1/0/1900 PHOTOVOLTAIC SYSTEM

CODES:

THIS PROJECT COMPLIES WITH THE FOLLOWING:
2020 7TH EDITION FLORIDA BUILDING CODE: BUILDING
2020 7TH EDITION FLORIDA BUILDING CODE: RESIDENTIAL
2020 7TH EDITION FLORIDA BUILDING CODE: MECHANICAL
2020 7TH EDITION FLORIDA BUILDING CODE: PLUMBING
2020 7TH EDITION FLORIDA BUILDING CODE: FUEL GAS
2020 7TH EDITION FLORIDA BUILDING CODE: ENERGY CONSERVATION
2020 7TH EDITION FLORIDA BUILDING CODE: EXISTING BUILDING
2020 7TH EDITION FLORIDA BUILDING CODE: ACCESSIBILITY
2020 7TH EDITION FLORIDA FIRE PREVENTION CODE
2017 NATIONAL ELECTRIC CODE
AS ADOPTED BY COUNTY OF COLUMBIA (FL)

VICINITY MAP:

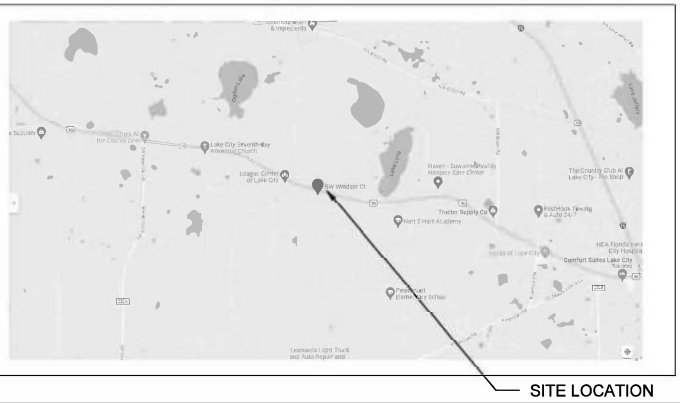


TABLE OF CONTENTS:

CONSTRUCTION NOTES:

CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.

ALL SOLAR ENERGY SYSTEM EQUIPMENT SHALL BE SCREENED TO THE MAXIMUM EXTENT POSSIBLE AND SHALL BE PAINTED A COLOR SIMILAR TO THE SURFACE UPON WHICH THEY ARE MOUNTED.

MODULES SHALL BE TESTED , LISTED AND INDENTIFIED WITH FIRE CLASSIFICATION IN ACCORDANCE WITH UL 2703. SMOKE AND CARBON MONOXIDE ALARMS ARE REQUIRED PER SECTION R314 AND 315 TO BE VERIFIED AND INSPECTED BY INSPECTOR IN THE FIELD.

DIG ALERT (811) TO BE CONTACTED AND COMPLIANCE WITH EXCAVATION SAFETY PRIOR TO ANY EXCAVATION TAKING PLACE

METHODE MANIRAGUHA LICENSE No. 85003 STATE OF FLORIDA PROFESSIONAL ENGINEER
EXP. 2/28/2025

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:42:59 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

freedom FOREVER
FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT
CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

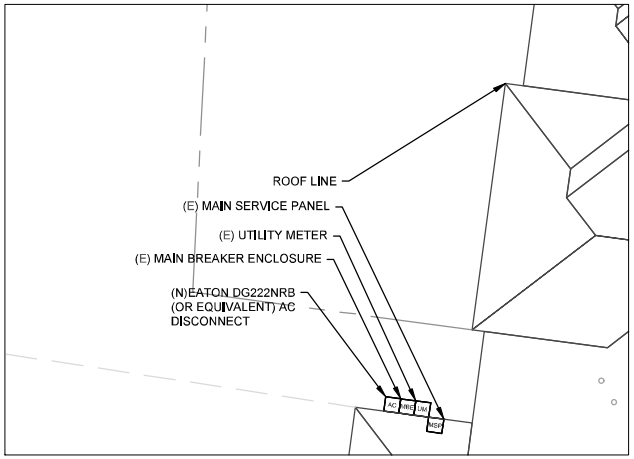
SITE LOCATION

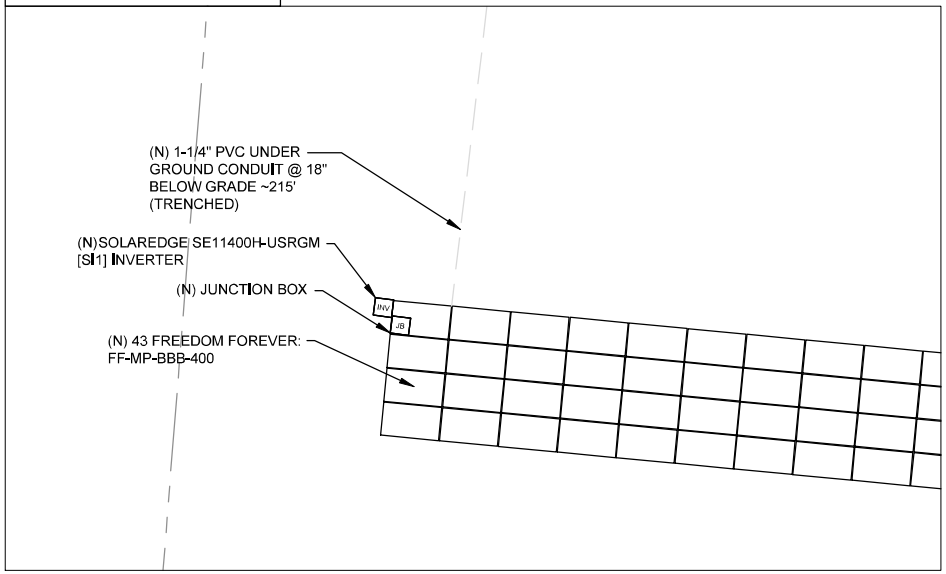
JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-1

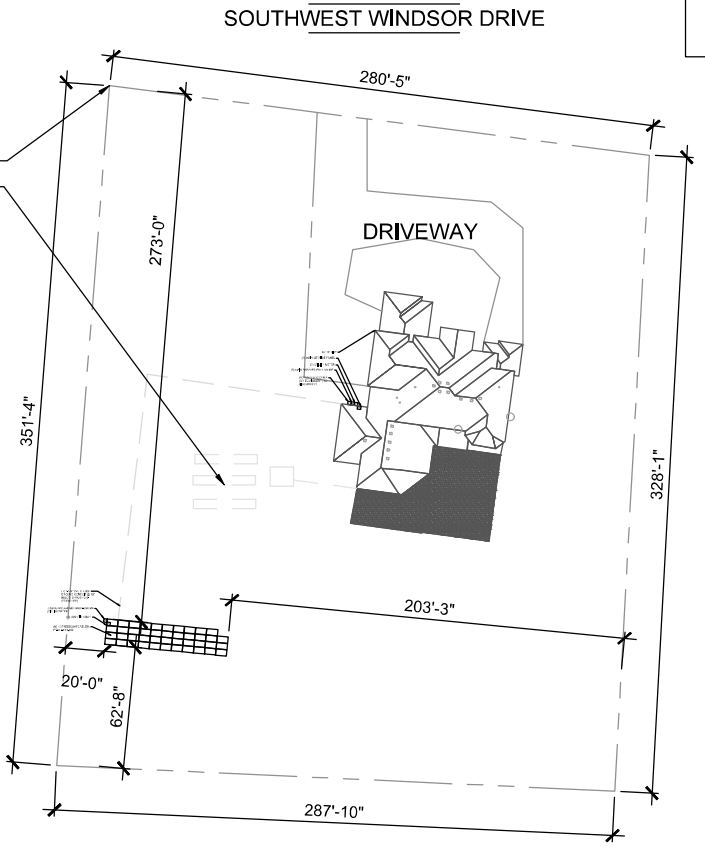
LEGEND:

- OBSTRUCTION
- PIPE VENT
- 43 FREEDOM FOREVER: FF-MP-BBB-400
- CONDUIT
- SETBACK
- UM — UTILITY METER
- MSP — MSP
- INV — INVERTER
- AC — VISIBLE LOCKABLE LABELED AC DISCONNECT
- JB — JUNCTION BOX

MESH/SCRIM REQUIRED ON GROUND MOUNT







SITE PLAN
SCALE: 1/64" = 1'-0"

1

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:43:18 +05'30'

#N/A: 2500 SQ FT

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

	REVISIONS	
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

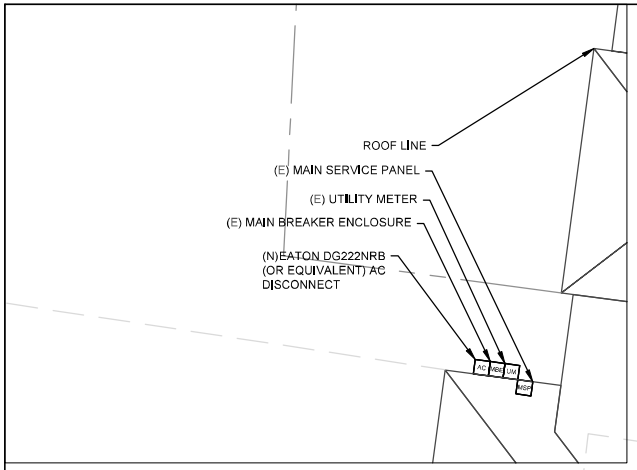
FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

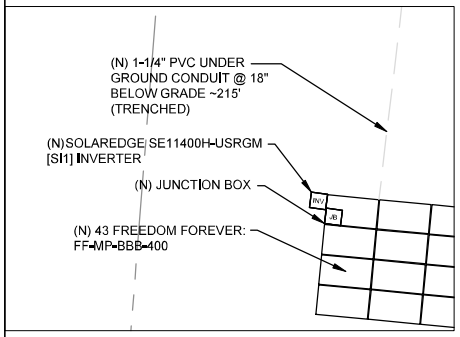
CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

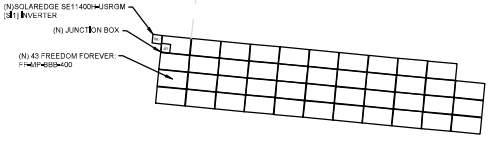
SITE PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-2

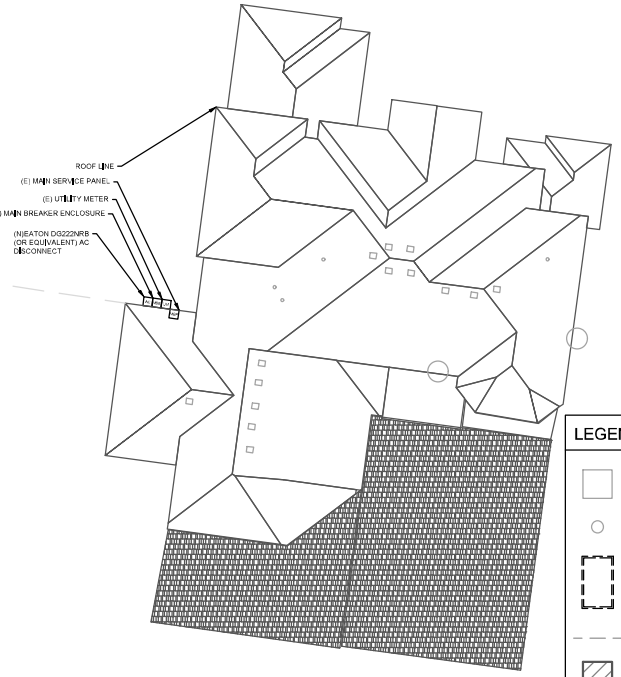
MESH/SCRIM REQUIRED ON GROUND MOUNT







(N) 1-1/4" PVC UNDER GROUND CONDUIT @ 18" BELOW GRADE ~215' (TRENCHED)



LEGEND:

- OBSTRUCTION
- PIPE VENT
- 43 FREEDOM FOREVER: FF-MP-BBB-400
- CONDUIT
- SETBACK
- UM — UTILITY METER
- MSP — MSP
- INV — INVERTER
- AC — VISIBLE LOCKABLE LABELED AC DISCONNECT
- JB — JUNCTION BOX

NOTES:
1. ATTACHED CLAMPS AT 25% FROM THE EDGE AND 50% FROM THE CENTER OF THE MODULES
2. JUNCTION BOX IS MOUNTED TO THE RAIL.

FLOOR PLAN
SCALE: 1/24" = 1'-0"
1

METHODE MANIRAGUHA LICENSE No. 85003 STATE OF FLORIDA PROFESSIONAL ENGINEER
EXP. 2/28/2025

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:43:35 +05'30'

#N/A : 2500 SQ FT

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

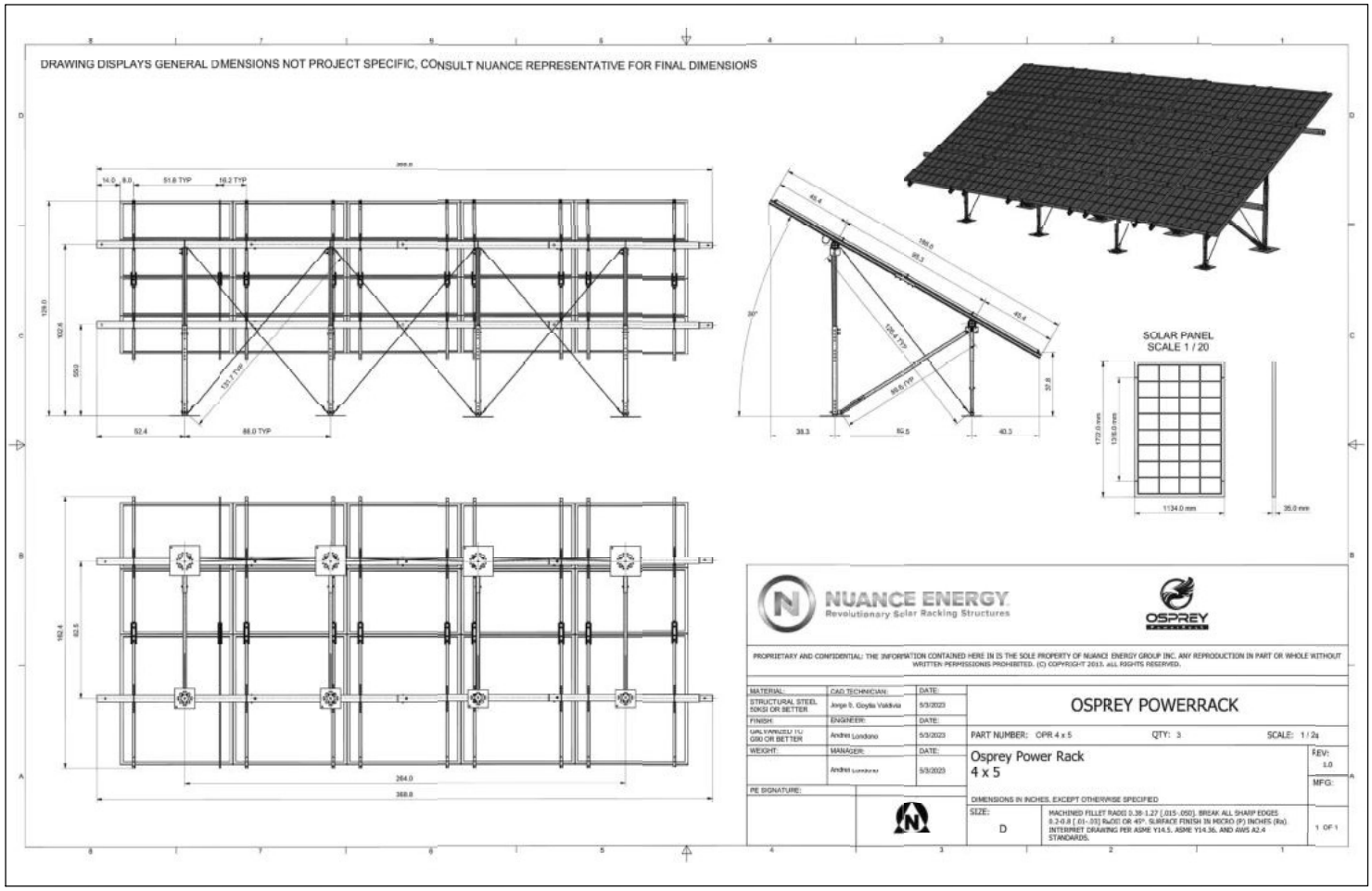
freedom FOREVER

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

ARRAY PLAN WITH MODULES LAYOUT

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-2AG



CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

NO.	REVISIONS REVISED BY	DATE
-	-	-
-	-	-
-	-	-

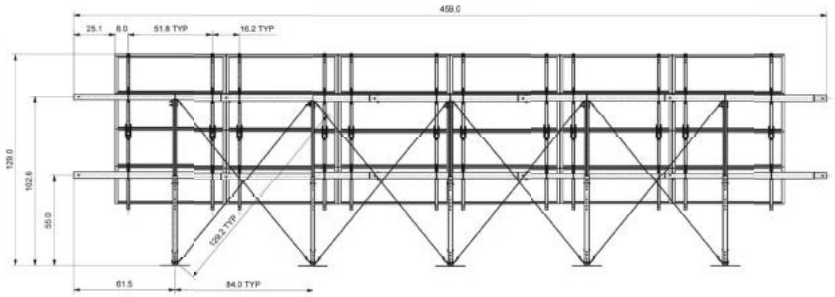
freedom FOREVER
FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

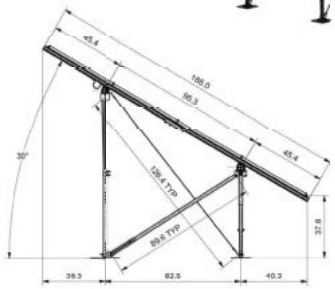
CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

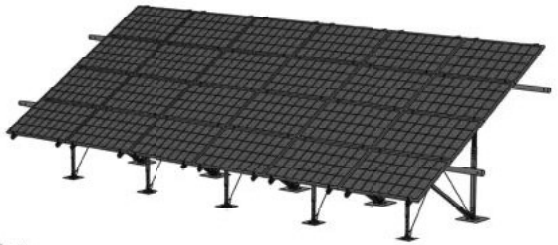
GROUNT MOUNT MOUNTING DETAILS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-3A

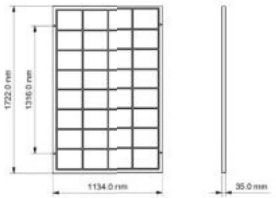
DRAWING DISPLAYS GENERAL DIMENSIONS NOT PROJECT SPECIFIC. CONSULT NUANCE REPRESENTATIVE FOR FINAL DIMENSIONS

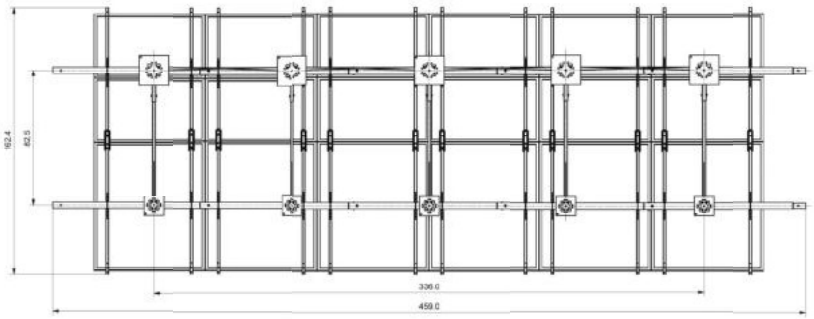






SOLAR PANEL
SCALE 1 / 20





NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY POWERRACK

MATERIAL: STRUCTURAL STEEL 50KSI OR BETTER	CAD TECHNICIAN: Jorge D. Goytia Valdivia	DATE: 5/4/2023
FINISH: GALVANIZED TO G90 OR BETTER	ENGINEER: Andres Londono	DATE: 5/4/2023
WEIGHT:	MANAGER: Andres Londono	DATE: 5/4/2023
PE SIGNATURE:		

PART NUMBER: OPR 4 x 6 QTY: 1 SCALE: 1 / 30

Osprey Power Rack
4 x 6

REV: 1.0
MFG:

DIMENSIONS IN INCHES. EXCEPT OTHERWISE SPECIFIED

SIZE: D

MACHINED FILLET RADII 0.38-1.27 [.015-.050]. BREAK ALL SHARP EDGES 0.2-0.8 [.01-.03] RADII OR 45°. SURFACE FINISH IN MICRO (F) INCHES (Ra). INTERPRET DRAWING PER ASME Y14.5, ASME Y14.36, AND AWS A2.4 STANDARDS.

1 OF 1

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:44:29 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

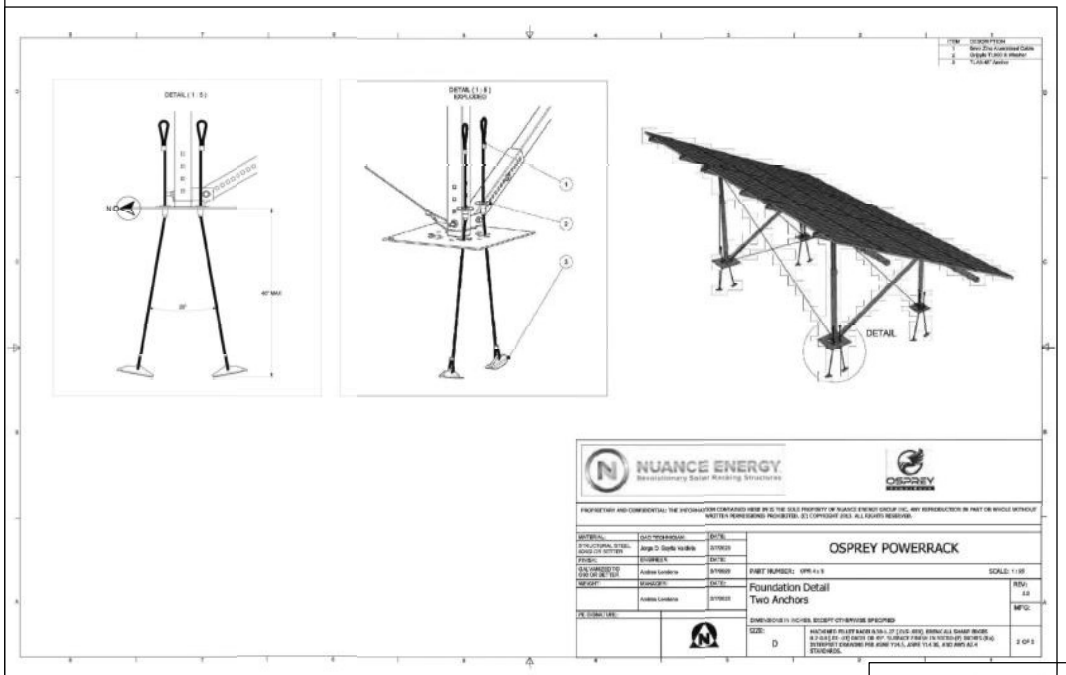
NO.	REVISIONS REVISED BY	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

GROUND MOUNT ATTACHMENT DETAILS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-3G



STRUCTURAL NOTES:

RACKING TYPE: OSPREY POWER RACK LTE
ANCHOR TYPE: TLA3 - 48"

ONCE INSTALLED, "PROOF LOADING" PULL TEST RESULTS FOR THE EARTH ANCHOR FOUNDATION SYSTEMS SHALL BE SUBMITTED TO AND APPROVED BY THE ENGINEER OF RECORD (EOR).

REQUIRED NUMBER OF EARTH ANCHORS (EACH BASEPLATE) AND TEST LOADS (EACH ANCHOR):

BACK LEGS (2) ANCHOR @ 4200 LBS
FRONT LEGS (1) ANCHOR @ 1000 LBS

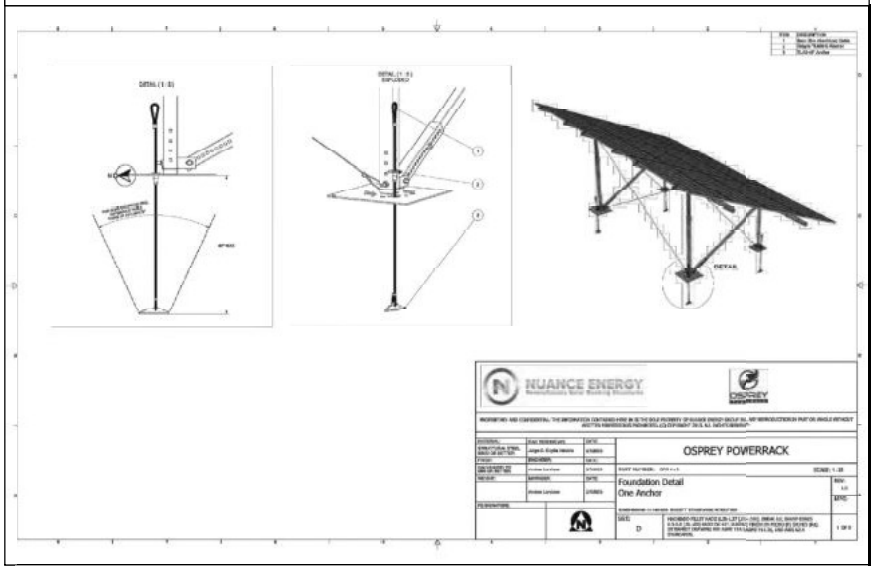
STRUCTURAL NOTES:

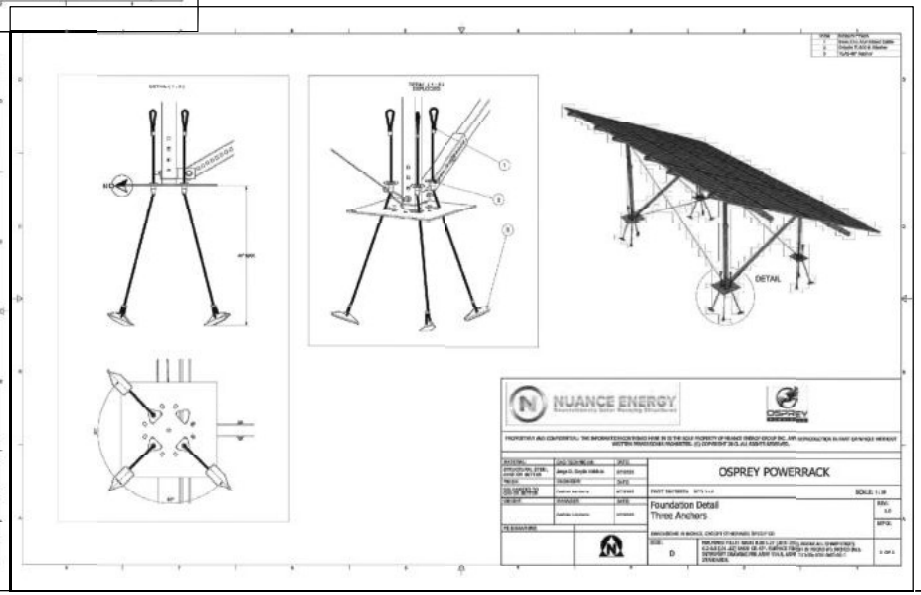
RACKING TYPE: OSPREY POWER RACK LTE
ANCHOR TYPE: TLA3 - 48"

ONCE INSTALLED, "PROOF LOADING" PULL TEST RESULTS FOR THE EARTH ANCHOR FOUNDATION SYSTEMS SHALL BE SUBMITTED TO AND APPROVED BY THE ENGINEER OF RECORD (EOR).

REQUIRED NUMBER OF EARTH ANCHORS (EACH BASEPLATE) AND TEST LOADS (EACH ANCHOR):

BACK LEGS (2) ANCHOR @ 3900 LBS
FRONT LEGS (1) ANCHOR @ 1000 LBS





METHODE MANIRAGUHA
LICENSE
No. 85003
STATE OF FLORIDA
PROFESSIONAL ENGINEER
EXP. 2/28/2025

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:44:49 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

	REVISIONS	
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

freedom FOREVER

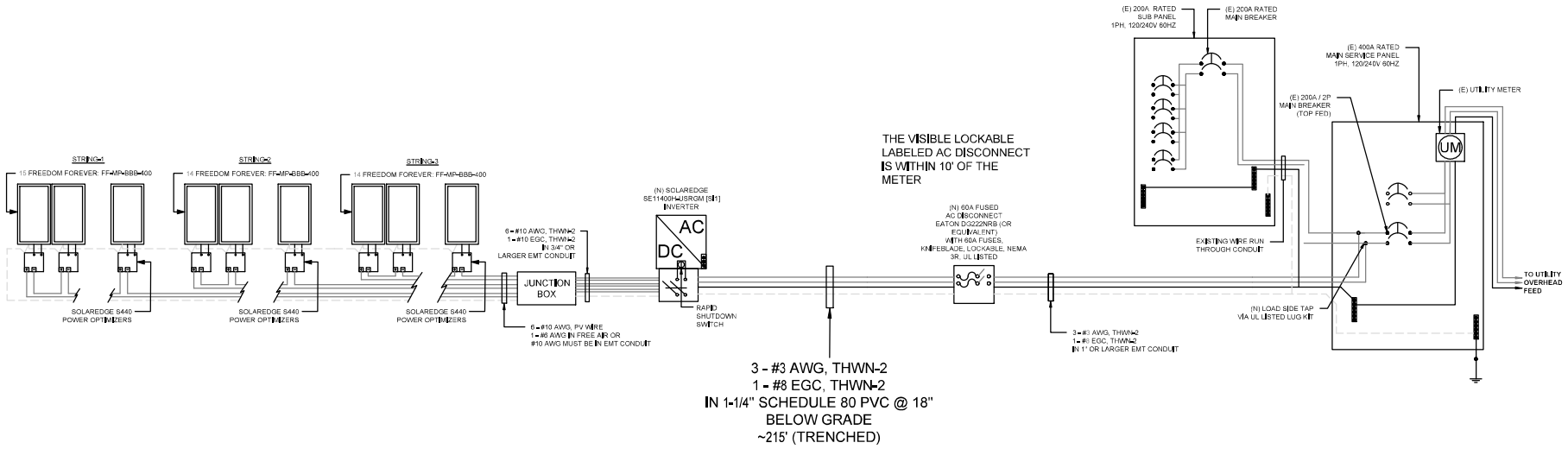
FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

GROUND MOUNT ATTACHMENT DETAILS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-3AG

BACKFEED FUSE SIZING					
MAX. CONTINUOUS OUTPUT 47.50A @ 240V					
47.50	X	1.25	=	59.38AMPS	60A FUSES - OK
SEE 705.12 OF 2017 NEC					
200	X	1.20	=	240	
240	-	200	=	40A ALLOWABLE BACKFEED	



NOTE:
CONDUIT AND CONDUCTORS SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:45:11 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

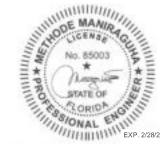
SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT
CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

THREE LINE DIAGRAM

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-4



This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:45:41 +05'30'

WIRE SCHEDULE												
RACEWAY #	EQUIPMENT				CONDUCTOR QTY.	AWG WIRE SIZE	STARTING ALLOWABLE AMPACITY @ 90°C 310.15(B)(16)	STARTING CURRENT APPLIED TO CONDUCTORS IN RACEWAY	TEMPERATURE CORRECTION FACTOR 310.15(B)(2)(a)	ADJUSTMENT FACTOR FOR MORE THAN 3 CONDUCTORS 310.15(B)(3)(a)	ADJUSTED CONDUCTOR AMPACITY @ 90°C	MAXIMUM CURRENT APPLIED TO CONDUCTORS IN RACEWAY
1	DC	MODULE	TO	OPTIMIZER	2	10	40	17.24	0.96	1	38.40	21.55
2	DC	OPTIMIZER	TO	JUNCTION BOX	2	10	40	15.00	0.96	1	38.40	18.75
3	DC	JUNCTION BOX	TO	INVERTER	6	10	40	15.00	0.96	0.8	30.72	18.75
4	AC	INVERTER	TO	AC DISCONNECT	3	3	115	47.50	0.96	1	110.40	59.38
5	AC	AC DISCONNECT	TO	POI	3	3	115	47.50	0.96	1	110.40	59.38

CONDUCTOR AMPACITY CALCULATIONS IN ACCORDANCE WITH NEC 690.8.

