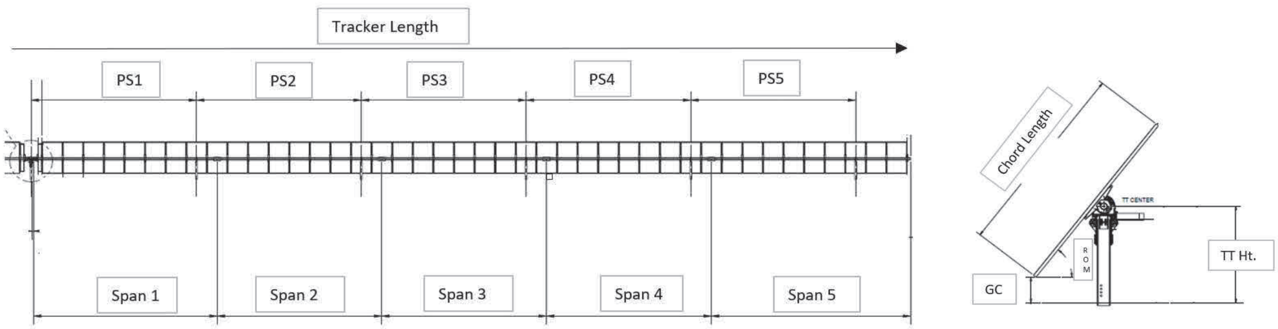
1 Post to Slew Drive - Fixed (Bolted Connection)
2 Post to Journal - Pinned (Bolted Connection)
3 Tube to Journal - Friction (Nylon Bushing)
4 Tube to Tube - Splice (Bolted Connection)
5 Tube to Damper Arm - Fixed (Bolted Connection)
6 Damper to Post - Fixed (Bolted Connection)
7 PV Modules to Rails - Shear (Bolted Connection)

3. Pioneer H - TRACKER ARCHITECTURE

Pioneer is single axis tracker (SAT) with a 1 solar panels in portrait architecture which rotates +/-52 deg developed by FTC Solar.

The racking structure(s) consists of cantilevered steel posts which are typically used as embedded (driven) steel piles. Steel hexagonal torque tubes are used to support the steel module rails which support the modules (mounted in portrait orientation). All torque tubes are connected to drive motor on the central drive post (each row).

3.1 Tracker Arrangement



- PS1 - Post Spacing 1
- PS2 - Post Spacing 2
- PS3 - Post Spacing 3
- PS3 - Post Spacing 4
- PS3 - Post Spacing 5

- Span 1 - Drive Beam
- Span 2 - Mid Beam
- Span 3 - Mid Beam 2
- Span 4 - End Beam
- Span 5 - End Beam 2

- GC - Ground Clearance
- ROM - Range of Motion

Fig. 4: Tracker Arrangement

The Tracker's safe stow angle is 0 deg (flat) and is designed for the full design wind speed. All other operation angles are designed for an operational wind speed of 45 mph. The Pioneer stow feature is triggered at wind speeds of 35mph (considered as wind event).

The trigger wind speed is detected by anemometer installed in site, and the communication to the tracker is sent through a wireless system.

3.2 RWDI Wind Tunnel Result Overview

3.2.1 Tracker Row classification

Pioneer is classified with respect to wind tunnel test results recommended by RWDI based on the scaled down prototype study. In wind tunnel testing pressures at various segments and rows are measured through wind sensors. The RWDI classifies rows as: Exterior and Interior as illustrated in the figure below (sourced from the RWDI report). RWDI then provided GCp (pressure) and GCm (moments) factors for each classification. Refer to section 8 herein for further detail.

EXTERIOR Row	EXTERIOR Row	EXTERIOR Row	EXTERIOR Row
EXTERIOR Row	EXTERIOR Row	EXTERIOR Row	EXTERIOR Row
INTERIOR Row	INTERIOR Row	INTERIOR Row	INTERIOR Row
INTERIOR Row	INTERIOR Row	INTERIOR Row	INTERIOR Row
INTERIOR Row	INTERIOR Row	INTERIOR Row	INTERIOR Row
INTERIOR Row	INTERIOR Row	INTERIOR Row	INTERIOR Row
INTERIOR Row	INTERIOR Row	INTERIOR Row	INTERIOR Row
EXTERIOR Row	EXTERIOR Row	EXTERIOR Row	EXTERIOR Row
EXTERIOR Row	EXTERIOR Row	EXTERIOR Row	EXTERIOR Row

Fig. 5 Tracker Row Classification Based on RWDI Recommendation.

3.2.2 Static, Dynamic, and Aeroelastic Wind Analysis Procedure

FTC has developed the wind loading model used to design Pioneer H tracking system through extensive wind tunnel testing and analysis performed with RWDI Consulting Engineers and Scientist. An atmospheric boundary layer wind tunnel study was used to determine the peak force and moment coefficient measurements in compliance with ASCE 7-10. Below are the extensive wind study reports that are the basis of FTC's understanding of the appropriate wind loading on the Pioneer H single axis 1P tracker structure.

Table 2 - RWDI Report Edition

Report No	Dated	Study
2203264	May 18, 2023	PIONEER 1P SINGLE-AXIS TRACKER

In the RWDI Report No.2203264 dated. May 18, 2023 a full aeroelastic study was performed by RWDI to:

i) Assess the aerodynamic stability and wind-induced buffeting responses of the tracker based on wind tunnel testing using a full aeroelastic model.

ii) Assess the static and dynamic wind loads based on wind tunnel testing using a rigid pressure model.

Due to the high level of torsional damping in the Pioneer Tracker, FTC included the damper mechanisms in the scaled model. The results of this study address wind loads (GCp static, GCp dynamic and GCm) from the rigid pressure model and aeroelastic model.

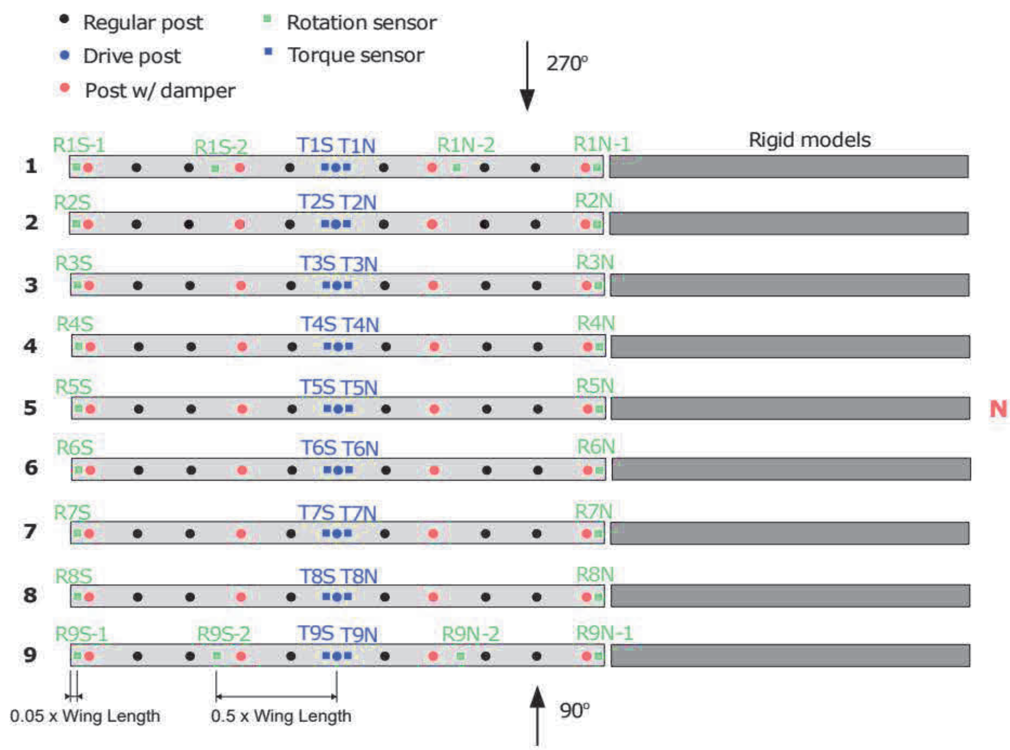


Fig. 6: Sensor Location for Rotation Measurement

For this specific project, conventional dampers are proposed for the 11-post Pioneer tracker system. The Exterior rows are provided with 4 conventional dampers and the Interior rows are provided with 4 or 2 conventional dampers based on Torsional Frequency, Wind speed & Chord Length. Refer to section 8.5 herein for further detail.

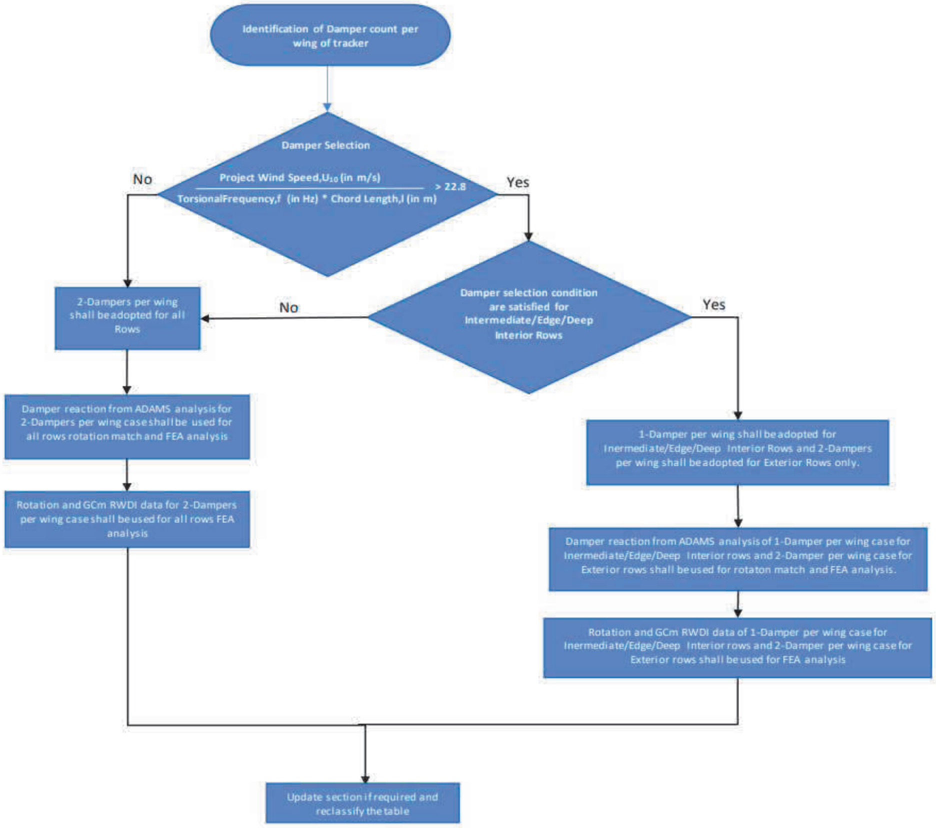


Fig. 7 Flowchart for Identification of Damper Count

For stow position, the higher design wind speed results in the aeroelastic moments governing the rotational aspects of the design. Based on the reduced frequency (as per Table 12), the maximum rotations are interpolated from the rotations provided in WTT report. A second structural model was created for these "rotated" sections and the corresponding GCp coefficients were used to apply the static and Dynamic Amplification Factor (DAF) GCp loads to each section based on their rotated tilt angle. The operational tilts (greater than 0°) were also analyzed for the tilt angles to determine maximum loads on the framing under operational (non-stow) conditions. An envelope case of both stow and operational stresses was used to determine the structural adequacy of the proposed racking and steel posts.

Aeroelastic moment coefficients (GCm) from the aeroelastic study are the dynamic coefficients. Damper GCm coefficients at stow positions and various tilt angles are provided as a function of reduced frequency (nL/V) in the WTT aeroelastic study report. Hence, coefficients for each configuration, geometry and wind speed will vary according to the reduced frequency.

The reduced frequency (fL/U) is dependent on the torsional frequency (f) of the torque tube being considered, the chord length (L), and the wind speed (U).

For the wind speed (U), RWDI states that "in the calculation of reduced frequency (fL/U), the wind speed (U) should be consistent with the governing code provision whether ASD or LRFD method is used in the structural analysis and design."

Since we use ASD design approach, the equivalent service load wind speed to use based on the design wind speed of 108 MPH and the load combination factor of 0.6 from the ASD load combinations would be: U= 108*Sqrt[0.6 * kd * ke] = 76.84 MPH, where kd=0.85 and ke=0.99 per ASCE 7 Standard.

3.2.3 Static + DAF Approach:

The wind tunnel data were presented as pressure or moment coefficients consistent with those defined in the ASCE 7 Standard. The definitions of these coefficients are given below.

$$GC_P = \frac{P_{net}}{\frac{1}{2}\rho \cdot u_{10}{}^2 \cdot K_{z\_ASCE}} \qquad GC_M = \frac{M_{torque}}{\frac{1}{2}\rho \cdot u_{10}{}^2 \cdot K_{z\_ASCE} \cdot A \cdot L}$$

Where,

P_{net} in the net pressure (normal to top surface of PV modules), and and Mtorque is the moment about torque tube,

ρ is the air density,

u10 is the 3-second gust wind speed at 10 m in open terrain,

$K_{z,ASCE}$ is the exposure factor of 0.85 at tracker height(H) in open terrain as per ASCE 7,

A is the averaging area of a rail, section, half or full tracker, and

L is the chord length.

3.2.4 Force and Moments

The following equations were used to estimate the wind forces and moments

$$F_N = (R2 \times GCp\ static \pm GCp\ Dynamic) \times qz \times A$$

$$M_{torque} = (R1 \times GCm\ Aero) \times qz \times A \times L$$

F_N is the normal force and M_{torque} is the moment about the torque tube,

qz is velocity pressure evaluated at height z at the centroid of the area, A, for selected exposure as per ASCE 7 procedure (i.e., constant below 15 ft and Kd = 0.85),

A is the averaging area of a rail, section, half or full tracker,

L is the chord length, and

R1 and R2 are combined adjustment factor for GCR and tracker height.

The coefficients (Static, Dynamic and Moment) are provided in WTT report.

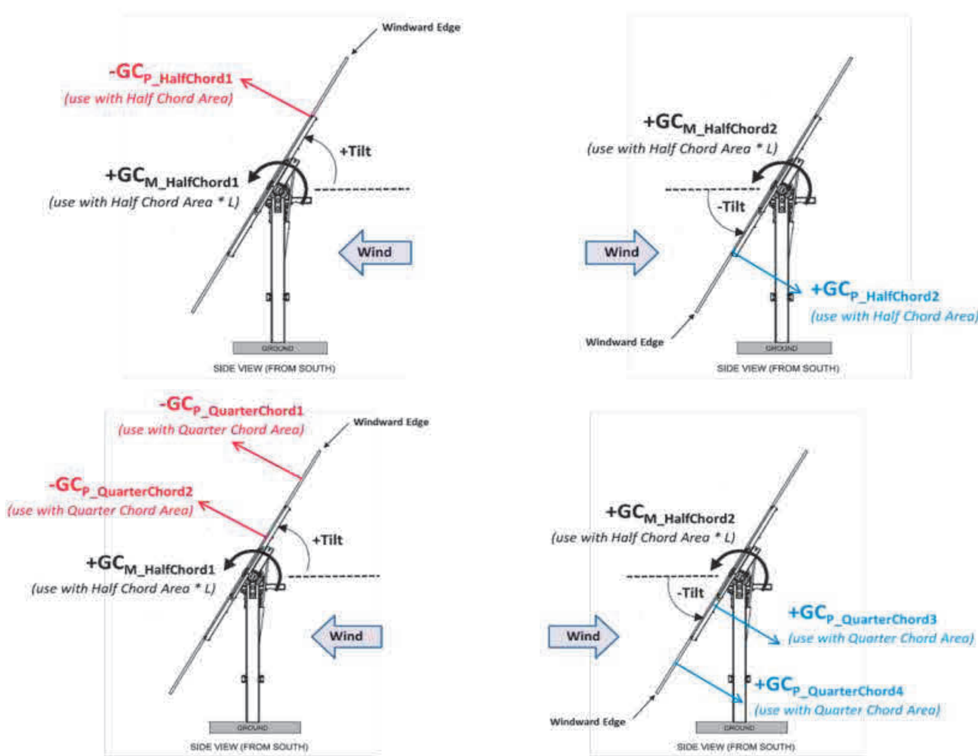


Fig. 8: Key Plan for Wind Loading from Pressure Model Tests in WTT Report

The flow chart summarizes the calculation of the wind load based on wind zone (row classification), tracker tilt, etc.,

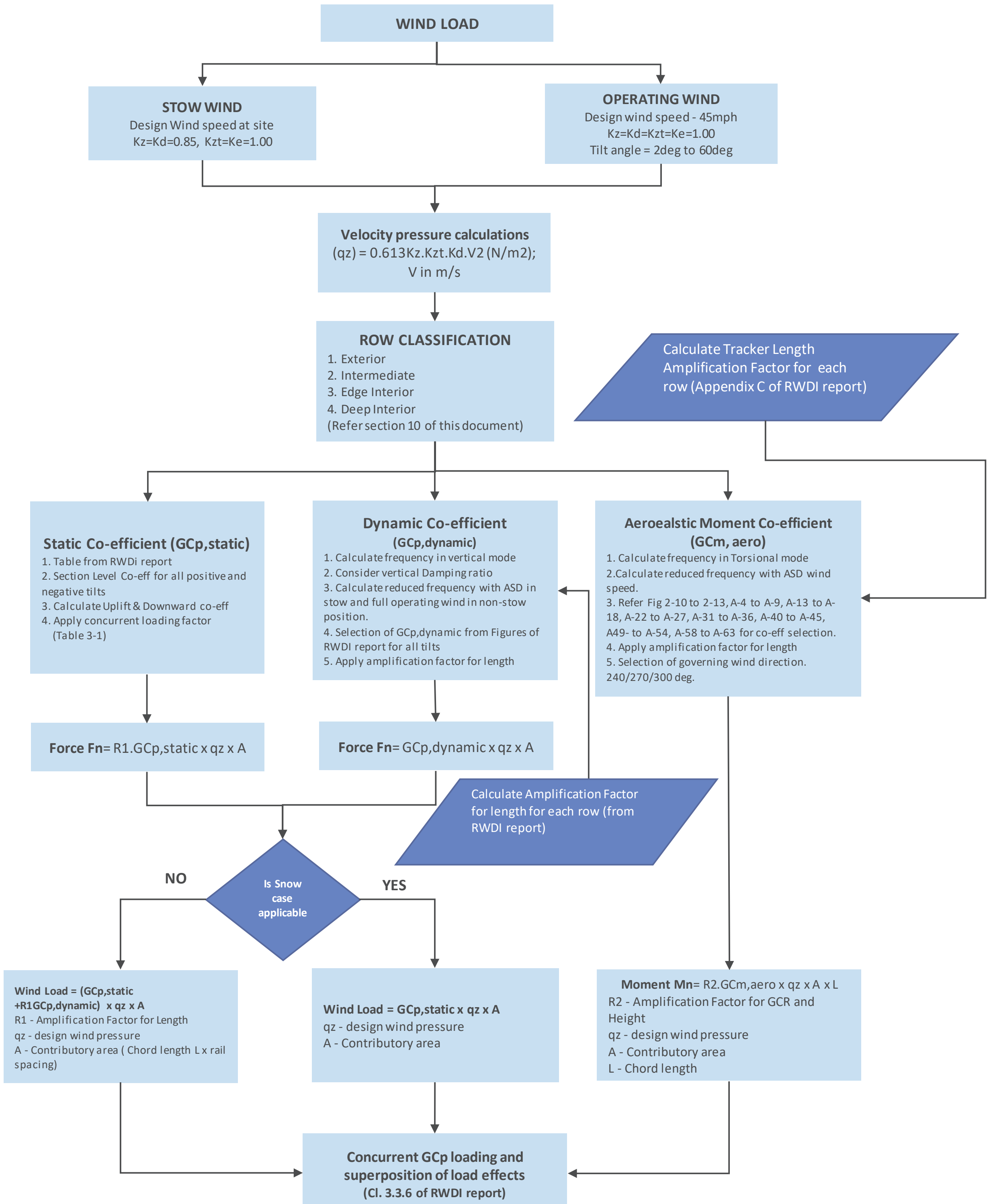


Fig. 9 : Flowchart for Wind Load Calculation

4. CODES AND STANDARDS

Design loads and design of steel members and components adhere to the following standards:

4.1 Design Standards:

- ASCE 7-16 - Minimum Design Loads for Buildings and Other Structures
- IBC 2015 - International Building Code
- AISC 360-16 - Specification for Structural Steel Buildings

4.2 Galvanization Standards:

- ASTM A385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
- ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ISO 1461 - Hot-Dip Galvanized Coatings on Fabricated Iron and Steel Assemblies Specifications and Test Methods

4.3 Material Standards:

Table 3 - Material Standards

Component	Standard	Description
Column/Post	ASTM A6/A6M	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
	ASTM A992	Standard Specification for Structural Steel Shapes
Torque Tube	ASTM A1085	Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
Module Rail	ASTM A653	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

5. MATERIAL SPECIFICATION

This section outlines the various specification for materials used in the tracker design and analysis, namely torque tube, post and rails. Minor components are included as those capacities are independently established though UL testing.

Table 4 - Material Properties

Member	Yield Strength	Ultimate Strength	Modulus of Elasticity	Rigidity Modulus	Material Density	Co-eff of thermal Expansion
	ksi	ksi	ksi	ksi	k/ft^3	/°F
Tubes	80	90	29000	11154	0.49	6.5
Posts	50	60	29000	11154	0.49	6.5
Rails	80	90	29000	11154	0.49	6.5

6. STRUCTURAL DESIGN PHILOSOPHY

As reported in wind tunnel study, tracker rows will be subjected to varying wind pressures and moments depending on row positions and module tilts. Exterior rows will absorb more loads compared to interior rows. The first two rows of the arrays are considered "Exterior rows". The next two rows (i.e. third and fourth rows) are considered "Intermediate rows". Rows on the perimeter (one side exposed) are considered "Edge rows". All other rows are considered as "Interior rows". STAAD. pro (FEA Software) is used to analyze and code check the structural elements using allowable stress design method as per AISC 360 provisions.

6.1 Design Criteria

The following are the design limits to approve the members:

(i) All the members shall be designed to utilize the stress ratio (or code unity check) less than 100%.

(ii) Allowable mid span deflection - Torque Tube

- For Dead Load Alone – Span/360
- For Wind Load Combinations – Span/100

7. CALCULATION AND DESIGN PROCESS

7.1 Analysis of Superstructure:

Pioneer H single axis tracker is analyzed using finite element method (FEM) which is the dominant discretization technique in structural mechanics. The basic concept in the physical interpretation of the FEM is the subdivision of the mathematical model into disjoint (non-overlapping) components of simple geometry called finite elements or elements for short. The response of each element is expressed in terms of a finite number of degrees of freedom characterized as the value of an unknown function, or functions, at a set of nodal points.

Pioneer H single axis tracker system can be modelled and designed using any available FEA software available in the industry (STAAD. pro, SAP2000, ETABS, RISA 3D etc.,).

FTC Solar adopted the finite element analysis software STAAD. Pro for the analysis of the tracker superstructure. This is a structural design software developed by Bentley. STAAD.Pro is used to analyze.

Once the loads are assigned to the member the model is analysed as per the code AISC 360-10. The members are checked against design limits as previously described in Section 6. The forces on the post (axial, lateral and moment) applied at the torque tube level are used to find the demand forces in the posts and subsequently required embedment of the posts into soil.

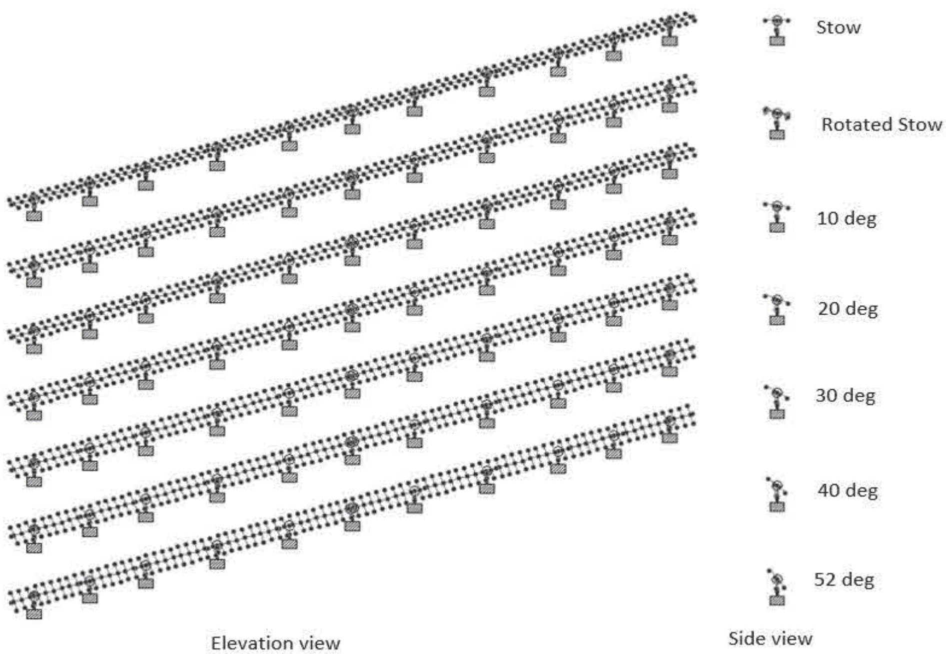


Fig. 10 : FEA Modelling

7.2 Analysis for Pile Embedment:

Analysis for the pile embedment requirements has been excluded from the scope herein. Pile embedment and the adequacy are to be determined by others. Pile shape selection is to be considered as part of the foundation and embedment analysis, which is by others. Structural analysis above grade shown herein included presumed pile sizes.

8. DESIGN LOADS

8.1 Dead Load

The dead load of the whole system is primarily from PV module and self weight of steel members. The dead weight of module is calculated as line load acting on the rail. The weight of the module is referenced from the data sheet provided in the appendix.

Size of the Module/Weight	=	2279 x 1134 x 35 mm / 29.2 kg	
Length of the module	=	7.48	ft
Width of the module	=	3.72	ft
Weight of the module	=	64.37	lbs
Module dead load	=	2.314	psf
Gap between modules	=	0.03	ft
Tributary Width of rail	=	3.75	ft
Distributed load on rail	=	8.61	lbs/ft

For ease of load application rails are modelled as 2.279 m, but have not been given a material density. Therefore, the module load along the full chord length is 8.61 lbs/ft, and has been adjusted in the structural model to account for the self-weight of the rails.

Table 5 - Dead Load on Rails

Rows	Distributed Dead Loads on various Rails		
	Power Module	Mid Module	End Module
Exterior	8.98	8.98	8.98
Interior	8.98	8.98	8.98

8.2 Snow Load

Snow loads on the panel calculated as per ground snow for ASCE 7-16.

Ground Snow load	=	30	psf
Snow Exposure (Ce):	=	0.9	
Thermal Factor (Ct):	=	1.2	
Snow Importance Factor (Is):	=	0.8	
Flat Roof Snow (pf):	=	18.14	psf
Max Snow Allowed:	=	7.5	psf
Governing Flat Roof Snow (pf):	=	7.5	psf

The tracker system is designed with snow sensors, such that the system will automatically shed snow by rotating to a high tilt if the snow thickness on the modules is 6” or more. This limits the max snow load to 7.5 psf. Hence, snow load on module rail is considered as indicated in the table below.

Snow load to rail per tilt (Ps)

Table 6 - Snow Load on Rails

Tilt (deg)	Ps (lbs/ft)
0	28.15
5	28.15
10	28.15
20	25.59
30	20.46
40	15.34
52	9.20

8.3 Seismic Load:

Based on the coordinates of the site, the spectral accelerations have been calculated and the site-specific spectral acceleration were determined by using the USGS website (refer the appendix):

8.3.1 Seismic Base Shear Calculation (ASCE 7-16) :

Weight of modules and self weight of the structure taken into account to the estimate seismic force.

Site Soil Class: C

S_{DS} = 0.156

S_{D1} = 0.055

Base Shear (V) = C_s x W

Cs = (SDS/(R/I))

R = 2 ASCE 7-10 Table 15.4.2 for Nonbuilding

I = 1 Seismic importance factor

Cs = Seismic Response Coeff. = 0.078

Seismic loads on rails (Exterior-Mid module) V = 0.078 x W

= 0.078 x 9.05

= 0.706 lbs/ft

This force will be applied in both direction (NS & EW) on the module rails.

Table 7 - Seismic Load on Rails

Rows	Seismic Loads on various Rails		
	Power Module	Mid Module	End Module
Exterior	0.71	0.71	0.71
Interior	0.71	0.71	0.71

8.4 Wind Load:

8.4.1 Design Wind & Operational Wind

The tracker is designed to carry the max design wind speed (108 mph) as per the location for the stow angle (0 deg). Due to small +/- tilt tolerance allowed in wind tunnel test, the rotated stow condition is also modelled and designed for max design wind speed.

For operation tilt angles, 2 to 52 deg, the tracker is designed for an operational wind speed of 45 mph and altered wind load parameter per Table 10. Even though the Pioneer stow trigger wind speed is 35 mph, for the operation tilts the design wind speed is considered as 45 mph to account the additional loads and to mitigate the gust variabilitiy.

Table 8 - Wind Parameters

	Stow & Rotated Stow	Operational
Angle of Rotation (deg)	0	2 - 60
Wind Speed (mph)	108	45
Wind Exposure Category	C	-
Height Factor (Kz)	0.85	1
Topographic Factor (Kzt)	1.00	1
Wind Directionality Factor (Kd)	0.85	1
Elevation Factor (Ke)	0.99	0.99
Wind Pressure qz (psf)	**21.42**	**5.15**

8.4.2 Reduced Frequency:

The reduced frequency (fL/U) is dependent on the torsional frequency (f) of the torque tube being considered, the chord length (L), and the wind speed (U) as discussed per section 3.2.2.

Torsional and vertical frequency of the torque tubes are analyzed using STAAD software. Below is the summary,

Table 9 - Frequency

Rows	Tube Thickness (mm)					Torsional Frequency (Hz)	Vertical Frequency (Hz)
	Span 1	Span 2	Span 3	Span 4	Span 5		
Exterior	2.70	2.75	2.75	2.00	2.00	1.04	2.69
Interior	2.75	2.00	2.00	2.00	2.00	0.97	2.54

The reduced frequency, which is used for GCm coefficient and rotation computation, are tabulated below

Table 10 - Reduced Frequency

Row	Stow (Rotation)	Stow (GCm)	Operation
Exterior	0.068	0.069	0.118
Interior	0.062	0.064	0.110

8.5 Damper Count per Wing

For Interior row:

Project design wind speed (U_{10})	=	48.28	m/s			
Torsional Frequency (f)	=	0.97	Hz			
Chord Length (L)	=	2.279	m			
Damper Selection Criteria	=	$U_{10}/(f*L)$	=	21.89	<	22.80

$U_{10}/(f*L)<22.8$, 1D per wing shall be provided

8.6 Calculated Forces and Moments

The GCp loads and GCm moments are computed based on the coefficients provided in WTT report. The GCp loads are applied as Uniform Distributed Loads (UDL) on the rails and the GCm moments are applied as nodal loads on the tube. The summary of loads is shown below for stow, rotated stow and max. operation angle.