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

freedom FOREVER

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

CONDUCTOR CALCULATIONS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-5

OCPD SIZES:

60A BREAKER

SERVICE LIST:

NONE

MATERIAL LIST:

QTY.	PART	PART #	DESCRIPTION
43	MODULES	PV-110-400	FREEDOM FOREVER: FF-MP-BBB-400
43	OPTIMIZERS	OPT-130-440-2	SOLAREDGE S440 POWER OPTIMIZER - FRAME MOUNTED MODULE ADD-ON
1	JUNCTION BOX	RAC-261-527	600VDC NEMA 3R UL LISTED JUNCTION BOX
2	ELECTRICAL ACCESSORIES	EA-350-326	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (FEMALE)
2	EQUIPMENT ACCESSORIES	EA-350-327	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (MALE)
1	INVERTERS	INV-120-118	SE11400H-US [SI1] RGM 240V INVERTER UL1741 SA CERTIFIED INTEGRATED ARC FAULT PROTECTION AND RAPID SHUTDOWN
1	MONITORING EQUIPMENT	ME-180-502	SOLAREDGE CELL MODEM
1	DISCONNECTS	EE-321-061	60A RATED 240VAC NEMA 3R UL LISTED
2	FUSES	BR-330-060	60A FUSE 1 PH 240VAC
3	ELECTRICAL ACCESSORIES	EA-350-113	IDEAL B-TAP 4/0-10 AWG

OPR MAX -30° 4X6 - 5	Quantity ea.	Total Qty.
OPR RAIL KIT MAX	6	6
OPR FOUNDATION KIT	5	5
OPR BEAM KIT	5	5
OPR CABLE KIT	4	4
OPR LANDSCAPE CLAMP KIT	6	6
OPR OVERAGE KIT	0	0

OPR MAX -30° 4X5 - 4	Quantity ea.	Total Qty.
OPR RAIL KIT MAX	5	5
OPR FOUNDATION KIT	4	4
OPR BEAM KIT	4	4
OPR CABLE KIT	3	3
OPR LANDSCAPE CLAMP KIT	5	5
OPR OVERAGE KIT	1	1

METHODE MANIRAGUHA LICENSE No. 85003 STATE OF FLORIDA PROFESSIONAL ENGINEER
EXP. 2/28/2025

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:46:03 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

	REVISIONS	
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

EQUIPMENT & SERVICE LIST

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-6

WARNING:
POWER SOURCE OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE.

705.12(B)(2)(3)(b)

M

"WARNING"
DUAL POWER SOURCES
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
RATED AC OUTPUT CURRENT - 47.50 AMPS
AC NORMAL OPERATING VOLTAGE - 240 VOLTS

690.54

NOTES:

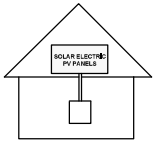
1. NEC ARTICLES 690 AND 705 AND IRC SECTION R324 MARKINGS SHOWN HEREON.
2. ALL MARKING SHALL CONSIST OF THE FOLLOWING:
   A. UV RESISTANT SIGN MATERIAL WITH ENGRAVED OR MACHINE PRINTED LETTERS OR ELECTRO-PLATING.
   B. RED BACKGROUND COLOR WHITE TEXT AND LINE WORK.
   C. ARIAL FONT.
3. ALL SIGNS SHALL BE SIZED APPROPRIATELY AND PLACED IN THE LOCATIONS SPECIFIED. SIGNAGE CANNOT BE HAND-WRITTEN.
4. SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:46:28 +05'30'

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

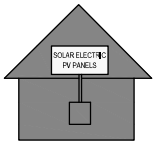
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY



690.56(C)(1)(A)

EMERGENCY RESPONDER
THIS SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN ENTIRE PV SYSTEM



NFPA 11.12.2.1.1.1.1

"WARNING"
ELECTRICAL SHOCK HAZARD.
TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.

690.13 (B)

MAXIMUM POWER POINT CURRENT (Imp):	43A or 30.5A
MAXIMUM POWER POINT VOLTAGE (Vmp):	400V
MAXIMUM SYSTEM VOLTAGE (Vmax):	480V
SHORT-CIRCUIT CURRENT (Ibc):	30.5A

690.53

AC

PV SYSTEM AC DISCONNECT
RATED AC OUTPUT CURRENT - **47.50** AMPS
AC NORMAL OPERATING VOLTAGE - 240 VOLTS

690.15, 690.54

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

690.56(C)(3)

INVERTER

DC

J/B

ARRAY

NEC 690.31(G)(3) & (4)

If you have any questions about your system, please call our Customer Support Team at
888.557.6431
or visit freedomforever.com/customer-service
This solar PV system was installed by
freedom FOREVER

"WARNING"
PHOTOVOLTAIC POWER SOURCE

EVERY 10' ON CONDUIT AND ENCLOSURES

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [SI1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

freedom FOREVER

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

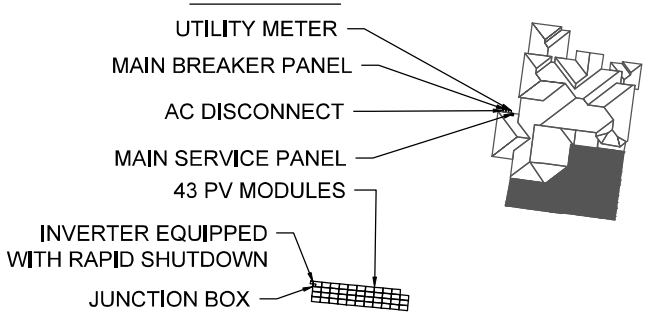
LABELS

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-7

CAUTION:

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS AS SHOWN

SOUTHWEST WINDSOR DRIVE



WARNING

TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL

N

NOTES:

1. NEC ARTICLES 690 AND 705 AND IRC SECTION R324 MARKINGS SHOWN HEREON.
2. ALL MARKING SHALL CONSIST OF THE FOLLOWING:
   - A. UV RESISTANT SIGN MATERIAL WITH ENGRAVED OR MACHINE PRINTED LETTERS OR ELECTRO-PLATING.
   - B. RED BACKGROUND COLOR WHITE TEXT AND LINE WORK.
   - C. AERIAL FONT.
3. ALL SIGNS SHALL BE SIZED APPROPRIATELY AND PLACED IN THE LOCATIONS SPECIFIED. SIGNAGE CANNOT BE HAND-WRITTEN.
4. SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS.

METHODE MANIRAGUHA LICENSE No. 85003 STATE OF FLORIDA PROFESSIONAL ENGINEER
EXP: 2/28/2025

This item has been electronically signed and sealed by Methode Maniraguha using a Digital Signature and Date. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Methode Maniraguha
Date: 2023.09.13 11:46:51 +05'30'

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

	REVISIONS	
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

freedom FOREVER

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

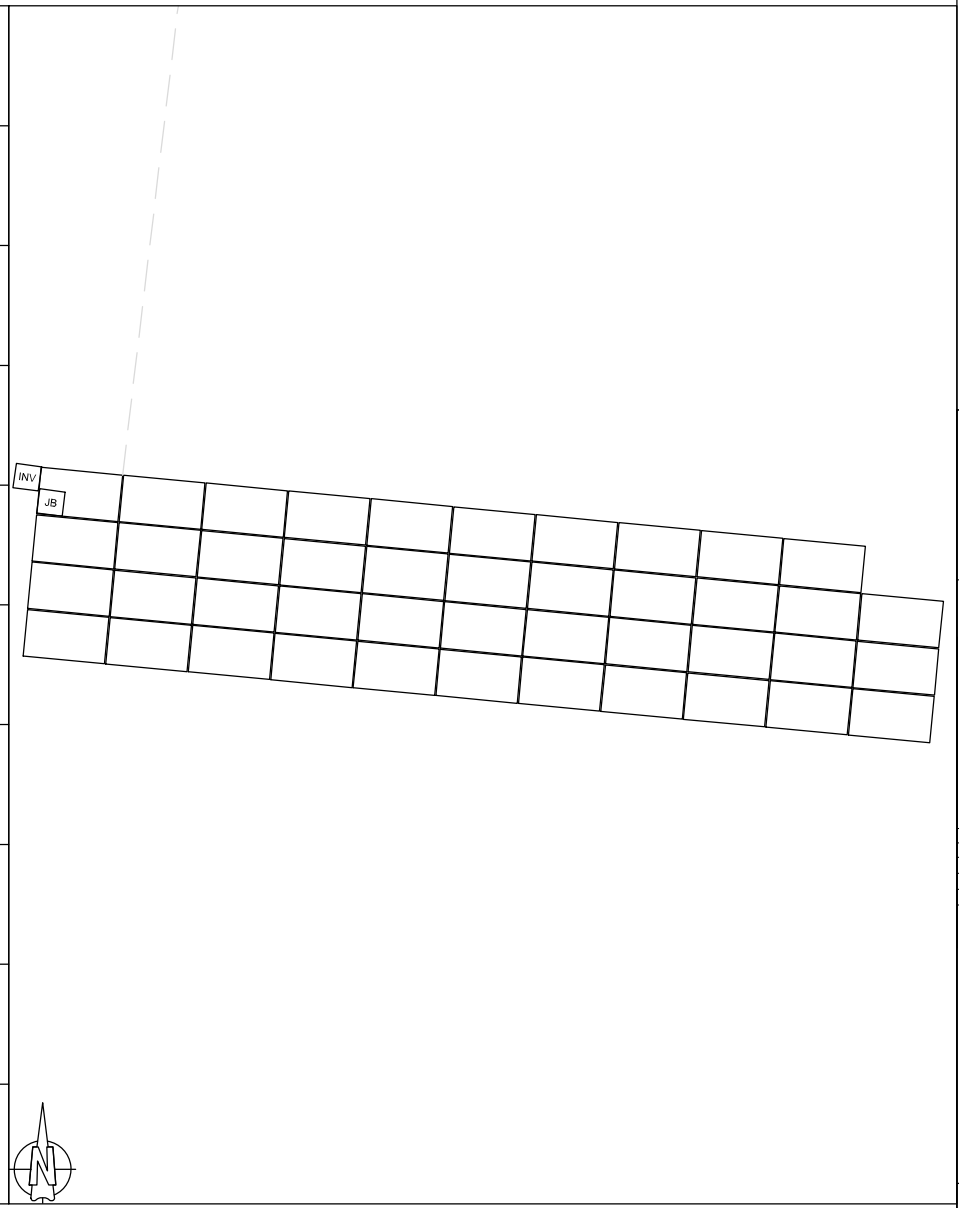
CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

SITE PLACARD

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-7A

SOLAREDGE OPTIMIZER CHART

	1-10	11-20	21-30	31-40	41-50	51-60
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						



CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S11]

NO.	REVISIONS	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

OPTIMIZER CHART

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-8

SAFETY PLAN

INSTRUCTIONS:

1. USE SYMBOLS IN KEY TO MARK UP THIS SHEET.
2. SAFETY PLAN MUST BE MARKED BEFORE JOB STARTS AS PART OF THE PRE-PLAN
3. DOCUMENT ALL ADDITIONAL HAZARDS ON THIS PAGE & MAKE NOTES ON THE JHA SHEET

INCIDENT REPORTING:

INJURIES - CALL INJURY HOTLINE

(855) 400-7233

**If injury is life threatening, call 911 first THEN the Injury Hotline*

NON-INJURIES - USE MOBILE INCIDENT REPORTING
(Auto, Property Damage, Near Miss)

NEAREST OCCUPATIONAL/INDUSTRIAL CLINIC:

NAME: _____

ADDRESS: _____

NEAREST HOSPITAL:

NAME: _____

ADDRESS: _____

SAFETY COACH CONTACT INFORMATION:

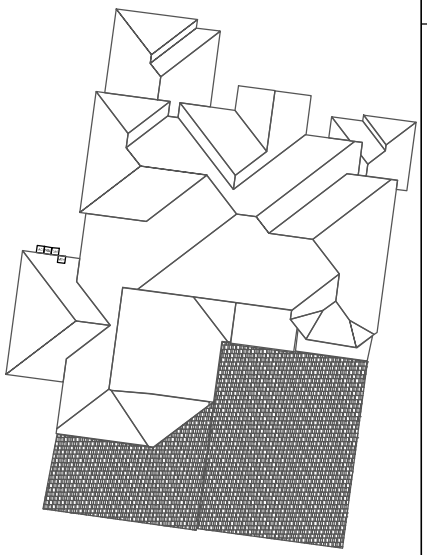
NAME: _____

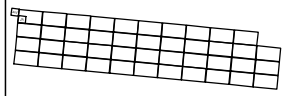
PHONE NUMBER: _____

ALL EMPLOYEES ON SITE SHALL BE MADE AWARE OF THE SAFETY PLAN AND SIGN INDICATING THAT THEY ARE AWARE OF THE HAZARDS ON-SITE AND THE PLAN FOR WORKING SAFELY.

NAME	SIGNATURE

DATE: _____ TIME: _____





MARK UP KEY

- (P) PERMANENT ANCHOR
- (T) TEMPORARY ANCHOR
- [IL] INSTALLER LADDER
- [B] JUNCTION / COMBINER BOX
- [S] STUB-OUT
- [X] SKYLIGHT
- NO LADDER ACCESS (STEEP GRADE OR GROUND LEVEL OBSTRUCTIONS)
- [ ] RESTRICTED ACCESS
- CONDUIT
- (GAS) GAS SHUT OFF
- (H_2O) WATER SHUT OFF
- (7) SERVICE DROP
- (Z) POWER LINES

BREAK AND WATER LOG

THIS LOG IS TO BE FILLED OUT ANY TIME THE TEMP EXCEEDS **90** DEGREES. THE CREW LEAD AND ROOF LEAD ARE RESPONSIBLE FOR ENSURING THIS IS COMPLETED AND UPLOADED AT THE END OF EVERYDAY WHEN TEMPS EXCEED **90** DEGREES

NAME	0800HRS	0900HRS	1000HRS	1100HRS	1200HRS	1300HRS	1400HRS	1500HRS	1600HRS

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

SAFETY PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-9

JOB HAZARD ANALYSIS

Crew leader to fill out all sections below, hold a pre-job safety meeting with all personnel, and upload this completed document and the Safety Plan to Site Capture

Ladder Access
- Ladders must be inspected before each use.
- Extension ladders must be set up on a firm and level surface at a 4-to-1 rise to run angle (or 75 degrees) and the top must be secured to the structure. Extension style ladders placed on uneven, loose or slippery surfaces must additionally have the base firmly anchored or lashed so the base will not slip out.
- Extension ladders must be used with walk-through devices or the ladder must extend 36" above the stepping off point.
- A-frame ladders must only be climbed with the ladder spreader bars locked in the open position; A-frame ladders shall not be climbed while in the closed position (ex, closed and used while leaned against a structure).
- Additional notes:

Mobile Equipment
- Only Qualified operators will operate equipment; operators must maintain a certification on their person for the equipment being operated.
- Type(s) of mobile equipment (Type/Make/Model):
- Qualified operator(s):

Material Handling and Storage
- Materials will be staged/stored in a way that does not present a hazard to client, personnel or public. Materials stored on the roof will be physically protect from failing or sliding off.

Fall Protection
- A site-specific plan for fall prevention and protection is required prior to starting work and must remain onsite at all times until work is complete; a fall rescue plan must be outlined and discussed among the crew prior to work start.
- First-person-Up (FPU) must install their anchor and connect before any other task, including installing other anchors. The Last-Person-Down (LPD) must be the only person on a roof uninstalling fall protection.
- FPCP (name and title):
- FPU and LPD (name and title):

Electrical Safety
- The Electrical Qualified Person (EQP) is required onsite to perform electrical work.
- All electrical work will be performed with equipment in an electrically safe condition (de-energized) unless approval has been granted prior to work.
- Service drops and overhead electrical hazards will be indentified and protected from contact, as neccessary.
- EQP (name and tile):

Public Protection
- The safety of the Client and Public must be maintained at all times.
- The Client and the Public shall be prevented from entering the work zone through the use of barriers and/or signage, as required.
- Company, Client and Public property shall be protected from falling objects.
- Pets (including dogs) shall be secured by their owners prior to work start.
- The Client should not leave pets, family members, or others in charge or care of Employees, Contractors, or Temporary Workers.
- Crew leader responsible for communication with the client:
- Client and public is excluded from work area by barricades (N/A, Yes, No):

Training and Pre-Job Safety Briefing
- All employees onsite shall be made aware of the specific hazards of this project and review this HJA during a pre-job briefing, and their signature indicates awareness of site conditions and the plan to eliminate any hazards identified prior to and during the project.
- Crew leader (name/title):
- Crew member (name/title):
- Crew member (name/title):
- Crew member (name/title):
- Crew member (name/title):
- Crew member (name/title):

Airborne Contaminants:
- Asbestos-containing (Transite) piping (ACP) - Do not disturb (move, drill, cut fracture, etc.)
- Asbestos-containing thermal insulation (ACI) and Asbestos-containing duct wrapping (ACW) - do not disturb, no attic or crawlspace access is allowed if work to be performed could cause exposure to personnel, client or public.
- If yes, list specific tasks and protection in place:

Weather and Environment
- The site supervisor shall forecast the weather conditions at the job site, prior to crew arrival, in order to mitigate any hazards associated with inclement weather (heat, cold, wind, rain, etc.)
- The site supervisor will utilized a portable wind meter (anemometer) to verify actual onsite wind conditions, by checking at the ground and on any elevated work surface (ex, rooftop) prior to work start, at midday and prior to solar panel staging on a roof.
- Elevated work involving the moving or maneuvering of solar panels shall cease at 25mph (sustained wind) until wind subsides.
- Forecasted weather maximum temp (degrees f):

Heat Related Illness Prevention
- Employees shall have access to potable drinking water that is fresh, pure, and suitably cool. The water shall be located as close as practicable to the areas where employees are working. Water shall be supplied in sufficient quantity at the beginning of the work shift to provide at least one quart per employee per hour for drinking for the entire shift. Employees may begin the shift with smaller quantities of water if they identify the location and have effective means for replenishment during the shift to allow employees to drink on quart or more per hour. The frequent drinking of water shall be encouraged.
- Shade shall be present when temperature exceeds 80 degrees Fahrenheit. When the outdoor temperature in the work exceeds 80 degrees Fahrenheit, employees shall have and maintain one or more areas with shade at all times.
- New employees must be acclimatized. New employees will be monitored by their Crew Leader (site supervisor) for the first two (2) weeks of employment or longer when necessary.
- Employees will be allowed and encouraged to implement scheduled breaks during each shift. Employees must take cool-down breaks in the shade any time they feel the need to do so to protect them from overheating. Supervisors are REQUIRED to allow employees any break period they need during high heat conditions.
- Cool Vests are encouraged for all employees at all times during periods of high heat.
- Identify the location of the closet Occupational/Industrial Clinic or Hospital in case a crew member becomes ill.

What is the specific plan to provide and replenish sufficient water for all employees on site?
- If offsite replenish is necessary, where will you go to replenish water (location/address):
- Who will replenish the drinking water (name):

Restroom facilities
- Employees shall have access to restroom facilities with hand-washing stations. Use of onsite restroom is at the client's discretion (location is annotated below). If client does not give permission, location of suitable restroom facilities with hand-washing stations offsite will be provided. The onsite supervisor will identify location and make arrangements to ensure all employees have access at any point.
- Restroom facilities will be (circle one): Onsite - Offsite
- If Offsite, add location name and address:

Incident Reporting Procedure
- Contact your Site Supervisor
  - Name:
  - Phone:
- Contact your Manager
  - Name:
  - Phone:
- Contact your Site Supervisor
  - Name:
  - Phone:

With: Your full name, phone number, office location, brief description of what happen and when.

NOTE ADDITIONAL HAZARDS NOT ADDRESSED ABOVE
(add as many as necessary by using additional sheets)

Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:

CLIENT:
SUNIL PATEL
518 SOUTHWEST WINDSOR DRIVE, LAKE CITY, FL 32024
AHJ: COUNTY OF COLUMBIA (FL)
UTILITY: FPL - FLORIDA POWER & LIGHT
PHONE: (386) 208-2467
EMAIL: SNP8991@GMAIL.COM
FINANCE: OTHER

SYSTEM:
SYSTEM SIZE (DC): 43 X 400 = 17.200 kW
SYSTEM SIZE (AC): 11.400 kW @ 240V
MODULES: 43 X FREEDOM FOREVER: FF-MP-BBB-400
OPTIMIZERS: 43 X SOLAREDGE S440
INVERTER: SOLAREDGE SE11400H-USRGM [S1]

REVISIONS		
NO.	REVISED BY	DATE
-	-	-
-	-	-
-	-	-

FREEDOM FOREVER LLC
2619 CONSULATE DR SUITE 800, ORLANDO, FL 32819
Tel: (800) 385-1075
GREG ALBRIGHT

CONTRACTOR LICENSE:
CERTIFIED ELECTRICAL CONTRACTOR
EC13008056

SAFETY PLAN

JOB NO:	DATE:	DESIGNED BY:	SHEET:
339145	9/12/2023	J.M.	PV-10

FOR INSTALLATION REFERENCE ONLY

SCAN QR CODE TO ACCESS REFERENCE LINK

FREEDOM REFERENCES

INSTALL HOTLINE

PV INSTALLATION REFERENCES

ENPHASE IQ8

SOLAREDGE HD WAVE

TESLA INVERTER

BATTERY INSTALLATION REFERENCES

TESLA POWERWALL 2

SHIFT/SELF CONSUMPTION

SOLAREDGE ENERGY BANK

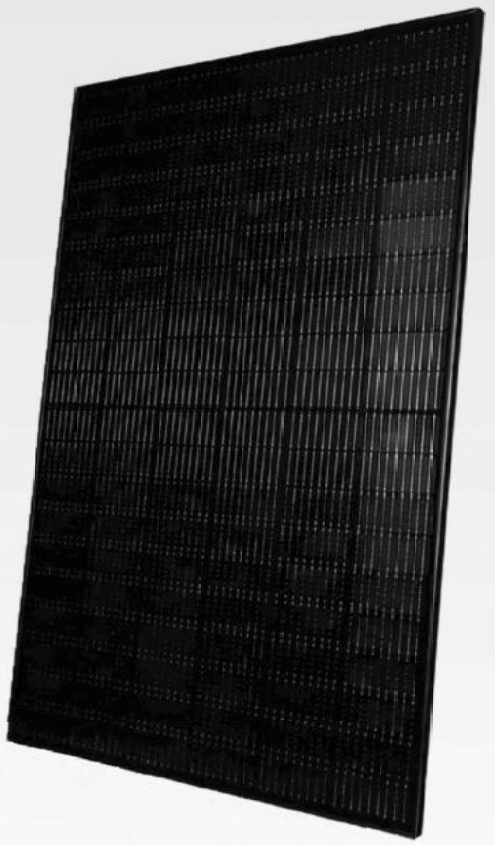
SOLAREDGE LG RESU (BACKUP)

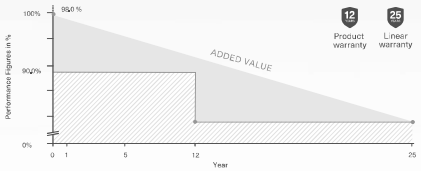
TESLA POWERWALL+ (BACKUP)

V1.2

freedom FOREVER

400W MODULE





MODULE SPECIFICATIONS

freedom FOREVER

ELECTRICAL CHARACTERISTICS

Characteristics	FF-MP-BBB-400
Maximum Power (Pmax)	400W
Maximum Power Voltage (Vmp)	31.01V
Maximum Power Current (Imp)[A]	12.90A
Open Circuit Voltage (Voc)[V]	37.04V
Short Circuit Current (Isc)[A]	13.79A
Module Efficiency	20.48%
Power Tolerance	0/+5W
STC	Irradiance of 1000W/m², AM1.5, Cell Temperature 25°C

MECHANICAL CHARACTERISTICS

Cell Type	Mono perc, 182 mm-half cells, 108 (6x9+6x9)
Weight	22.1 kgs (48.7 lbs)
Dimension	1722 x 1134 x 35 mm (67.80 x 44.65 x 1.38 in)
Front Glass	3.2 mm (.13 in)
Junction Box	IP68 (3 Bypass Diodes)
Output Cables	1200 mm (47.24 in)
Connector	Staubli MC4
Frame & Installation	Anodized aluminum profile

OPERATIONS CHARACTERISTICS

Operational Temperature	-40°C~+85°
Max System Voltage	1500V
Max Series Fuse Rating	25A
Safety Class	Class II
Fire Rating	Type 1

MECHANICAL LOADING

Snow Load	5,400Pa (113lb/ft2)
Rear Side Design Load	2,400Pa (50lb/ft2)

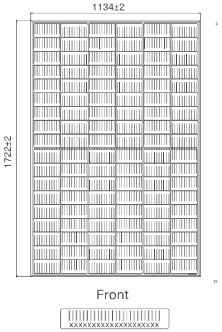
PACKAGING INFORMATION

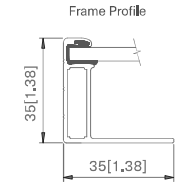
Container	20' GP	40' HC
Pallets per Container	6	26
Panels per Container	186	806
Panels per Pallet	31	31
Packaging Box Weight	679 kg (1497 lbs)	
Panels per Pallet	1785 x 1130 x 1180 mm (70.28 x 44.49 x 46.46 in)	

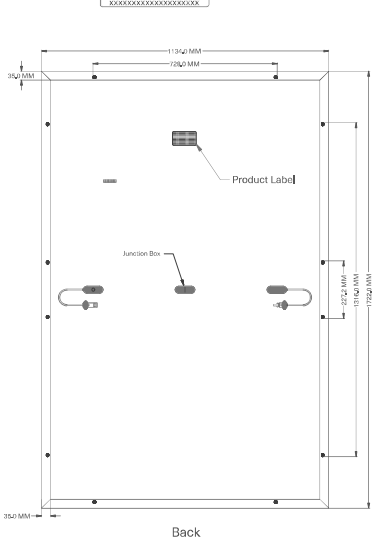
TEMPERATURE RATINGS

Temperature Coefficient of P_{max}	-0.350%/°C
Temperature Coefficient of V_{oc}	-0.275%/°C
Temperature Coefficient of I_{sc}	+0.045%/°C
Nominal Operating cell Temperature (NOCT)	42°C±2°C

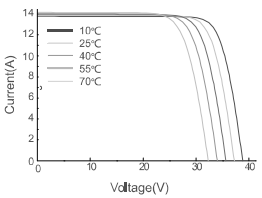
UL 61730 | UL 61215 | ISO 9001 | ISO 14001

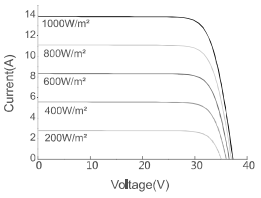






CURRENT-VOLTAGE CURVE





CERTIFICATE
OF COMPLIANCE

This certificate confirms the model(s) for the product listed are in compliance and authorized to bear the Certification Mark(s) shown below when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This document is for use with the Design Light Consortium or California Energy Commission application only.

Basic Listee:	PT IDN SOLAR TECH	**Multiple Listee:**	Freedom Forever Procurement LLC
Address:	KOMPLEK KABIL INDONUSA ESTATE, BLOK A NOMOR 19B, BATU BESAR, Batam	**Address:**	43445 Business Park Drive, Suite 110, Temecula, CA 92590
Country:	Indonesia	**Country:**	USA

Party Authorized to Apply Label: PT IDN SOLAR TECH
Report Issuing Office: Intertek Testing Services Shanghai Limited

Control Number: 5019087 **Authorized by:** for L. Matthew Snyder, Certification Manager

VALID LISTING MARKS

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights, IL 60005
Telephone 800-345-3851 or 847-439-5667

Standard(s):	Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [UL 61730-1:2017 Ed.1+R:30Apr2020] Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [CSA C22.2#61730-1:2019 Ed.2] Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [UL 61730-2:2017 Ed.1+R:30Apr2020]

CERTIFICATE
OF COMPLIANCE

	Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [CSA C22.2#61730-2:2019 Ed.2] Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 1: Test Requirements [UL 61215-1:2017 Ed.1] Terrestrial Photovoltaic (PV) Modules - Design Qualification And Type Approval - Part 1-1: Special Requirements For Testing of Crystalline Silicon Photovoltaic (PV) Modules [UL 61215-1-1:2017 Ed.1] Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 2: Test Procedures[UL 61215-2:2017 Ed.1]
Product:	Crystalline Silicon Photovoltaic (PV) Modules
Brand Name:	Freedom Forever
Models:	MULTIPLE LISTEE 12 MODELS: FF-MP-BBB- followed by 365, 370, 375 or 380. FF-MP-BBB- followed by 395, 400, 405 or 410. BASIC LISTEE MODELS: NUSA120H- followed by 365, 370, 375 or 380; followed by MB. NUSA108H- followed by 395, 400, 405 or 410; followed by MB.

Power Optimizer

For North America

S440, S500

POWER OPTIMIZER

PV power optimization at the module level

- Specifically designed to work with SolarEdge residential inverters
- Detects abnormal PV connector behavior, preventing potential safety issues*
- Module-level voltage shutdown for installer and firefighter safety
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch loss, from manufacturing tolerance to partial shading
- Faster installations with simplified cable management and easy assembly using a single bolt
- Flexible system design for maximum space utilization
- Compatible with bifacial PV modules
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)

* Expected availability in 2022

solaredge.com

solaredge

Power Optimizer

For North America

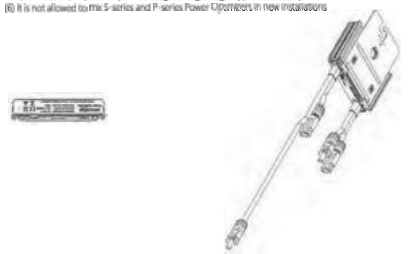
S440, S500

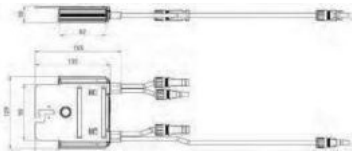
	S440	S500	Unit
INPUT			
Rated Input DC Power(1)	440	500	W
Absolute Maximum Input Voltage (Voc)	60		Vdc
MPPT Operating Range	8 - 60		Vdc
Maximum Short Circuit Current (Isc) of Connected PV Module	11.5	15	Adc
Maximum Efficiency	99.5		%
Weighted Efficiency	98.8		%
Overvoltage Category	II		
OUTPUT DURING OPERATION			
Maximum Output Current	15		Adc
Maximum Output Voltage	60		Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR INVERTER OFF)			
Safety Output Voltage per Power Optimizer	1 +/- 0.1		Vdc
STANDARD COMPLIANCE			
Photovoltaic Rapid Shutdown System	NEC 2014, 2017 & 2020		
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3		
Safety	IEC62109-1 (class II safety), UL1741		
Material	UL94 V-0, UV Resistant		
RoHS	Yes		
Fire Safety	VDE-AR-E 2100-712:2013-05		
INSTALLATION SPECIFICATIONS			
Maximum Allowed System Voltage	1000		Vdc
Dimensions (W x L x H)	129 x 153 x 30 / 5.07 x 6.02 x 1.18		mm / in
Weight (including cables)	655 / 1.5		gr / lb
Input Connector	MC4(2)		
Input Wire Length	0.1 / 0.32		m / ft
Output Connector	MC4		
Output Wire Length	(+) 2.3, (-) 0.10 / (+) 7.54, (-) 0.32		m / ft
Operating Temperature Range(3)	-40 to +85		°C
Protection Rating	IP68 / Type6B		
Relative Humidity	0 - 100		%

(1) Rated power of the module at STC will not exceed the power optimizer Rated Input DC Power. Modules with up to +5% power tolerance are allowed
(2) For other connector types please contact SolarEdge
(3) For ambient temperature above +70°C / +158°F power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for more details.

PV System Design Using a SolarEdge Inverter		Single Phase HD-Wave	Three Phase for 208V grid	Three Phase for 277/480V grid	
Minimum String Length (Power Optimizers)	S440, S500	8	14	18	
Maximum String Length (Power Optimizers)		25		50(5)	
Maximum Nominal Power per String		5700 (6000 with SE7600-US-SE11400-US)	6000	12750	W
Maximum Allowed Connected Power per String(5) (Permitted only when the difference in connected power between strings is 1,000W or less)		Refer to Footnote 5	One String 7200W Two strings or more 7800W	15,000W	
Parallel Strings of Different Lengths or Orientations		Y			

(4) A string with more than 30 optimizers does not meet NEC rapid shutdown requirements; safety voltage will be above the 30V requirement
(5) If the inverter's rated AC power / maximum nominal power per string, then the maximum power per string will be able to reach up to the inverter's maximum input DC power. Refer to: https://www.solaredge.com/sites/default/files/se-power-optimizer-single-string-design-application-note.pdf
(6) It is not allowed to mix S-series and P-series Power Optimizers in new installations





Intertek RoHS

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

INVERTERS

12-25 YEAR WARRANTY

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking 99% weighted efficiency
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020 per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Small, lightweight, and easy to install both outdoors or indoors
- Built-in module-level monitoring
- Optional: Faster installations with built-in consumption metering (1% accuracy) and production revenue grade metering (0.5% accuracy, ANSI C12.20)

solaredge.com

solaredge

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/ SE7600H-US / SE10000H-US / SE11400H-US

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5(1)							Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable -0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380				400			Vdc
Maximum Input Current @240V(2)	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V(2)	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption	< 2.5							W

(1) For other regional settings please contact SolarEdge support
(2) A higher current source may be used, the inverter will limit its input current to the values stated

/ Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/
SE7600H-US / SE10000H-US / SE11400H-US

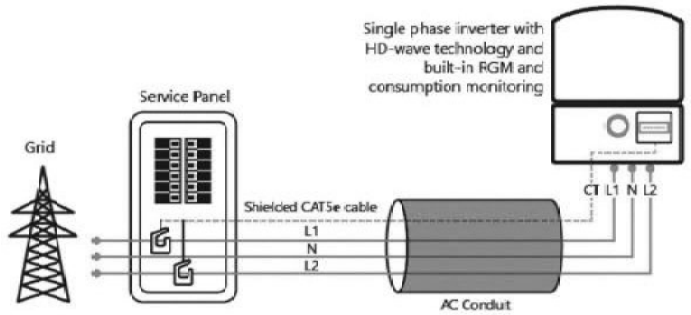
MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)							
Revenue Grade Metering, ANSI C12.20	Optional[3]							
Consumption metering								
Inverter Commissioning	With the SetApp mobile application using Built-in Wi-Fi Access Point for Local Connection							
Rapid Shutdown - NEC 2014, NEC 2017 and NEC 2020, 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect							
STANDARD COMPLIANCE								
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07							
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)							
Emissions	FCC Part 15 Class B							
INSTALLATION SPECIFICATIONS								
AC Output Conduit Size / AWG Range	1" Maximum / 14-6 AWG					1" Maximum /14-4 AWG		
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1-2 strings / 14-6 AWG					1" Maximum / 1-3 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174					21.3 x 14.6 x 7.3 / 540 x 370 x 185		in / mm
Weight with Safety Switch	22 / 10		25.1 / 11.4	26.2 / 11.9		38.8 / 17.6		lb / kg
Noise	< 25				<50			dBA
Cooling	Natural Convection							
Operating Temperature Range	-40 to +140 / -40 to +60[4]							°F / °C
Protection Rating	NEMA 4X (Inverter with Safety Switch)							

(3) Inverter with Revenue Grade Meter P/N: SExxxxH-US000BNC4; Inverter with Revenue Grade Production and Consumption Meter P/N: SExxxxH-US000BNI4 . For consumption metering, current transformers should be ordered separately: SEACT0750-200NA-20 or SEACT0750-400NA-20, 20 units per box

(4) Full power up to at least 50°C / 122°F; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

How to Enable Consumption Monitoring

By simply wiring current transformers through the inverter's existing AC conduits and connecting them to the service panel, homeowners will gain full insight into their household energy usage helping them to avoid high electricity bills



RoHS

Product specifications

Eaton DG222NRB

Catalog Number: DG222NRB

Eaton General duty cartridge fuse safety switch, 60 A, NEMA 3R, Painted galvanized steel, Class H fuses, Fusible with neutral, Two-pole, Three-wire, Category: general duty safety switch, 240 V

General specifications

Product Name
Eaton general duty cartridge fuse safety switch

Catalog Number
DG222NRB

UPC
782113144221

Product Length/Depth
7.35 in

Product Height
14.37 in

Product Width
8.4 in

Product Weight
10 lb

Warranty
Eaton Selling Policy 25-000, one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

Certifications
UL Listed

Catalog Notes
Maximum hp ratings apply only when dual element fuses are used. 3-Phase hp rating shown is a grounded B phase rating, UL listed.