Table 11 - Forces on 0 deg tilt - Stow

				Static GCp Loads lbs/ft		Dynamic GCp Loads lbs/ft		Aero GCm Moments lbs-ft	
Tilt	Wing	Rows	Section	Uplift	Down	Uplift	Down	Positive	Negative
STOW	North	Exterior	**Cantilever**	42.6	-13.7	9.4	-9.4	264	-264
			Sec-5	52.0	-14.6	9.4	-9.4	306	-306
			Sec-4	52.0	-14.6	9.4	-9.4	324	-324
			Sec-3	52.0	-14.6	9.4	-9.4	368	-368
			Sec-2	52.0	-14.6	9.4	-9.4	431	-431
			Sec-1	50.8	-14.6	9.4	-9.4	422	-422
		Interior	**Cantilever**	15.4	-13.2	13.1	-13.1	199	-199
			Sec-5	13.5	-10.6	13.1	-13.1	224	-224
			Sec-4	13.5	-10.5	13.1	-13.1	213	-213
			Sec-3	13.5	-10.5	13.1	-13.1	200	-200
			Sec-2	13.5	-10.6	13.1	-13.1	186	-186
			Sec-1	13.5	-10.6	13.1	-13.1	169	-169
	South	Exterior	**Cantilever**	50.0	-23.0	9.4	-9.4	288	-288
			Sec-5	50.0	-14.6	9.4	-9.4	329	-329
			Sec-4	49.9	-14.6	9.4	-9.4	334	-334
			Sec-3	42.0	-14.6	9.4	-9.4	346	-346
			Sec-2	40.6	-13.4	9.4	-9.4	365	-365
			Sec-1	39.7	-7.5	9.4	-9.4	411	-411
		Interior	**Cantilever**	31.5	-19.8	15.2	-15.2	181	-181
			Sec-5	21.8	-12.4	14.9	-14.9	205	-205
			Sec-4	13.5	-11.4	14.4	-14.4	198	-198
			Sec-3	12.5	-10.7	13.8	-13.8	187	-187
			Sec-2	12.4	-10.3	13.6	-13.6	166	-166
			Sec-1	11.2	-9.5	13.5	-13.5	141	-141

Table 12 - Forces on Rotated Stow & Operational Angle

				Static GCp Loads lbs/ft		Dynamic GCp Loads lbs/ft		Aero GCm Moments lbs-ft	
Tilt	Wing	Rows	Section	Uplift	Down	Uplift	Down	Positive	Negative
ROTATED STOW	North	Exterior	Cantilever	12.0	-65.9	5.8	-5.8	264	-264
			Sec-5	7.6	-63.2	6.1	-6.1	306	-306
			Sec-4	8.5	-59.6	6.5	-6.5	324	-324
			Sec-3	11.4	-51.7	7.1	-7.1	368	-368
			Sec-2	19.7	-41.5	7.8	-7.8	431	-431
			Sec-1	30.7	-30.1	8.5	-8.5	422	-422
		Interior	Cantilever	9.9	-38.0	15.2	-15.2	199	-199
			Sec-5	6.1	-29.2	14.9	-14.9	224	-224
			Sec-4	5.8	-26.3	14.4	-14.4	213	-213
			Sec-3	6.1	-25.1	13.8	-13.8	200	-200
			Sec-2	7.7	-23.1	13.6	-13.6	186	-186
			Sec-1	9.3	-19.9	13.5	-13.5	169	-169
	South	Exterior	Cantilever	29.9	-58.3	6.7	-6.7	288	-288
			Sec-5	10.5	-55.2	6.9	-6.9	329	-329
			Sec-4	10.9	-50.1	7.1	-7.1	334	-334
			Sec-3	12.8	-44.7	7.5	-7.5	346	-346
			Sec-2	16.3	-39.2	7.9	-7.9	365	-365
			Sec-1	20.2	-20.5	8.4	-8.4	411	-411
		Interior	Cantilever	29.1	-63.3	15.3	-15.3	181	-181
			Sec-5	13.3	-48.7	15.0	-15.0	205	-205
			Sec-4	12.7	-28.4	14.5	-14.5	198	-198
			Sec-3	10.7	-25.9	14.0	-14.0	187	-187
			Sec-2	9.3	-23.7	13.7	-13.7	166	-166
			Sec-1	8.7	-23.6	13.6	-13.6	141	-141
OPERATIONAL TILT - 52 deg	North	Exterior	Cantilever	2.6	-24.9	0.2	-0.2	61	-61
			Sec-5	1.5	-19.9	0.2	-0.2	70	-70
			Sec-4	1.4	-19.9	0.2	-0.2	70	-70
			Sec-3	1.4	-19.9	0.2	-0.2	70	-70
			Sec-2	1.5	-19.9	0.2	-0.2	70	-70
			Sec-1	1.5	-20.0	0.2	-0.2	70	-70
		Interior	Cantilever	3.9	-12.0	0.7	-0.7	28	-28
			Sec-5	2.1	-7.6	0.7	-0.7	32	-32
			Sec-4	1.9	-7.5	0.7	-0.7	31	-31
			Sec-3	1.9	-7.5	0.7	-0.7	31	-31
			Sec-2	2.1	-7.6	0.7	-0.7	31	-31
			Sec-1	2.2	-7.6	0.7	-0.7	31	-31
	South	Exterior	Cantilever	12.0	-26.3	0.2	-0.2	49	-49
			Sec-5	4.2	-20.7	0.2	-0.2	56	-56
			Sec-4	3.8	-20.6	0.2	-0.2	56	-56
			Sec-3	2.8	-20.6	0.2	-0.2	56	-56
			Sec-2	2.4	-19.0	0.2	-0.2	56	-56
			Sec-1	2.2	-19.0	0.2	-0.2	56	-56
		Interior	Cantilever	10.4	-28.2	0.7	-0.7	21	-21
			Sec-5	4.1	-13.2	0.7	-0.7	24	-24
			Sec-4	3.5	-9.2	0.7	-0.7	24	-24
			Sec-3	2.7	-8.0	0.7	-0.7	24	-24
			Sec-2	2.6	-7.4	0.7	-0.7	24	-24
			Sec-1	2.8	-7.2	0.7	-0.7	23	-23

9. LOADS AND LOAD COMBINATIONS

The basic loads acting on the tracker are dead load, snow load, seismic and wind load. With these basic loads the load combinations are derived as per ASCE 7 code and recommendations from WTT report.

9.1 Basic Load Cases

Table 13 - Basic Load Cases

BLC No.	BLC Description	Category
1	DL	DL
2	SL	SL
3	Seismic X	EL
4	Seismic Z	EL
5	WL-Uplift-LC1	WL
6	WL-Uplift-LC2	WL
7	WL-Uplift-LC3	WL
8	WL-Uplift-LC4	WL
9	WL-Uplift-LC5	WL
10	WL-Uplift-LC6	WL
11	WL-Uplift-LC7	WL
12	WL-Uplift-LC8	WL
13	WL-Uplift-LC9	WL
14	WL-Uplift-LC10	WL
15	WL-Uplift-LC11	WL
16	WL-Uplift-LC12	WL
17	WL-Down-LC1	WL
18	WL-Down-LC2	WL
19	WL-Down-LC3	WL
20	WL-Down-LC4	WL
21	WL-Down-LC5	WL
22	WL-Down-LC6	WL
23	WL-Down-LC7	WL
24	WL-Down-LC8	WL
25	WL-Down-LC9	WL
26	WL-Down-LC10	WL
27	WL-Down-LC11	WL
28	WL-Down-LC12	WL
29	WL-Up (Dyn)	WL
30	WL-Dow (Dyn)	WL
31	WL-Up(Moment)	WL
32	WL-Down(Moment)	WL

9.2 Concurrent Loads

The normal force (GCp) coefficients described in WTT report represent the expected peak values on each span. The simultaneous application of those coefficients to the entire tracker would be conservative. To provide a more reasonable estimate of the concurrent loading on the tracker, WTT report suggested concurrent load combinations for different sections specifying GCp and GCm as below.

1. Maximum GCp (100% static + 90% dynamic)+ simultaneous GCm aero (75%)
2. Maximum GCm aero(100%) + simultaneous GCp (75% static+50% dynamic)

9.3 Load Combinations

Table 14 - AISC - ASD Load Combinations

Description	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
ASD_DL	1	1	-	-	-	-	-	-
ASD_DL+SL	1	1	2	1	-	-	-	-
ASD_DL+0.75SL	1	1	2	0.75	-	-	-	-
ASD_DL+0.6WL,uplift_LC1	1	1	5	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,Uplift_LC2	1	1	6	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC3	1	1	7	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC4	1	1	8	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC5	1	1	9	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC6	1	1	10	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC7	1	1	11	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC8	1	1	12	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC9	1	1	13	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC10	1	1	14	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC11	1	1	15	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,uplift_LC12	1	1	16	0.6	29	0.54	31	0.45
ASD_DL+0.6WL,Down_LC1	1	1	17	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC2	1	1	18	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC3	1	1	19	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC4	1	1	20	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC5	1	1	21	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC6	1	1	22	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC7	1	1	23	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC8	1	1	24	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC9	1	1	25	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC10	1	1	26	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC11	1	1	27	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,Down_LC12	1	1	28	0.6	30	0.54	32	0.45
ASD_DL+0.6WL,uplift_LC1	1	1	5	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,Uplift_LC2	1	1	6	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC3	1	1	7	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC4	1	1	8	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC5	1	1	9	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC6	1	1	10	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC7	1	1	11	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC8	1	1	12	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC9	1	1	13	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC10	1	1	14	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC11	1	1	15	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,uplift_LC12	1	1	16	0.45	29	0.3	31	0.6
ASD_DL+0.6WL,Down_LC1	1	1	17	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC2	1	1	18	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC3	1	1	19	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC4	1	1	20	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC5	1	1	21	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC6	1	1	22	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC7	1	1	23	0.45	30	0.3	32	0.6

Description	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
ASD_DL+0.6WL,Down_LC8	1	1	24	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC9	1	1	25	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC10	1	1	26	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC11	1	1	27	0.45	30	0.3	32	0.6
ASD_DL+0.6WL,Down_LC12	1	1	28	0.45	30	0.3	32	0.6
ASD_DL+0.7EQX	1	1	3	0.7	-	-	-	-
ASD_DL+0.7EQZ	1	1	4	0.7	-	-	-	-
ASD_DL+0.75SL+0.45WL, uplift_LC1	1	1	2	0.75	5	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC2	1	1	2	0.75	6	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC3	1	1	2	0.75	7	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC4	1	1	2	0.75	8	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC5	1	1	2	0.75	9	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC6	1	1	2	0.75	10	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC7	1	1	2	0.75	11	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC8	1	1	2	0.75	12	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC9	1	1	2	0.75	13	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC10	1	1	2	0.75	14	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC11	1	1	2	0.75	15	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC12	1	1	2	0.75	16	0.45	31	0.34
ASD_DL+0.75SL+0.45WL, down_LC1	1	1	2	0.75	17	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC2	1	1	2	0.75	18	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC3	1	1	2	0.75	19	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC4	1	1	2	0.75	20	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC5	1	1	2	0.75	21	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC6	1	1	2	0.75	22	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC7	1	1	2	0.75	23	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC8	1	1	2	0.75	24	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC9	1	1	2	0.75	25	0.45	32	0.34

Description	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
ASD_DL+0.75SL+0.45WL, down_LC10	1	1	2	0.75	26	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC11	1	1	2	0.75	27	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, down_LC12	1	1	2	0.75	28	0.45	32	0.34
ASD_DL+0.75SL+0.45WL, uplift_LC1	1	1	2	0.75	5	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC2	1	1	2	0.75	6	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC3	1	1	2	0.75	7	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC4	1	1	2	0.75	8	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC5	1	1	2	0.75	9	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC6	1	1	2	0.75	10	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC7	1	1	2	0.75	11	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC8	1	1	2	0.75	12	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC9	1	1	2	0.75	13	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC10	1	1	2	0.75	14	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC11	1	1	2	0.75	15	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, uplift_LC12	1	1	2	0.75	16	0.34	31	0.45
ASD_DL+0.75SL+0.45WL, down_LC1	1	1	2	0.75	17	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC2	1	1	2	0.75	18	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC3	1	1	2	0.75	19	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC4	1	1	2	0.75	20	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC5	1	1	2	0.75	21	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC6	1	1	2	0.75	22	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC7	1	1	2	0.75	23	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC8	1	1	2	0.75	24	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC9	1	1	2	0.75	25	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC10	1	1	2	0.75	26	0.34	32	0.45

Description	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
ASD_DL+0.75SL+0.45WL, down_LC11	1	1	2	0.75	27	0.34	32	0.45
ASD_DL+0.75SL+0.45WL, down_LC12	1	1	2	0.75	28	0.34	32	0.45
ASD_DL+0.75SL+0.525EQX	1	1	2	0.75	3	0.525	-	-
ASD_DL+0.75SL+0.525EQZ	1	1	2	0.75	4	0.525	-	-
ASD_0.6DL_0.6WL,uplift_LC1	1	0.6	5	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC2	1	0.6	6	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC3	1	0.6	7	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC4	1	0.6	8	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC5	1	0.6	9	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC6	1	0.6	10	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC7	1	0.6	11	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC8	1	0.6	12	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC9	1	0.6	13	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC10	1	0.6	14	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC11	1	0.6	15	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,uplift_LC12	1	0.6	16	0.6	29	0.54	31	0.45
ASD_0.6DL_0.6WL,down_LC1	1	0.6	17	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC2	1	0.6	18	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC3	1	0.6	19	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC4	1	0.6	20	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC5	1	0.6	21	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC6	1	0.6	22	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC7	1	0.6	23	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC8	1	0.6	24	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC9	1	0.6	25	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC10	1	0.6	26	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC11	1	0.6	27	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,down_LC12	1	0.6	28	0.6	30	0.54	32	0.45
ASD_0.6DL_0.6WL,uplift_LC1	1	0.6	5	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC2	1	0.6	6	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC3	1	0.6	7	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC4	1	0.6	8	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC5	1	0.6	9	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC6	1	0.6	10	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC7	1	0.6	11	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC8	1	0.6	12	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC9	1	0.6	13	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC10	1	0.6	14	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC11	1	0.6	15	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,uplift_LC12	1	0.6	16	0.45	29	0.3	31	0.6
ASD_0.6DL_0.6WL,down_LC1	1	0.6	17	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC2	1	0.6	18	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC3	1	0.6	19	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC4	1	0.6	20	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC5	1	0.6	21	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC6	1	0.6	22	0.45	30	0.3	32	0.6

Description	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
ASD_0.6DL_0.6WL,down_LC7	1	0.6	23	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC8	1	0.6	24	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC9	1	0.6	25	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC10	1	0.6	26	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC11	1	0.6	27	0.45	30	0.3	32	0.6
ASD_0.6DL_0.6WL,down_LC12	1	0.6	28	0.45	30	0.3	32	0.6
ASD_0.6DL+0.7EQX	1	0.6	3	0.7	-	-	-	-
ASD_0.6DL+0.7EQZ	1	0.6	4	0.7	-	-	-	-

10. STRUCTURAL DESIGN SUMMARY

The calculated forces and moments on the rails and tubes are applied in the Staad model (FEA) and load combinations are developed as listed in the previous sections. The tracker structure in Staad is simulated for envelope load case and the design results are extracted. The design summary for different rows types are tabulated below.

10.1 Torque Tubes - Design Summary

10.1.1 Exterior Rows

Table 15 - Torque Tube (TT) Design Summary - Exterior

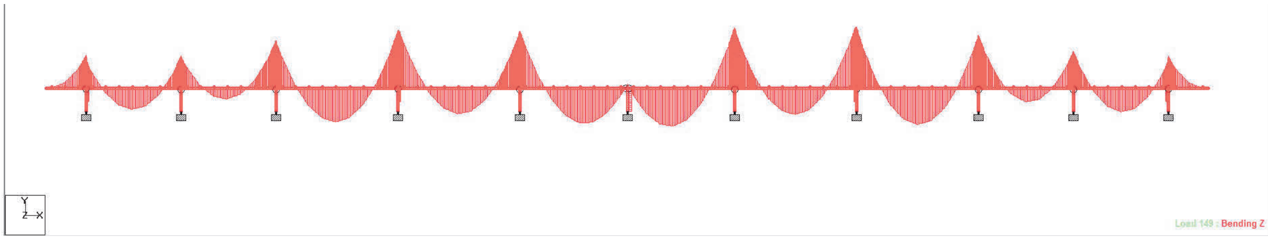
Exterior						
TT	**DB**	**MB**	**MB 2**	**EB**	**EB2**	**Canti-Sec**
Sapn (mm)	9048	9152	9152	8008	6914	3518
Thickness (mm)	2.75	2.75	2.75	2.00	2.00	-
Stow (%)	71%	53%	52%	45%	53%	-
Rotated Stow(%)	82%	72%	82%	79%	79%	-
Operational (%)	79%	63%	62%	54%	59%	-
Maximum (%)	82%	72%	82%	79%	79%	-
Dead Load Deff Limit (in)	0.99	1.00	1.00	0.88	0.76	0.77
Dead Load Deff act (in.)	0.83	0.26	0.46	0.26	0.11	0.45
Wind Load Defff Limit (in)	3.56	3.60	3.60	3.15	2.72	2.77
Wind Load Deff act (in.)	3.16	1.37	2.20	1.48	0.77	2.16

10.1.2 Interior Rows

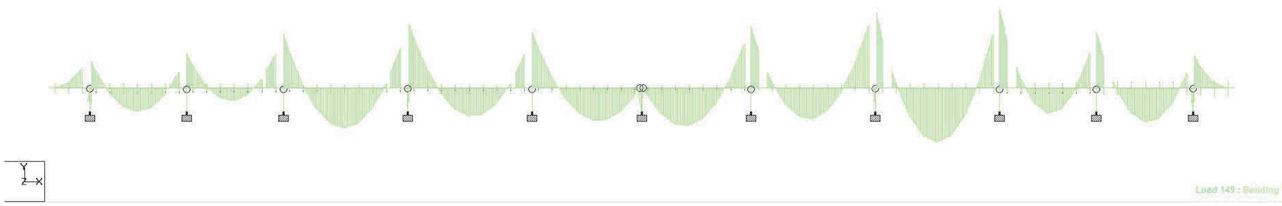
Table 16- Torque Tube (TT) Design Summary - Interior

Interior						
TT	**DB**	**MB**	**MB 2**	**EB**	**EB2**	**Canti-Sec**
Sapn (mm)	9048	9152	9152	8008	6914	3518
Thickness (mm)	2.75	2.00	2.00	2.00	2.00	-
Stow (%)	67%	72%	70%	46%	51%	-
Rotated Stow(%)	77%	87%	87%	61%	85%	-
Operational (%)	80%	86%	83%	55%	59%	-
Maximum (%)	80%	87%	87%	61%	85%	-
Dead Load Deff Limit (in)	0.99	1.00	1.00	0.88	0.76	0.77
Dead Load Deff act (in.)	0.84	0.29	0.59	0.29	0.10	0.46
Wind Load Defff Limit (in)	3.56	3.60	3.60	3.15	2.72	2.77
Wind Load Deff act (in.)	2.96	1.30	2.32	1.15	0.55	2.49

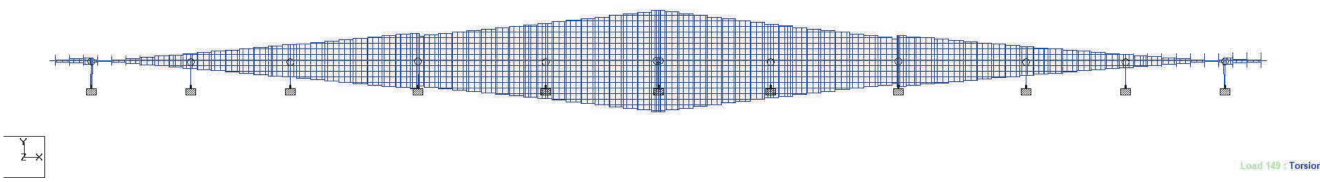
10.2 Representative behaviour of Torque Tubes



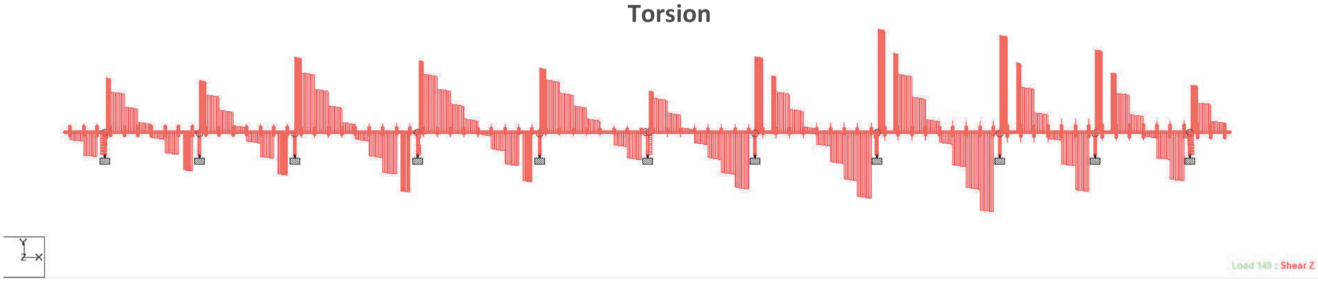
Bending Z



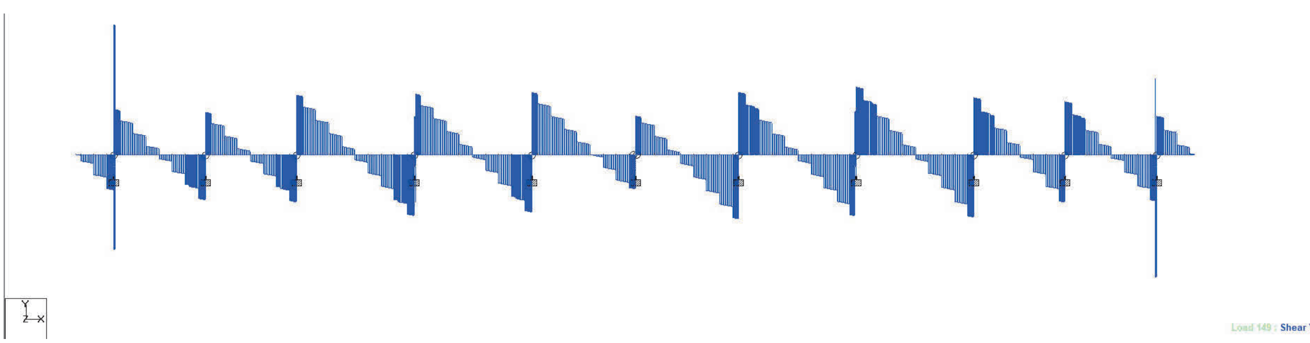
Bending Y



Torsion



Shear Z



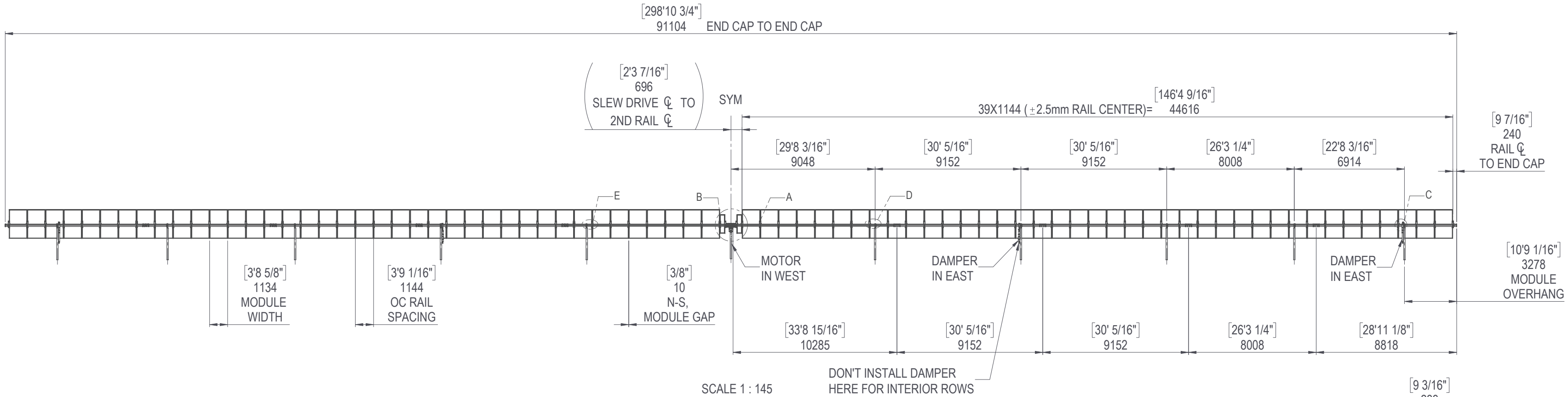
Shear Y

11. REFERENCES

- Minimum Design Loads for Buildings and Other Structures (ASCE7-16)
- Specification for Structural Steel Buildings (AISC 360-10)
- Standard Specification for Structural Steel Shapes (ASTM A992)
- Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes (ASTM A500)
- Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) (ASTM A1085)
- Corrosion of Galvanized Steel in Soils, by Irving A Denison and Melvin Romanoff
- Corrosion Resistance of Zinc & Zinc Alloys, by Frank C. Porter – ISBN 0-8247-9213-0 – 1994
- Corrosion Guidelines, Version 2.0, November 2012, by California Department of Transportation
- Hot-Dip Galvanizing, In Soil, by American Galvanizers Association, 2011
- Durability/Corrosion of Soil Reinforced structures, Federal Highway Administration (FHWA-RD-89-186)

Appendix

IFP/IFC FINAL GA FOR BOM



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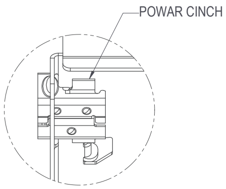
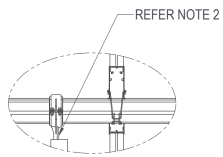
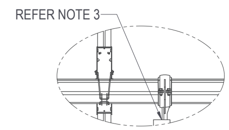


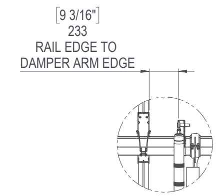
DETAIL A
SCALE 1 : 1



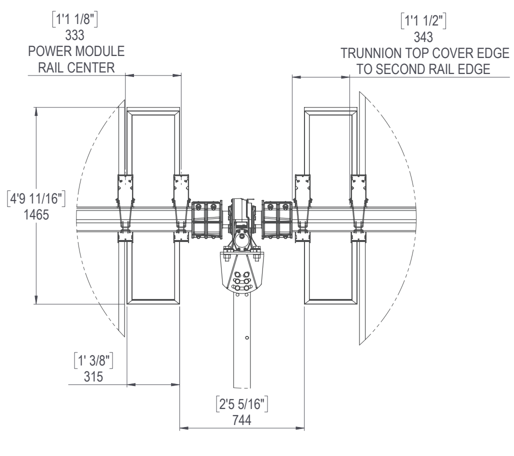
DETAIL E
SCALE 1 : 15



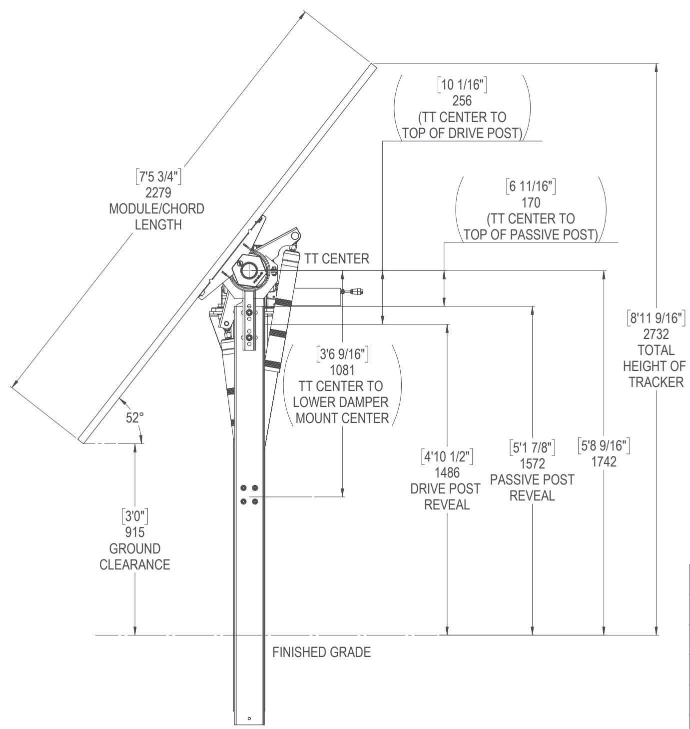
DETAIL D
SCALE 1 : 15



DETAIL C
SCALE 1 : 20



DETAIL B
SCALE 1 : 15
POWER MODULE DETAILS



SCALE 1 : 12
N-S ELEVATION VIEW AT MAXIMUM TILT

HEXAGON TORQUE TUBE SPECIFICATIONS -80KSI GRADE			
	LENGTH	EXTERIOR ROW	INTERIOR ROW
DRIVE BEAM	[33'8 15/16"] 10285	[1/8"] 2.75	[1/8"] 2.75
MID BEAM	[30' 5/16"] 9152	[1/8"] 2.75	[1/16"] 2.00
MID BEAM 2	[30' 5/16"] 9152	[1/8"] 2.75	[1/16"] 2.00
END BEAM	[26'3 1/4"] 8008	[1/16"] 2.00	[1/16"] 2.00
END BEAM -2	[28'11 1/8"] 8818	[1/16"] 2.00	[1/16"] 2.00

STANDARD DESIGN NOTES			
1.	SITE WIND SPEED	108 MPH	
2.	GROUND SNOW	30 PSF	
3.	SYSTEM VOLTAGE	1500V	
4.	STRING SIZE	26	
5.	ROW TYPE	FULL ROW	
6.	MODULE TYPE (DIM)	HELIENE 144HC M10 SL BIFACIAL 540W	
		(2279) X (1134) X (35)	
7.	DAMPERS	EXTERIOR	INTERIOR
		4	2