Physical Attributes

Enclosure
NEMA 3R

Enclosure material
Painted galvanized steel

Fuse configuration
Fusible with neutral

Number Of Poles
Two-pole

Number of wires
3

Type
General duty, cartridge fused

Performance Ratings

Amperage Rating
60A

Fuse class provision
Class H fuses

Voltage rating
240V

Miscellaneous

Product Category
General duty safety switch

Resources

Catalogs
Eaton's Volume 2—Commercial Distribution

Multimedia
Double Up on Safety
Switching Devices Flex Center

Specifications and datasheets
Eaton Specification Sheet - DG222NRB

Eaton Corporation plc
Eaton House
30 Pembroke Road
Dublin 4, Ireland
Eaton.com

Eaton.com/socialmedia

BUCHANAN

B-TAP®

Listed 486B
Pressure Cable Connectors
File No. E-5238
Suitable for use on the line side of the service equipment.

INSULATION-PIERCING TAP CONNECTORS
CONECTORES DE DERIVACIÓN QUE PERFORAN EL AISLAMIENTO

Installation Instructions:

⚠ Warning

Improperly installed electrical wiring can be dangerous and cause electrical fires. The connector chosen must be sized to the wires being used. Consult local building code before doing any electrical work. For assistance, refer to an instructional book or consult a qualified electrician.

⚠ Warning

Contact with electricity can cause serious injury or death. Use on insulated cable only. [RHH, RHW(-2), THHN, THHW, THW, THWN, USE, XHHW(-2). Consult factory for other insulation types]. If the installation is to be made on an energized run, the tap conductor must be under no load and must not be grounded. Use electrically insulated gloves. De-energize the run cable if there are any questions of these conditions being met.

1. Determine the direction for the tap conductor to exit and discard one end cap. **See figure 1.**
2. Position the main (or feeder) side of the connector around the run cable and tighten the bolt finger tight. **See figure 2.** If required, loosen the bolt slightly to allow the connector to open completely. **DISASSEMBLY NOT RECOMMENDED.** The plastic "Turbo" spacer holds the connector open which eases installation and ensures proper connections.
3. Cut the end of the tap cable squarely. **DO NOT STRIP CABLE INSULATION.**
4. Insert the tap cable into the tap side of the connector until it is seated in the remaining end cap. **See figure 3.**
5. Continue tightening the torque regulating bolt with a standard box or socket wrench until the torque regulating piece breaks away. If the connector has two (2) assembly bolts, alternately tighten until the hexagonal torque devices break away. **See figures 4a & 4b.** Note that the plastic "turbo" spacer on the side will also break. To make the installation even easier and to relieve torque from the cables, a second wrench can be used on the hexagonal piece on the bottom of the connector.

   DO NOT use gripping type pliers, pipe, open ended or adjustable wrenches as these may damage the hexagonal torque regulating device. A torque wrench is not required.

   MAKE SURE ONLY THE TOP HEXAGONAL TORQUE DEVICE OF THE BOLT HEAD IS USED FOR ASSEMBLY. THE SECOND HEX PIECE [CLOSER TO THE BODY OF THE CONNECTOR] IS USED FOR DISASSEMBLY.

Note: The torque regulating bolt ensures the correct torque is applied to the conductors without using a torque wrench. Important information such as run and tap ranges, voltage ratings and material/temperature ratings is marked on the connector.

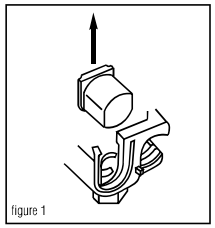


figure 1

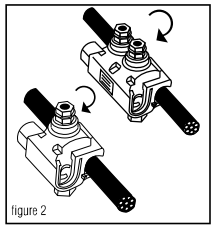


figure 2

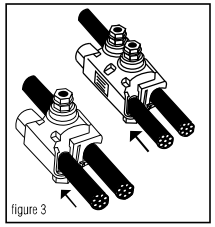
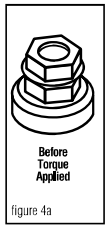


figure 3


Before Torque Applied
figure 4a


After correct Torque Reached, One Hex Piece Breaks-Away
figure 4b

Instalación Instrucciones:

⚠ Advertencia

Los cables eléctricos mal instalados pueden ser peligrosos y provocar incendios. El conector escogido debe ser de un tamaño adecuado para los cables que se utilicen. Consulte los códigos de construcción locales antes de efectuar trabajos eléctricos. Si necesita ayuda, consulte un libro de instrucciones o consulte con un electricista capacitado.

⚠ Advertencia

Use sólo en cable aislado. [RHH, RHW(-2), THHN, THHW, THW, THWN, USE, XHHW(-2). Consulte con la fábrica para obtener información sobre otros tipos de aislamiento]. Si se va a hacer la instalación sobre un cable con corriente el conductor derivado debe estar libre de carga y no debe estar aterado. Use guantes con aislamiento eléctrico. Quite le la corriente al cable del cual se hace la derivación si no se pueden cumplir estas condiciones. El contacto con electricidad puede producir lesiones graves o mortales.

1. Determine la dirección en la que el conductor derivado saldrá y deseche la tapa terminal sobrante. **Vea la ilustración 1.**
2. Coloque el lado principal (o de alimentación) del conector alrededor del cual se hace la derivación y apriete firmemente el dedo del perno. **Vea la ilustración 2.** Si hace falta, afloje el perno ligeramente para permitir que el conector se abra completamente. **NO ES RECOMENDABLE DESARMAR EL CONECTOR.** El espaciador "Turbo" de plástico mantiene al conector abierto, lo cual facilita la instalación y asegura que las conexiones se hagan correctamente.
3. Corte el extremo del cable de derivación perpendicularmente a su eje. **NO PELE EL AISLAMIENTO DEL CABLE.**
4. Inserte el cable de derivación en el lado de derivación del conector hasta que tope contra la tapa terminal que queda. **Vea la ilustración 3.**
5. Continué apretando este perno que regula la torsión con una llave estándar o de cubo hasta que la pieza que regula la torsión se parta y se separe. Si el conector tiene dos (2) pernos de ensamblaje, apriételos alternativamente hasta que el dispositivo de regulación de torció se parta. **Vea la ilustración 4a y 4b.** Observe que el espaciador "turbo" de plástico en el costado también se fracturará. Para hacer esta instalación aún más fácil y para aliviar la torsión de los cables, se puede usar una segunda llave sobre la pieza hexagonal al fondo del conector.

   NO USE alicates de presión, llaves de turbo, llaves comunes o ajustables ya que éstas pueden dañar el dispositivo hexagonal que regula la torsión. No se requiere una llave de torsión.

   ASEGÚRESE QUE SE USE, PARA EL ENSAMBLADO, SÓLO EL DISPOSITIVO SUPERIOR DE REGULACIÓN DE TORSIÓN DE LA CABEZA DEL PERNO. LA SEGUNDA PIEZA HEXAGONAL (LA MÁS CERCANA AL CUERPO DEL CONECTOR) SE USA SÓLO PARA DESARMAR EL CONECTOR.

Nota: El perno regulador de torsión garantiza la aplicación de la torsión correcta a los conductores sin usar una llave de torsión. La información importante de longitud de cable pelado y de toma, las clasificaciones de materiales y temperatura está marcada en el conector.

B-TAP® INSULATION PIERCING TAP CONNECTORS TORQUE AND CURRENT RATINGS

(Solid and/or Stranded)

CATALOG#	MAIN	TAP	NOMINAL TORQUE	TAP CURRENT RATIING (IN AMPS)*
BTC2/0-14	2/0-4	10-14+	80 IN. LBS.	40
BTC1/0-10	1/0-8	2-10++	80 IN. LBS.	130
BTC4/0-10	4/0-3	2-10+++	125 IN. LBS.	130
BTC4/0-6	4/0-2	1/0-6	160 IN. LBS.	170
BTC4/0-2	4/0-2	4/0-2	160 IN. LBS.	260
BTC250-6	250-4	4/0-6	160 IN. LBS.	260
BTC250-4	250-1	3/0-4	160 IN. LBS.	225
BTC250-2	250-1/0	4/0-2	160 IN. LBS.	260
BTC350-1/0	350-1/0	350-1/0	330 IN. LBS.	350
BTC500-4	500-2/0	4/0-4	330 IN. LBS.	260
BTC500-1/0	500-4/0	350-1/0	330 IN. LBS.	350
BTC500-14	750-3/0	10-14 ++++	80 IN. LBS.	40
BTC750-250	750-250	500-250	330 IN. LBS.	430

+10-14 Cu SOLID/STRANDED; 10-12 Al SOLID/STRANDED
++2-10 Cu SOLID/STRANDED; 2-10 Al STRANDED
+++2-10 Cu SOLID/STRANDED; 2-8 Al STRANDED
++++10-14 Cu SOLID/STRANDED; 10-12 Al STRANDED

Full line is 600V dual-rated, 194°F(90°C)

* Based on NEC Table 310-16 1996 (Not more than 3 insulated conductors in a raceway at ambient temperature of 30° C) for the largest tap wire size.

⚠ **WARNING:** Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

⚠ **ADVERTENCIA:** Cáncer y Daño Reproductivo - www.P65Warnings.ca.gov.

One year limited warranty. See idealind.com for more information.

Garantía limitada de un año. Visite www.idealind.com para obtener detalles de la garantía.

CONSTRUCTION PRODUCTS
BUCHANAN
1800 S. Prairie Drive
Sycamore, IL, U.S.A.
800-435-0705 • www.idealind.com

ND 9053-2
1839420

IDEAL INDUSTRIES, INC.
1375 Park Avenue • Sycamore, Illinois 60178 • 815.895.5181 • www.idealind.com

ALL IDEAL Customers 2/9/23

Subject: **The Buchanan B-TAP® splice/tap connectors meet the 2020 NEC article 230.46 requirement for "line side applications"**

The Buchanan B-TAP® brand of insulation piercing connectors which correspond to part numbers beginning with "BTC" meet the requirements of article 230.46 of the 2020 NEC. These products have already been tested to the newer requirements. The installation instructions are in the process of being updated to show the required notation: "suitable for use on the line side of the service equipment". This change will take a few weeks to get into our production.

In addition, the marking "SR" will be added to the product. That addition is in process and will take a few months to complete.

This notice will provide confirmation to the inspectors that B-TAP® products meet the requirements of the 2020 and 2023 NEC article 230.46 "Spliced and Tapped Conductors".

Sushil Keswani

Director of Engineering
IDEAL Industries, Inc.,

ZMVV.E5238 - Wire Connectors and Soldering Lugs

Note: We are enhancing our systems and you may notice duplicate entries, missing/outdated data. During this interim period, please contact our Customer Service at https://www.ul.com/about/locations

Wire Connectors and Soldering Lugs

IDEAL INDUSTRIES INC E5238
1375 Park Ave
SYCAMORE, IL 60178 United States

View model for additional information

Insulated butt splice crimp type connectors, Model(s): BVS1, BVS2, BVS5

Insulated flange spade type crimp cconnectors, Model(s): SV5-3.7, SVL5-4, SVL5-6

Insulated flange spade type crimp connectors, Model(s): FSNYD1-3.7, FSNYD1-4, FSNYD1-5, FSNYD2-3.7, FSNYD2-4, FSNYD2-5, FSNYD5-3.7, FSNYD5-4, FSNYD5-5

Insulated hook type crimp connectors, Model(s): HNYD1-3.7, HNYD1-4, HNYD1-5, HNYD2-3.7, HNYD2-4, HNYD2-5, HNYD5-3.7, HNYD5-4, HNYD5-5, HVY1-3.7, HVY1-4, HVY1-5, HVY2-4, HVY2-5, HVY5-3.7, HVY5-4, HVY5-5

Insulated locking spade crimp connectors, Model(s): LSNYD1-3.7, LSNYD2-3.7, LSNYD5-3.7, LSNYD5-4, LSNYD5-5, LSNYDL1-4, LSNYDL1-5, LSNYDL2-4, LSNYDL2-5

Insulated multiple stud ring type crimp connectors, Model(s): MSRNYD1-3753, MSRNYD2-3753, MSRNYD5-3753

Insulated parallel connectors, Model(s): PVT1, PVT14, PVT2, PVT22, PVT5, PVT8

Insulated pin type connectors, Model(s): PTNYD1-12, PTNYD2-12, PTNYD5-13

Insulated ring type crimp connectors, Model(s): RNYB14-11, RNYB22-11, RNYD1-10, RNYD1-3.2, RNYD1-5, RNYD1-6, RNYD1-8, RNYD2-10, RNYD2-2, RNYD2-3.2, RNYD2-6, RNYD2-8, RNYD5-10, RNYD5-12, RNYD5-3.2, RNYD5-3.7, RNYD5-5, RNYD5-6, RNYD5-8, RNYDL1-3.7, RNYDL1-4, RNYDL2-3.7, RNYDL2-4, RNYDL5-3.7, RNYDL5-4, RNYDM2-3.7, RNYDS1-3.7, RNYDS1-4, RNYDS2-4, RNYDS2-5, RNYDS5-4, RV1-3.2, RV1-5, RV1-6, RV2-3.2, RV5-10, RV5-3.7, RV5-5, RV5-6, RV5-8, RVL1-4, RVL2-4, RVL5-4, RVM1-3.7, RVM2-3.7, RVY1-3.2

Insulated spade type crimp connectors, Model(s): SNYD1-3.2, SNYD5-3.7, SNYD5-5, SNYDL1-3.7, SNYDL1-4, SNYDL2-3.7, SNYDL2-4, SNYDL2-5, SNYDL5-4, SNYDLL1-3.7, SNYDLL2-3.7, SNYDM1-4, SNYDM2-4, SNYDS1-5, SNYDS2-5, SVL1-3.7, SVL1-5, SVL2-3.7, SVL2-5, SVM1-4, SVM2-4, SVY1-3.2, SVY2-3.2, SVY5-3.7, SVY5-5, SVYL1-3.7, SVYL1-4, SVYL2-3.7, SVYL2-4, SVYL2-5, SVYL5-4, SVYLL1-3.7, SVYLL2-3.7, SVYM1-4, SVYM2-4, SVYS1-5, SVYS2-5, SVYS5-4

Insulated splice connectors, Model(s): PB1-, PB2-, PB5-

Insulating caps or covers, for use on manufacturer`s splice caps, for 2006-S, 2008-S connectors, Model(s): 2007

Insulating caps or covers, for use on manufacturer`s splice caps, for 2011-S connector, Model(s): 2014

Listed pressure cable connectors, Model(s): BHT1, BHT2, BHT5, BN1, BN2, BN5, BNT1-16, BNT14, BNT2-16, BNT22, BNT5-20, BNT8, BNYDF1, BNYDF2, BNYDF5, BNYT1, BNYT2, BNYT5, BV1, BV2, BV5, BVT14, BVT22, BVT8

Listed pressure ring terminal connectors, Model(s): RNYB14-8, RNYB8-11, RNYBL22-5, RNYBL22-6

Listed splicing wire connectors, Model(s): L12, L13, L15

Non-insulated flange spade crimp connectors, Model(s): FSN1-3.7, FSN1-4, FSN1-5, FSN2-3.7, FSN2-4, FSN2-5, FSN5-3.7, FSN5-4, FSN5-5, FSNB1-3.7, FSNB1-4, FSNB1-5, FSNB2-3.7, FSNB2-4, FSNB2-5, FSNB5-3.7, FSNB5-4, FSNB5-5, FSNL1-3.7, FSNL2-5

Non-insulated hook crimp connectors, Model(s): HN1-4, HN1-5, HN2-3.7, HN2-4, HN2-5, HN5-3.7, HN5-4, HN5-5

Non-insulated locking type crimp connectors, Model(s): LSN1-3.7, LSN2-3.7, LSN5-3.7, LSN5-4, LSN5-5, LSN5-6, LSNL1-4, LSNL1-5, LSNL2-5

Non-insulated multiple stud ring type crimp connectors, Model(s): MSRNB1-3753

Non-insulated parallel crimp connectors, Model(s): PNT 1, PNT 14, PNT 2, PNT 22, PNT 5, PNT 8, PNT1, PNT2, PNT5

Non-insulated pin type crimp connectors, Model(s): PTN1-12, PTN2-12, PTN5-13

Non-insulated ring type crimp connector, Model(s): RNB1-10, RNB1-3.2, RNB14-11, RNB14-12, RNB14-16, RNB1-6, RNB1-8, RNB2-10, RNB2-2, RNB2-6, RNB5-12, RNB8-12, RNBL1-4

Non-insulated ring type crimp connectors, Model(s): RNB1-3.2, RNB14-10, RNB14-5, RNB14-8, RNB1-5, RNB2-10, RNB22-10, RNB22-12, RNB22-8, RNB2-3.2, RNB2-8, RNB5-10, RNB5-3.2, RNB5-3.7, RNB5-3.7, RNB5-5, RNB5-6, RNB5-8, RNB8-10, RNB8-11, RNB8-16, RNB8-8, RNBL1-3.7, RNBL22-5, RNBL22-6, RNBL2-3.7, RNBL2-5, RNBL38-10, RNBL5-3.7, RNBL5-4, RNBM1-3.7, RNBM1-3.7, RNBM2-3.7, RNBM2-3.7, RNBM8-5, RNBS1-4, RNBS14-5, RNBS2-4, RNBS2-5, RNBS5-4, RNBS8-6

Non-insulated spade type crimp connectors, Model(s): SN1-3.2, SN2-3.2, SN5-3.7, SN5-5, SNB1-3.2, SNB5-3.7, SNB5-5, SNBL1-3.7, SNBL1-4, SNBL2-4, SNBL2-5, SNBL5-4, SNBL5-6, SNBLL1-3.7, SNBLL2-3.7, SNBM1-4, SNBS1-5, SNBS5-4, SNL1-3.7, SNL1-4, SNL2-3.7, SNL2-4, SNL2-5, SNLL1-3.7, SNLL2-3.7, SNM1-4, SNM2-4, SNS1-5, SNS2-5, SNS5-4

Pressure cable connectors, Model(s): KB - 1000, KB - 2/0, KB - 350, KB - 4/0, KB - 500, KB - 800, KS - 1000, KS - 2/0, KS - 350, KS - 4/0, KS - 500, KS - 800

Pressure terminal connectors, Model(s): FSVY1-3.7, FSVY1-4, FSVY1-5, FSVY2-3.7, FSVY2-4, FSVY2-5, FSVY5-3.7, FSVY5-4, FSVY5-5, K-5655, K-5656, LSV1-3.7, LSV2-3.7, LSV5-4, LSV5-5, LSV5-6, LSVL2-4, LSVS1-4, LSVS1-5, LSVS2-5, LSVY1-3.7, LSVY2-3.7, LSVY5-3.7, LSVY5-4, LSVY5-5, LSVY5-6, LSVYL1-4, LSVYL1-5, LSVYL2-4, LSVYL2-5, MSRNB2-3753, MSRVY1-3753, MSRVY2-3753, MSRVY5-3753, PTVY1-12, PTVY2-12, PTVY5-13, RVY1-10, RVY1-5, RVY1-6, RVY1-8, RVY2-10, RVY2-2, RVY2-3.2, RVY2-6, RVY2-8, RVY5-10, RVY5-12, RVY5-3.2, RVY5-3.7, RVY5-5, RVY5-6, RVY5-8, RVYL1-3.7, RVYL1-4, RVYL2-3.7, RVYL2-4, RVYL2-5, RVYL5-3.7, RVYL5-4, RVYM2-3.7, RVYS1-3.7, RVYS1-4, RVYS2-3.7, RVYS2-4, RVYS2-5, RVYS5-4, SNBM2-4, SNYD2-3.2, TLK16-6, TLK25-10

Pressure Terminal Connectors, Model(s): RNYB14-10, RNYB14-12, RNYB14-5, RNYB22-12, RNYB22-8, RNYB8-10, RNYB8-12, RNYB8-8, RNYBM8-5, RNYBS14-6

Slicing wire connectors, Model(s): OK-2 (Pkg. cat No. 84), OK-3 (Pkg. cat No. 85), OK-4 (Pkg. cat No. 86), OK-5 (Pkg. cat No. 87), OK-6W (Pkg. cat No. 88), OK-8 (Pkg. cat No. 90), OK-8W (NA)

Splicing wire connectors, Model(s): 12, 13, 14, 14-6, 15, 199, 199S, 200, 2002, 2006-S, 2008-S, 2011-S, 22-10, 22-12, 29, 299, 299S, 30, 300, 32, 33, 34, 340, 36, 37, 38, 39, 399, 400, 400AL, 42, 50, 615069, 66, 70, 800, AS-1/0, AS-2, AS-2/0, AS-350, AS-4, AS-4/0, AS-500, AS-6, B1, B2, B4, BT-2, BTC 1/0-10, BTC 1/0-14, BTC 2/0-14, BTC 250-4, BTC 350-1/0, BTC 4/0-10, BTC 4/0-2, BTC 4/0-6, BTC 500-1/0, BTC 500-14, BTC 500-4, BTC1/0-10, BTC2/0-14, BTC250-4, BTC350-1/0, BTC4/0-10, BTC4/0-2, BTC4/0-6, BTC500-1/0, BTC500-14, BTC500-4, BV1, BV1, BV2, BV2, BV5, BV5, C-3, C-4, C-5, K1/0, K1000, K2, K2/0, K250, K3, K3/0, K350, K4, K500, K6, K750, K8, KS10, R1, S1/0, S2, S2/0, S250, S3, S3/0, S350, S4, S500, S6, TRO1, TRO2, W1, W2, W4, WT1, WT2, WT3, WT4, WT6, WTW51, WTW52, WTW53, WTW54

Splicing Wire Connectors, Model(s): BNT1, BNT2

Splicing Wire Connectors:, Model(s): 46-404, 46-405

Feedback

Splicinig wire connectors, Model(s): H-1566, H-1567, H-1570, H-1571, H-1572, H-1591, H-1592, H-1594

Terminal connectors, Model(s): 10, 11, 22, 250, 300, 341, 342, 410 with insulating cap No. 415, 411 with insulating cap No. 417, 412 with insulating cap No. 417, 451, 452, 454, 48, 49, 49 Black, 53-B, 59B, 600, 71B#, 72B#, 73B#, 73B+, 74B, 76B, 76B+, 78B+, 82, K-5504, LSNL2-4, M-3, PV3-750, PV3-750, PV3-750, PV4-750, PV4-750, PV4-750, RNBL2-4, RNBS14-6, RNBS38-6, RNBS38-8, RNYB22-10, RNYBS8-6, RV2-6, RVL2-5, SV5-5, WT1, WT2, WT3, WT4, WT41, WT51, WT52, WT53, WT54, WT6

Terminal Connectors, Model(s): RNB22-11

Wire Connectors, Model(s): 65, 653

Wire Connectors and Soldering Lugs, Model(s): L22, L23, L25, PS10, PS12, PS2, PS3, PS4, PS4S, PS5, PS6, PS8

- The equipment (71B, 72B and 73B) were also evaluated to the requirements of UL 2043 and are suitable for use in air handling spaces.
* - May be followed by suffix B, J, T or X.
NOTE - All models may be provided with or without prefix "V" or suffix "MP" or "V" and prefix "BP". All models may be followed by suffixes BT, UB or UF with or without a two or four digit number, with or without suffixes B, LP, NP, PF, PH, SP and/or T. Die Series terminals may be followed by Suffixes UI, UT, UF, US, or UB, with or without a two to four digit number, with or without Suffix T or B, followed by Suffixes SP, LP, NP, PF, or and/or NM, by PH or BE, with or without Suffixes NT, BS, and /or G.

NUANCE ENERGY
Revolutionary Solar Racking Structures

ANCHOR LOADING REFERENCE TABLE

Western F170				
SSM Load	Anchors	Load Per Anchor	1 Additional Anchor Load	2 Additional Anchor Load
700	1	700	400	300
800	1	800	500	300
900	1	900	500	300
1000	1	1000	600	400
1100	1	1100	700	400
1200	1	1200	700	500
1300	1	1300	800	500
1400	1	1400	800	500
1500	1	1500	900	600
1600	1	1600	1000	600
1700	1	1700	1000	600
1800	1	1800	1100	700
1900	1	1900	1100	700
2000	1	2000	1200	800
2100	1	2100	1300	800
2200	1	2200	1300	800
2300	1	2300	1400	900
2400	1	2400	1400	900
2500	1	2500	1500	1000
2600	1	2600	1600	1000
2700	1	2700	1600	1000
2800	1	2800	1700	1100
2900	1	2900	1700	1100
3000	1	3000	1800	1100
3100	1	3100	1900	1200
3200	1	3200	1900	1200
3300	2	2200	2000	1300
3400	2	2300	2000	1300
3500	2	2300	2100	1300
3600	2	2400	2200	1400
3700	2	2500	2200	1400
3800	2	2500	2300	1400
3900	2	2600	2300	1500
4000	2	2700	2400	1500
4100	2	2700	2500	1600
4200	2	2800	2500	1600
4300	2	2900	2600	1600
4400	2	2900	2600	1700
4500	2	3000	2700	1700
4600	2	3100	2800	1700
4700	2	3100	2800	1800
4800	2	3200	2900	1800
4900	2	3300	2900	1900
5000	3	2300	3000	1200
5100	3	2300	1900	1200
5200	3	2300	2000	1200
5300	3	2400	2000	1300
5400	3	2400	2100	1300
5500	3	2500	2100	1300
5600	3	2500	2100	1300
5700	3	2600	2200	1400
5800	3	2600	2200	1400
5900	3	2700	2200	1400
6000	3	2700	2300	1400

Western F120				
SSM Load	Anchors	Load Per Anchor	1 Additional Anchor Load	2 Additional Anchor Load
700	1	700	400	300
800	1	800	500	300
900	1	900	500	300
1000	1	1000	600	400
1100	1	1100	700	400
1200	1	1200	700	500
1300	1	1300	800	500
1400	1	1400	800	500
1500	1	1500	900	600
1600	1	1600	1000	600
1700	1	1700	1000	600
1800	1	1800	1100	700
1900	1	1900	1100	700
2000	1	2000	1200	800
2100	1	2100	1300	800
2200	1	2200	1300	800
2300	1	2300	1400	900
2400	1	2400	1400	900
2500	1	2500	1500	1000
2600	1	2600	1600	1000
2700	2	1800	1600	1000
2800	2	1900	1700	1100
2900	2	1900	1700	1100
3000	2	2000	1800	1100
3100	2	2100	1900	1200
3200	2	2100	1900	1200
3300	2	2200	2000	1300
3400	2	2300	2000	1300
3500	2	2300	2100	1300
3600	2	2400	2200	1400
3700	2	2500	2200	1400
3800	2	2500	2300	1400
3900	2	2600	2300	1500
4000	3	1800	1500	1000
4100	3	1800	1600	1000
4200	3	1900	1600	1000
4300	3	1900	1600	1000
4400	3	2000	1700	1100
4500	3	2000	1700	1100
4600	3	2100	1700	1100
4700	3	2100	1800	1100
4800	3	2200	1800	1200
4900	3	2200	1900	1200
5000	3	2300	1900	1200
5100	3	2300	1900	1200
5200	3	2300	2000	1200
5300	3	2400	2000	1300
5400	3	2400	2100	1300
5500	3	2500	2100	1300
5600	3	2500	2100	1300
5700	3	2600	2200	1400
5800	3	2600	2200	1400
5900	3	2700	2200	1400
6000	3	2700	2300	1400

Structural Rack & Components Calculation Package

Components & Racking System:

Osprey PowerRack & Structural/Light Gauge Steel

Components Structural Analysis

Client:

Nuance Energy, Inc

2450 Colorado Avenue

Santa Monica, CA 90404

Prepared By:

Joshua M. Bice, PE

Valkyrie Engineering & Design, LLC

Table of Contents:

Scope of Analysis

Design Criteria:

ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

Based on International Building Code (IBC) 2018. Superceded editions 2015, 2012, & 2009.

Max wind: 110 mph (Ultimate), 85 mph (Factored)

Max Snow, Pg: 30 psf

Racking Description:

The calculation package consists of analyzing the individual components that when assembled create the Osprey PowerRack, a ground mount photovoltaic (PV) racking structure. This analysis addresses the assembled rack. The rack sizes analyzed are the following: 4x3 table (12 PV Panels), 4x4 table (16 PV Panels) & 4x5 table (20 PV Panels). It shall be noted that the addition of a column of panels constituted an addition of one leg set to extend the table. The primary 4x3 rack will demonstrate the worst case analysis of the three systems. The component materials used are either structural steel, light gauge steel, or stainless steel. Once the rack is installed it is anchored to the ground utilizing earth anchors (analyzed by others) to resist the applied vertical loading.

Nuance energy has provided the structural results of all components and assembled racks. The purpose of this packet is to define and review the structural calculations with the associated data, each part shall be analyzed individually.

Site Specific Design Requirements

It is recommended that each project shall have site specific engineering, provided as an SSM (Site Specific Memo) signed and sealed by the Engineer of Record (EOR) for the specific site. This process ensures that the Osprey PowerRack will be an acceptable solution to the site specific conditions. The site conditions per site shall fall into the range of the stated structural design parameters outlined in this package. This package shall not be used if those parameters are outside the range of what is listed in this package. For sites that fall outside the scope of this report, individual analysis shall be performed on the racking system to ensure

structural stability. A signed and sealed approval letter shall be obtained from the EOR for each project prior to the installation of the racking systems. If no approval letter is supplied this package shall not be referenced or used in any way. This package can be supplemented by analysis signed and sealed by Valkyrie Engineering & Design that may include loading conditions and racking geometry outside the scope of this package.

This analysis was performed utilizing a standard PV module consisting of an aluminum frame hosting the PV cells. The size of the module provided measured approximately 95" x 45" and weighs 69lbs see appendix for module spec sheet. The mounting locations of the module are based on manufacturing specifications of the module manufacturer. This package covers module mounting spacings up to 55". It shall be noted that similar size panels are acceptable to use in lieu of the tested module. The SSM must include the desired panel, this panel must be smaller than or equal to, but not greater than the parameters stated above.

Geotechnical reports, if obtained, shall be referred to in the evaluation of any and all site specific approval letters. However, Nuance Energy requires real-time load testing for each foundation as they are being installed. Thus, a Geotechnical report is not required. It is the owner's responsibility to supply Nuance Energy with the tested values as a form provided by Nuance Energy. Failure to provide testing results voids this package.

The earth anchors must be tested and recorded individually at the time of installation. The SSM shall provide a required anchor count and factored load required to be met by the earth anchors for each foundation. When one (1) earth anchor is required by the SSM, the earth anchor must be installed at 0° vertical (+/- 5°). When two (2) earth anchors are required by the SSM the earth anchors shall each be installed at 10° from vertical and opposite of each other on the North-South plane. When three (3) earth anchors are required by the SSM, each earth anchor shall be installed at 10° from vertical rotated 120° from each other about the center of the baseplate. If the earth anchor load testing results are not sufficient an additional earth anchor shall be installed 20° from vertical. The placement of the additional anchor in respect to the required earth anchors shall be the following:

- (1) required earth anchor – Install additional (2^{nd}) earth anchor on N-S plane at 20° from vertical away from the structure.
- (2) required earth anchors – Install additional (3^{rd}) earth anchor on east-west plane away from the structure at 20° from vertical.
- (3) required earth anchors – Install additional (4^{th}) earth anchor at 0° from vertical.