NOTES:
1. THIS MODULE FRAME HAS AN OVERHANG OF 5mm SMALLER SIDE AND 20mm ON THE LARGER SIDE AS SPECIFIED BY CUSTOMER FOR THIS PROJECT.
2. JOURNAL ON NORTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON NORTH SIDE OF PILE
3. JOURNAL ON SOUTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON SOUTH SIDE OF PILE

FTC PIONEER 1P TRACKER™

PROJECT PHASE:

ISSUED FOR CONSTRUCTION

STAMP :

REVISIONS					
ZONE	REV.	DESCRIPTION	DATE	BY	RVW
	A	INITIAL RELEASE	04-APR-2024	RK	PC
	B	UPDATED AS PER FSD REV-A ON 11-APR-2024	12-APR-2024	RK	PA

PROJECT NAME
AUI PARTNERS
MULNITE-1P -
MILLER RD, EAST WINDSOR, CT 06016

PROJECT NUMBER
0066O00000rgWzOQAU

PIONEER-H INSTALLATION MANUAL
VERSION:- TBR

SHEET TITLE
TRACKER GENERAL ASSEMBLY- PIONEER-H

DRAWING TITLE:
PIONEER-H, 1500V TRACKER (26X3S=78 MODULES), MULNITE_1P

DRAWING NO:
600200

DATE : 04-APR-2024
DRAWN BY: RK
APPROVED BY: GK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM
DIMENSION UNITS: mm
TOLERANCES (UNLESS OTHERWISE SPECIFIED)
ZERO DECIMAL PLACE: X ±1.25
ONE DECIMAL PLACE: X.X ±.5
TWO DECIMAL PLACE: X.XX ±.1
THREE DECIMAL PLACE: X.XXX ±.05
ANGLE: ± 1.0°

NOTE:
PROVIDED TOLERANCE ARE NOT APPLICABLE FOR STRUCTURAL SPECIFICATIONS. FOR STRUCTURAL SHAPE TOLERANCE PLEASE REFER RESPECTIVE PART DRAWINGS

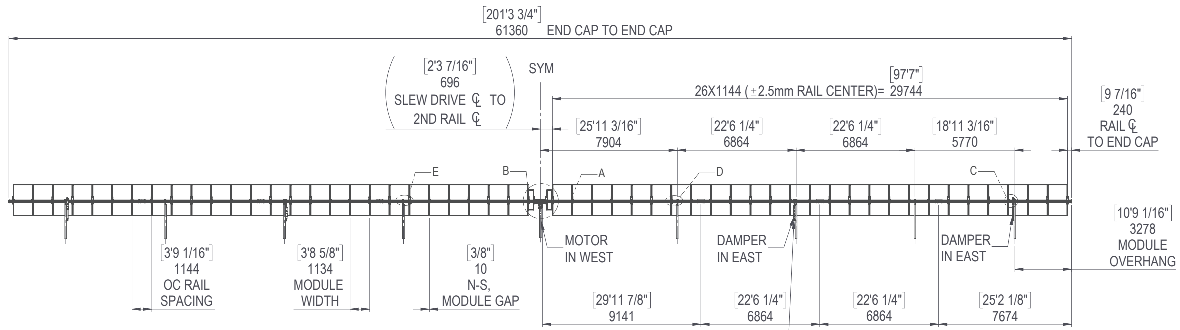
THIRD ANGLE PROJECTION

SHEET NO:
S-200

DRAWING SIZE A1
REV B

DO NOT SCALE DRAWING

IFP/IFC FINAL GA FOR BOM



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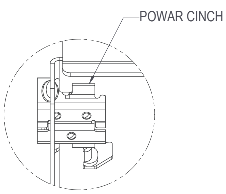
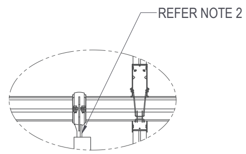


DETAIL A
SCALE 1 : 1



DETAIL E
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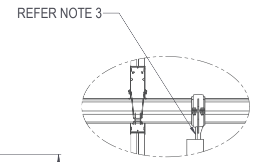
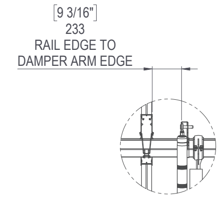
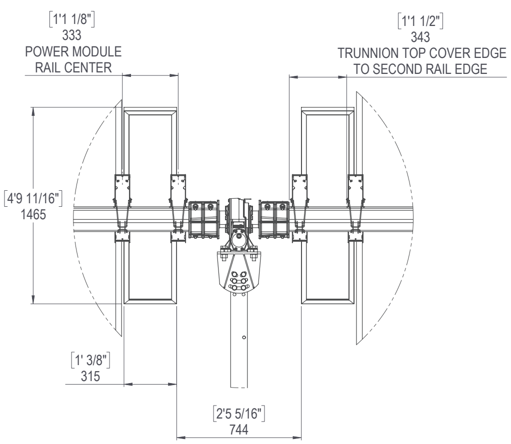


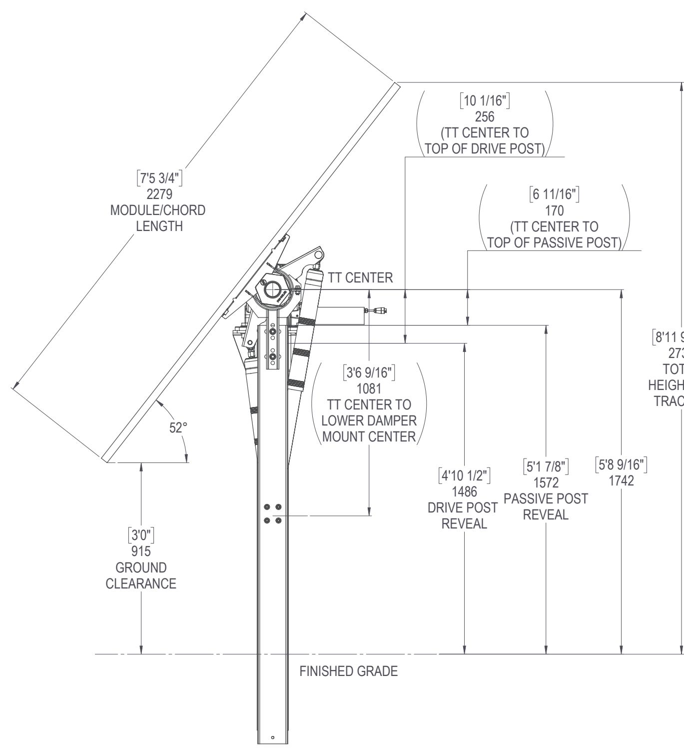
DETAIL D
SCALE 1 : 15



DETAIL C
SCALE 1 : 20



DETAIL B
SCALE 1 : 15
POWER MODULE DETAILS



SCALE 1 : 12
N-S ELEVATION VIEW AT MAXIMUM TILT

HEXAGON TORQUE TUBE SPECIFICATIONS -80KSI GRADE			
	LENGTH	EXTERIOR ROW	INTERIOR ROW
DRIVE BEAM	[29'11 7/8"] 9141	[1/8"] 2.75	[1/8"] 2.75
MID BEAM	[22'6 1/4"] 6864	[1/8"] 2.75	[5/64] 2.00
MID BEAM-2	[22'6 1/4"] 6864	[1/8"] 2.75	[5/64] 2.00
END BEAM	[25'2 1/8"] 7674	[5/64] 2.00	[5/64] 2.00

STANDARD DESIGN NOTES			
1.	SITE WIND SPEED	108 MPH	
2.	GROUND SNOW	30 PSF	
3.	SYSTEM VOLTAGE	1500V	
4.	STRING SIZE	26	
5.	ROW TYPE	PARTIAL ROW	
6.	MODULE TYPE (DIM)	HELIENE 144HC M10 SL BIFACIAL 540W	
		(2279) X (1134) X (35)	
7.	DAMPERS	EXTERIOR	INTERIOR
		4	2

NOTES:
1. THIS MODULE FRAME HAS AN OVERHANG OF 5mm SMALLER SIDE AND 20mm ON THE LARGER SIDE AS SPECIFIED BY CUSTOMER FOR THIS PROJECT.
2. JOURNAL ON NORTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON NORTH SIDE OF PILE
3. JOURNAL ON SOUTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON SOUTH SIDE OF PILE

FTC PIONEER 1P TRACKER™

PROJECT PHASE:

ISSUED FOR CONSTRUCTION

STAMP :

REVISIONS					
ZONE	REV.	DESCRIPTION	DATE	BY	RVW
	A	INITIAL RELEASE	04-APR-2024	RK	PC
	B	UPDATED AS PER FSD REV-A ON 11-APR-2024	12-APR-2024	RK	PA

PROJECT NAME
AUI PARTNERS
MULNITE-1P -
MILLER RD, EAST WINDSOR, CT 06016

PROJECT NUMBER
0066O00000rgWzOQAU

PIONEER-H INSTALLATION MANUAL
VERSION:- TBR

SHEET TITLE
TRACKER GENERAL ASSEMBLY- PIONEER-H

DRAWING TITLE:
PIONEER-H, 1500V TRACKER (26X2S=52 MODULES), MULNITE_1P

DRAWING NO:
600201

DATE : 04-APR-2024
DRAWN BY: RK
APPROVED BY: GK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM

DIMENSION UNITS: mm
TOLERANCES (UNLESS OTHERWISE SPECIFIED)
ZERO DECIMAL PLACE: X ±1.25
ONE DECIMAL PLACE: X.X ±.5
TWO DECIMAL PLACE: X.XX ±.1
THREE DECIMAL PLACE: X.XXX ±.05
ANGLE: ± 1.0°

NOTE:
PROVIDED TOLERANCE ARE NOT APPLICABLE FOR STRUCTURAL SPECIFICATIONS. FOR STRUCTURAL SHAPE TOLERANCE PLEASE REFER RESPECTIVE PART DRAWINGS

THIRD ANGLE PROJECTION

SHEET NO:
S-200

DRAWING SIZE A1
REV B

DO NOT SCALE DRAWING

HELIENE

144HC M10 SL Bifacial Module

144 Half-Cut Monocrystalline 520W – 540W

21%

Utilizes the latest M10 size super high efficiency Monocrystalline PERC cells. Half cut design further reduces cell to module (CTM) losses.

Stability & Looks

Rugged, double webbed frame design withstands wind, snow, and other mechanical stresses. Framed Glass–Backsheet aesthetic is ideal for high visibility installation.

Anti-Reflective

Premium solar glass with anti reflective coating delivers more energy throughout the day

High Reliability

Proven resistance to PID and reliable in high temperature and humidity environments.

Manufactured Using International Quality System Standards: ISO9001

Half-Cut Design with Split Junction Box Technology

Bifacial Technology Enabling Additional Energy Harvest from Rear Side

1500V System Voltage Rating

World-class Quality

- Heliene's fully automated manufacturing facilities with state-of-the-art robotics and computer aided inspection systems ensure the highest level of product quality and consistency
- All manufacturing locations are compliant with international quality standards and are ISO 9001 certified
- Heliene modules have received Top Performer rankings in several categories from PV Evolution Labs (PV EL) independent quality evaluations

Bankable Reputation

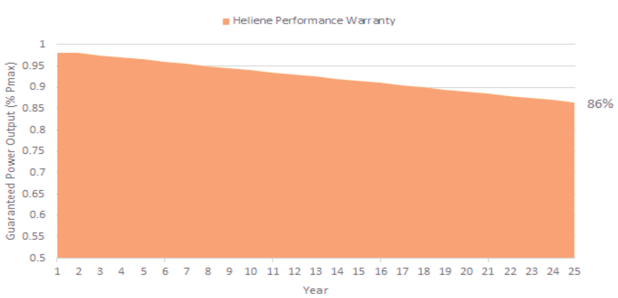
- Established in 2010, Heliene is recognized as highly bankable Tier 1 manufacturer of solar modules and has been approved for use by the U.S. Department of Defense, U.S. Army Corps of Engineers and from numerous top tier utility scale project debt providers
- By investing heavily in research and development, Heliene has been able to stay on the cutting edge of advances in module technology and manufacturing efficiency

Local Sales, Service, and Support

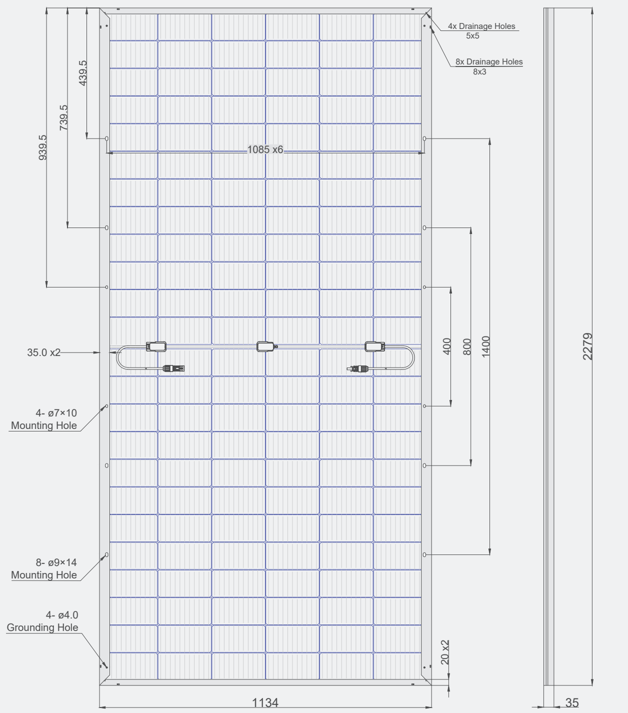
- With sales offices across the U.S. and Canada, Heliene prides itself on unsurpassed customer support for our clients. Heliene has become the brand of choice for many of the leading residential installers, developers and Independent Power Producers due to our innovative technology, product customization capability and just in time last-mile logistics support
- Local sales and customer support means answered phone calls and immediate answers to your technical and logistics questions. We understand your project schedules often change with little warning and endeavor to work with you to solve your project management challenges

No Compromise Guarantee

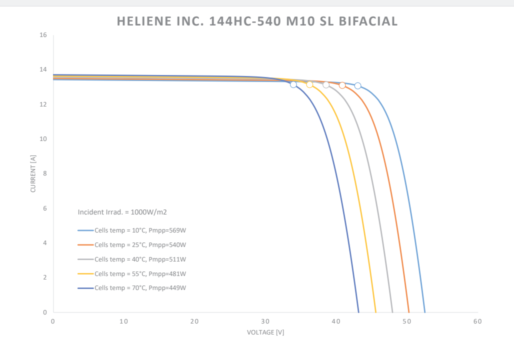
15 Year Workmanship Warranty
25 Year Linear Performance Guarantee

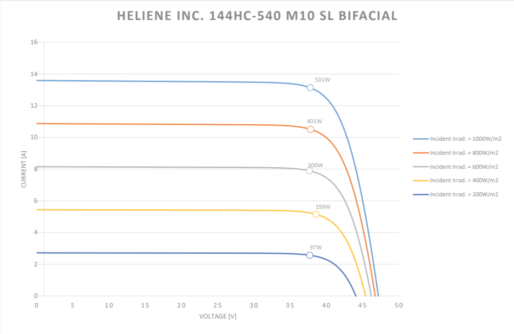


Dimensions for 144HC M10 SL Bifacial Series Modules



I-V Curves for 144HC M10 SL Bifacial Series Modules





Certifications & Listing

Electrical Data (STC)

Peak Rated Power	P_{mpp} (W)	540	535	530	525	520
Maximum Power Voltage	V_{mpp} (V)	42.32	42.13	41.94	41.75	41.56
Maximum Power Current	I_{mpp} (A)	12.77	12.70	12.64	12.58	12.52
Open Circuit Voltage	V_{oc} (V)	50.22	49.97	49.72	49.23	48.73
Short Circuit Current	Isc (A)	13.50	13.44	13.37	13.32	13.28
Module Efficiency	Eff (%)	20.9	20.7	20.5	20.3	20.1
Maximum Series Fuse Rating	MF (A)	30	30	30	30	30
Power Output Tolerance		[- 0/+3%]				
Bifaciality Factor		70%				

STC - Standard Test Conditions: Irradiation 1000 W/m2 - Air mass AM 1.5 - Cell temperature 25 °C

Electrical Data (NMOT)

Maximum Power	P_{mpp} (W)	400	395	390	385	380
Maximum Power Voltage	V_{mpp} (V)	39.19	38.58	38.58	37.97	37.96
Maximum Power Current	I_{mpp} (A)	10.21	10.24	10.11	10.14	10.01
Open Circuit Voltage	V_{oc} (V)	47.13	46.89	46.66	46.20	45.73
Short Circuit Current	Isc (A)	10.87	10.82	10.77	10.72	10.70

NMOT - Nominal Module Operating Temperature:
Irradiance at 800W/m2, Ambient Temperature 20°C, Wind speed 1m/s

Mechanical Data

Solar Cells	144 Half Cut, M10, 182mm, PERC Cells
Module Construction	Framed Glass–Backsheet
Dimensions (L x W x D)	2279 x 1134 x 35 mm (89.72 x 44.65 x 1.38 inch)
Weight	29.2 kg (64.3 lbs)
Frame	Double Webbed 15-Micron Anodized Aluminum Alloy
Glass	3.2mm Low-Iron Content, High-Transmission, PV Solar Glass with Anti Reflective Coating
Junction Box	IP-68 rated with 3 bypass diodes
Output Cables	0.3-meter Symmetrical Cables
Connectors	Multi-Contact/ Stäubli MC4

Certifications

UL Certification	UL61215, UL61730

Temperature Ratings

Nominal Operating Cell Temperature (NOCT)	+45°C (±2°C)
Temperature Coefficient of P_{max}	-0.36%/°C
Temperature Coefficient of V_{oc}	-0.28%/°C
Temperature Coefficient of I_{sc}	0.034%/°C

Maximum Ratings

Operational Temperature	-40°C to +85°C
Max System Voltage	1500V
Mech. Load Test (Front)	113 psf / 5400 Pa
Mech. Load Test (Back)	50 psf / 2400 Pa
Fire Type	Type 1

Warranty

15 Year Workmanship Warranty

25 Year Linear Power Guarantee

Packaging Configuration

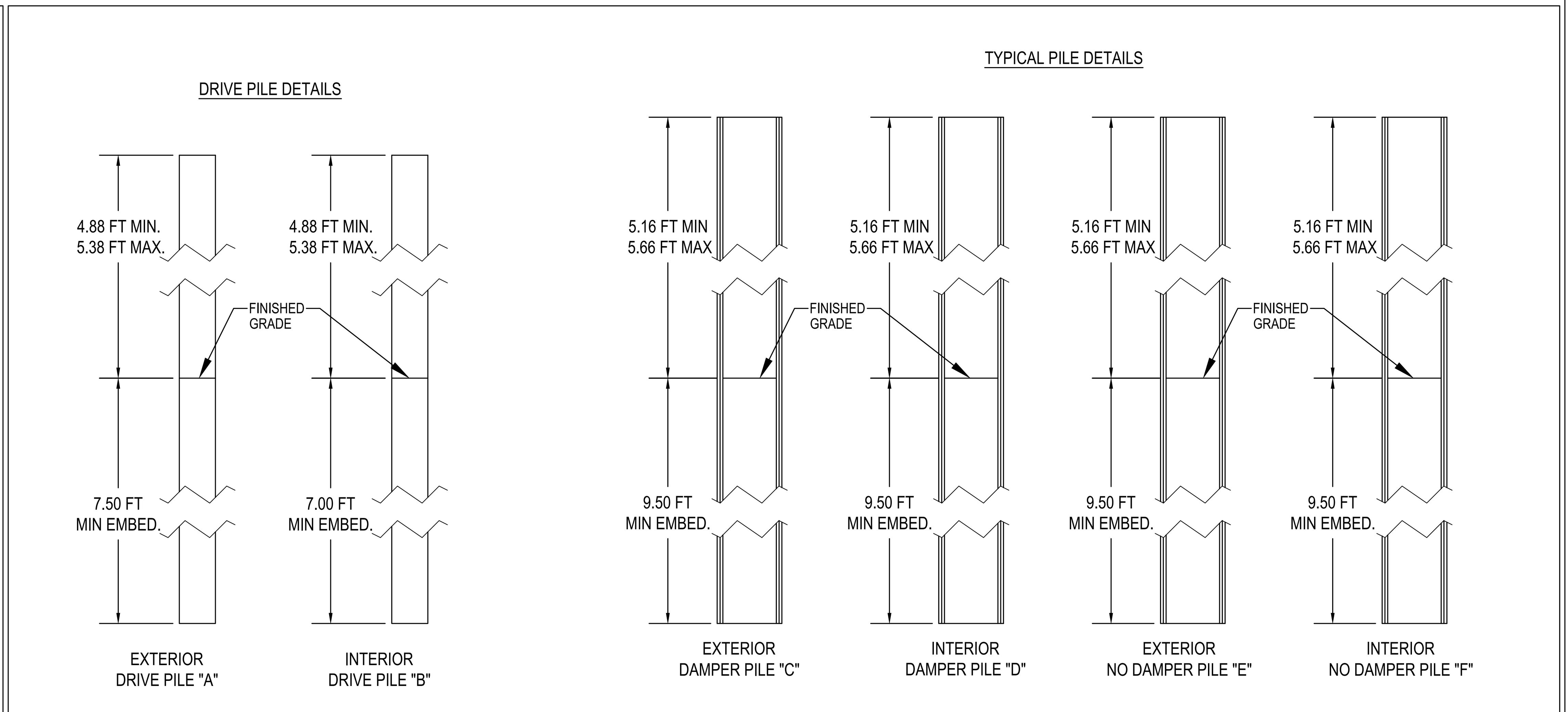
Modules per box:	31 pieces
Modules per 40' Container:	620 pieces
Modules per 53' Trailer:	806 pieces

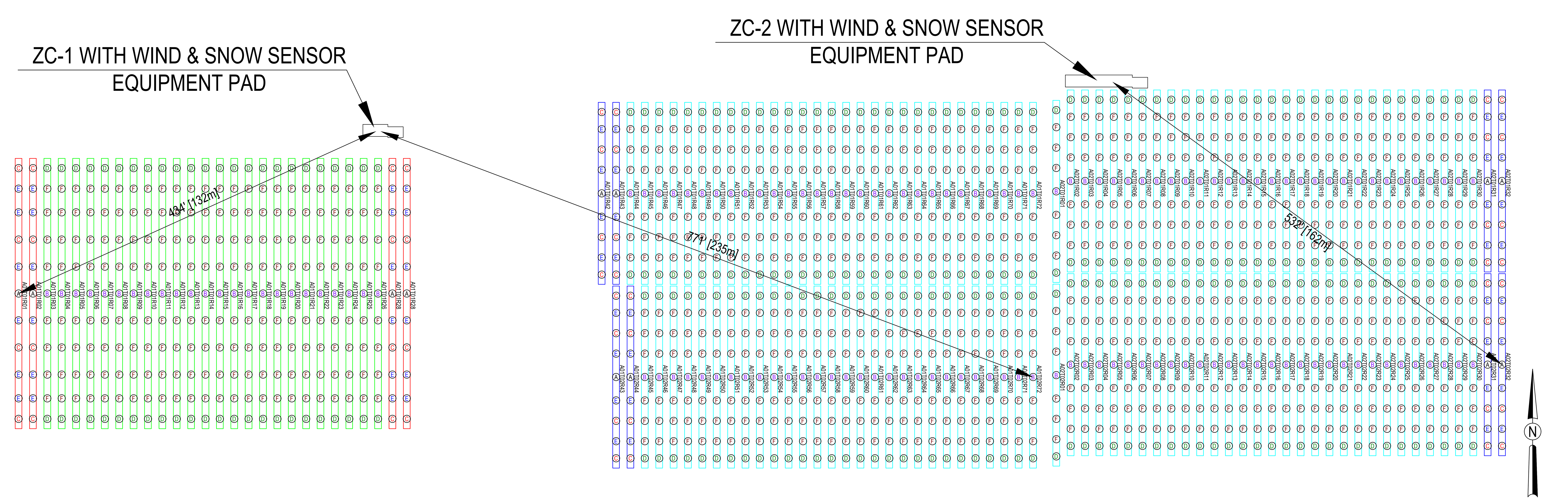
GENERAL DESCRIPTION		ZONE CONTROLLER DETAILS		
PROJECT CAPACITY	4.68936 MWDC	ZONE CONTROLLERS (QTY.)	2 Nos.	
LATITUDE / LONGITUDE	41.884572° / -72.537160°	ROW CONTROLLERS (QTY.)	153 Nos.	
TRACKER LENGTH (N-S)	298.90' (91.10 m)	WIND SENSORS (QTY.)	2 Nos.	
CHORD LENGTH (E-W)	7.48' (2.28 m)	SNOW SENSORS (QTY.)	2 Nos.	
PITCH	15.91' (4.85 m)			
GCR	47.0%	C E C E A E C E C	2 STRING EXTERIOR	8 Nos.
RANGE OF MOTION	+/- 52°	D F F F B F F F D	2 STRING INTERIOR	117 Nos.
WIND ZONE	108 MPH	C E E C E A E C E E C	3 STRING EXTERIOR	4 Nos.
SNOW LOAD	30 PSF	D F F F F B F F F F D	3 STRING INTERIOR	24 Nos.

PILE TYPE	SYMBOL	TYPE	MIN. EMBEDMENT* (ft)	MIN. REVEAL (ft)	MAX. REVEAL** (ft)	TOTAL LENGTH** (ft)	TOTAL LENGTH** (m)	F_y YIELD (ksi)	DESIGN QTY.	COLOR CODE
EXTERIOR DRIVE PILES	A	W6x12	7.50	4.88	5.38	12.88	3.93	50.00	12	BLACK
INTERIOR DRIVE PILES	B	W6x9	7.00	4.88	5.38	12.38	3.77	50.00	141	PURPLE
EXTERIOR DAMPER PILES	C	W6x7	9.50	5.16	5.66	15.16	4.62	50.00	48	RED
INTERIOR DAMPER PILES	D	W6x7	9.50	5.16	5.66	15.16	4.62	50.00	282	GREEN
EXTERIOR NO DAMPER PILES	E	W6x7	9.50	5.16	5.66	15.16	4.62	50.00	56	BLUE
INTERIOR NO DAMPER PILES	F	W6x7	9.50	5.16	5.66	15.16	4.62	50.00	894	MAROON

SHEET NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS NOTED OTHERWISE.
2. REFER TO MECHANICAL DRAWINGS FOR GENERAL ASSEMBLY TRACKER DETAILS.
3. REFER TO PILE FOUNDATION DRAWING FOR EMBEDMENT, MINIMUM AND MAXIMUM REVEAL DETAILS.
4. ANY DISCREPANCY IN THE DRAWING SHALL BE BROUGHT TO THE NOTICE OF FT ENGINEER OR EOR.
5. THESE PLANS SHALL BE VERIFIED WITH ELECTRICAL AND CIVIL PLANS PRIOR TO CONSTRUCTION.
6. REFER TO THE PILE FOUNDATION DETAIL DRAWINGS FOR PILE INSTALLATION REQUIREMENTS.
7. SENSORS TO BE INTEGRATED WITH THE ZC WIND SENSORS, AND SNOW SENSORS.
8. ZONE CONTROLLERS ARE LOCATED NEXT TO 110V AC SUPPLY AND SCADA PANEL SHOULD BE AVAILABLE NEXT TO THE INVERTER FOR ZC INTEGRATION.
9. A MINIMUM HEIGHT OF 4.5 M (15 FT) MAXIMUM HEIGHT OF 5.5 M (18 FT) TO BE MAINTAINED FOR THE ZONE CONTROLLER ANTENNA FROM THE GROUND LEVEL TO AVOID COMMUNICATION LINE OF SIGHT ISSUE.
10. CUSTOMER APPROVED DRAWINGS NO: Mulnite Layout - 3.27.24 (PER EXHIBIT "B")
11. REFERENCE TRACKER GA DRAWINGS NUMBER: 600200, 600201





SCALE: 1": 60'

FTC SOLAR

AUI DG SOLUTIONS

ISSUED FOR CONSTRUCTION

STAMP:

MULNITE PV PROJECT
MILLER ROAD
EAST WINDSOR, CT 06016

PROJECT NUMBER: DG-24-0068

SHEET TITLE: TRACKER CLASSIFICATION OVERALL LAYOUT

SHEET SIZE: ARCH "D" 36" x 24" (914 x 610)

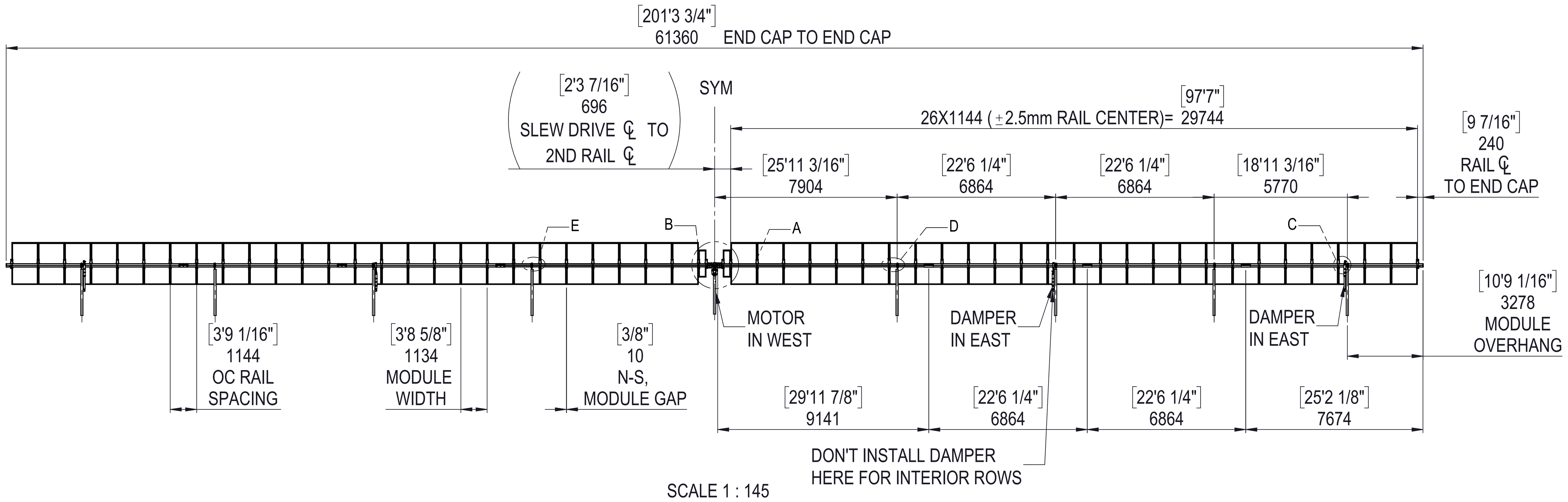
NO.	REVISION	DATE	INIT.
0	IFC	18-APR-2024	BLD