Earth Anchors work on the pricipal that the soil above them create the capacity of the foundation. Thus, a reduction in capacity must be accounted for as the cone of influence will overlap depending on the soil conditions, anchor angle, anchor depth, and relative location. See table below for specific reductions based on the number of anchors installed.

Anchor Reduction Table		
Required Anchors per SSM		(1) Additional Anchor
Anchors Required	Revised Capacity Factor	Reduced Value
1	100%	60%
2	67%	40%
3	42%	30%
4	32%	N/A

The load stated in the SSM is factored by the table above. For Example : if the SSM load requirement is 1,000lbs and requires one anchor, that anchor must be tested and recorded to 1,000lbs. If an additional anchor is needed based on the 1,000lb load the reduction is 60% therefore the capacity of both anchors is 600lbs each. In the case that the SSM states 2 anchors at 1,000lbs each anchor must be installed and must reach a load of 670lbs as stated in the table above.

The bearing capacity of the soil shall be reviewed in the selection of a sufficient base plate. The earth anchors shall be tested per the requirements of Nuance Energy and supplied to the EOR for review and submittal of a signed and sealed (S&S) earth anchor approval letter.

Scope of Work achieved by this report:

Valkyrie Engineering & Design has been hired by Nuance Energy to address the following items:

- The initial design criteria of those found in ASCE 7-16 along with a range of acceptable variations for the racking system including the following: table tilt, leg heights, spacing, and base plate evaluation.
  - Maximum wind speed of 110 mph
  - Maximum ground snow load, P_g, of 30 psf
  - Risk Category I
  - Exposure Category C
  - Panel table tilt angle of 15° to 30°
  - Front leg range of 26.8" to 52.0"
  - Rear leg range of 48.9" to 105.0"
  - North-South leg spacing of 82.5"
  - Seismic S_{DS} factor equal to .0577 g or less
- Structural analysis of each member supplied by Nuance Energy
- Structural analysis of hardware for each connection supplied by Nuance Energy
- Structural analysis of the rack assembly supplied by Nuance Energy

Conclusion:

Valkyrie Engineering & Design has evaluated the design results provided by Nuance Energy in addition to the models and provided installation documentation and has determined that if the racking systems are built per the installation manual and design criteria falls inside this structural analysis the racking system shall be structural sufficient to support the imposed lateral and vertical loads.

An approved SSM shall be supplied by the project EOR for each project in addition to an signed and sealed earth anchor approval letter. Unless both sign and sealed site specific documents are provided, this calculation package shall not be utilized for the installation of the racking system included in this package.

Exclusions and Limitations:

Site specific calculations and/or analysis shall be completed by an EOR for any project found to have design conditions outside the scope of this package. Any changes to the racking system after issuance of this package but prior to the expiration shall be sent to Valkyrie Engineering & Design for written approval. All non-structural issues not covered in this design package including but not limited to corrosion, erosion, electrical, mechanical or waterproofing shall not be the responsibility of Valkyrie Engineering & Design and shall be addressed by the solar designer, installer, or owner.

The design conditions listed in the structural package are the extent of the racking systems structural sufficiency. It is the installer of the racking system to verify that the earth anchors achieve the required capacities for each project.

Notes and Material Specifications:

The intent of this package is to address the structural sufficiency of the components and assembled racking system and internal connections of the components to one another per the required loading criteria listed prior.

The means and methods of construction are the responsibility of the racking contractor and personell on site. Valkyrie Engineering & Design nor the EOR shall bear responsibility for the means and methods of the project construction as neither have control over the installation and erection of any project.

Any inspection required by the local authority having jurisdiction, shall be provided to the EOR.

Diagrams and drawings shown for reference only and shall not be scaled.

- Material Specifications:
  - All racking components are to be steel and shall have a minimum yield strength, Fy, 50KSI or greater, unless noted otherwise.
  - All base plates shall be ¼" thick with a minimum Fy of 50KSI.
  - All cable braces shall be 3/16"Ø and have a minimum Fy of 36KSI.
  - The rear legs shall consist of telescoping tube steel consisting of one universal external leg (2-3/4"x2-3/4" – 14ga) & one universal internal leg (2-3/8"x2-3/8" – 14ga).

- The front legs shall be Trailer Jack assemblies consisting of (3) tube steel parts. The lower tube section shall be 1-5/8" square with a minimum thickness of 12ga. The middle tube section shall be 2" square with a minimum thickness of 11ga. The upper tube section shall be 2-1/4" square and shall have a minimum thickness of 11ga.
- The diagonal brace is comprised of (2) telescoping steel tubes. The external bracing tube shall be 2" square and the internal bracing tube shall be 2.4" square. Each tube shall have a minimum thickness of 14ga.
- Each east-west long tube shall be a minimum HSS4" round tube with a minimum thickness of 11ga.
- Each north-south purlin shall be a cold formed section with a height of 2-5/8" and a width of 1-5/8". The minimum thickness shall be 11ga.
- Each purlin splice shall be a cold formed U-section with a height of 1.94" and a width of 1.97". It shall have a minimum thickness of 10ga.
- All bolts shall be 1/2"Ø A325 (Gr 5) Bolts except the U-bolt which shall be 3/8" Ø A325 (Gr 5) bolt.
- All connection brackets shall be a minimum of 10ga.

*Dimensions given in US Imperial units. It shall be acceptable to use equivalent metric sizes in lieu of the sizes given above.

NUANCE ENERGY
Revolutionary Solar Racking Structures

OPR MAX - 4X3 -FOUNDATION SETS 2							
BOM Level				***QTY.***	***Part Description***	***Specification (in)***	***Part Number***
1					*NS SLOPE PURLIN ASSEMBLY*		
	2			12.0	NS PURLIN MAX	UNI2.56X1.65	OPR-821-11-215-093
	2			6.0	RAIL BRACKET	PL14X5.40	OPR-821-10-115-014
1					*EW BEAM ASSEMBLY*		
	2			6.0	EAST WEST BEAM	○101.6mm	OPR-821-11-235-098
1					*SOUTH LEG- UNIVERSAL*		
	2			2.0	12" FOUNDATION MAX	PL12X12X25	UNV-011-03-345-012
	2			2.0	FRONT LEG	TRAILER JACK	OPR-810-11-530-051
1					NORTH LEG - 0		
	2			2.0	18" FOUNDATION MAX	PL18X18X25	UNV-011-03-345-018
	2			2.0	UNIVERSAL EXTERNAL LEG	■70x70mm	OPR-821-14-215-054
	2			2.0	UNIVERSAL INTERNAL LEG	■60x60mm	OPR-821-14-215-060
	2			2.0	NORTH BRACKET	PL11.5X5.8	OPR-821-10-115-012
1					LATERAL BRACE		
	2			2.0	LATERAL BRACE EXTERNAL	■60x60mm	OPR-821-14-215-018
	2			2.0	LATERAL BRACE INTERNAL	■50x50mm	OPR-821-14-215-078
	2			2.0	LATERAL BRACKET	PL9.31X2.0	OPR-821-09-115-008
	2			2.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					SEISMIC BRACE		
	2			2.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					HARWARE		
	2			22.0	CARRIAGE BOLTS GENERAL	1/2-13-4.5" CARRIAGE BOLT	OPR-831-050-X45
	2			6.0	BRACING BOLTS	1/2-13-3" HEX HEAD BOLT	OPR-831-050-B03
	2			28.0	1/2" NUTS	1/2-13 SERRATED NUT	OPR-831-050-N12
	2			16.0	EW U-BOLT TUBE	3/8-16-4OD U-BOLT	OPR-831-050-U04
	2			24.0	SPLICE BOLTS	3/8-16-1" HEX HEAD BOLT	OPR-831-050-B01
	2			56.0	3/8" NUTS	3/8-16 SERRATED NUT	UNV-031-050-N38
	2			18.0	MID CLAMPS	SOLAR MASTERS	UNV-051-050-M05
	2			12.0	END CLAMPS	SOLAR MASTERS	UNV-051-050-E05
					ANCHORS -DEPENDS ON SOIL		
					6FT GRIPPLE ANCHOR LOW	GRIPPLE 6FT TLA3	UNV-223-007-01

OSPREY

NUANCE ENERGY
Revolutionary Solar Racking Structures

OPR MAX - 4X4 -FOUNDATION SETS 3							
BOM Level				***QTY.***	***Part Description***	***Specification (in)***	***Part Number***
1					*NS SLOPE PURLIN ASSEMBLY*		
	2			16.0	NS PURLIN MAX	UNI2.56X1.65	OPR-821-11-215-093
	2			8.0	RAIL BRACKET	PL14X5.40	OPR-821-10-115-014
1					*EW BEAM ASSEMBLY*		
	2			6.0	EAST WEST BEAM	○101.6mm	OPR-821-11-235-098
1					*SOUTH LEG- UNIVERSAL*		
	2			3.0	12" FOUNDATION MAX	PL12X12X25	UNV-011-03-345-012
	2			3.0	FRONT LEG	TRAILER JACK	OPR-810-11-530-051
1					NORTH LEG - 0		
	2			3.0	18" FOUNDATION MAX	PL18X18X25	UNV-011-03-345-018
	2			3.0	UNIVERSAL EXTERNAL LEG	■70x70mm	OPR-821-14-215-054
	2			3.0	UNIVERSAL INTERNAL LEG	■60x60mm	OPR-821-14-215-060
	2			3.0	NORTH BRACKET	PL11.5X5.8	OPR-821-10-115-012
1					LATERAL BRACE		
	2			3.0	LATERAL BRACE EXTERNAL	■60x60mm	OPR-821-14-215-018
	2			3.0	LATERAL BRACE INTERNAL	■50x50mm	OPR-821-14-215-078
	2			3.0	LATERAL BRACKET	PL9.31X2.0	OPR-821-09-115-008
	2			3.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					SEISMIC BRACE		
	2			4.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					HARWARE		
	2			30.0	CARRIAGE BOLTS GENERAL	1/2-13-4.5" CARRIAGE BOLT	OPR-831-050-X45
	2			9.0	BRACING BOLTS	1/2-13-3" HEX HEAD BOLT	OPR-831-050-B03
	2			39.0	1/2" NUTS	1/2-13 SERRATED NUT	OPR-831-050-N12
	2			22.0	EW U-BOLT TUBE	3/8-16-4OD U-BOLT	OPR-831-050-U04
	2			32.0	SPLICE BOLTS	3/8-16-1" HEX HEAD BOLT	OPR-831-050-B01
	2			76.0	3/8" NUTS	3/8-16 SERRATED NUT	UNV-031-050-N38
	2			24.0	MID CLAMPS	SOLAR MASTERS	UNV-051-050-M05
	2			16.0	END CLAMPS	SOLAR MASTERS	UNV-051-050-E05
					ANCHORS -DEPENDS ON SOIL		
					6FT GRIPPLE ANCHOR LOW	GRIPPLE 6FT TLA3	UNV-223-007-01

OSPREY

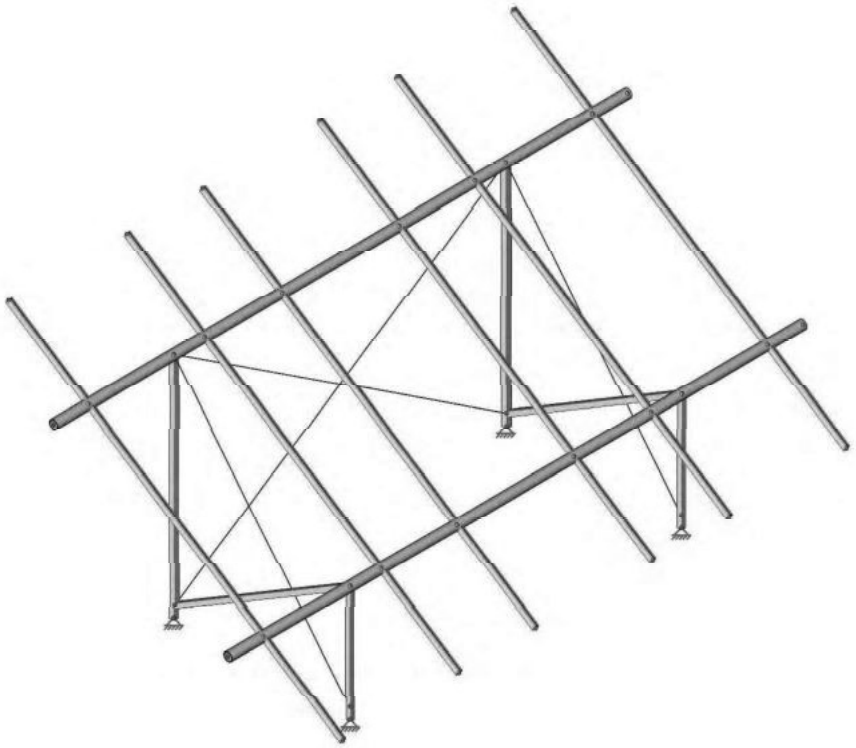
NUANCE ENERGY
Revolutionary Solar Racking Structures

OPR MAX - 4X5 -FOUNDATION SETS 4							
BOM Level				***QTY.***	***Part Description***	***Specification (in)***	***Part Number***
1					*NS SLOPE PURLIN ASSEMBLY*		
	2			20.0	NS PURLIN MAX	UNI2.56X1.65	OPR-821-11-215-093
	2			10.0	RAIL BRACKET	PL14X5.40	OPR-821-10-115-014
1					*EW BEAM ASSEMBLY*		
	2			8.0	EAST WEST BEAM	○101.6mm	OPR-821-11-235-098
1					*SOUTH LEG- UNIVERSAL*		
	2			4.0	12" FOUNDATION MAX	PL12X12X25	UNV-011-03-345-012
	2			4.0	FRONT LEG	TRAILER JACK	OPR-810-11-530-051
1					NORTH LEG - 0		
	2			4.0	18" FOUNDATION MAX	PL18X18X25	UNV-011-03-345-018
	2			4.0	UNIVERSAL EXTERNAL LEG	■70x70mm	OPR-821-14-215-054
	2			4.0	UNIVERSAL INTERNAL LEG	■60x60mm	OPR-821-14-215-060
	2			4.0	NORTH BRACKET	PL11.5X5.8	OPR-821-10-115-012
1					LATERAL BRACE		
	2			4.0	LATERAL BRACE EXTERNAL	■60x60mm	OPR-821-14-215-018
	2			4.0	LATERAL BRACE INTERNAL	■50x50mm	OPR-821-14-215-078
	2			4.0	LATERAL BRACKET	PL9.31X2.0	OPR-821-09-115-008
	2			4.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					SEISMIC BRACE		
	2			6.0	CABLE BRACE	18FT 4MM CABLE BRACE	OPR-811-500-C18
1					HARWARE		
	2			40.0	CARRIAGE BOLTS GENERAL	1/2-13-4.5" CARRIAGE BOLT	OPR-831-050-X45
	2			12.0	BRACING BOLTS	1/2-13-3" HEX HEAD BOLT	OPR-831-050-B03
	2			52.0	1/2" NUTS	1/2-13 SERRATED NUT	OPR-831-050-N12
	2			28.0	EW U-BOLT TUBE	3/8-16-4OD U-BOLT	OPR-831-050-U04
	2			40.0	SPLICE BOLTS	3/8-16-1" HEX HEAD BOLT	OPR-831-050-B01
	2			96.0	3/8" NUTS	3/8-16 SERRATED NUT	UNV-031-050-N38
	2			30.0	MID CLAMPS	SOLAR MASTERS	UNV-051-050-M05
	2			20.0	END CLAMPS	SOLAR MASTERS	UNV-051-050-E05
					ANCHORS -DEPENDS ON SOIL		
					6FT GRIPPLE ANCHOR LOW	GRIPPLE 6FT TLA3	UNV-223-007-01

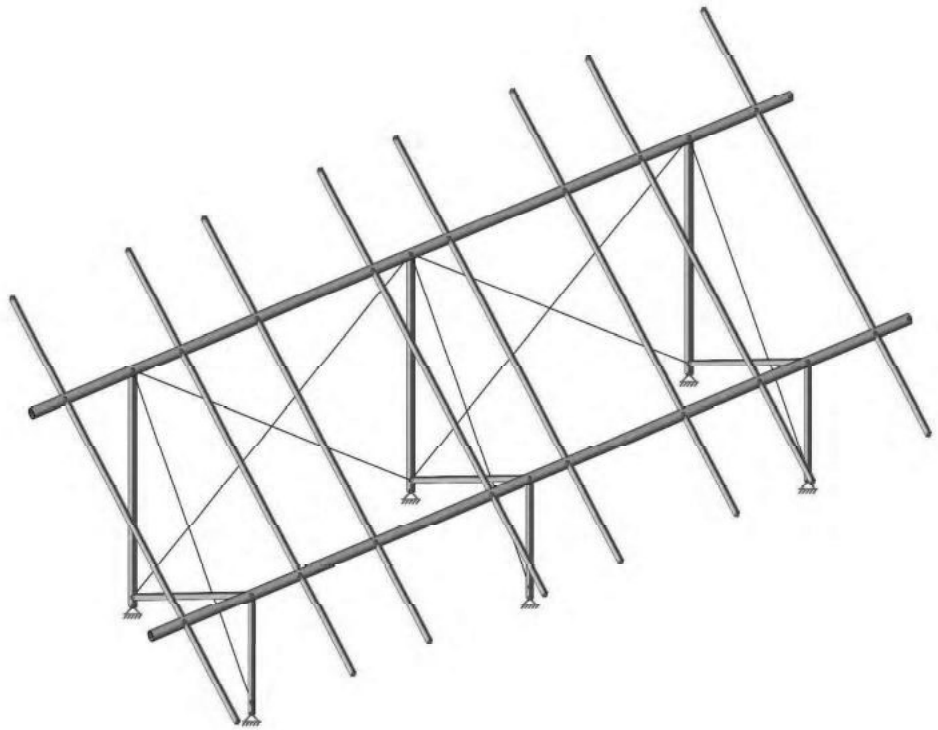
OSPREY

Unit Types

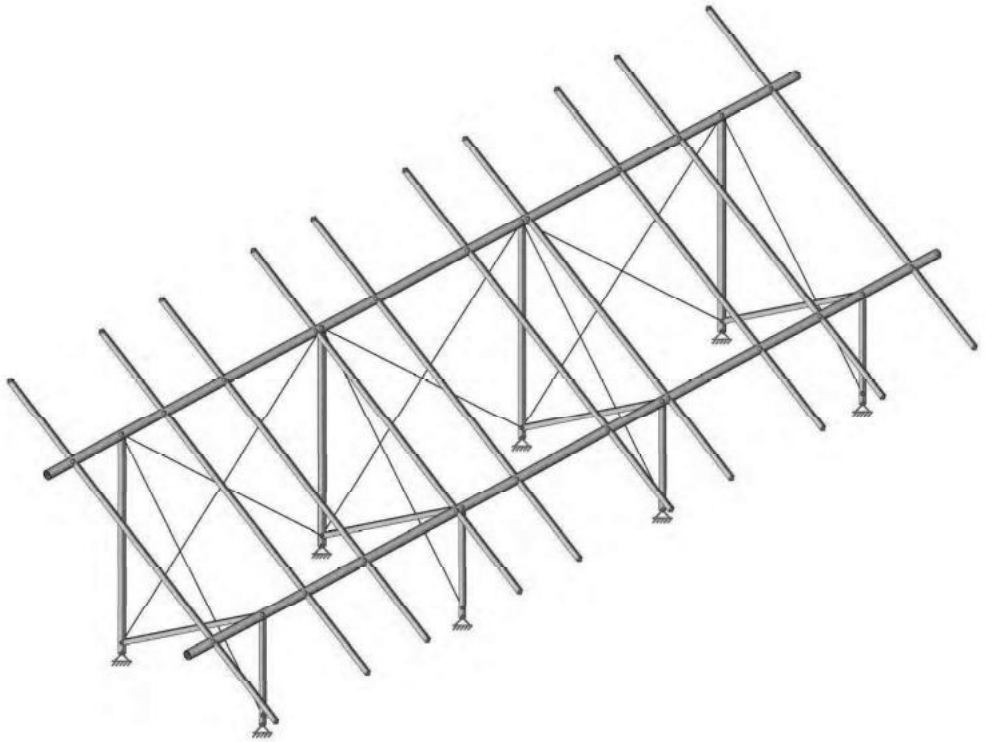
4x3 Osprey PowerRack



4x4 Osprey PowerRack



4x5 Osprey PowerRack



Vertical & Lateral Load Calculations:

Site Design Criteria

Racking System Information:

- Array Size — 4x3, 4x4, 4x5
- Module Size & Weight — 95" x 45" & 69lbs
- Front Leg Height Range — 26.8" to 52"
- Rear Leg Height Range — 48.9" to 105"
- Table Tilt Range — 15° to 30°

Wind Design Criteria:

- Wind Speed V (ult) — 110 mph
- Exposure Category — C
- Wind directional Factor (K_d) — 0.85
- Velocity Pressure Coefficient (K_h) — 0.85
- Topographic Factor (K_{zt}) — 1.00
- Ground Elevation Factor (K_e) — 1.00

Snow Loading:

- Ground Snow (P_g) — 30 psf

Seismic Design Criteria:

- Site Class (assumed) — D
- S_{Ds} — 0.507g
- S_{D1} — 0.096g
- Building Risk Category — I
- Seismic Design Category — D

Open Wind Pressure C&C Result Table

Clear Wind Flow, P					
Zone 3		Zone 2		Zone 1	
74.2 psf	-72.3 psf	74.2 psf	-72.3 psf	49.5 psf	-47.6 psf
Obstructed Wind Flow, P					
Zone 3		Zone 2		Zone 1	
45.7 psf	-66.6 psf	45.7 psf	-66.6 psf	30.4 psf	-43.8 psf

Seismic Loading Calculation:

Base Shear (V) = C_s*W

$C_S = S_{DS} / (R/I)$

R = 2.0 for Non-Building Structures Not Similar to Buildings

I = 1.0 (Seismic Importance Factor)

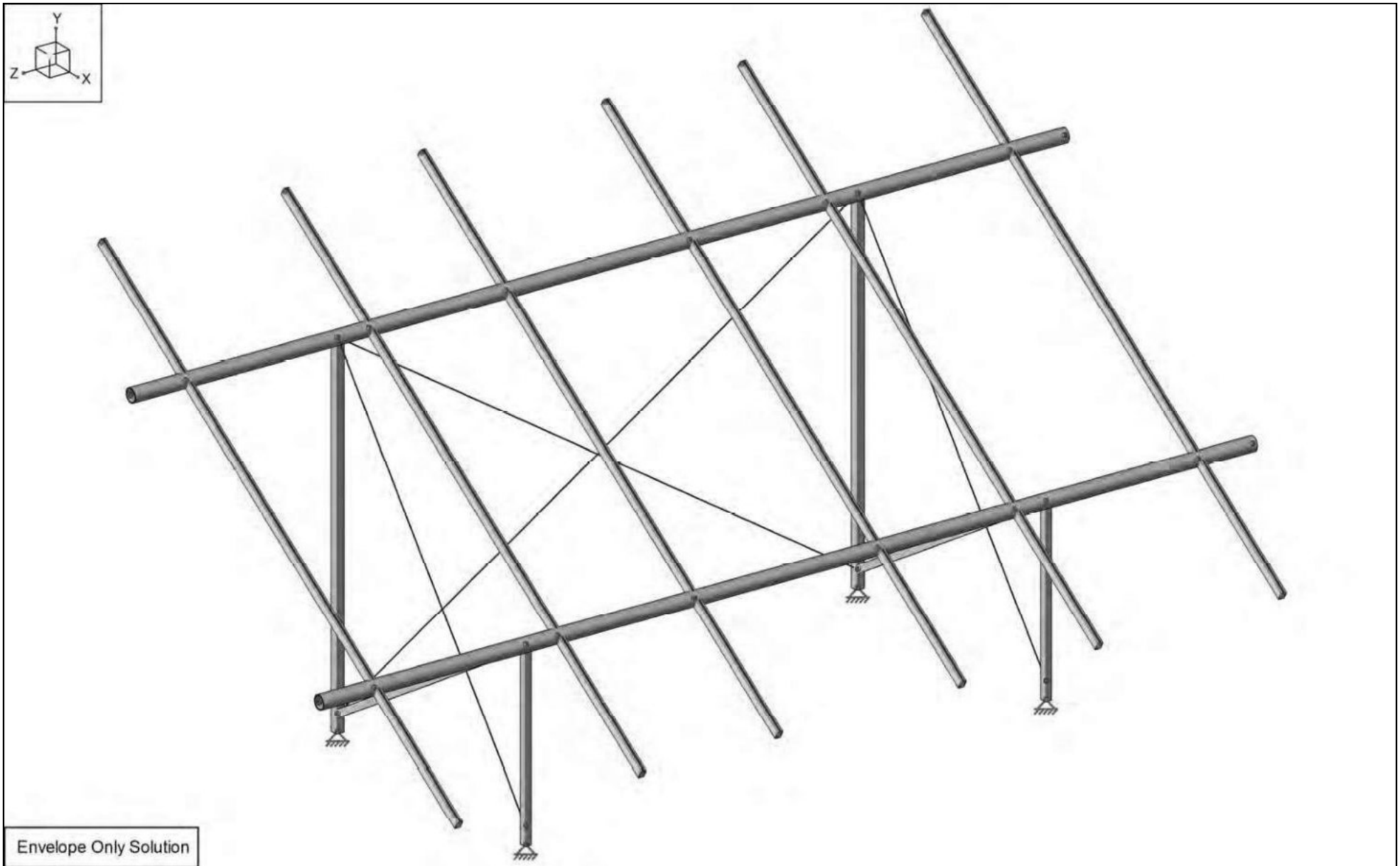
C_S = (.507) / (2/1) => (1/2) = .255

Panel Weight, W = 69lbs

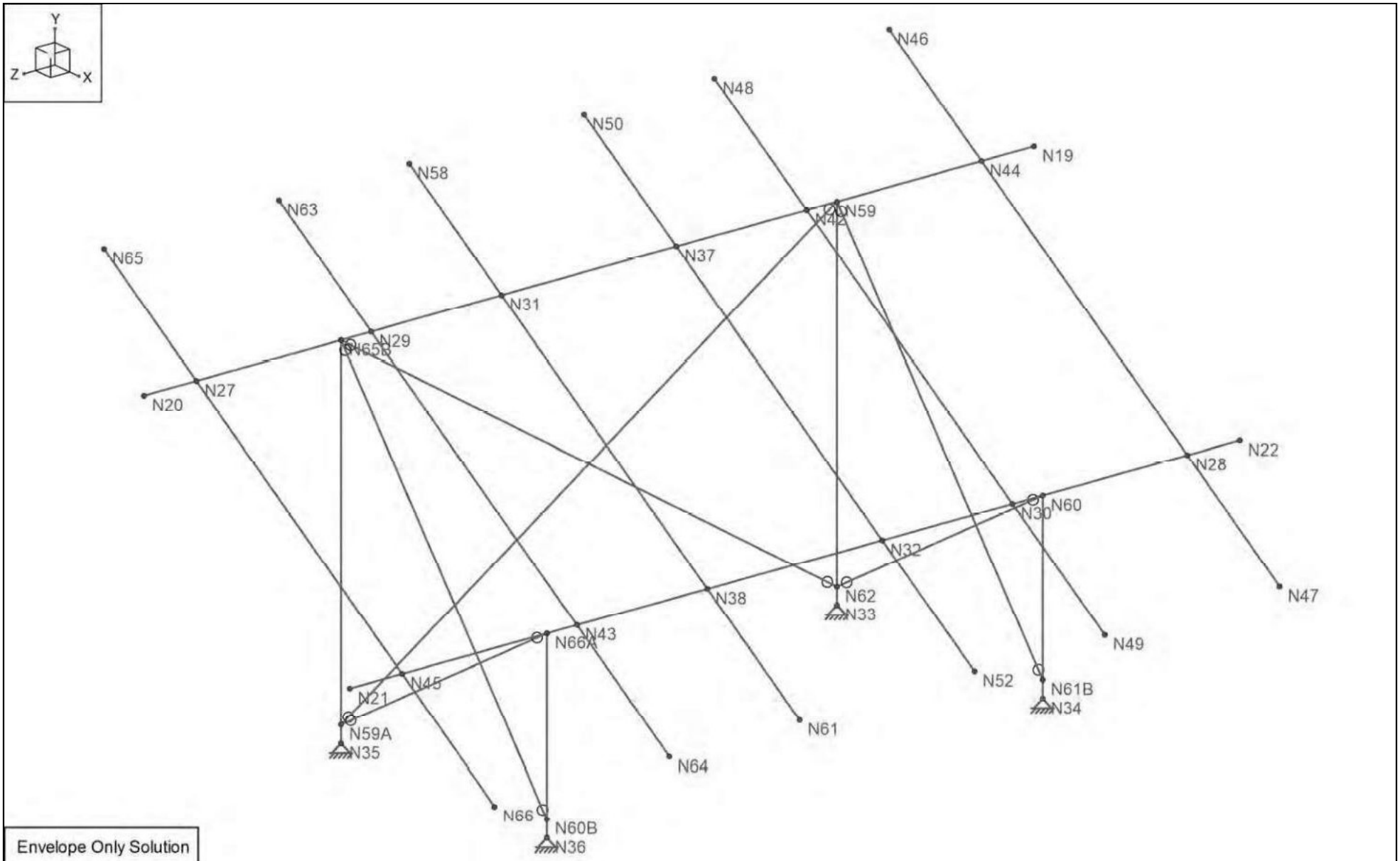
V = (.255) * (69lbs) = 17.6lbs

Panel Tributary Width per Purlin = 3.96ft

Panel Lateral Load Applied to Purlin = (17.6lbs) / (3.96ft) = 4.4plf

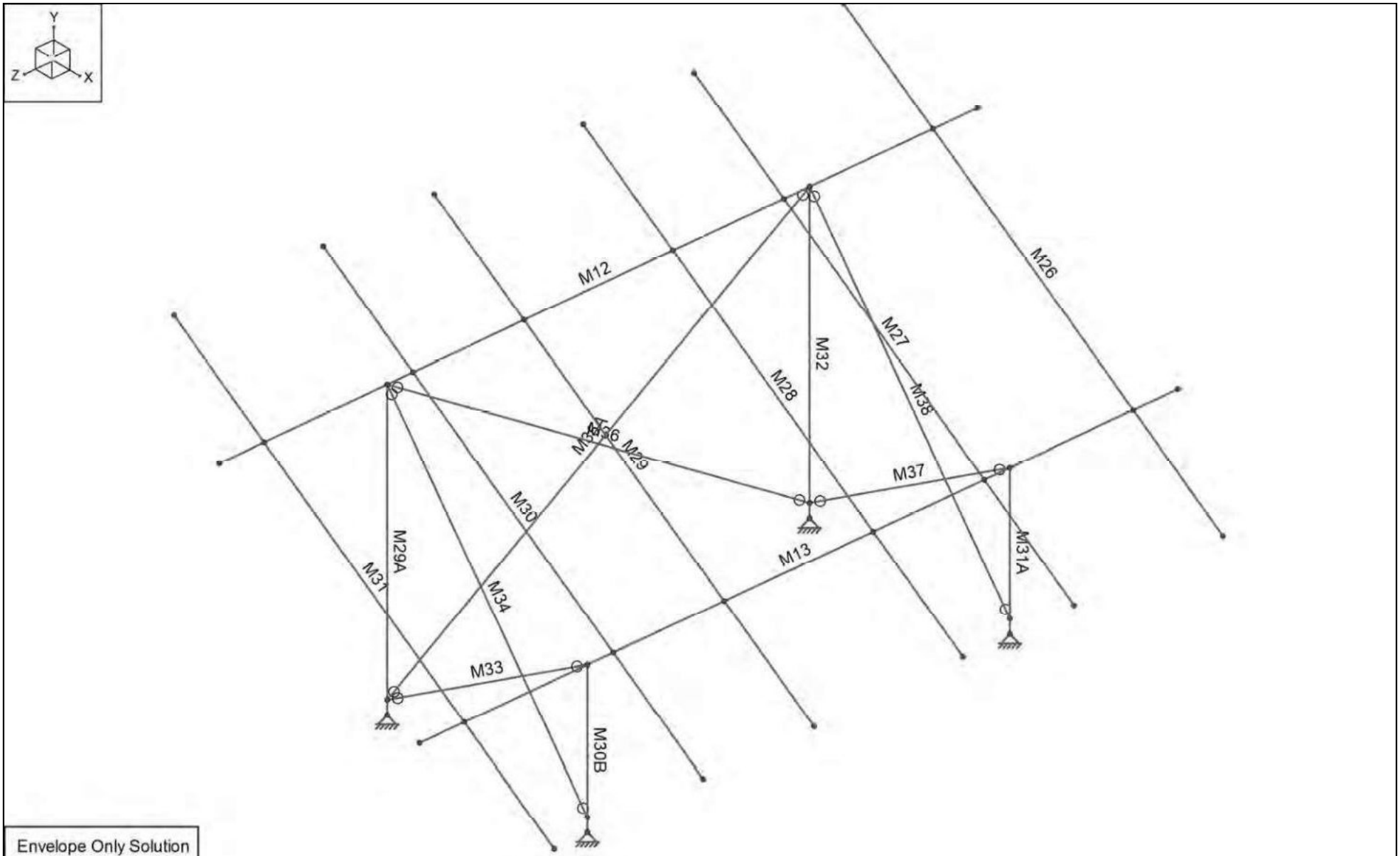


GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-1
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d

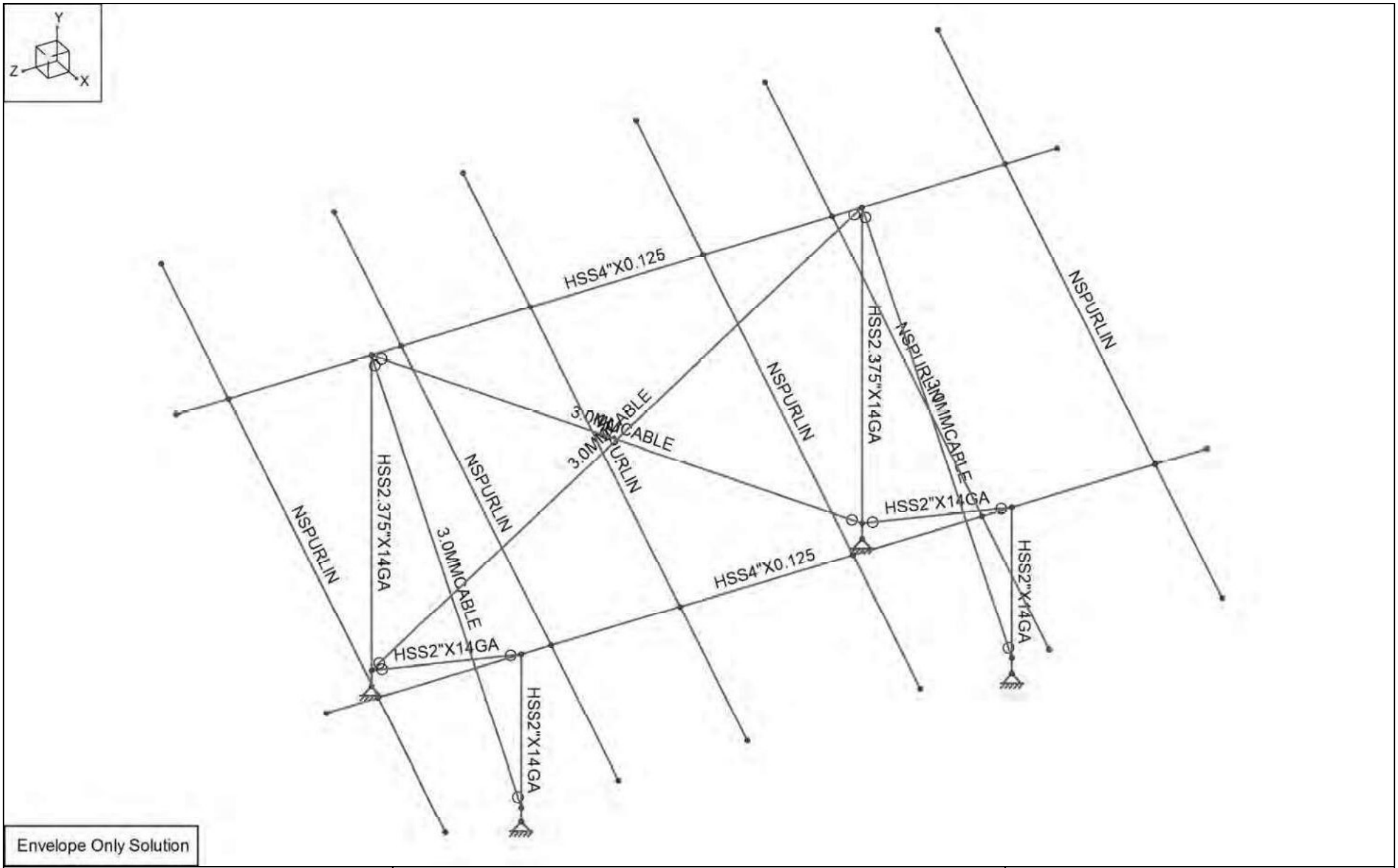


Envelope Only Solution

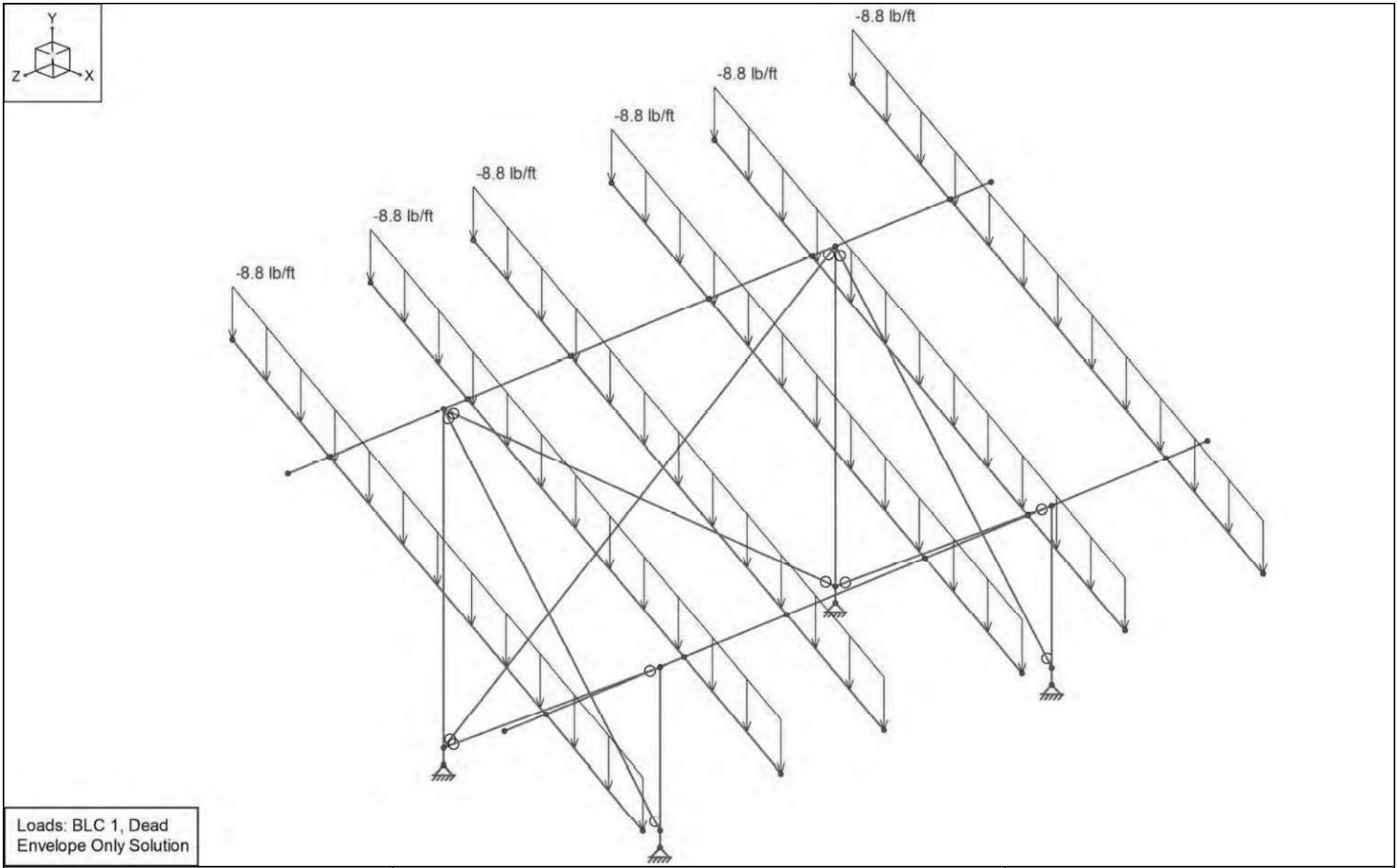
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-2
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



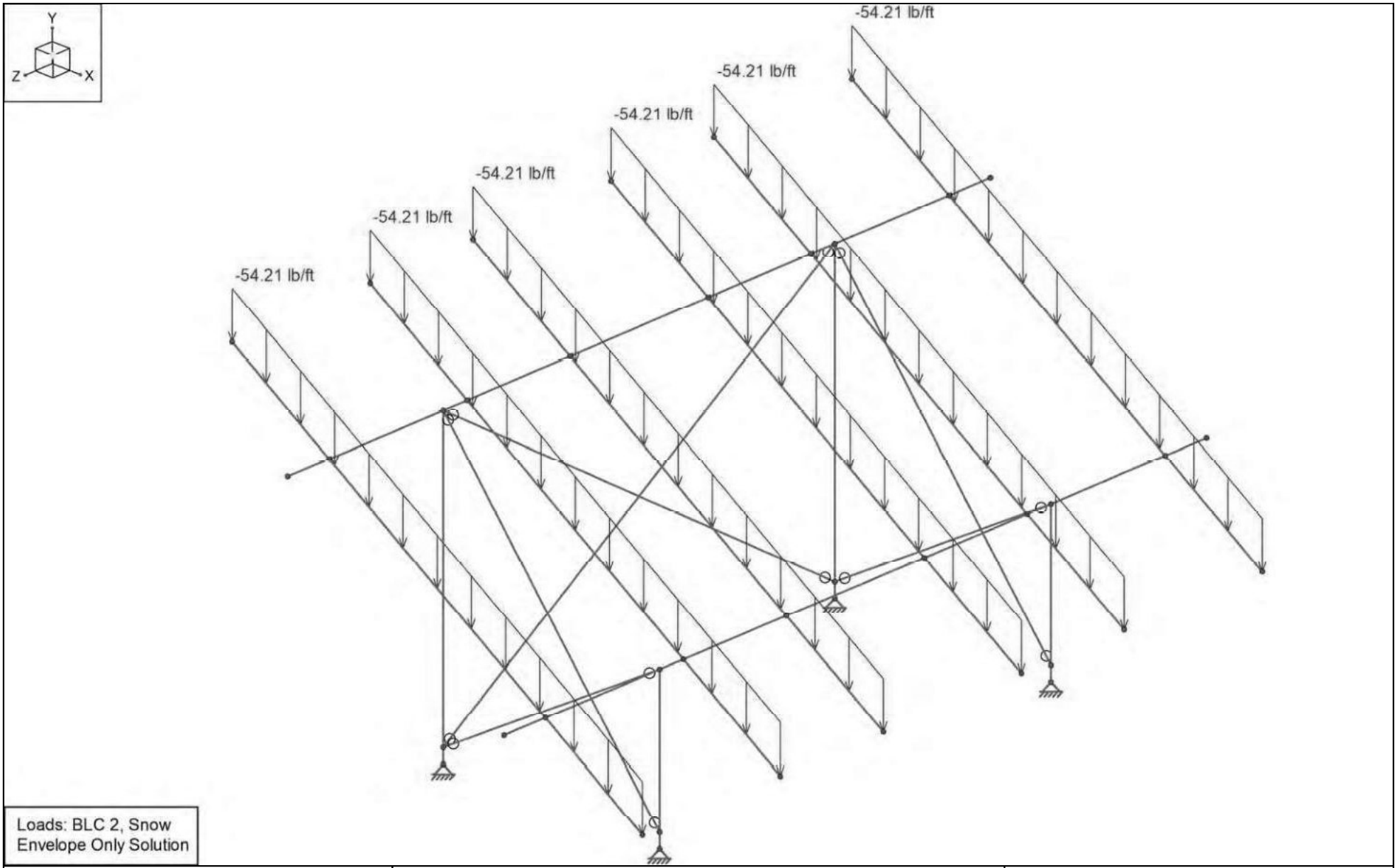
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-3
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



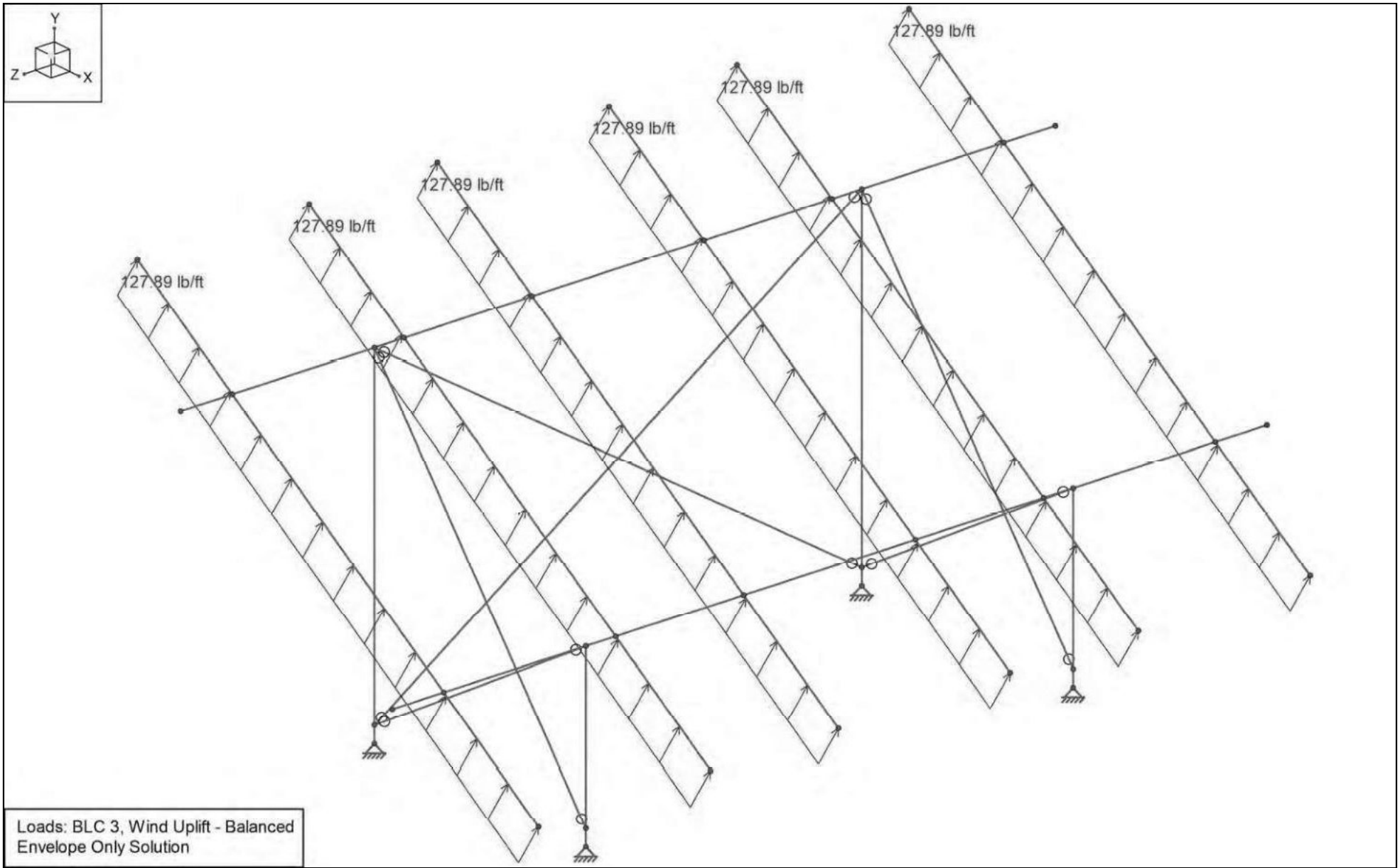
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-4
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



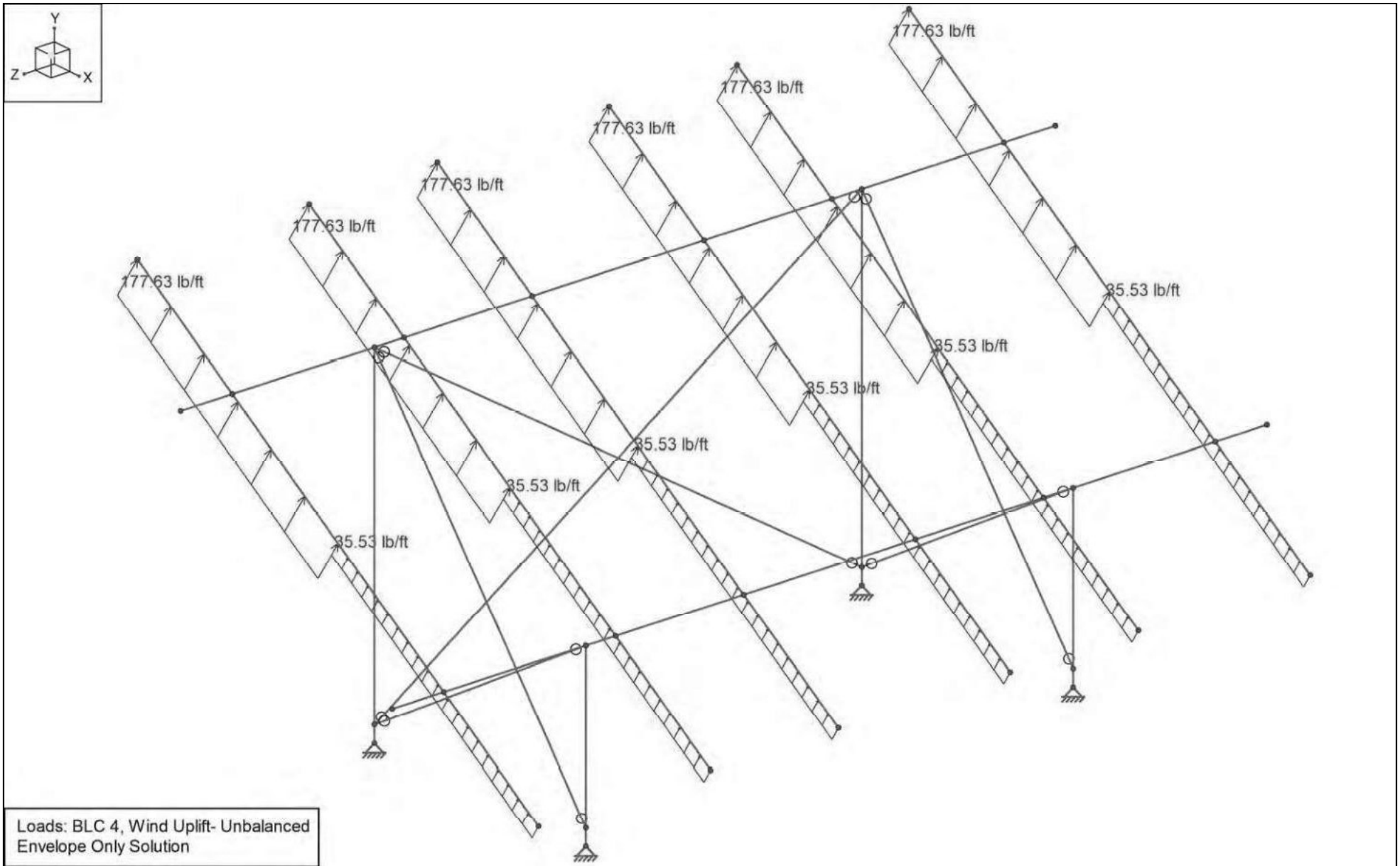
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-5
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



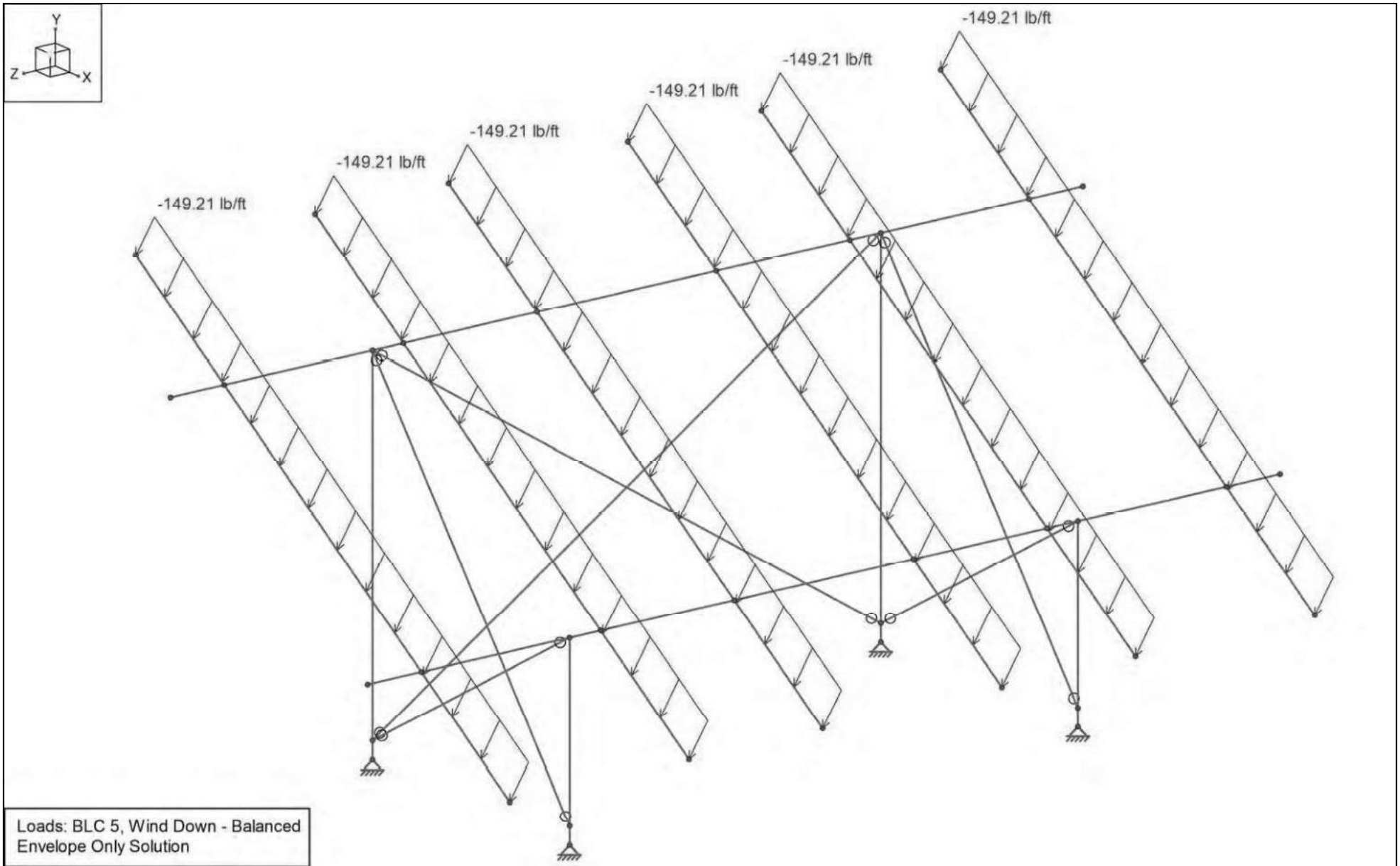
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-6
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



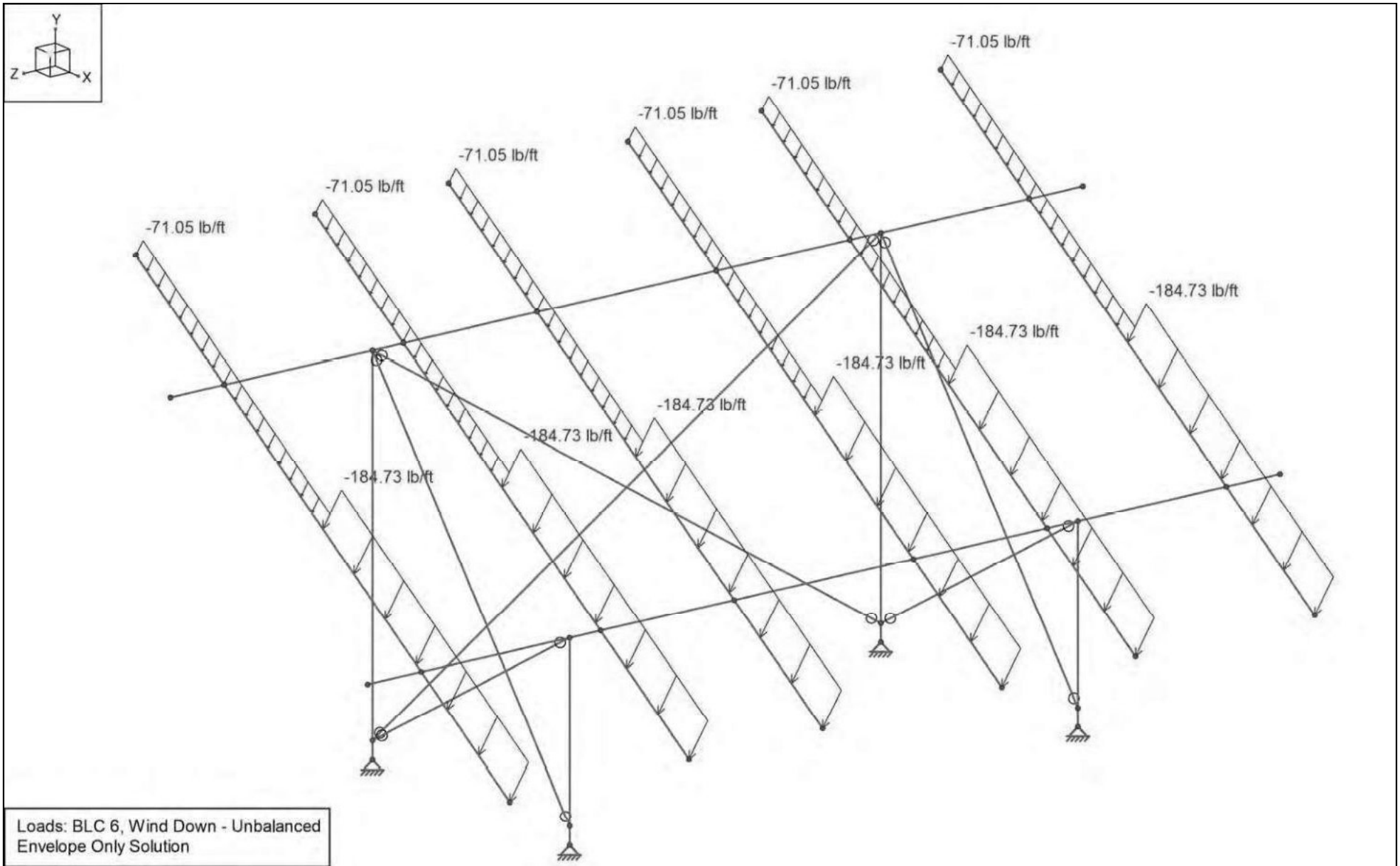
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-7
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



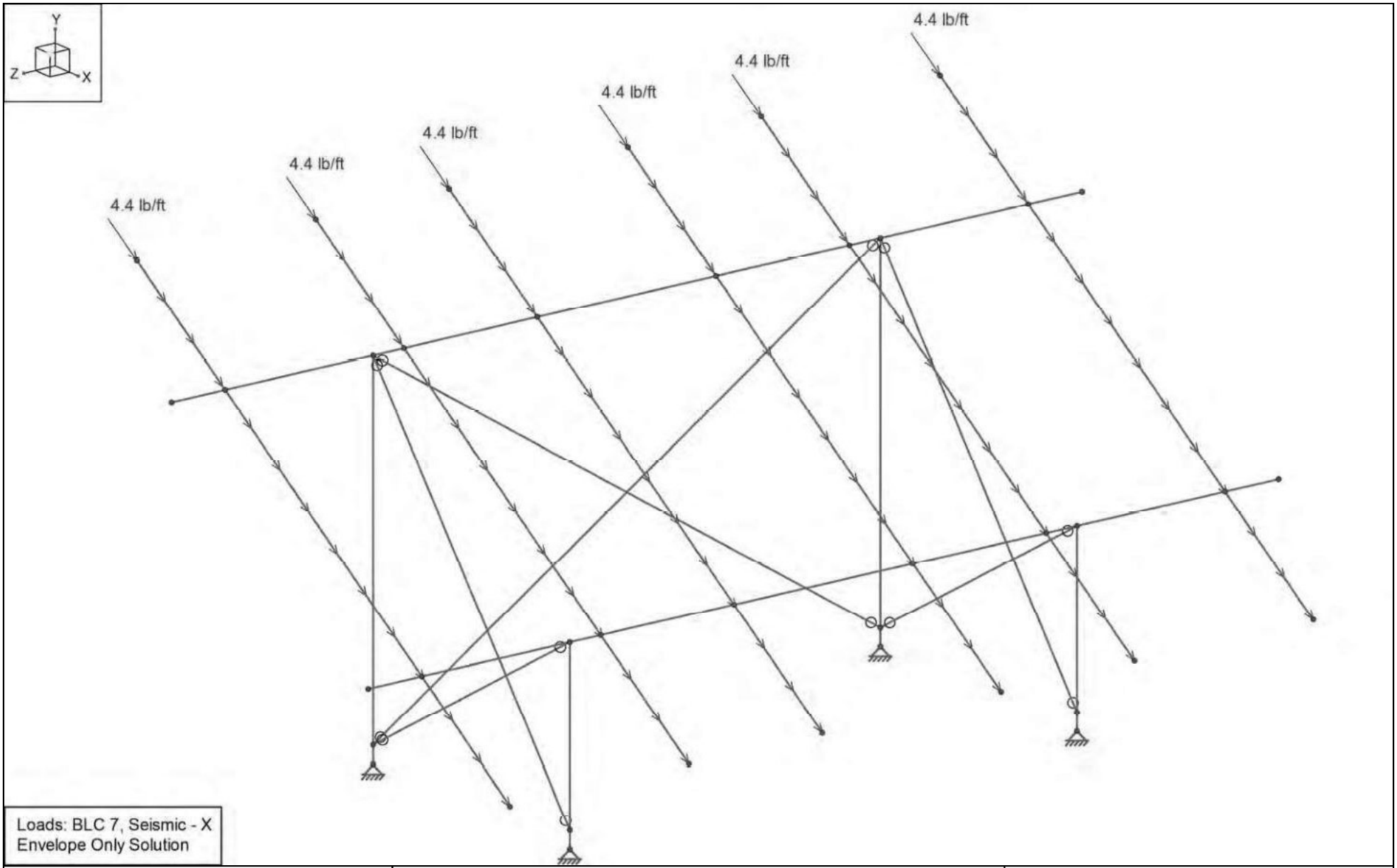
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-8
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



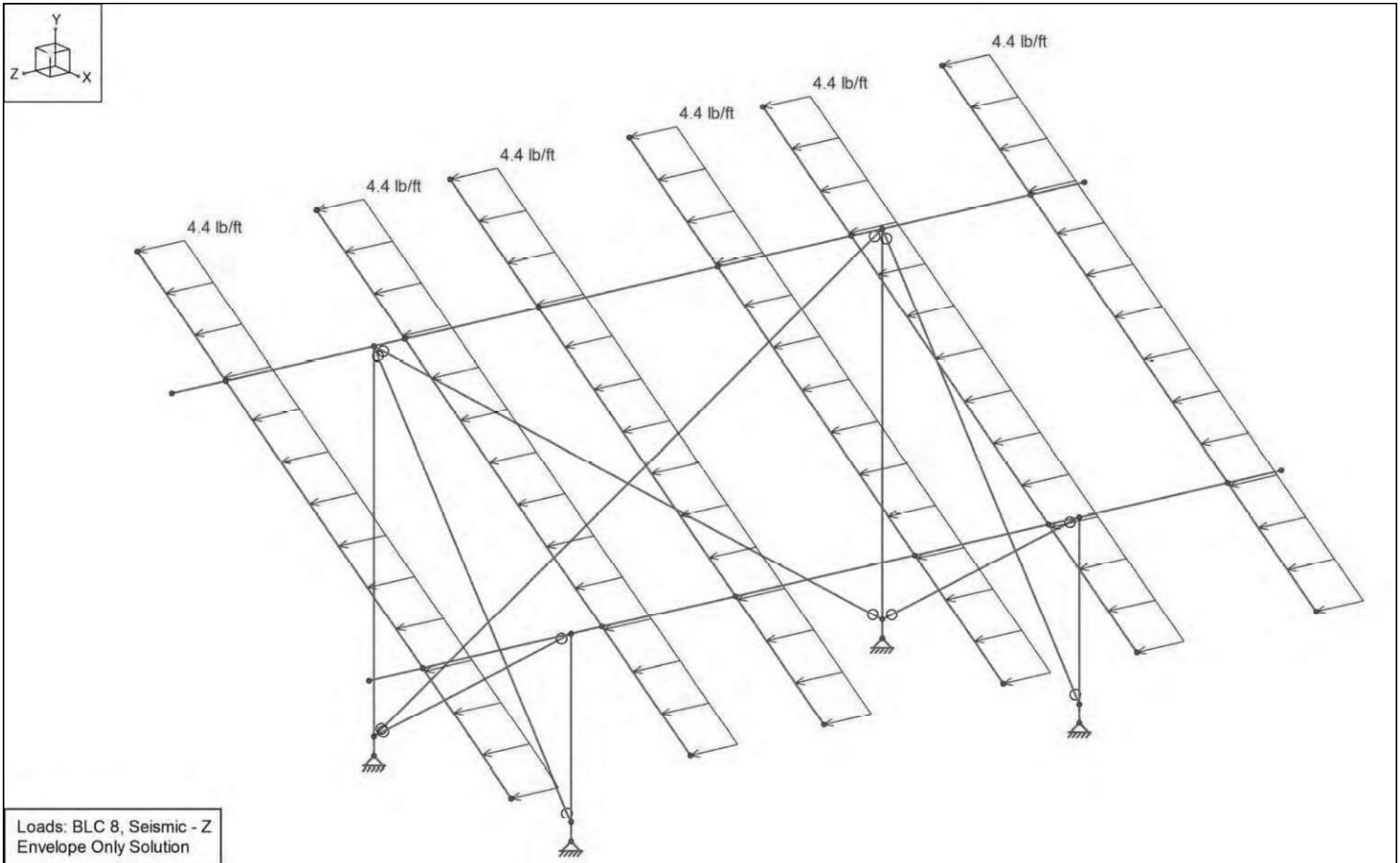
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-9
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