DATE:	18-APR-2024
DRAWN BY:	BLD
ENGINEER:	BLD
APPROVED BY:	WF

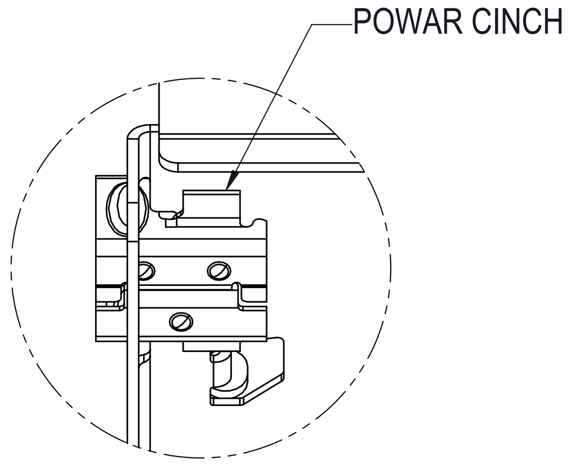
TRACKER INSTALLATION MANUAL VERSION: TO BE RELEASED

SHEET NO.: S-900

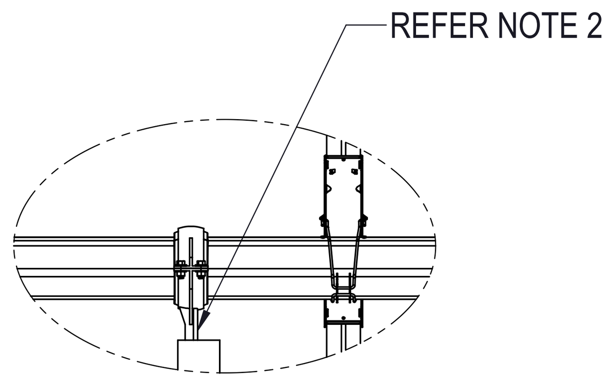
IFP/IFC FINAL GA FOR BOM



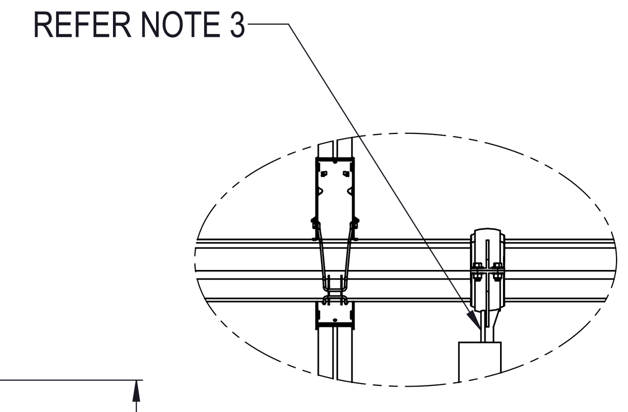
SCALE 1 : 145



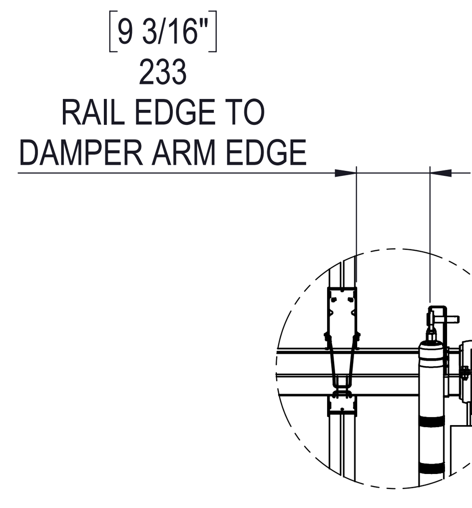
DETAIL A
SCALE 1 : 1



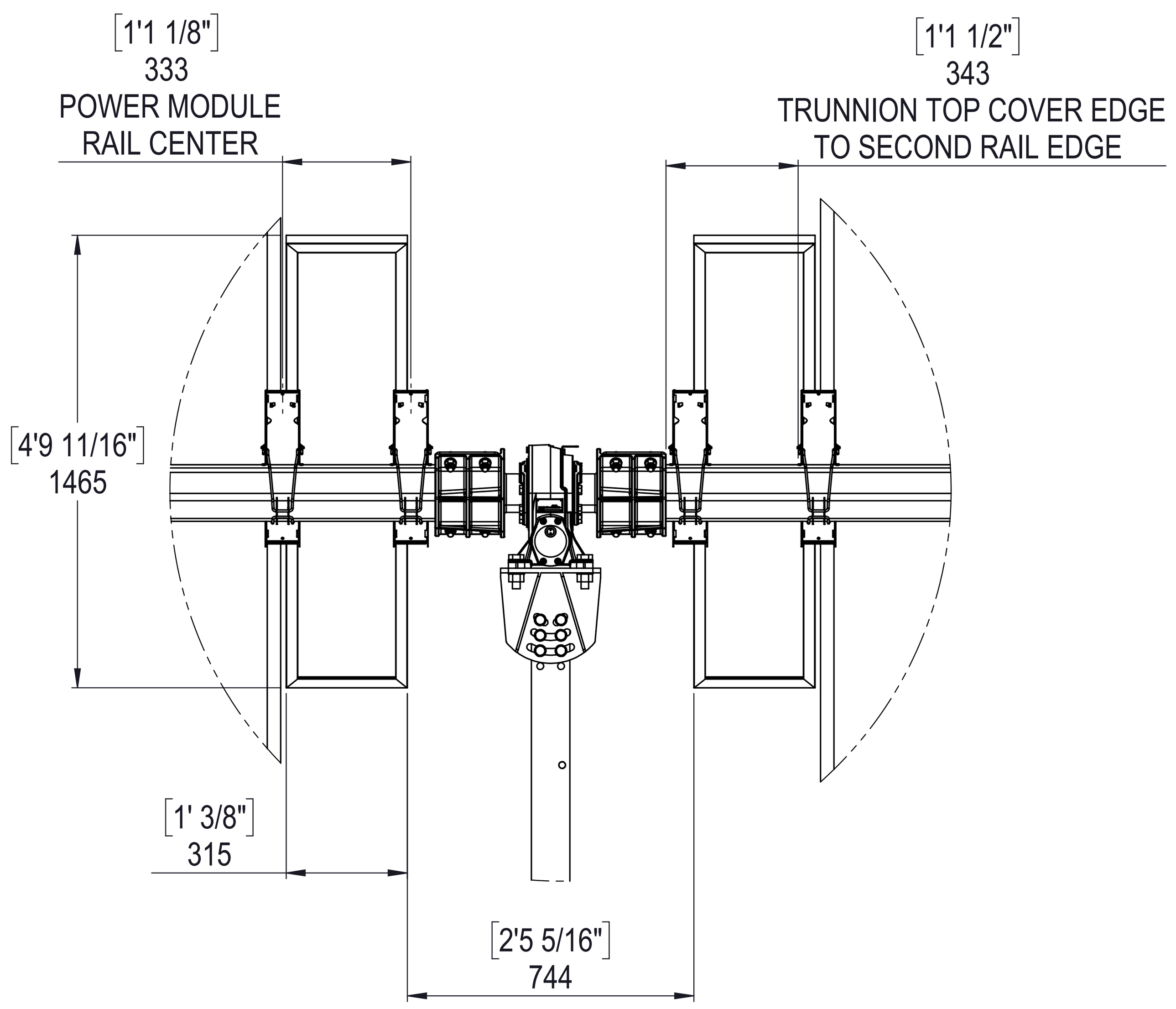
DETAIL E
SCALE 1 : 15



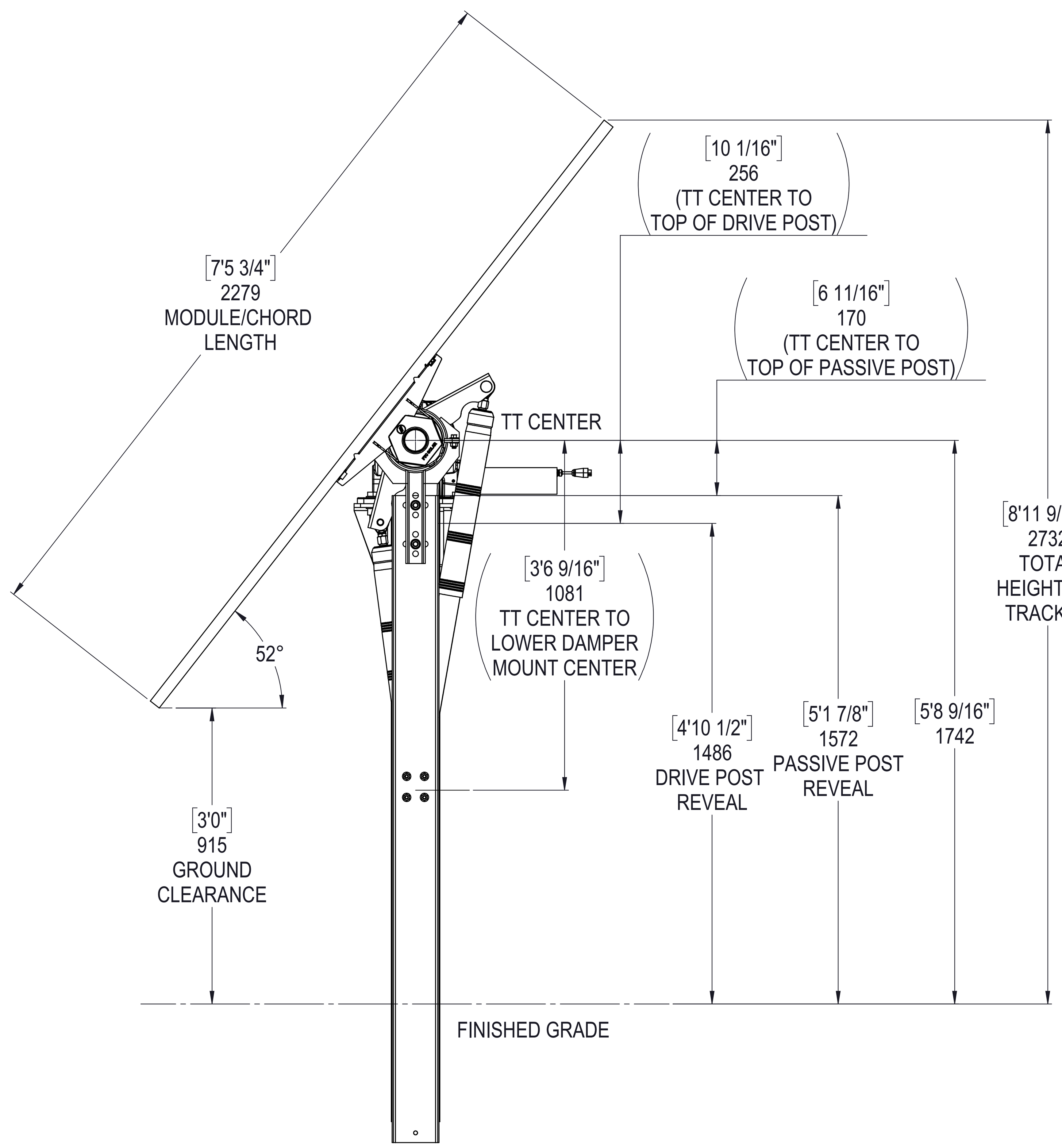
DETAIL D
SCALE 1 : 15



DETAIL C
SCALE 1 : 20



DETAIL B
SCALE 1 : 15
POWER MODULE DETAILS



SCALE 1 : 12
N-S ELEVATION VIEW AT MAXIMUM TILT

NOTES:
1. THIS MODULE FRAME HAS AN OVERHANG OF 5mm SMALLER SIDE AND 20mm ON THE LARGER SIDE AS SPECIFIED BY CUSTOMER FOR THIS PROJECT.
2. JOURNAL ON NORTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON NORTH SIDE OF PILE
3. JOURNAL ON SOUTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON SOUTH SIDE OF PILE

HEXAGON TORQUE TUBE SPECIFICATIONS -80KSI GRADE

	LENGTH	EXTERIOR ROW	INTERIOR ROW
DRIVE BEAM	[29'11 7/8"] 9141	[1/8"] 2.75	[1/8"] 2.75
MID BEAM	[22'6 1/4"] 6864	[1/8"] 2.75	[5/64] 2.00
MID BEAM-2	[22'6 1/4"] 6864	[1/8"] 2.75	[5/64] 2.00
END BEAM	[25'2 1/8"] 7674	[5/64] 2.00	[5/64] 2.00

STANDARD DESIGN NOTES

1.	SITE WIND SPEED	108 MPH	
2.	GROUND SNOW	30 PSF	
3.	SYSTEM VOLTAGE	1500V	
4.	STRING SIZE	26	
5.	ROW TYPE	PARTIAL ROW	
6.	MODULE TYPE (DIM)	HELIENE 144HC M10 SL BIFACIAL 540W	
		(2279) X (1134) X (35)	
7.	DAMPERS	EXTERIOR	INTERIOR
		4	2

FTC PIONEER 1P TRACKER™

PROJECT PHASE:
ISSUED FOR CONSTRUCTION

STAMP :

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	BY	RVW
	A	INITIAL RELEASE	04-APR-2024	RK	PC
	B	UPDATED AS PER FSD REV-A ON 11-APR-2024	12-APR-2024	RK	PA

PROJECT NAME
AUI PARTNERS
MULNITE-1P -
MILLER RD, EAST WINDSOR, CT 06016

PROJECT NUMBER
0066O00000rgWzOQAU

PIONEER-H INSTALLATION MANUAL
VERSION:- TBR

SHEET TITLE
TRACKER GENERAL ASSEMBLY- PIONEER-H

DRAWING TITLE:
PIONEER-H, 1500V TRACKER (26X2S=52 MODULES), MULNITE_1P

DRAWING NO:
600201

DATE : 04-APR-2024
DRAWN BY: RK
APPROVED BY: GK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM
DIMENSION UNITS: mm
TOLERANCES (UNLESS OTHERWISE SPECIFIED)
ZERO DECIMAL PLACE: X±1.25
ONE DECIMAL PLACE: X.X±.5
TWO DECIMAL PLACE: X.XX±.1
THREE DECIMAL PLACE: X.XXX±.05
ANGLE: ±1.0°

NOTE:
PROVIDED TOLERANCE ARE NOT APPLICABLE FOR STRUCTURAL SPECIFICATIONS. FOR STRUCTURAL SHAPE TOLERANCE PLEASE REFER RESPECTIVE PART DRAWINGS