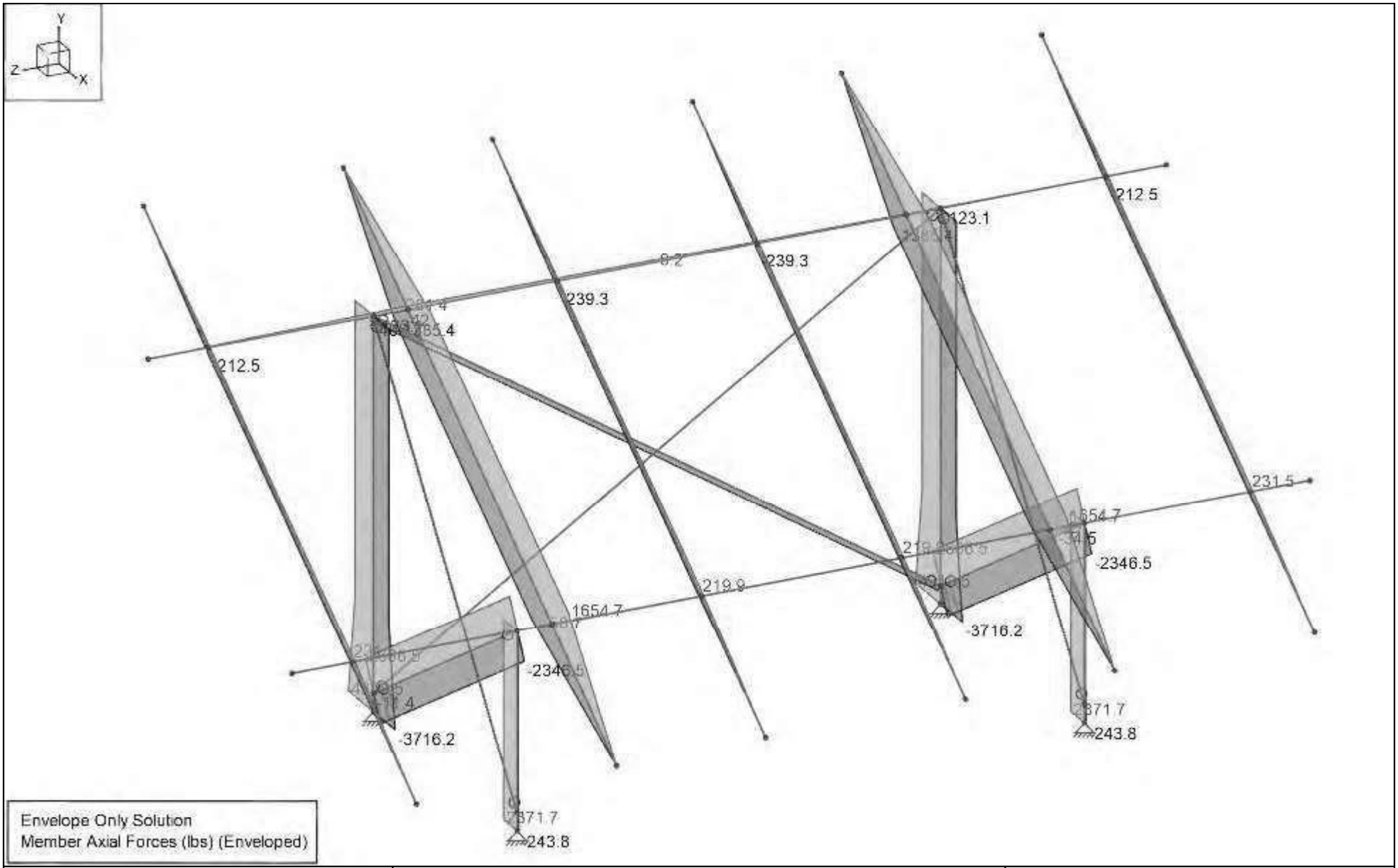
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-10
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



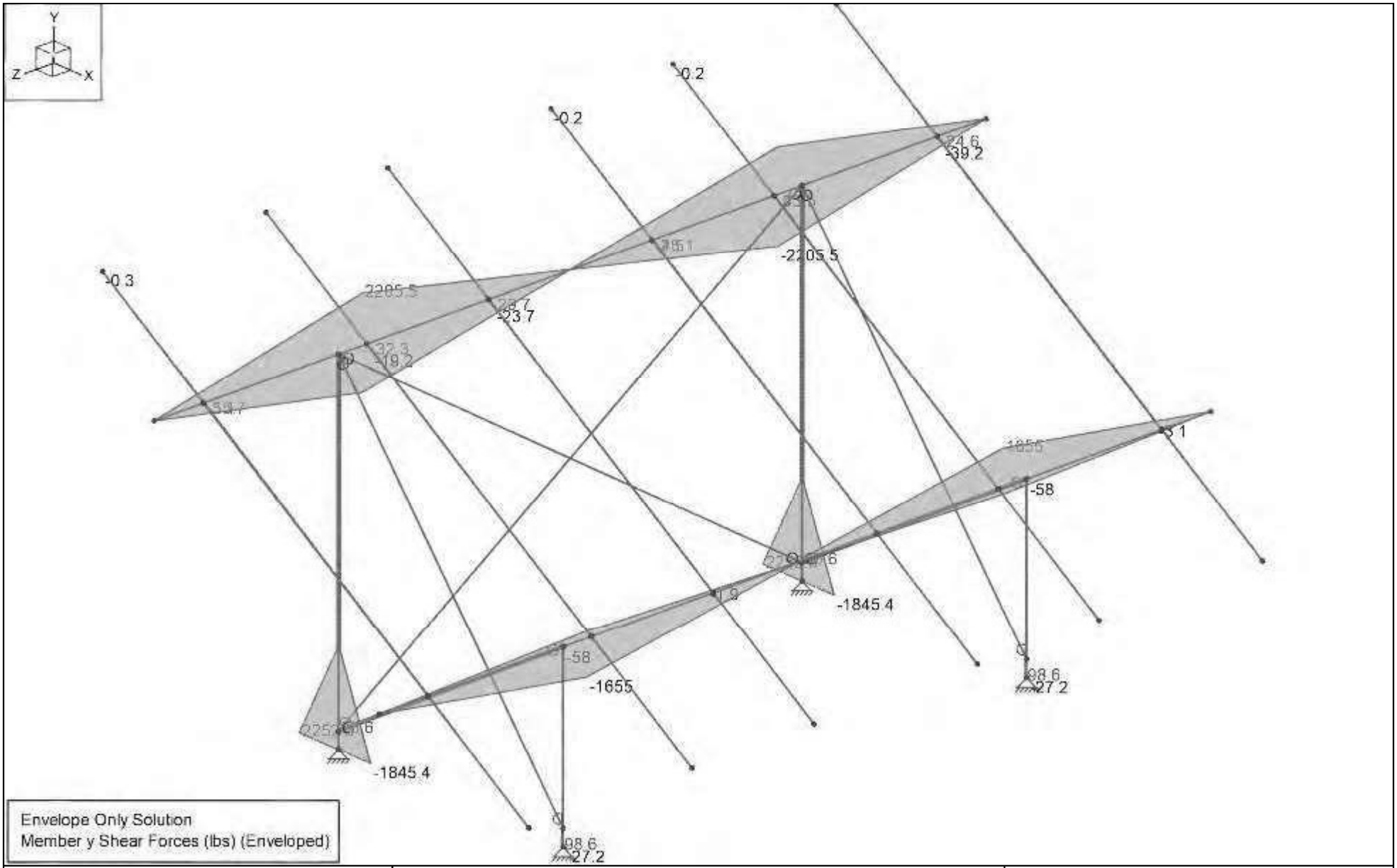
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-11
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



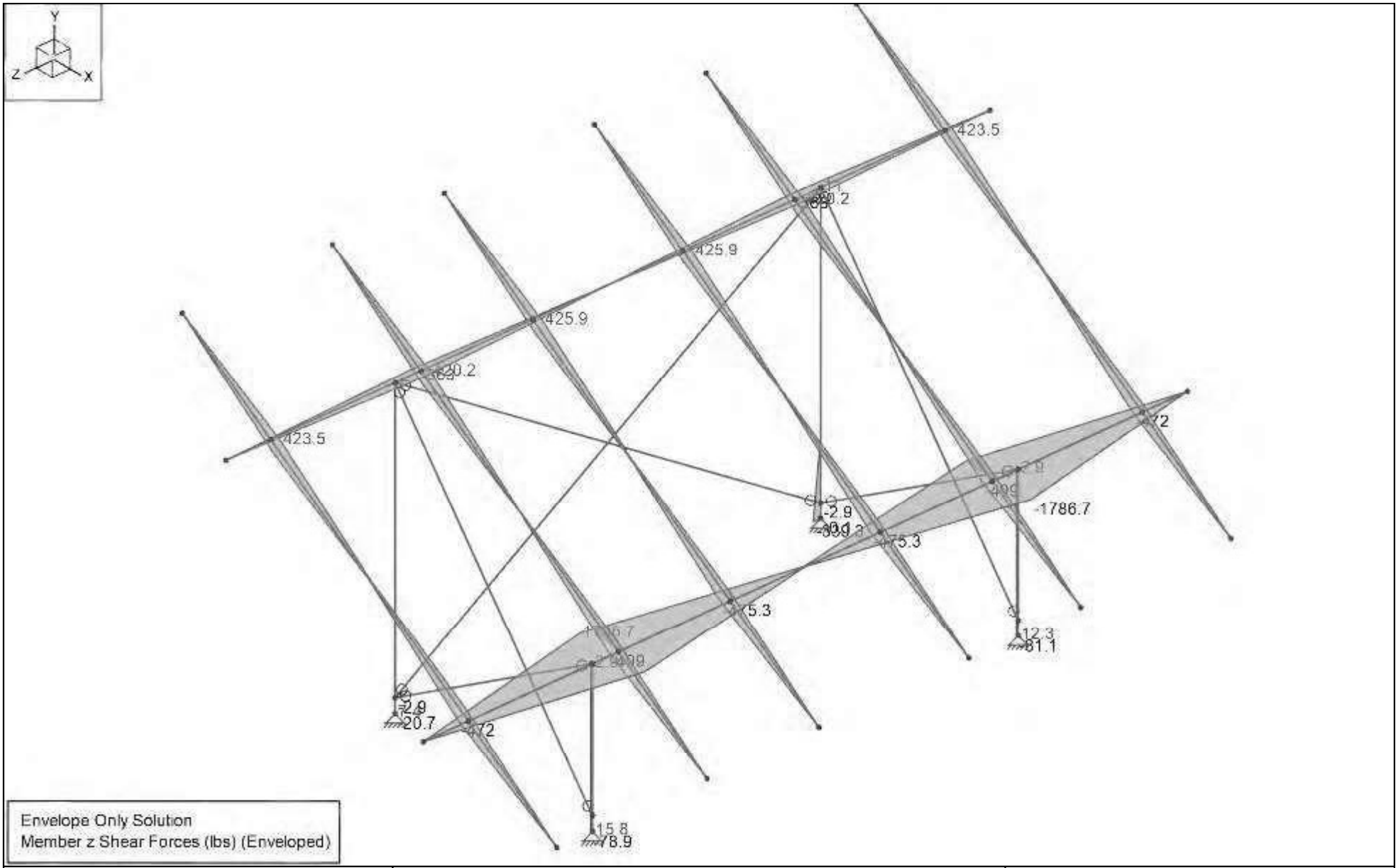
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-12
AB		Jul 28, 2022
OPR-		4x3-30-110,30-2leg-95X45 28-07.r3d



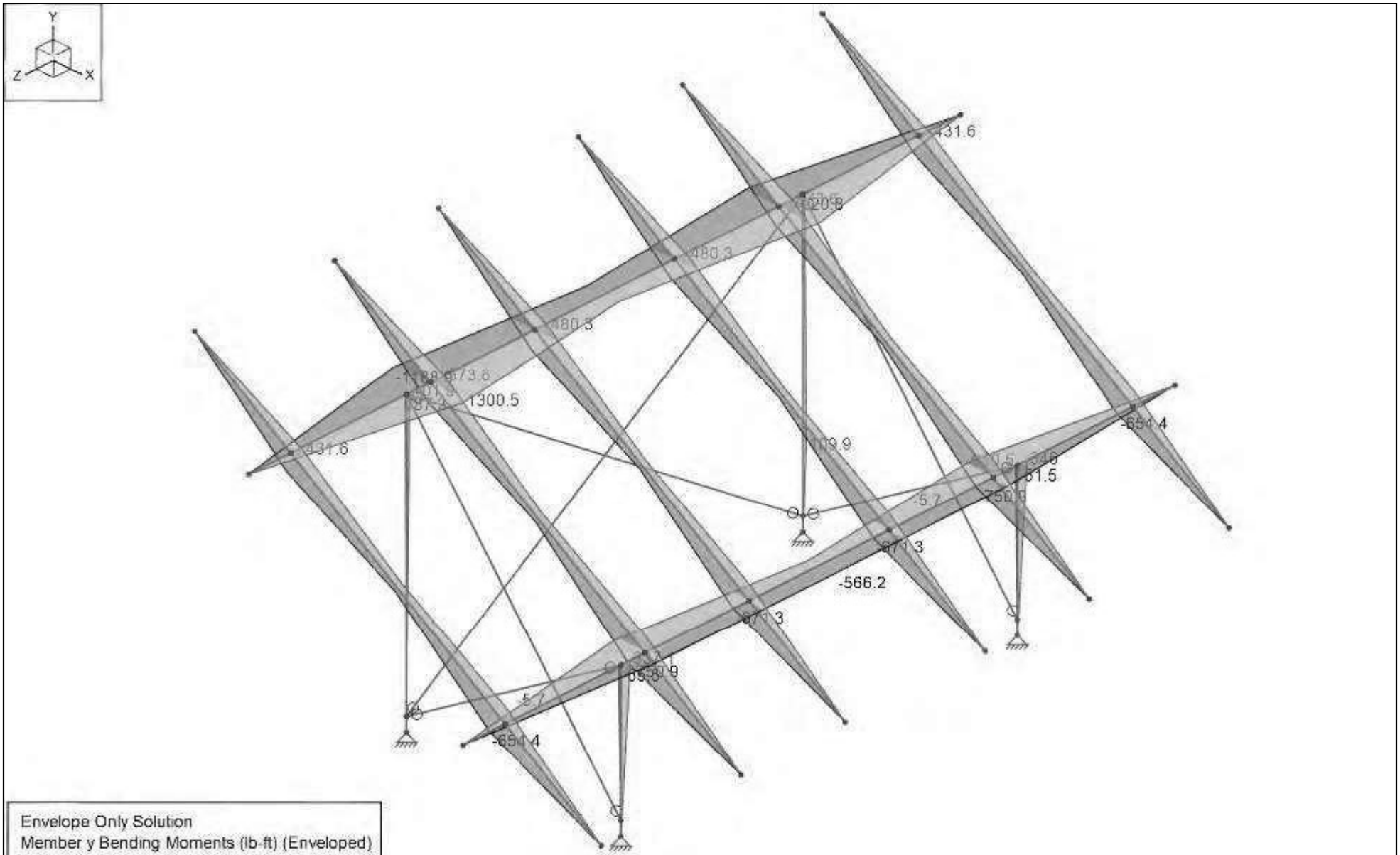
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-13
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



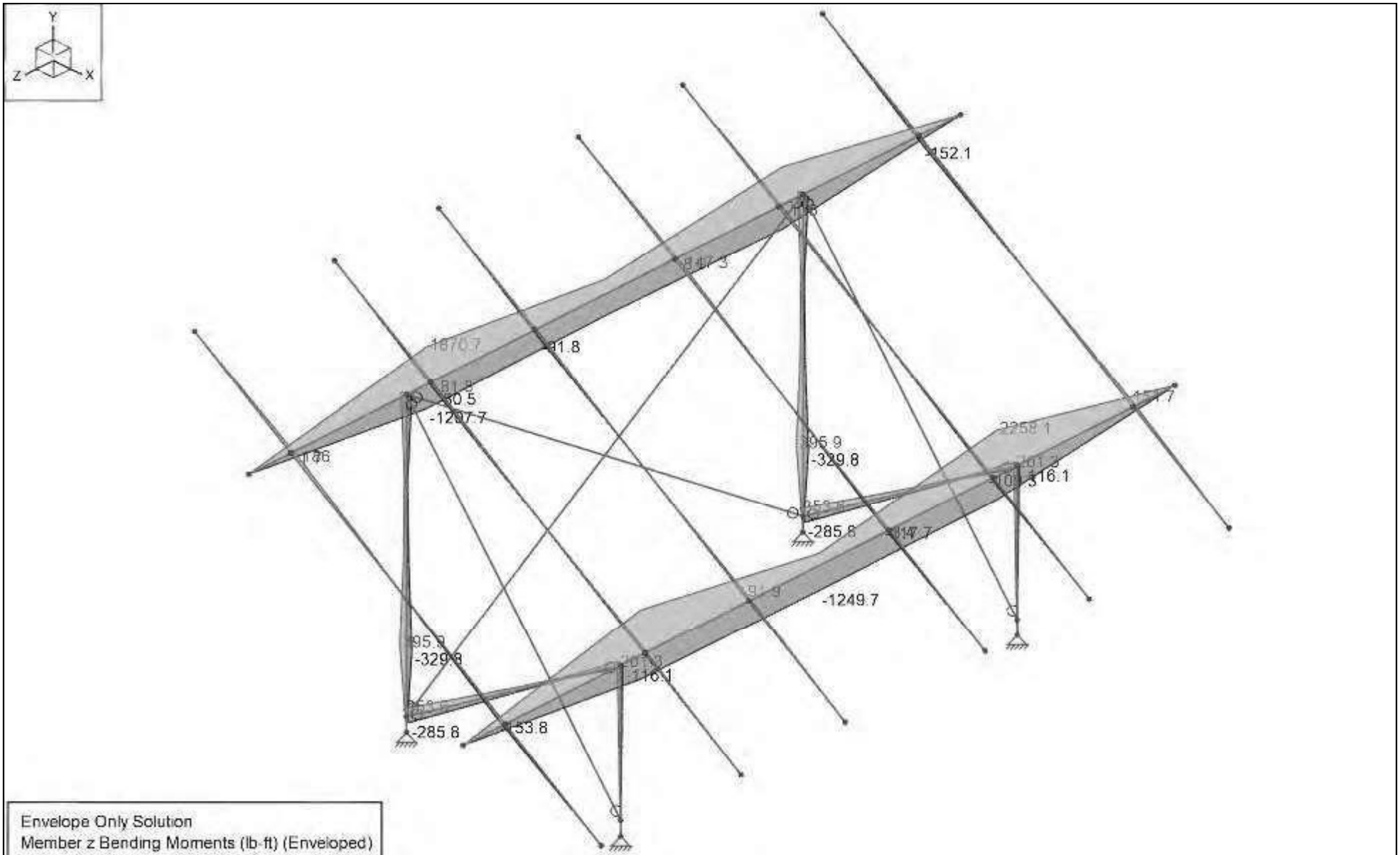
GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-14
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-15
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d

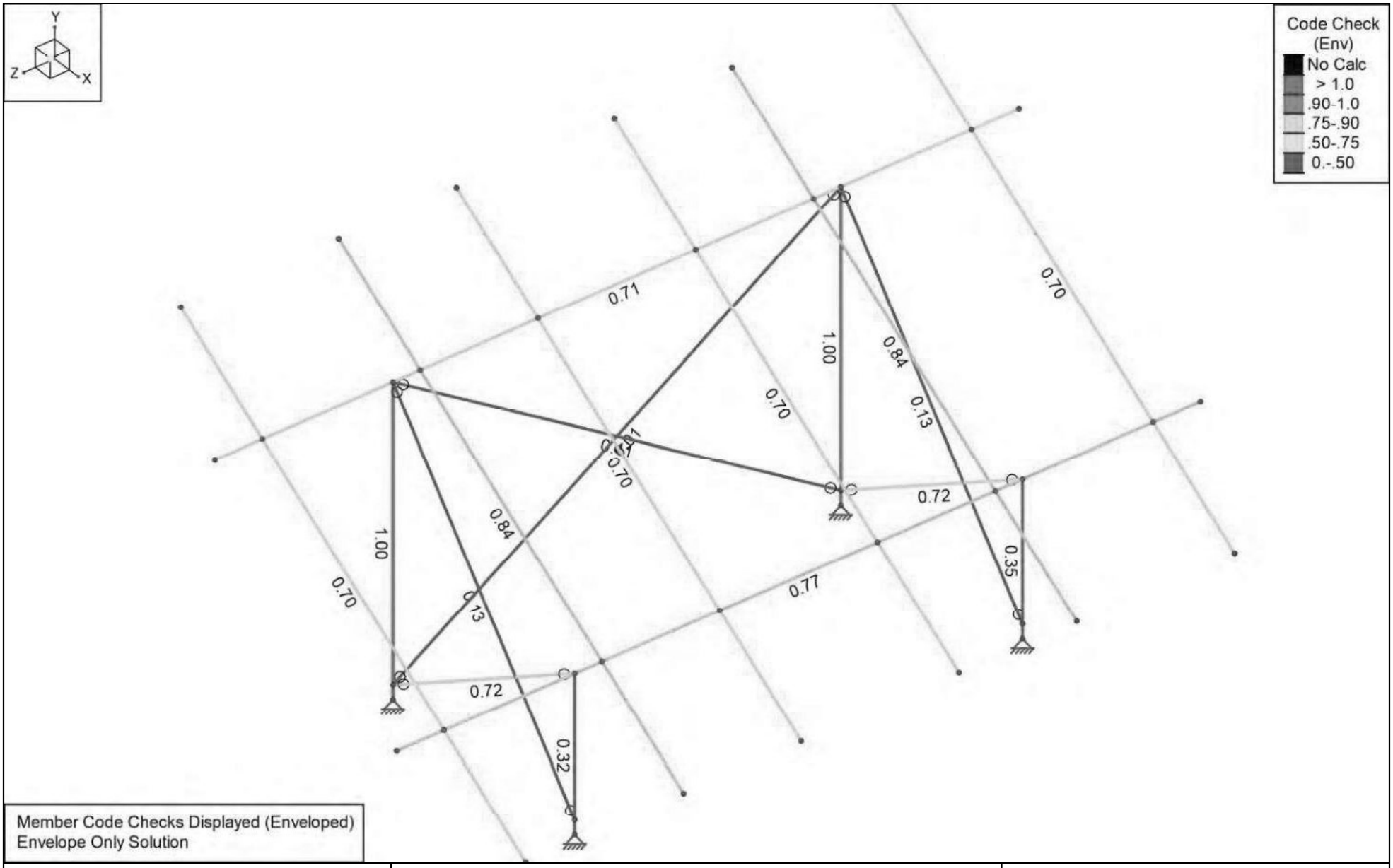


GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-16
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d

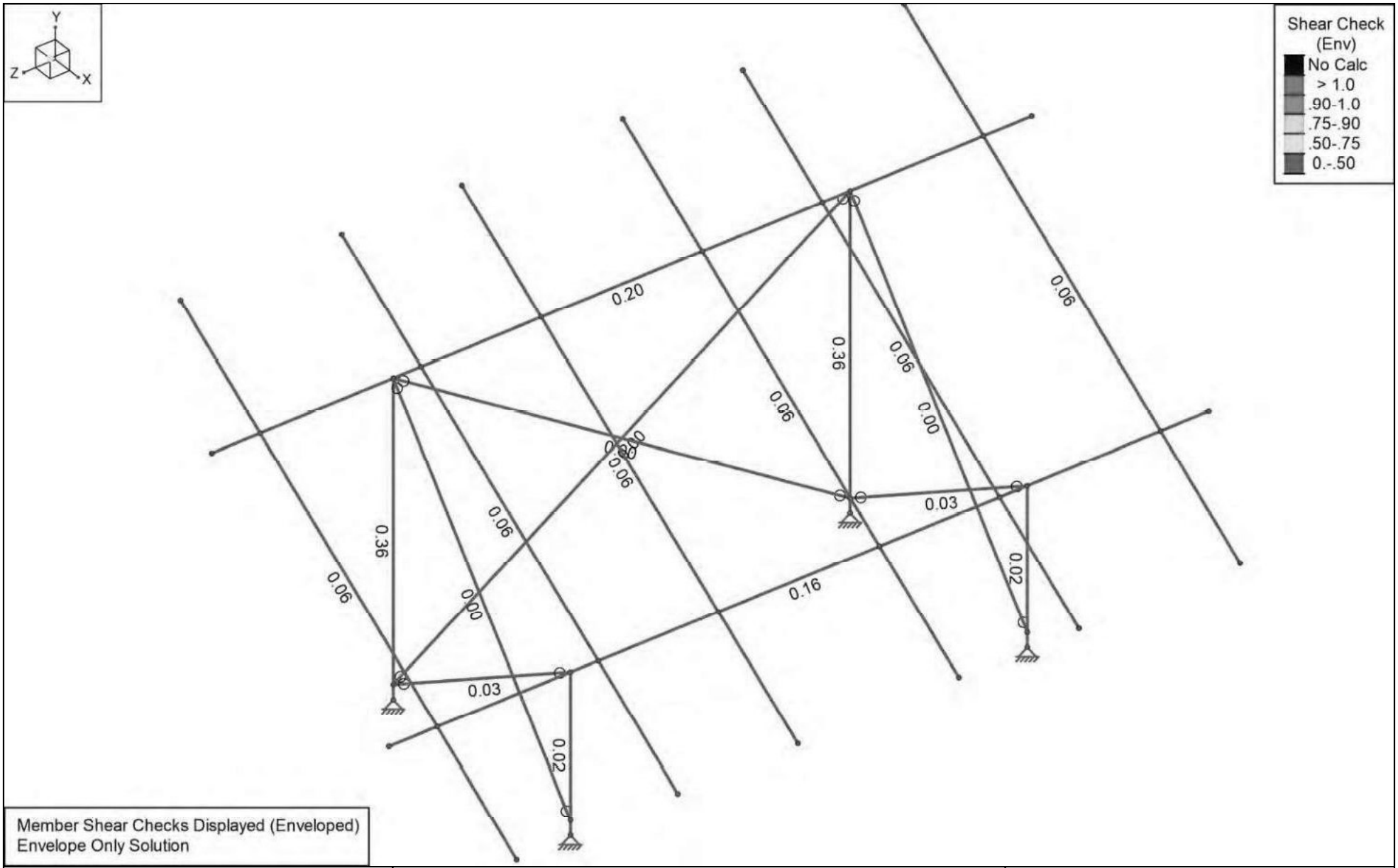


Envelope Only Solution
Member z Bending Moments (lb-ft) (Enveloped)

GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-17
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-18
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d



GWRE	4X3-30-110W,30S,3LEG-95"X45"	SK-19
AB		Jul 28, 2022
OPR		4x3-30-110,30-2leg-95X45 28-07.r3d

Node Coordinates

	Label	X [in]	Y [in]	Z [in]	Detach From Diaphragm
1	N19	31.5	58.4	-30.51104	
2	N20	31.5	58.4	249.48896	
3	N21	114	5.4	249.48896	
4	N22	114	5.4	-30.51104	
5	N33	31.5	-48.6	31.48896	
6	N34	114	-48.6	31.48896	
7	N35	31.5	-48.6	187.48896	
8	N36	114	-48.6	187.48896	
9	N65B	31.5	58.4	187.48896	
10	N66A	114	5.4	187.48896	
11	N59	31.5	58.4	31.48896	
12	N60	114	5.4	31.48896	
13	N59A	31.5	-43.6	187.48896	
14	N60B	114	-43.6	187.48896	
15	N61B	114	-43.6	31.48896	
16	N62	31.5	-43.6	31.48896	
17	N27	31.5	58.4	232.98896	
18	N28	114	5.4	-14.01104	
19	N29	31.5	58.4	177.98896	
20	N30	114	5.4	40.98896	
21	N31	31.5	58.4	136.98896	
22	N32	114	5.4	81.98896	
23	N37	31.5	58.4	81.98896	
24	N38	114	5.4	136.98896	
25	N42	31.5	58.4	40.98896	
26	N43	114	5.4	177.98896	
27	N44	31.5	58.4	-14.01104	
28	N45	114	5.4	232.98896	
29	N46	-5.5	82.169697	-14.01104	
30	N47	151	-18.369697	-14.01104	
31	N48	-5.5	82.169697	40.98896	
32	N49	151	-18.369697	40.98896	
33	N50	-5.5	82.169697	81.98896	
34	N52	151	-18.369697	81.98896	
35	N58	-5.5	82.169697	136.98896	
36	N61	151	-18.369697	136.98896	
37	N63	-5.5	82.169697	177.98896	

Node Coordinates (Continued)

	Label	X [in]	Y [in]	Z [in]	Detach From Diaphragm
38	N64	151	-18.369697	177.98896	
39	N65	-5.5	82.169697	232.98896	
40	N66	151	-18.369697	232.98896	

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^{5}°F^{-1}]	Density [k/ft^{3}]	Yield [ksi]	Ry	Fu [ksi]	Rt
1	A36 Gr.36	29000	11154	0.3	0.65	0.49	36	1.5	58	1.2
2	Cable	29000	11154	0.3	0.65	0	150	1.5	160	1.2
3	A572 Gr.50	29000	11154	0.3	0.65	0.49	50	1.1	65	1.1
4	A992	29000	11154	0.3	0.65	0.49	50	1.1	65	1.1
5	A500 Gr.42	29000	11154	0.3	0.65	0.49	42	1.4	58	1.3
6	A500 Gr.46	29000	11154	0.3	0.65	0.49	46	1.4	58	1.3
7	HR Grade 60	29000	11154	0.3	0.65	0.49	60	1.5	72	1.2
8	HR Grade 80	29000	11154	0.3	0.65	0.49	80	1.5	90	1.2
9	HR Grade 51.5	29000	11154	0.3	0.65	0.49	51.5	1.5	65	1.2

Cold Formed Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^{5}°F^{-1}]	Density [k/ft^{3}]	Yield [ksi]	Fu [ksi]
1	A570 Gr.33	29500	11346	0.3	0.65	0.49	33	52
2	A607 C1 Gr.55	29500	11346	0.3	0.65	0.49	55	70
3	Grade 50 Steel	29500	11346	0.3	0.65	0.49	50	65
4	Grade 60 Steel	29500	11346	0.3	0.65	0.49	60	72
5	Grade 80 Steel	29500	11346	0.3	0.65	0.49	80	90
6	Grade 51.5 Steel	29500	11346	0.3	0.65	0.49	51.5	65

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in^{2}]	Iyy [in^{4}]	Izz [in^{4}]	J [in^{4}]
1	Cable Brace	3.0MMCABLE	VBrace	BAR	Cable	Typical	0.011	1e-5	1e-5	1.9e-5
2	HSS4"x11GA	HSS4"X0.125	Beam	Pipe	HR Grade 51.5	Typical	1.519	2.854	2.854	5.707
3	HSS2.375"x14ga	HSS2.375"X14GA	Column	Tube	HR Grade 51.5	Typical	0.717	0.631	0.631	0.945
4	HSS2"X14GA	HSS2"X14GA	Column	Tube	HR Grade 51.5	Typical	0.6	0.37	0.37	0.554

Cold Formed Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	NS PURLIN	NSPURLIN	Beam	CS	Grade 51.5 Steel	Typical	0.846	0.62	0.372	0.004

Member Primary Data

	Label	I Node	J Node	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rule
1	M12	N20	N19		HSS4"x11GA	Beam	Pipe	HR Grade 51.5	Typical
2	M13	N22	N21		HSS4"x11GA	Beam	Pipe	HR Grade 51.5	Typical
3	M29A	N65B	N35		HSS2.375"x14ga	Column	Tube	HR Grade 51.5	Typical
4	M30B	N66A	N36		HSS2"X14GA	Column	Tube	HR Grade 51.5	Typical
5	M31A	N60	N34		HSS2"X14GA	Column	Tube	HR Grade 51.5	Typical
6	M32	N59	N33		HSS2.375"x14ga	Column	Tube	HR Grade 51.5	Typical
7	M35A	N59A	N59		Cable Brace	VBrace	BAR	Cable	Typical
8	M36	N65B	N62		Cable Brace	VBrace	BAR	Cable	Typical
9	M33	N59A	N66A		HSS2"X14GA	Column	Tube	HR Grade 51.5	Typical
10	M34	N65B	N60B		Cable Brace	VBrace	BAR	Cable	Typical
11	M37	N62	N60		HSS2"X14GA	Column	Tube	HR Grade 51.5	Typical
12	M38	N59	N61B		Cable Brace	VBrace	BAR	Cable	Typical
13	M26	N46	N47	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical
14	M27	N48	N49	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical
15	M28	N50	N52	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical
16	M29	N58	N61	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical
17	M30	N63	N64	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical
18	M31	N65	N66	270	NS PURLIN	Beam	CS	Grade 51.5 Steel	Typical

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Distributed
1	Dead	DL		-1		6
2	Snow	SL				6
3	Wind Uplift - Balanced	WL				6
4	Wind Uplift- Unbalanced	WL				12
5	Wind Down - Balanced	WL				6
6	Wind Down - Unbalanced	WL				12
7	Seismic - X	ELX	0.5			6
8	Seismic - Z	ELZ			0.5	6
9	Live	LL				

Basic Load Cases (Continued)

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Distributed
10	Diff. Settlement	EPL				
11	Self Weight	OL1		-1		

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	ASCE ASD 1	Yes	Y	DL	1										
2	ASCE ASD 2	Yes	Y	DL	1	LL	1	LLS	1						
3	ASCE ASD 3 (a)	Yes	Y	DL	1										
4	ASCE ASD 3 (b)	Yes	Y	DL	1	SL	1	SLN	1						
5	ASCE ASD 4 (b)	Yes	Y	DL	1	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
6	ASCE ASD 5 (a)	Yes	Y	DL	1	3	0.6								
7	ASCE ASD 5 (a)	Yes	Y	DL	1	4	0.6								
8	ASCE ASD 5 (a)	Yes	Y	DL	1	5	0.6								
9	ASCE ASD 5 (a)	Yes	Y	DL	1	6	0.6								
10	ASCE ASD 6 (a)	Yes	Y	DL	1	3	0.45	LL	0.75	LLS	0.75				
11	ASCE ASD 6 (a)	Yes	Y	DL	1	4	0.45	LL	0.75	LLS	0.75				
12	ASCE ASD 6 (a)	Yes	Y	DL	1	5	0.45	LL	0.75	LLS	0.75				
13	ASCE ASD 6 (a)	Yes	Y	DL	1	6	0.45	LL	0.75	LLS	0.75				
14	ASCE ASD 6 (c)	Yes	Y	DL	1	3	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
15	ASCE ASD 6 (c)	Yes	Y	DL	1	4	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
16	ASCE ASD 6 (c)	Yes	Y	DL	1	5	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
17	ASCE ASD 6 (c)	Yes	Y	DL	1	6	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
18	ASCE ASD 7	Yes	Y	DL	0.6	3	0.6								
19	ASCE ASD 7	Yes	Y	DL	0.6	4	0.6								
20	ASCE ASD 7	Yes	Y	DL	0.6	5	0.6								
21	ASCE ASD 7	Yes	Y	DL	0.6	6	0.6								
22	ASCE ASD 5 (b) (a)	Yes	Y	DL	1	ELX	0.7								
23	ASCE ASD 5 (b) (b)	Yes	Y	DL	1	ELZ	0.7								
24	ASCE ASD 6 (b) (a)	Yes	Y	DL	1	ELX	0.525	LL	0.75	LLS	0.75				
25	ASCE ASD 6 (b) (b)	Yes	Y	DL	1	ELZ	0.525	LL	0.75	LLS	0.75				
26	ASCE ASD 6 (d) (a)	Yes	Y	DL	1	ELX	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
27	ASCE ASD 6 (d) (b)	Yes	Y	DL	1	ELZ	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
28	ASCE ASD 8 (a)	Yes	Y	DL	0.6	ELX	0.7								
29	ASCE ASD 8 (b)	Yes	Y	DL	0.6	ELZ	0.7								
30	Diff. Settlement		Y	DL	1	EPL	1	5	0.6						
31	Self-Weight		Y	11	1										

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N35	max	2150.967	8	4318.53	8	6.741	19	0	29	0	29	0	29
2		min	-1905.034	6	-3716.193	19	-16.3	29	0	1	0	1	0	1
3	N36	max	100.137	20	2371.721	15	14.557	16	0	29	0	29	0	29
4		min	-24.391	18	-243.788	20	-72.697	29	0	1	0	1	0	1
5	N34	max	100.137	20	2371.721	15	11.456	18	0	29	0	29	0	29
6		min	-24.391	18	-243.788	20	-73.568	29	0	1	0	1	0	1
7	N33	max	2150.967	8	4318.53	8	-0.309	28	0	29	0	29	0	29
8		min	-1905.034	6	-3716.193	19	-338.148	23	0	1	0	1	0	1
9	Totals:	max	4500.445	8	10457.327	16	0	17						
10		min	-3857.395	6	-5151.307	18	-497.658	23						

Envelope Member Section Deflections - Service

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
1	M12	1	max	0	19	0.527	19	0.437	19	0.005	19	NC	28	NC	28
2			min	-0.399	23	-0.726	16	-0.464	8	-0.002	16	6129.772	23	4582.15	23
3		2	max	0	19	0.03	19	0.118	7	0.004	19	NC	14	NC	29
4			min	-0.399	23	-0.032	16	-0.135	20	-0.002	16	403.384	16	848.49	8
5		3	max	0	28	0.264	19	0.282	7	0.005	19	NC	28	NC	29
6			min	-0.399	23	-0.359	16	-0.266	20	-0.003	16	763.171	16	1311.321	16
7		4	max	0	4	0.03	19	0.118	7	0.004	19	NC	14	NC	29
8			min	-0.4	23	-0.032	16	-0.135	20	-0.002	16	403.384	16	848.49	8
9		5	max	0	4	0.527	19	0.437	19	0.005	19	NC	29	NC	29
10			min	-0.4	23	-0.726	16	-0.464	8	-0.002	16	NC	1	NC	1
11	M13	1	max	0.537	23	0.364	18	0.49	9	0.001	18	NC	29	NC	29
12			min	0	20	-0.75	17	-0.38	18	-0.005	9	NC	1	NC	1
13		2	max	0.537	23	0.001	20	0.106	20	0.001	18	NC	29	NC	29
14			min	0	20	-0.02	15	-0.093	6	-0.004	9	380.565	17	700.278	9
15		3	max	0.537	23	0.162	18	0.266	21	0.001	18	NC	29	NC	29
16			min	0	1	-0.388	17	-0.215	6	-0.005	9	774.457	17	1195.586	17
17		4	max	0.537	23	0.007	29	0.106	20	0.001	18	NC	14	NC	28
18			min	0	6	-0.02	15	-0.093	6	-0.004	9	380.565	17	700.278	9
19		5	max	0.537	23	0.364	18	0.49	9	0.001	18	NC	28	NC	28
20			min	0	14	-0.75	17	-0.38	18	-0.005	9	2352.124	23	2408.016	23
21	M29A	1	max	0.021	16	0.144	20	0	19	0.002	8	NC	29	NC	29
22			min	-0.017	19	-0.125	7	-0.399	23	-0.002	19	NC	1	NC	1

Envelope Member Section Deflections - Service (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
23		2	max	0.016	16	0.188	21	0.017	17	0.002	8	NC	29	NC	28
24			min	-0.013	19	-0.163	6	-0.353	23	-0.002	19	993.482	21	1980.194	23
25		3	max	0.011	16	0.266	20	0.018	17	0.002	8	NC	29	NC	28
26			min	-0.009	19	-0.229	6	-0.261	23	-0.001	19	505.734	21	1742.891	23
27		4	max	0.005	16	0.251	20	0.01	17	0.001	8	NC	29	NC	28
28			min	-0.005	19	-0.212	6	-0.137	23	-0.001	19	498.77	20	2855.848	23
29		5	max	0	29	0	29	0	29	0.001	27	NC	29	NC	29
30			min	0	1	0	1	0	1	-0.001	19	NC	1	NC	1
31	M30B	1	max	0.009	15	0.096	20	0	14	0.001	27	NC	29	NC	29
32			min	-0.001	20	-0.083	6	-0.537	23	0	20	807.888	7	NC	1
33		2	max	0.007	15	0.111	21	0.015	16	0.001	27	NC	29	NC	28
34			min	0	20	-0.088	6	-0.479	23	0	20	1107.527	9	711.427	23
35		3	max	0.005	15	0.099	9	0.017	16	0.001	27	NC	29	NC	28
36			min	0	20	-0.071	18	-0.355	23	0	20	939.266	9	620.847	23
37		4	max	0.002	15	0.058	9	0.011	16	0.001	27	NC	29	NC	28
38			min	0	20	-0.039	18	-0.189	23	0	20	1441.48	9	990.918	23
39		5	max	0	29	0	29	0	29	0.001	27	NC	29	NC	29
40			min	0	1	0	1	0	1	0	20	NC	1	NC	1
41	M31A	1	max	0.009	15	0.096	20	0	20	0	29	NC	29	NC	29
42			min	-0.001	20	-0.083	6	-0.537	23	-0.001	15	807.888	7	NC	1
43		2	max	0.007	15	0.111	21	0.012	18	0	29	NC	29	NC	28
44			min	0	20	-0.088	6	-0.481	23	-0.001	15	1107.527	9	693.081	23
45		3	max	0.005	15	0.099	9	0.013	18	0	29	NC	29	NC	28
46			min	0	20	-0.071	18	-0.358	23	-0.001	15	939.266	9	604.805	23
47		4	max	0.002	15	0.058	9	0.008	18	0	29	NC	29	NC	28
48			min	0	20	-0.039	18	-0.19	23	-0.001	15	1441.48	9	965.219	23
49		5	max	0	29	0	29	0	29	0	29	NC	29	NC	29
50			min	0	1	0	1	0	1	-0.001	15	NC	1	NC	1
51	M32	1	max	0.021	16	0.144	20	0	4	0.002	19	NC	29	NC	29
52			min	-0.017	19	-0.125	7	-0.4	23	-0.002	8	NC	1	NC	1
53		2	max	0.016	16	0.188	21	0.007	18	0.002	19	NC	29	NC	28
54			min	-0.013	19	-0.163	6	-0.378	23	-0.002	8	993.482	21	1363.795	23
55		3	max	0.011	16	0.266	20	0.006	18	0.001	19	NC	29	NC	28
56			min	-0.009	19	-0.229	6	-0.311	23	-0.002	8	505.734	21	961.72	23
57		4	max	0.005	16	0.251	20	0.002	18	0.001	29	NC	29	NC	28
58			min	-0.005	19	-0.212	6	-0.188	23	-0.001	8	498.77	20	1217.804	23
59		5	max	0	29	0	29	0	29	0.002	29	NC	29	NC	29

Envelope Member Section Deflections - Service (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
60			min	0	1	0	1	0	1	-0.001	8	NC	1	NC	1
61	M35A	1	max	0.001	15	0.014	23	0.062	6	0.01	6	NC	29	NC	29
62			min	-0.022	23	-0.002	16	-0.074	20	-0.011	20	NC	1	NC	1
63		2	max	0.003	19	0.065	23	0.078	6	0.007	6	NC	29	NC	29
64			min	-0.1	23	-0.006	16	-0.091	20	-0.008	20	NC	1	NC	1
65		3	max	0.005	19	0.116	23	0.093	6	0.005	19	NC	29	NC	29
66			min	-0.179	23	-0.01	16	-0.109	20	-0.006	8	NC	1	NC	1
67		4	max	0.007	19	0.166	23	0.109	6	0.004	19	NC	29	NC	29
68			min	-0.257	23	-0.014	16	-0.127	20	-0.003	8	NC	1	NC	1
69		5	max	0.01	19	0.217	23	0.125	7	0.002	19	NC	29	NC	29
70			min	-0.336	23	-0.018	16	-0.144	20	-0.001	14	NC	1	NC	1
71	M36	1	max	0.011	16	0.015	19	0.125	7	0.002	19	NC	29	NC	29
72			min	-0.332	23	-0.221	23	-0.144	20	-0.001	14	NC	1	NC	1
73		2	max	0.008	16	0.011	19	0.109	6	0.004	19	NC	29	NC	29
74			min	-0.257	23	-0.172	23	-0.127	20	-0.003	8	NC	1	NC	1
75		3	max	0.005	16	0.008	19	0.093	6	0.005	19	NC	29	NC	29
76			min	-0.183	23	-0.122	23	-0.109	20	-0.006	8	NC	1	NC	1
77		4	max	0.003	8	0.004	19	0.078	6	0.007	6	NC	29	NC	29
78			min	-0.108	23	-0.072	23	-0.091	20	-0.008	20	NC	1	NC	1
79		5	max	0	20	0.001	18	0.062	6	0.01	6	NC	29	NC	29
80			min	-0.034	23	-0.022	23	-0.074	20	-0.011	20	NC	1	NC	1
81	M33	1	max	0.054	6	0.037	20	0.026	23	0.004	23	NC	29	NC	29
82			min	-0.064	20	-0.031	6	-0.002	17	-0.001	16	NC	1	NC	1
83		2	max	0.058	6	0.219	20	0.159	23	0.003	23	NC	29	NC	29
84			min	-0.069	20	-0.187	6	-0.001	17	0	17	535.773	20	NC	1
85		3	max	0.062	6	0.222	21	0.289	23	0.002	23	NC	29	NC	29
86			min	-0.073	20	-0.188	6	-0.001	17	0	7	518.998	21	NC	1
87		4	max	0.066	6	0.142	21	0.415	23	0.002	23	NC	29	NC	29
88			min	-0.078	20	-0.112	6	0	17	-0.001	7	924.631	21	NC	1
89		5	max	0.07	6	0.05	20	0.537	23	0.001	8	NC	29	NC	29
90			min	-0.082	20	-0.045	6	0	14	-0.001	19	NC	1	NC	1
91	M34	1	max	0.069	6	0.108	19	0.399	23	0.002	16	NC	29	NC	29
92			min	-0.077	20	-0.124	8	0	19	-0.001	18	NC	1	NC	1
93		2	max	0.054	6	0.082	19	0.317	23	0.003	27	NC	29	NC	29
94			min	-0.061	20	-0.097	8	-0.001	16	-0.001	18	NC	1	NC	1
95		3	max	0.04	6	0.058	18	0.235	23	0.005	23	NC	29	NC	29
96			min	-0.045	20	-0.07	8	-0.002	16	0	18	NC	1	NC	1

Envelope Member Section Deflections - Service (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
97		4	max	0.025	6	0.035	18	0.153	23	0.007	23	NC	29	NC	29
98			min	-0.029	20	-0.043	8	-0.003	16	0	18	NC	1	NC	1
99		5	max	0.01	6	0.011	18	0.071	23	0.009	23	NC	29	NC	29
100			min	-0.014	21	-0.018	9	-0.004	16	0	20	NC	1	NC	1
101	M37	1	max	0.054	6	0.037	20	0.04	23	0.006	23	NC	29	NC	29
102			min	-0.064	20	-0.031	6	0	18	-0.001	18	NC	1	NC	1
103		2	max	0.058	6	0.219	20	0.17	23	0.005	23	NC	29	NC	29
104			min	-0.069	20	-0.187	6	0	18	0	18	535.773	20	NC	1
105		3	max	0.062	6	0.222	21	0.296	23	0.003	23	NC	29	NC	29
106			min	-0.073	20	-0.188	6	0	18	0	20	518.998	21	NC	1
107		4	max	0.066	6	0.142	21	0.418	23	0.002	23	NC	29	NC	29
108			min	-0.078	20	-0.112	6	0	18	-0.001	20	924.631	21	NC	1
109		5	max	0.07	6	0.05	20	0.537	23	0.001	19	NC	29	NC	29
110			min	-0.082	20	-0.045	6	0	20	-0.001	8	NC	1	NC	1
111	M38	1	max	0.069	6	0.108	19	0.4	23	0.001	18	NC	29	NC	29
112			min	-0.077	20	-0.124	8	0	4	-0.002	16	NC	1	NC	1
113		2	max	0.054	6	0.082	19	0.318	23	0.002	29	NC	29	NC	29
114			min	-0.061	20	-0.097	8	-0.001	18	-0.002	16	NC	1	NC	1
115		3	max	0.04	6	0.058	18	0.236	23	0.005	23	NC	29	NC	29
116			min	-0.045	20	-0.07	8	-0.002	18	-0.001	16	NC	1	NC	1
117		4	max	0.025	6	0.035	18	0.154	23	0.007	23	NC	29	NC	29
118			min	-0.029	20	-0.043	8	-0.002	18	-0.001	17	NC	1	NC	1
119		5	max	0.01	6	0.011	18	0.072	23	0.009	23	NC	29	NC	29
120			min	-0.014	21	-0.018	9	-0.003	18	-0.001	15	NC	1	NC	1
121	M26	1	max	0.151	14	0.131	16	0.928	19	0.012	19	NC	29	NC	29
122			min	-0.092	20	-0.383	29	-0.921	16	-0.015	16	NC	1	NC	1
123		2	max	0.15	14	0.002	19	0.464	19	0.012	19	NC	28	NC	29
124			min	-0.092	20	-0.402	23	-0.57	16	-0.015	16	2108.368	16	544.91	16
125		3	max	0.15	14	0.028	19	0.415	18	0.01	18	NC	29	NC	29
126			min	-0.091	20	-0.473	23	-0.621	16	-0.015	16	2386.691	19	662.202	16
127		4	max	0.15	14	0.007	15	0.35	18	0.01	18	NC	29	NC	28
128			min	-0.091	20	-0.534	23	-0.57	17	-0.017	17	1925.552	15	521.191	17
129		5	max	0.15	14	0.031	20	0.568	18	0.01	18	NC	29	NC	29
130			min	-0.091	20	-0.599	23	-1.044	17	-0.017	17	NC	1	NC	1
131	M27	1	max	0.088	6	0.053	19	0.49	19	0.003	16	NC	29	NC	29
132			min	-0.096	20	-0.423	23	-0.411	16	-0.003	19	NC	1	NC	1
133		2	max	0.088	6	0.005	16	0.083	19	0.003	16	NC	28	NC	14

Envelope Member Section Deflections - Service (Continued)

	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
134			min	-0.096	20	-0.4	23	-0.098	8	-0.003	19	2710.282	16	571.082	16
135		3	max	0.086	6	0.026	8	0.114	18	0.003	16	NC	29	NC	29
136			min	-0.094	20	-0.478	23	-0.147	8	-0.002	18	2100.546	19	707.074	16
137		4	max	0.083	6	0.002	20	0.046	18	0.003	17	NC	28	NC	29
138			min	-0.091	20	-0.537	23	-0.057	8	-0.002	18	2645.242	15	497.524	17
139		5	max	0.083	6	0.089	15	0.263	18	0.003	17	NC	29	NC	29
140			min	-0.091	20	-0.536	23	-0.493	9	-0.002	18	NC	1	NC	1
141	M28	1	max	0.146	14	0.001	20	0.747	19	0.006	16	NC	29	NC	29
142			min	-0.078	20	-0.426	23	-0.682	16	-0.005	19	NC	1	NC	1
143		2	max	0.146	14	0.004	4	0.297	19	0.006	16	NC	28	8704.184	28
144			min	-0.078	20	-0.399	23	-0.324	16	-0.005	19	2532.138	27	531.894	16
145		3	max	0.147	14	0.008	19	0.259	18	0.006	16	NC	29	NC	29
146			min	-0.078	20	-0.475	23	-0.376	16	-0.003	18	7829.055	7	642.751	16
147		4	max	0.147	14	0	19	0.202	18	0.006	17	NC	28	NC	29
148			min	-0.079	20	-0.537	23	-0.331	17	-0.003	18	3780.76	27	507.859	17
149		5	max	0.147	14	0.077	4	0.422	18	0.006	17	NC	29	NC	29
150			min	-0.079	20	-0.542	23	-0.8	9	-0.003	18	NC	1	NC	1
151	M29	1	max	0.146	14	0.077	4	0.747	19	0.005	19	NC	29	NC	29
152			min	-0.078	20	-0.395	29	-0.682	16	-0.006	16	NC	1	NC	1
153		2	max	0.146	14	0	20	0.297	19	0.005	19	NC	28	NC	29
154			min	-0.078	20	-0.401	23	-0.324	16	-0.006	16	4053.229	15	531.894	16
155		3	max	0.147	14	0.007	8	0.259	18	0.003	18	NC	29	NC	29
156			min	-0.078	20	-0.475	23	-0.376	16	-0.006	16	7829.055	7	642.751	16
157		4	max	0.147	14	0.004	4	0.202	18	0.003	18	NC	29	NC	28
158			min	-0.079	20	-0.535	23	-0.331	17	-0.006	17	4148.11	16	507.859	17
159		5	max	0.147	14	0.007	19	0.422	18	0.003	18	NC	29	NC	29
160			min	-0.079	20	-0.574	23	-0.8	9	-0.006	17	NC	1	NC	1
161	M30	1	max	0.088	6	0.091	16	0.49	19	0.003	19	NC	29	NC	29
162			min	-0.096	20	-0.399	29	-0.411	16	-0.003	16	NC	1	NC	1
163		2	max	0.088	6	0.003	19	0.083	19	0.003	19	NC	28	NC	29
164			min	-0.096	20	-0.4	23	-0.098	8	-0.003	16	2710.282	16	571.082	16
165		3	max	0.086	6	0.032	19	0.114	18	0.002	18	NC	29	NC	29
166			min	-0.094	20	-0.477	23	-0.147	8	-0.003	16	2100.546	19	707.074	16
167		4	max	0.083	6	0.005	15	0.046	18	0.002	18	NC	29	NC	28
168			min	-0.091	20	-0.536	23	-0.057	8	-0.003	17	2645.242	15	497.524	17
169		5	max	0.083	6	0.033	20	0.263	18	0.002	18	NC	29	NC	29
170			min	-0.091	20	-0.561	23	-0.493	9	-0.003	17	NC	1	NC	1

Envelope Member Section Deflections - Service (Continued)

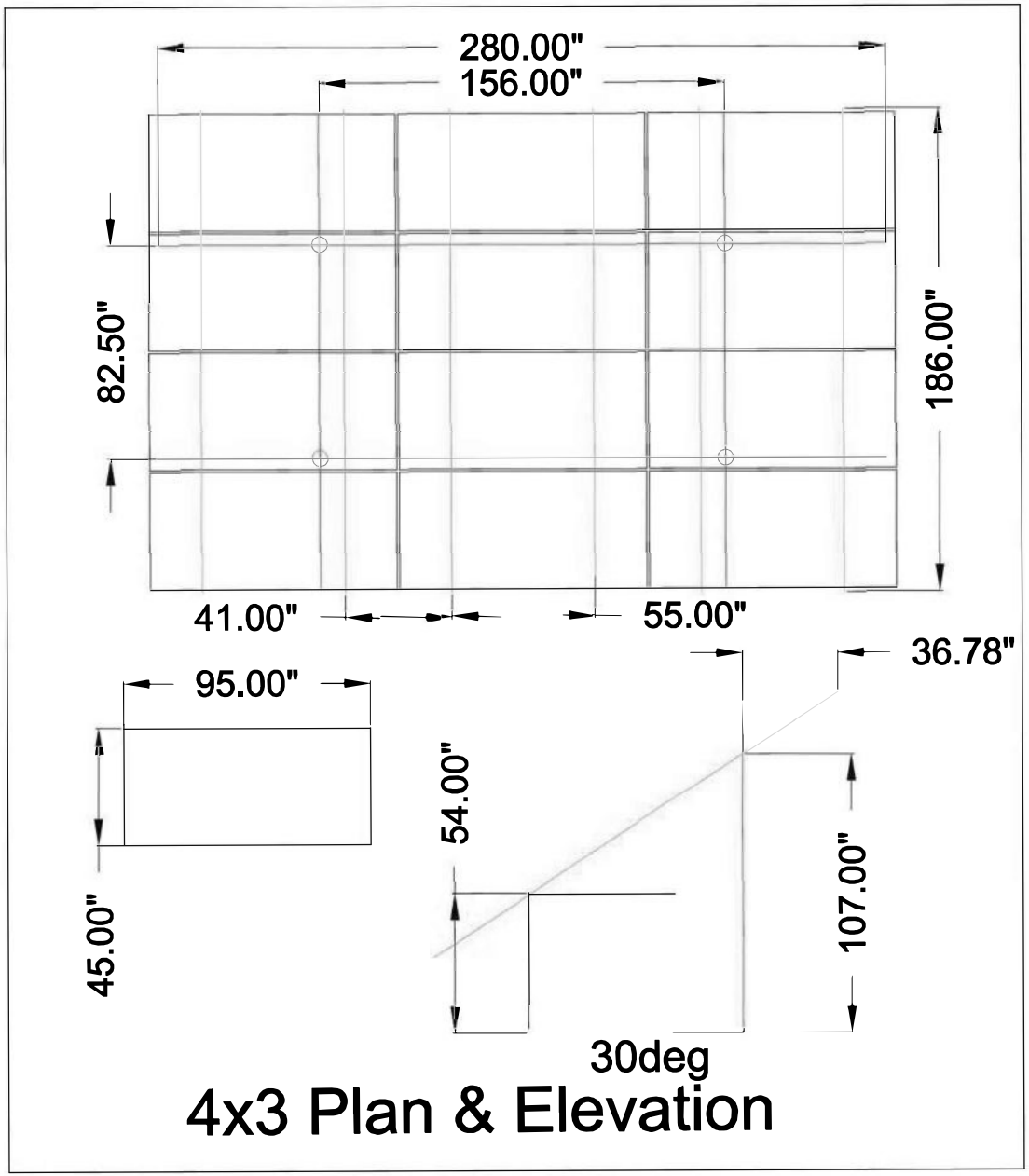
	Member	Sec		x [in]	LC	y [in]	LC	z [in]	LC	x Rotate [rad]	LC	(n) L/y' Ratio	LC	(n) L/z' Ratio	LC
171	M31	1	max	0.151	14	0.031	19	0.928	19	0.015	16	NC	29	NC	29
172			min	-0.092	20	-0.433	27	-0.921	16	-0.012	19	NC	1	NC	1
173		2	max	0.15	14	0.007	16	0.464	19	0.015	16	NC	28	8586.728	29
174			min	-0.092	20	-0.399	23	-0.57	16	-0.012	19	1977.833	27	544.91	16
175		3	max	0.15	14	0.023	8	0.415	18	0.015	16	NC	29	NC	29
176			min	-0.091	20	-0.473	23	-0.621	16	-0.01	18	2386.691	19	662.202	16
177		4	max	0.15	14	0.002	20	0.35	18	0.017	17	NC	29	NC	29
178			min	-0.091	20	-0.537	23	-0.57	17	-0.01	18	1925.552	15	521.191	17
179		5	max	0.15	14	0.141	15	0.568	18	0.017	17	NC	29	NC	29
180			min	-0.091	20	-0.547	29	-1.044	17	-0.01	18	NC	1	NC	1

Envelope AISC 14TH (360-10): ASD Member Steel Code Checks

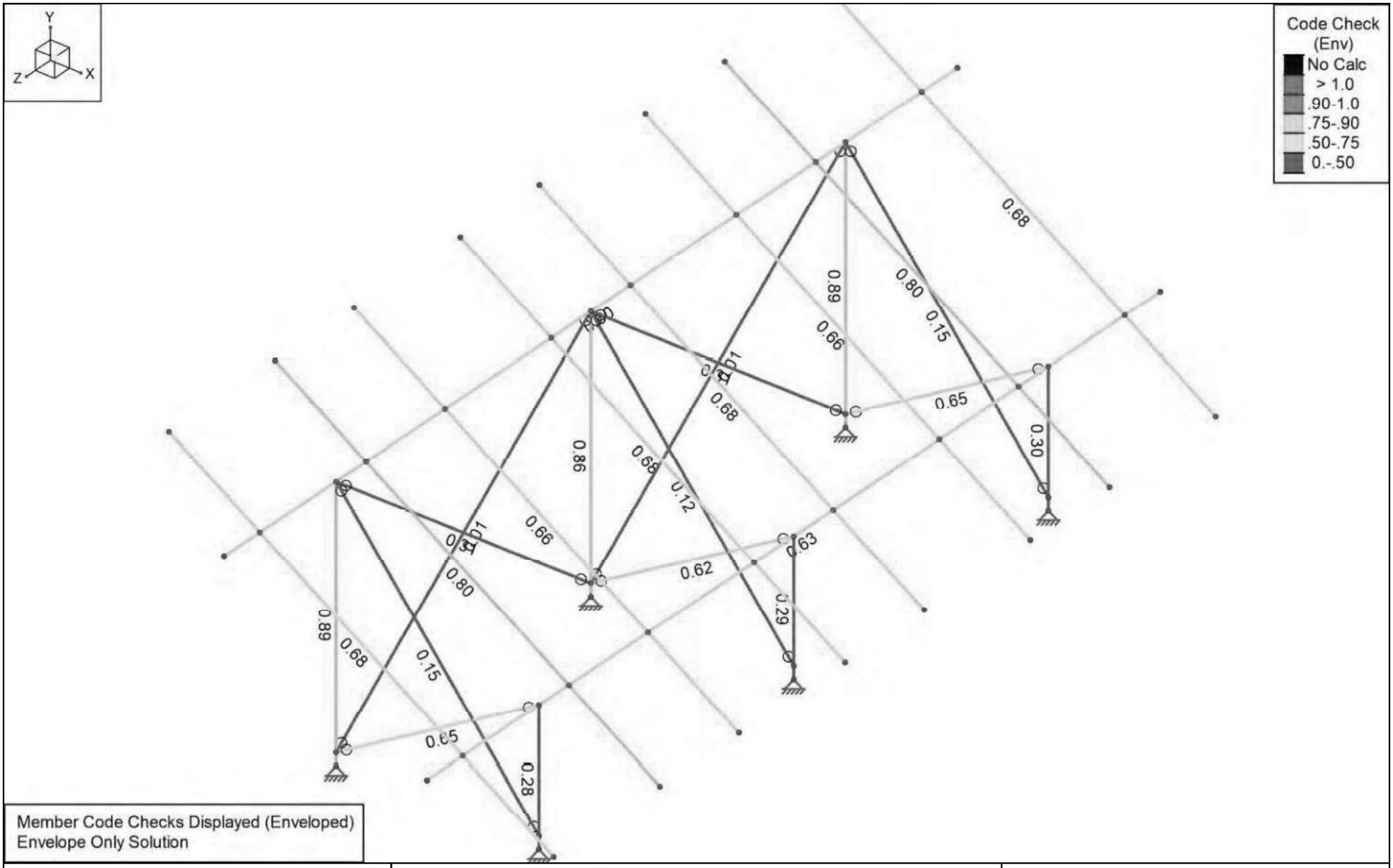
	Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn
1	M12	HSS4"X0.125	0.711	218.75	16	0.199	215.833		16	43100.663	46829.228	4815.458	4815.458	1	H1-1b
2	M13	HSS4"X0.125	0.768	218.75	17	0.157	215.833		17	43100.663	46829.228	4815.458	4815.458	1	H1-1b
3	M29A	HSS2.375"X14GA	1	102.542	8	0.364	107	y	8	8283.238	22100.716	1558.333	1558.333	2.527	H1-1a
4	M30B	HSS2"X14GA	0.323	0	23	0.019	54	y	8	12952.26	18492.632	1111.323	1111.323	1.663	H1-1b
5	M31A	HSS2"X14GA	0.349	0	27	0.019	54	y	8	12952.26	18492.632	1111.323	1111.323	1.653	H1-1b
6	M32	HSS2.375"X14GA	1	102.542	8	0.364	107	y	8	8283.238	22100.716	1558.333	1558.333	2.527	H1-1a
7	M35A	3.0MMCABLE	0.012	186.387	19	0.001	186.387		6	0.043	982.275	2.03	2.03	1	H1-1b*
8	M36	3.0MMCABLE	0.413	186.387	23	0.001	186.387		6	0.043	982.275	2.03	2.03	1	H1-1a*
9	M33	HSS2"X14GA	0.725	0	8	0.026	0	y	8	6037.11	18492.632	1111.323	1111.323	2.201	H1-1a
10	M34	3.0MMCABLE	0.125	131.188	20	0.001	131.188		29	0.087	982.275	2.03	2.03	1	H1-1b*
11	M37	HSS2"X14GA	0.725	0	8	0.033	95.954	y	23	6037.11	18492.632	1111.323	1111.323	2.201	H1-1a
12	M38	3.0MMCABLE	0.125	131.188	20	0	131.188		8	0.087	982.275	2.03	2.03	1	H1-1b*