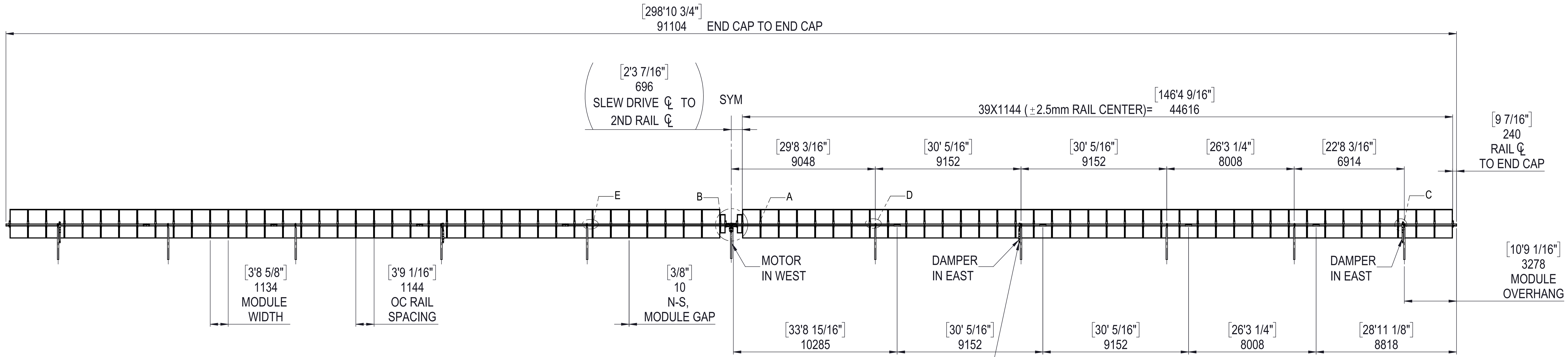
THIRD ANGLE PROJECTION

SHEET NO:
S-200

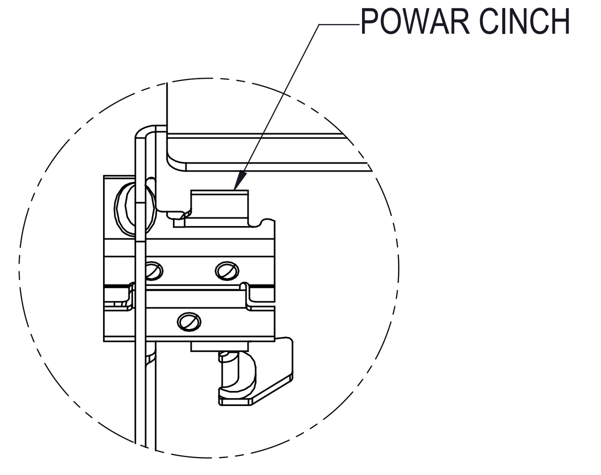
DRAWING SIZE A1
REV B

DO NOT SCALE DRAWING

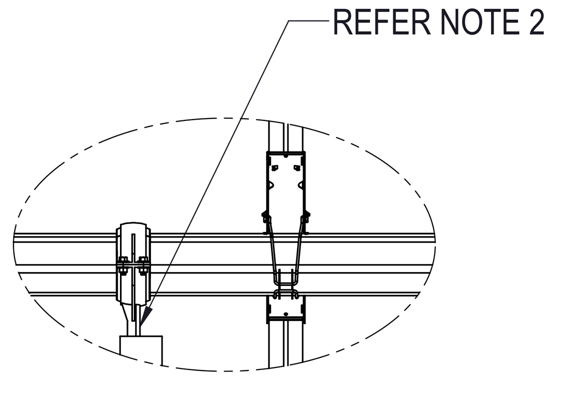
IFP/IFC FINAL GA FOR BOM



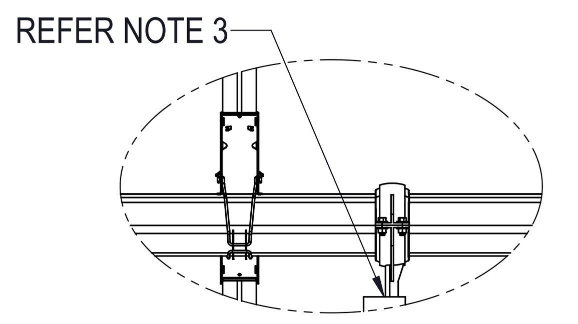
SCALE 1 : 145



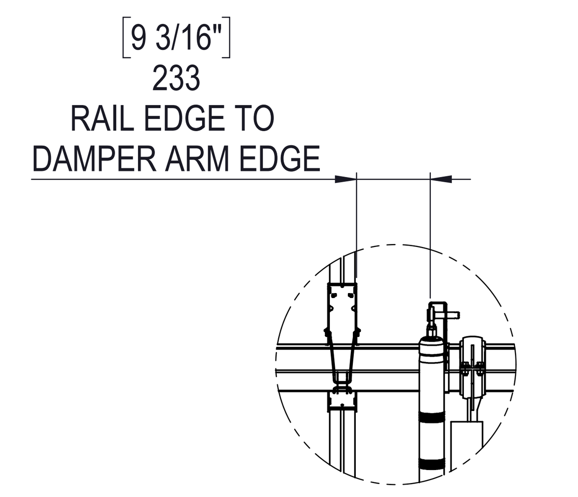
DETAIL A
SCALE 1 : 1



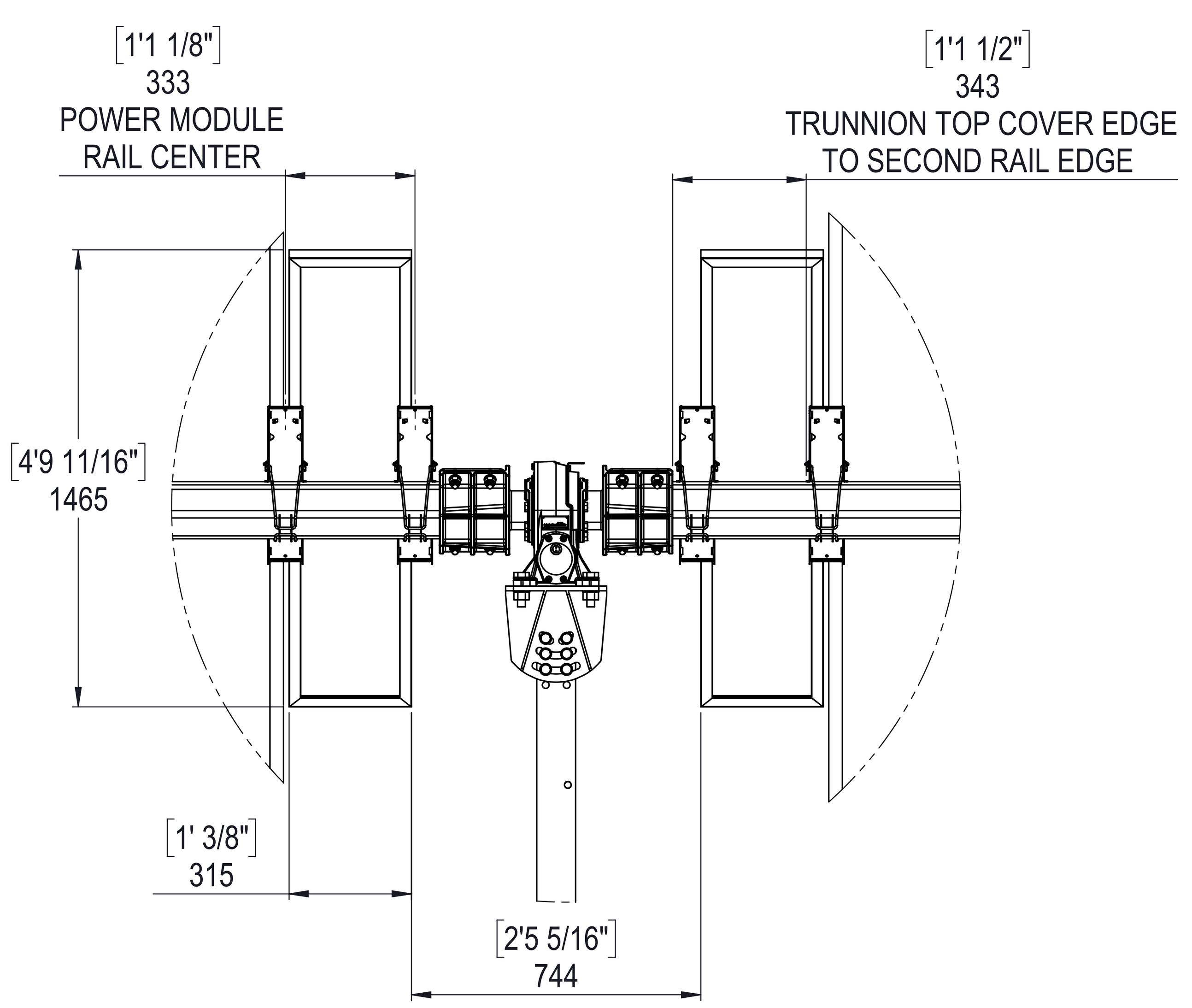
DETAIL E
SCALE 1 : 15



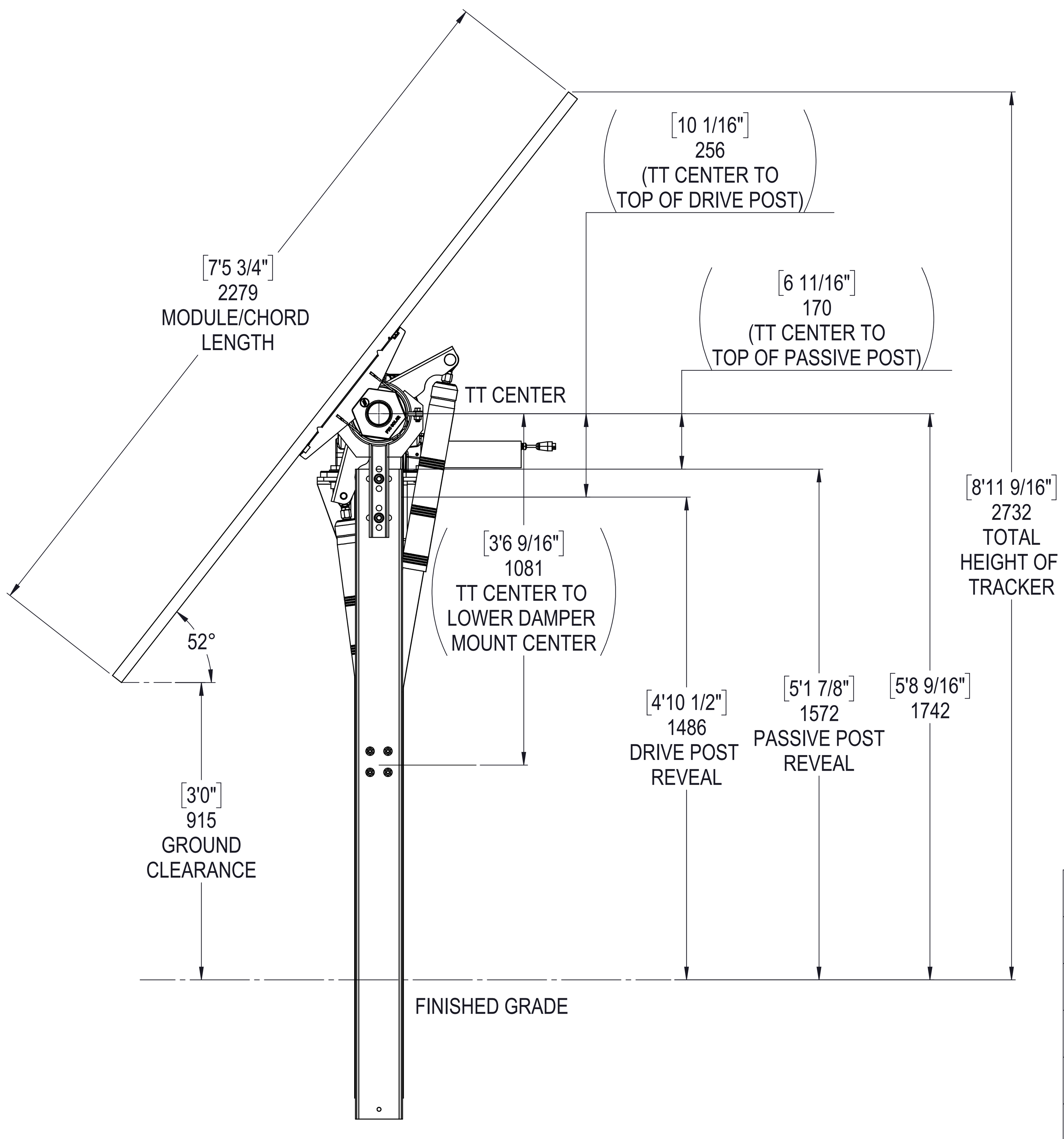
DETAIL D
SCALE 1 : 15



DETAIL C
SCALE 1 : 20



DETAIL B
SCALE 1 : 15
POWER MODULE DETAILS



SCALE 1 : 12
N-S ELEVATION VIEW AT MAXIMUM TILT

HEXAGON TORQUE TUBE SPECIFICATIONS -80KSI GRADE			
	LENGTH	EXTERIOR ROW	INTERIOR ROW
DRIVE BEAM	[33'8 15/16"] 10285	[1/8"] 2.75	[1/8"] 2.75
MID BEAM	[30' 5/16"] 9152	[1/8"] 2.75	[1/16"] 2.00
MID BEAM 2	[30' 5/16"] 9152	[1/8"] 2.75	[1/16"] 2.00
END BEAM	[26'3 1/4"] 8008	[1/16"] 2.00	[1/16"] 2.00
END BEAM -2	[28'11 1/8"] 8818	[1/16"] 2.00	[1/16"] 2.00

STANDARD DESIGN NOTES			
1.	SITE WIND SPEED	108 MPH	
2.	GROUND SNOW	30 PSF	
3.	SYSTEM VOLTAGE	1500V	
4.	STRING SIZE	26	
5.	ROW TYPE	FULL ROW	
6.	MODULE TYPE (DIM)	HELIENE 144HC M10 SL BIFACIAL 540W	
		(2279) X (1134) X (35)	
7.	DAMPERS	EXTERIOR	INTERIOR
		4	2

NOTES:
1. THIS MODULE FRAME HAS AN OVERHANG OF 5mm SMALLER SIDE AND 20mm ON THE LARGER SIDE AS SPECIFIED BY CUSTOMER FOR THIS PROJECT.
2. JOURNAL ON NORTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON NORTH SIDE OF PILE
3. JOURNAL ON SOUTH SIDE OF SLEW DRIVE HAS JOURNAL INSTALLED ON SOUTH SIDE OF PILE

FTC PIONEER 1P TRACKER™

PROJECT PHASE:
ISSUED FOR CONSTRUCTION

STAMP :
STATE OF CONNECTICUT
WOLFGANG U. FRITZ
No. 27916
LICENSED
PROFESSIONAL ENGINEER

REVISIONS					
ZONE	REV.	DESCRIPTION	DATE	BY	RVW
	A	INITIAL RELEASE	04-APR-2024	RK	PC
	B	UPDATED AS PER FSD REV-A ON 11-APR-2024	12-APR-2024	RK	PA

PROJECT NAME
AUI PARTNERS
MULNITE-1P -
MILLER RD, EAST WINDSOR,
CT 06016

PROJECT NUMBER
0066O00000rgWzOQAU

PIONEER-H INSTALLATION MANUAL
VERSION:- TBR

SHEET TITLE
TRACKER GENERAL ASSEMBLY- PIONEER-H

DRAWING TITLE:
PIONEER-H, 1500V TRACKER (26X3S=78 MODULES), MULNITE_1P

DRAWING NO:
600200

DATE : 04-APR-2024
DRAWN BY: RK
APPROVED BY: GK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MM

DIMENSION UNITS: mm
TOLERANCES (UNLESS OTHERWISE SPECIFIED)
ZERO DECIMAL PLACE: X±1.25
ONE DECIMAL PLACE: X.X±.5
TWO DECIMAL PLACE: X.XX±.1
THREE DECIMAL PLACE: X.XXX±.05
ANGLE: ±1.0°

NOTE:
PROVIDED TOLERANCE ARE NOT APPLICABLE FOR STRUCTURAL SPECIFICATIONS. FOR STRUCTURAL SHAPE TOLERANCE PLEASE REFER RESPECTIVE PART DRAWINGS

THIRD ANGLE PROJECTION

SHEET NO:
S-200

DRAWING SIZE A1
REV B

DO NOT SCALE DRAWING