Envelope AISI S100-10: ASD Member Cold Formed Steel Code Checks

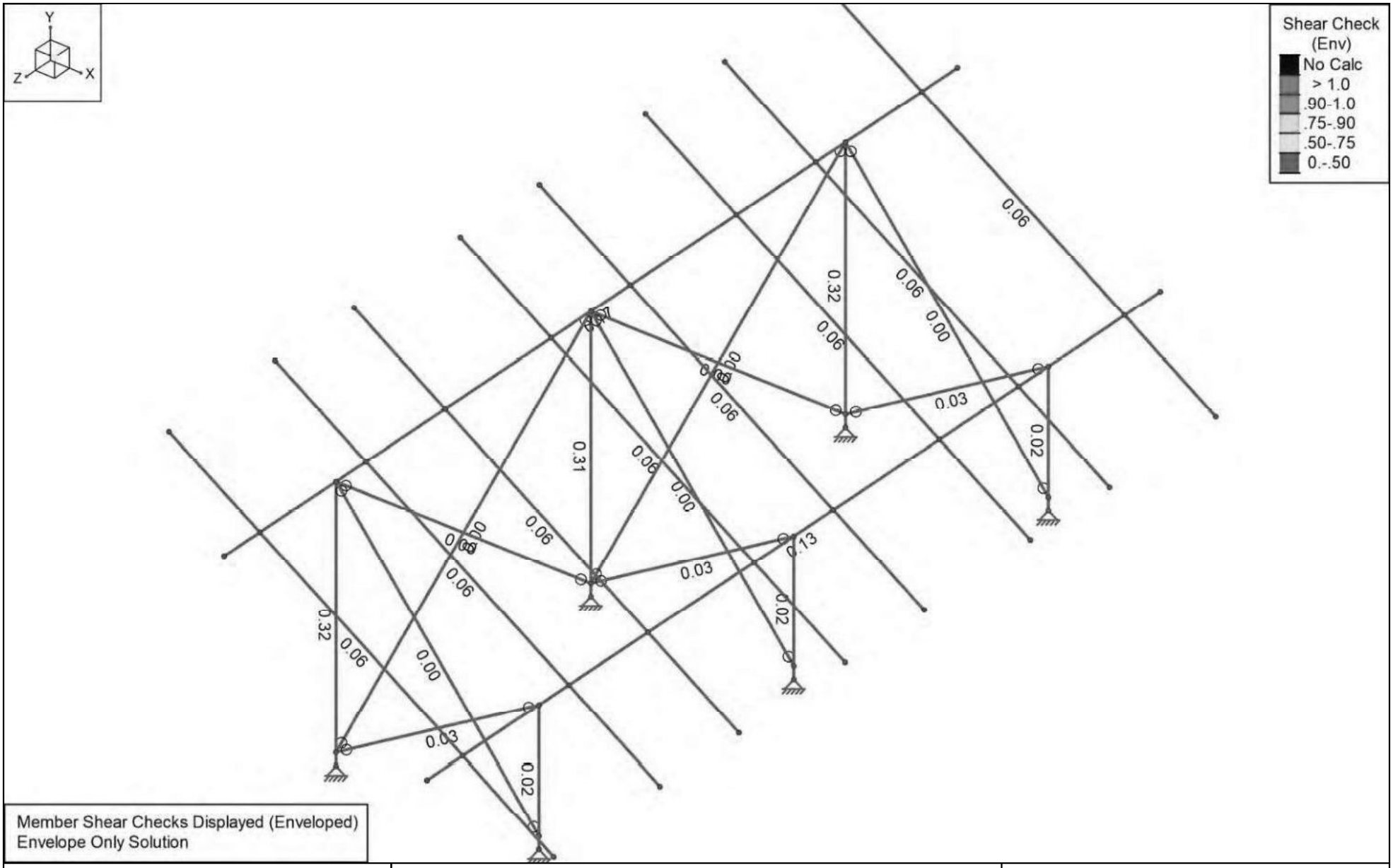
	Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pn/Om[lb]	Tn/Om[lb]	Mnyy/Om[lb-ft]	Mnzz/Om[lb-ft]	Cb	Cmyy	Cmzz	Eqn
1	M26	NSPURLIN	0.702	141.447	17	0.06	141.447	z	17	7723.227	26095.313	1232.913	1157.296	1	0.85	0.6	C5.2.1-2
2	M27	NSPURLIN	0.845	44.565	19	0.061	141.447	z	17	7723.227	26095.313	1027.555	1157.296	1	0.85	0.6	C5.2.1-2
3	M28	NSPURLIN	0.7	141.447	17	0.059	141.447	z	17	7723.227	26095.313	1232.913	1157.296	1	0.85	0.6	C5.2.1-2
4	M29	NSPURLIN	0.7	141.447	17	0.059	141.447	z	17	7723.227	26095.313	1232.913	1157.296	1	0.85	0.6	C5.2.1-2
5	M30	NSPURLIN	0.845	44.565	19	0.061	141.447	z	17	7723.227	26095.313	1027.555	1157.296	1	0.85	0.6	C5.2.1-2
6	M31	NSPURLIN	0.702	141.447	17	0.06	141.447	z	17	7723.227	26095.313	1232.913	1157.296	1	0.85	0.6	C5.2.1-2



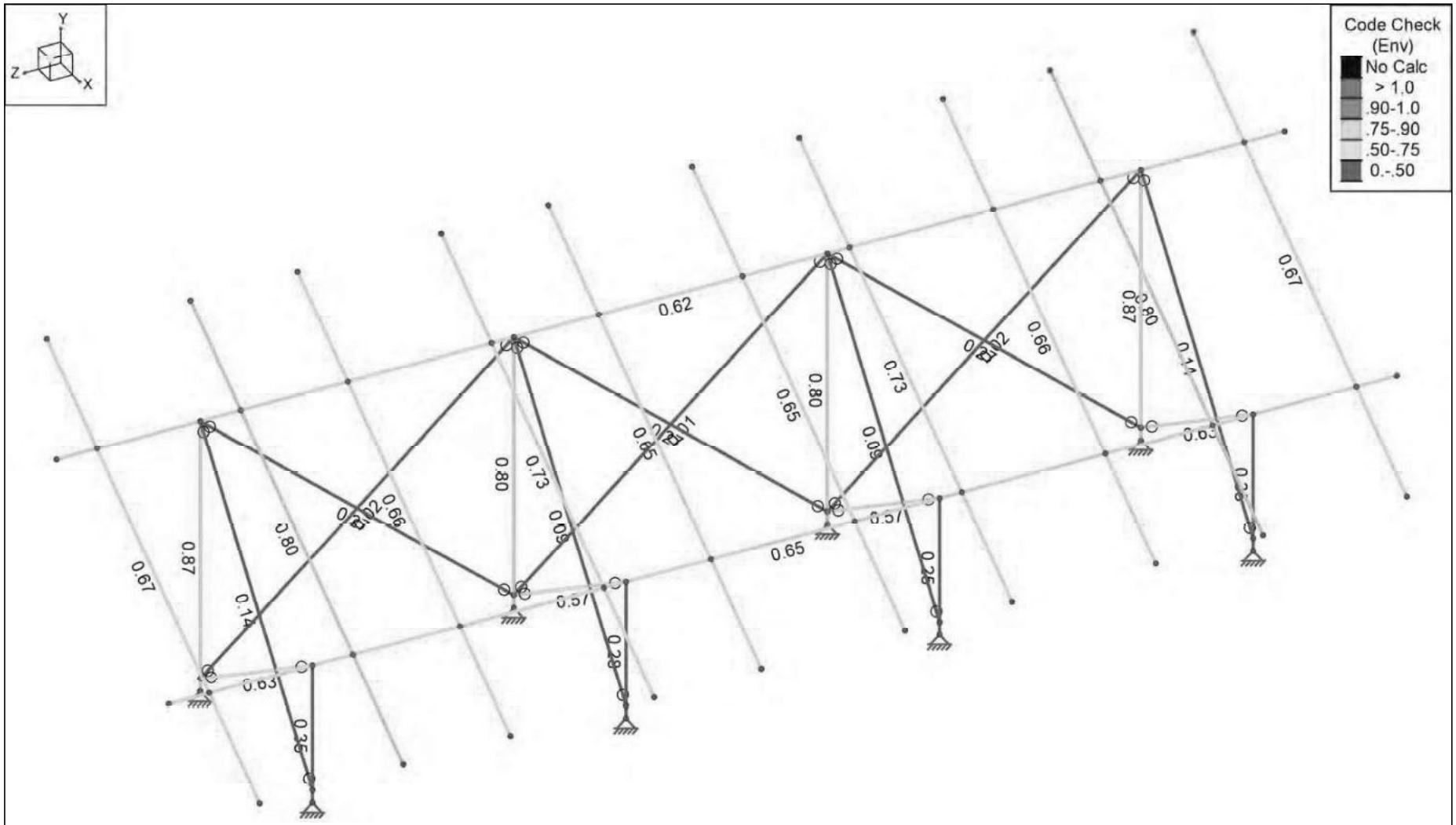
4x3 Plan & Elevation



GWRE	4X4-30-110W,30S,3LEG-95"X45"	SK-18
AB		Jul 28, 2022
OPR-LITE		4x4-30-110,30-3leg-95X45_28-07.r3d

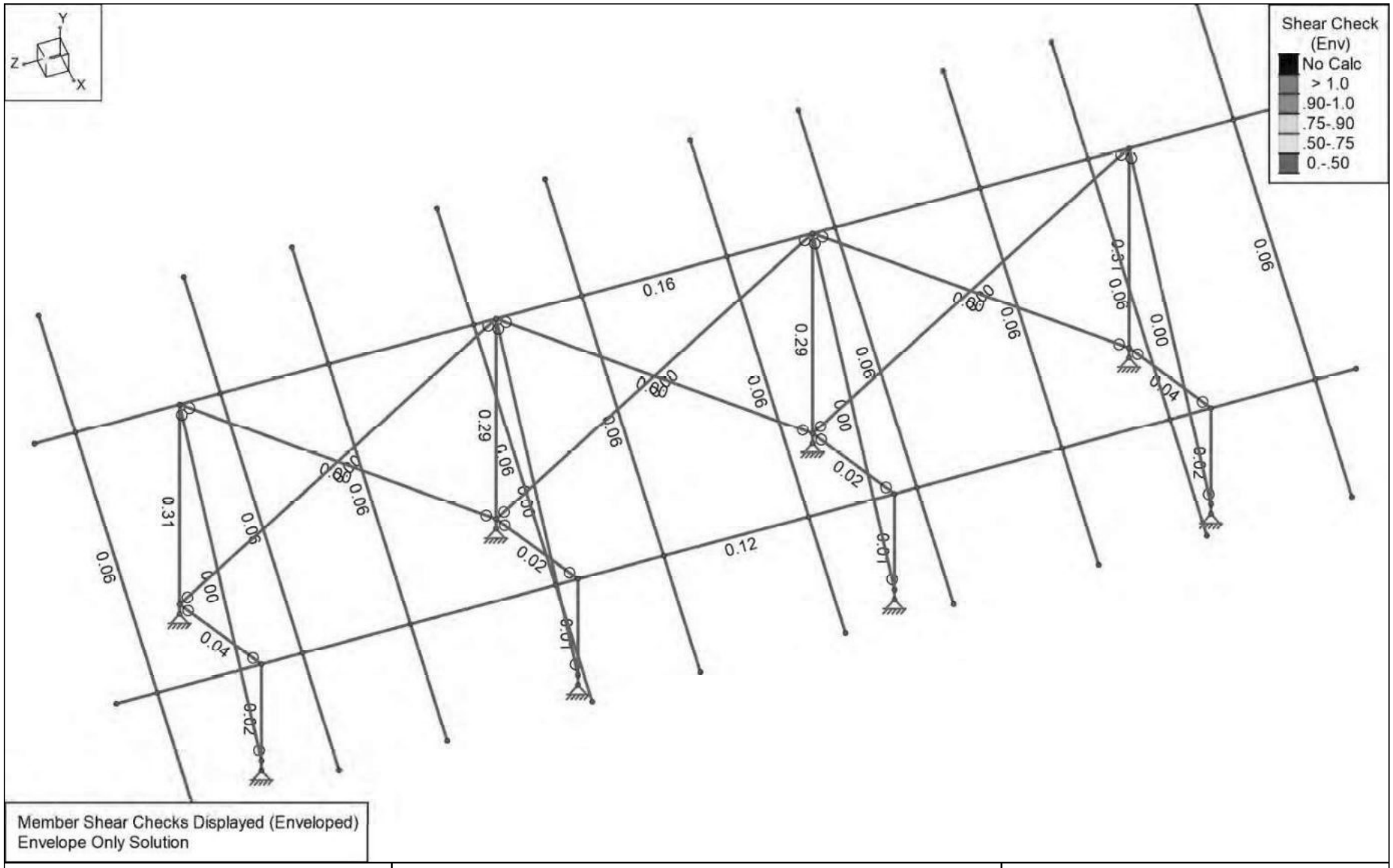


GWRE	4X4-30-110W,30S,3LEG-95"X45"	SK-19
AB		Jul 28, 2022
OPR-LITE		4x4-30-110,30-3leg-95X45_28-07.r3d



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

GWRE	4X5-30-110W,30S,4LEG-95"X45"	SK-18
AB		Jul 28, 2022
OPR		4x5-30-110,30-4leg-95X45_28-07.r3d



GWRE	4X5-30-110W,30S,4LEG-95"X45"	SK-19
AB		Jul 28, 2022
OPR		4x5-30-110,30-4leg-95X45_28-07.r3d

Bolted Connection Capacity Equations and Results:

Typical Bolt Size	1/2" A325 Gr5
U-Bolt Size	3/8" A325 Gr5

1/2" Bolt Capacities

Allowable Tension	8,835 lbs
Allowable Single Shear, SS	5,301 lbs
Allowable Double Shear,DS	10,602 lbs
Bearing Strength, 14ga (min t)	4,477 lbs (SS) 8,955 lbs (DS)
Worst Case Uplift	3,716 lbs
Worst Case Compression	4,318 lbs

These loads happen at the bearing location where the rear legs transfer loads to the base plate. Per equation J3-6a, the bolt strength controls the failure of this connection. Allowable double shear capacity for this connection is 10,602 lbs which is greater than the applied loads of either 3,716 lbs or 4,318 lbs. Therefore, the connection passes.

3/8" Bolt Capacities

Allowable Tension	4,970 lbs
Allowable Single Shear, SS	2,982 lbs
Allowable Double Shear,DS	5,964 lbs
Bearing Strength, 10ga (min t)	7,169 lbs (SS) 14,338 lbs (DS)
Bracket Pull through Strength	3,465 lbs (2 holes)
Worst Case Uplift	2,464 lbs

This load is calculated by using the worst case unbalanced wind load applied to each purlin. That load was then transferred to the east-west beam. The connection from the east-west beam to the top of each leg resists this load primarly through the tensile capacity of the steel bolts and the pull through capacity of the U-bracket atop the leg. The tensile load applied is 2,464 lbs being resisted by 3/8" U-bolts that have a factored tensile capacity of 4,970 lbs. The pull through capacity of the 10ga steel bracket is 1,732 lbs per hole. The U-Bolt anchors through (2) holes on the bracket, thus giving a total capacity of 3,464 lbs. Therefore, the connection is sufficient to resist the applied vertical loading. The required shear loading is minimal due to the design of the structure in comparison to uplift or bearing pressure and does not control.

Appendix A

Approved Anchor List

- Gripple TLA3
- Gripple TLA4
- Western Green Falcon F80
- Western Green Falcon F120
- Western Green Falcon F170
- Milspec Friction Flare Rock Anchors F5F 5/8" threaded rod (ASTM A307A)

Note: Any anchors outside of this table shall be approved by Nuance Energy and supplied for the SSM

TLA3 Anchor Ultimate Strength

Product Data Sheet

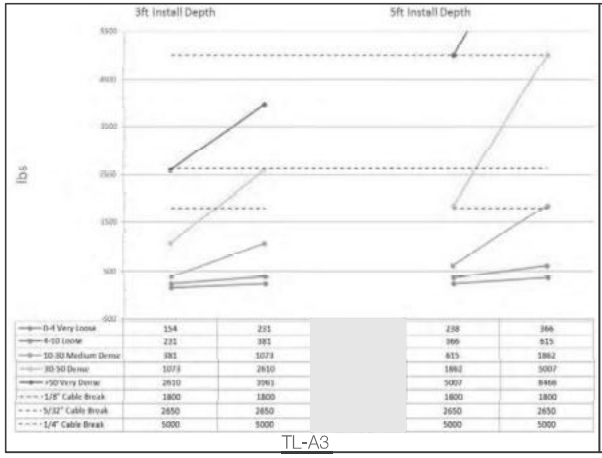
Terra-Lock™ Earth Percussion Anchors are designed to provide drive efficiency and maximize load capacity across a wide range of applications. The Terra-A3 Anchor is made of Corrosion resistant Zinc Aluminum and will provide the holding capacity your project needs for many years.

Component	Type	Material	Test Method	Physical Properties
Anchor Head	TLA3	Zinc-Aluminum Alloy - ZA 2 (1)	ASTM B-240-10	5.00" x 1.62" x 1.23" (L x W x H) Bearing Area: 6 in^2

(1) Corrosion resistant pressure die cast zinc alloy

Performance Properties	Value	Data
Ultimate Anchor Pull Out(3)	lbs	5,000

(3) Value based on an install depth of 5ft in very dense soil.



TL-A3

SPT Count & Gripple Anchor Performance

General information

The Standard penetration test (SPT) is widely used to determine the strength and deformation properties of the course soil.

Approximate correlation of properties of drained granular soil are:

Very Loose	SPT 0–4
Loose	SPT 4-10
Medium Dense	SPT 10-30
Dense	SPT 30-50
Very Dense	> 50

These figures can then be used to obtain typical shear strength and bulk unit weight for each soil.

This information is then used to predict Gripple Anchor Performance in relation to the conditions described.

The following graphs are derived from idealized theoretical calculations and should be used as a guide only. The variability of soil types should always be taken into account and on-site testing should always be carried out in order to obtain more accurate results.

Gripple Inc | 1611 Emily Lane | Aurora | IL 60502 USA
Tel +1 866 474 7753 Fax +1 800 654 0689 email grippleinc@gripple.com

TLA4 Anchor Ultimate Strength

Product Data Sheet

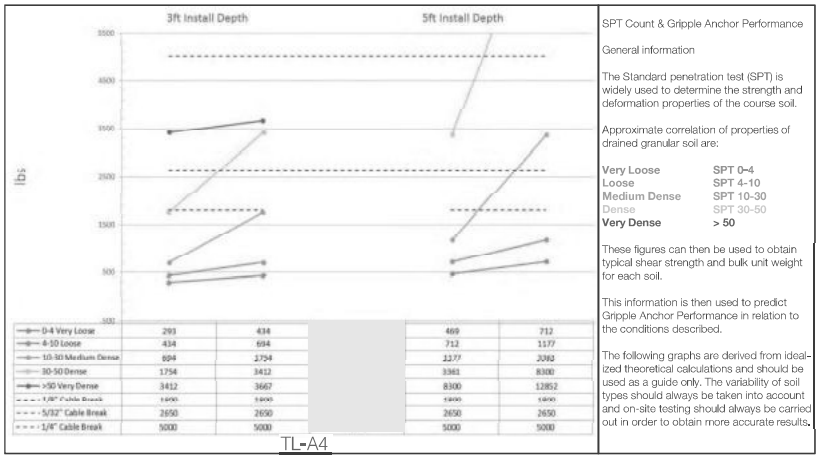
Terra-Lock™ Earth Percussion Anchors are designed to provide drive efficiency and maximize load capacity across a wide range of applications. The Terra-Lock™ A4 Anchor is Gripple's largest anchor. It is made of corrosion resistant Zinc Aluminum and will provide the holding capacity your project needs for many years.

Component	Type	Material	Test Method	Physical Properties
Anchor Head	TLA4	Zinc-Aluminum Alloy - ZA 2 (1)	ASTM B-240-10	6.50" x 2.36" x 1.40" (L x W x H) Bearing Area: 12 in^2

(1) Corrosion resistant pressure die cast zinc alloy

Performance Properties	Value	Data
Ultimate Anchor Pull Out(3)	lbs	8,300

(3) Value based on an install depth of 5ft in very dense soil.



TL-A4

SPT Count & Gripple Anchor Performance

General information

The Standard penetration test (SPT) is widely used to determine the strength and deformation properties of the course soil.

Approximate correlation of properties of drained granular soil are:

Very Loose	SPT 0-4
Loose	SPT 4-10
Medium Dense	SPT 10-30
Dense	SPT 30-50
Very Dense	> 50

These figures can then be used to obtain typical shear strength and bulk unit weight for each soil.

This information is then used to predict Gripple Anchor Performance in relation to the conditions described.

The following graphs are derived from idealized theoretical calculations and should be used as a guide only. The variability of soil types should always be taken into account and on-site testing should always be carried out in order to obtain more accurate results.

Gripple Inc | 1611 Emily Lane | Aurora | IL 60502 USA
Tel +1 866 474 7753 Fax +1 800 654 0689 email grippleinc@gripple.com

MATERIAL PROPERTY DATA SHEET

FALCON ANCHORS™

F80-X-Z SERIES

PATENT PENDING

Specifications

Falcon Percussion Driven Anchors (PDAs) are designed to provide drive efficiency and maximize load capability across a wide range of applications. The F80-X-Z assembly consists of a top plate that allows for vegetation establishment with one-way wire grip, tethered to a deep-seated earth anchor. Once the anchor is driven into the ground, typically 3 feet (0.9 m), the top plate is secured to the ground and held fast, holding an HPTRM or structure firmly in place. The anchor and top plate of the F80-X-Z are cast in the USA. The assembly is fabricated in the USA. The F80-X-Z assembly allows for re-tensioning, negates the need for time consuming cable crimping and comes fully assembled.

Typical Pullout Resistance*		
Soil Type	Install Depth	
	3 ft	5 ft
Loose (SPT > 4)	150	250
Medium (SPT > 10)	450	650
Dense (SPT > 30)	1,100	2,000
Very Dense (SPT > 50)	2,000	4,000

System Performance	
Typical Anchor Load*	750 lbs
Maximum Working Load	1,300 lbs
Ultimate Assembly Strength	1,500 lbs
Ultimate Cable Strength	2,000 lbs

Assembly Components†		Physical Properties
Top Plate	Zinc-aluminum alloy	Diameter: 4.0” (100 mm) Thickness: 0.11” (2.8 mm) Open Area: 50%
Grip	Spring-loaded crush roller	Ceramic
Cable	Zinc-aluminum coated steel	Diameter: 1/8” (3.1 mm)
Anchor	Zinc-aluminum alloy	3.1 L x 1.3 W x 1.1 H inches (80 L x 33 W x 28 H mm) Bearing Area: 3.0 in^2 (20 cm^2)
Length	Varies	F80-X-Z3: 3 ft (0.9 m) F80-X-Z6: 6 ft (1.8 m) Additional Lengths Available

Typical Use
Upgraded strength, light duty assembly - used for standard ARVS systems

* Soil dependent value.

† Assembly is shown as standard configuration. Cable lengths and other components may be customized as required.

WESTERN GREEN

North American Green • 5401 St. Wendel-Cynthiana Rd • Poseyville, In. 47633 • (800) 772-2040
Western Excelsior • 4609 E. Boonville-New Harmony Rd • Evansville, In. 47725 • (866) 540-9810

nagreen.com • westernexcelsior.com

MATERIAL PROPERTY DATA SHEET

FALCON ANCHORS™

F120-SW-Z Series

PATENT PENDING

Specifications

Falcon Percussion Driven Anchors (PDAs) are designed to provide drive efficiency and maximize load capability across a wide range of applications. The F120-SW-Z assembly consists of a top plate that allows for vegetation establishment with one-way wire grip, tethered to a deep-seated earth anchor. Once the anchor is driven into the ground, typically 6 feet (1.8 m), the top plate is secured to the ground and held fast, holding an HPTRM or structure firmly in place. The anchor and cable grip of the F120-SW-Z are cast in the USA. The assembly is fabricated in the USA. The F120-SW-Z assembly allows for re-tensioning, negates the need for time consuming cable crimping and comes fully assembled.

Typical Pullout Resistance*		
Soil Type	Install Depth	
	3 ft	5 ft
Loose (SPT > 4)	300	450
Medium (SPT > 10)	750	1,250
Dense (SPT > 30)	1,750	3,250
Very Dense (SPT > 50)	3,250	> 5,000

System Performance	
Typical Anchor Load*	2,500 lbs
Maximum Working Load	2,700 lbs
Ultimate Assembly Strength	3,000 lbs
Ultimate Cable Strength	7,000 lbs

Components†		Physical Properties
Top Plate	Zinc-aluminum alloy inert with plastisol coated steel plate	Diameter: 6.0” (150 mm) Thickness: 0.13” (3.0 mm) Open Area: 50%
Grip	Spring-loaded crush roller	Ceramic
Cable	Zinc-aluminum coated steel	Diameter: 1/4” (6.35 mm)
Anchor	Zinc-aluminum alloy	4.7 L x 1.6 W x 1.3 H inches (120 L x 40 W x 32 H mm) Bearing Area: 6.0 in^2 (39 cm^2)
Length	Varies	F120-SW-Z3: 3ft (0.9 m) F120-SW-Z6: 6 ft (1.8 m) Additional Lengths available

Typical Use
Heavy duty assembly for standard ARVS systems

* Soil dependent value.

† Assembly is shown as standard configuration. Cable lengths and other components may be customized as required.

WESTERN GREEN

North American Green • 5401 St. Wendel-Cynthiana Rd • Poseyville, In. 47633 • (800) 772-2040
Western Excelsior • 4609 E. Boonville-New Harmony Rd • Evansville, In. 47725 • (866) 540-9810

nagreen.com • westernexcelsior.com

MATERIAL PROPERTY DATA SHEET

FALCON ANCHORS™

F170-SW-Z Series

PATENT PENDING

Specifications

Falcon Percussion Driven Anchors (PDAs) are designed to provide drive efficiency and maximize load capability across a wide range of applications. The F170-SW-Z assembly consists of a top plate that allows for vegetation establishment with one-way wire grip, tethered to a deep-seated earth anchor. Once the anchor is driven into the ground, typically 6 feet (1.8 m), the top plate is secured to the ground and held fast, holding an HPTRM or structure firmly in place. The anchor and cable grip of the F170-SW-Z are cast in the USA. The assembly is fabricated in the USA. The F170-SW-Z assembly allows for re-tensioning, negates the need for time consuming cable crimping and comes fully assembled.

Typical Pullout Resistance*		
Soil Type	Install Depth	
	3 ft	5 ft
Loose (SPT > 4)	550	950
Medium (SPT > 10)	1,250	2,250
Dense (SPT > 30)	2,500	5,500
Very Dense (SPT > 50)	3,500	8,000

System Performance	
Typical Anchor Load*	3,000 lbs
Maximum Working Load	3,500 lbs
Ultimate Assembly Strength	3,800 lbs
Ultimate Cable Strength	7,000 lbs

Components†		Physical Properties
Top Plate	Zinc-aluminum alloy inert with plastisol coated steel plate	Diameter: 6.0” (150 mm) Thickness: 0.13” (3.0 mm) Open Area: 55%
Grip	Spring-loaded crush roller	Ceramic
Cable	Zinc-aluminum coated steel	Diameter: 1/4” (6.35 mm)
Anchor	Zinc-aluminum alloy	6.7 L x 2.2 W x 1.5 H inches (170 L x 55 W x 39 H mm) Bearing Area: 12.2 in^2 (79 cm^2)
Length	Varies	F170-SW-Z3: 3 ft (0.9 m) F170-SW-Z6: 6 ft (1.8 m) Additional Lengths Available

Typical Use
Heavy duty assembly for soft soils in standard ARVS systems

* Soil dependent value.

† Assembly is shown as standard configuration. Cable lengths and other components may be customized as required.

WESTERN GREEN

North American Green • 5401 St. Wendel-Cynthiana Rd • Poseyville, In. 47633 • (800) 772-2040
Western Excelsior • 4609 E. Boonville-New Harmony Rd • Evansville, In. 47725 • (866) 540-9810

nagreen.com • westernexcelsior.com

New Technology: Friction Flair Rock Anchors

F1FR® Reccommended for resin. Available with straight or friction flair bail.

F1F® Recommended for general use. Available with straight or friction flair bail.

F3F® Recommended for general use. Available with straight or friction flair bail.

FLF® Recommended for soft or friable strata. Available with friction flair and popout bail features.

F5F® Recommended for general use. Available with straight or friction flair bail.

F8F® Recommended for general use. Available with straight or friction flair bail.

F9F® Recommended for general use. Available with straight or friction flair bail.

Style	Thread Size UNC or (metric)	Drill Hole Size in. (mm)	Shell Length In.	Wedge Length In.	Non-Seizure Load Lbs.
F1FR*	5/8 (M16)	1-1/32 (26) & 1-1/16 (27)	2-1/8	1-5/8	18000
F1F*	5/8 (M16)	1-1/32 (26) & 1-1/16 (27)	2-1/8	1-5/8	18000
F3F*	5/8 (M16)	1-3/16 (30) & 1-1/4 (32)	2-1/8	1-3/4	22500
FLF*	5/8 (M16)	1-1/4 (32)	3-1/4	2-1/8	18000
F5F*	5/8 (M16)	1-3/8 (35)	2-7/8	2	22500
F5F*	3/4 (M20)	1-3/8 (35)	2-7/8	2	30000
F8F*	3/4 (M20)	1-5/8 (41)	3-1/4	2-1/4	30000
F8F*	7/8 (M22)	1-5/8 (41)	3-1/4	2-1/4	39500
F9F*	3/4 (M20)	1-3/4 (44)	3-1/4	2-1/4	30000
F9F*	7/8 (M22)	1-3/4 (44)	3-1/4	2-1/4	40000
F9F*	1 (M24)	1-3/4 (44)	3-1/4	2-1/4	40000

® Registered trademark * Patented item

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack

7/12/2023

SSM – Nuance Energy

Client Name: Freedom Forever LLC - Sunil Patel - 17200

Job Address: 518 Southwest Windsor Drive, Lake City, Florida 32024

EST/SO Number:

At your request, we have reviewed the information regarding the ground mount solar panel installation at the above location. Our evaluation was based on the following documents:

1. Structural Documentation Packet - prepared by Valkyrie Engineering & Design, LLC - which includes a detailed engineering evaluation and calculations of the Osprey ground mount system. This documentation identifies the specific racking layout and components required for the proposed ground mount system.
2. Ground Anchor Load Letter - prepared by Valkyrie Engineering & Design, LLC. This document identifies the calculated pull values for the Osprey PowerRack system, as they relate to the specific project under consideration.

Our analysis of the proposed Photovoltaic Array System, indicates that the Osprey Ground Mount System adheres to the following design parameters:

- Loading Criteria:
  - Wind Speed: 120
  - Ground Snow Load: 5
- Racking Paramenters
  - Units: 4x6x5 (1) 4x5x4 (1)
  - Array Tilt: 30
  - Baseplate size: 18x18x1/4
  - Maximum Allowable Front Leg Height: 54"
- Required Anchors per Base Plate:
  - Back Legs: 6200 lbs- 2 Anchors (Test each at 4200 lbs)
  - Front Legs: 750 lbs - 1 Anchor

The proposed solar array will be adequately supported with proper construction and post assembly. Our evaluation follows the 2018 International Building Code, relevant industry standards, and the Osprey Structural Documentation Packet, and is based on the information provided to us at the time of this report.

Please note that after installation, the "Proof Loading" pull test results for the earth anchor foundation systems must be submitted to GreenWorld Energy for review and approval.

Sincerely,

Andres Londono

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

Anchor Load Test Proof Form

The required load test values will be provided through your SSM and can be obtained directly from Nuance Energy. It is important to keep in mind any special considerations when using multiple anchors per leg.	To be eligible for a 20-year warranty from Nuance Energy, submit this information online within 60 days of installation at Nuanceenergy.com/warranty.

It is recommended to purchase additional anchors for each project in case loads cannot be reached with required number of anchors.

Extra anchors can be obtained through our Distributor Partners or directly from Nuance Energy as required.

PROJECT SIZE (DC):		CONTRACTOR:	
TILT:		PROJECT NAME:	
PANEL COUNT:			
WIND SPEED/(ACSE 7 EDITION):		SITE ADDRESS:	
SNOW LOAD:			

ANCHOR REDUCTION TABLE		
REQUIRED ANCHORS PER SSM		1 ADDITIONAL ANCHOR
ANCHORS REQUIRED	REVISED CAPACITY FACTOR	REDUCED VALUE
1	100%	60%
2	67%	38%
3	45%	24%
4	34%	N/A

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack

Array Number		SSM Required Load	Individual Anchor Load	Recorded Test Values Per Anchor							
				East		East/Center		West/Center		West	
1	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
2	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
3	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
4	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
5	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
6	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
7	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
8	Front			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4
	Rear			1	2	1	2	1	2	1	2
				3	4	3	4	3	4	3	4

*Loads are all in pounds.

Duplicate this worksheet and use multiple pages for bigger projects.

Signature: _____ Date: _____

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

Osprey PowerRack Capacity

		4x3-2 MAX	4x3-2 LTE	4x3-3 MAX	4x3-3 LTE	4x4-2 MAX	4x4-2 LTE	4x4-3 MAX	4x4-3 LTE	4x5-3 MAX	4x5-3 LTE	4x5-4 MAX	4x5-4 LTE	4x6-4 MAX	4x6-4 LTE
10 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	90	1	1		1	1	1	1	1	1	1		1	1	1
	100	1	1		1	1	1	1	1	1	1		1	1	1
	110	1	1		1	2	1	1	1	2	1		1	2	1
	120	2	1		1			1	1	2	2		1	2	2
	130	2	2		1			2	1	2	2		2		2
	140	2	2					2	2	3	2				2
15 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	90	1	1		1	1	1	1	1	1	1		1	1	1
	100	1	1		1	2	1	1	1	2	1		1	2	1
	110	2	1		1	2	2	1	1	2	2		1	2	2
	120	2	2		1			2	1	2	2		2	2	2
	130	2	2		2			2	2	3	2		2		2
	140	2	2					2	2	3	3				3
18 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	90	1	1		1	1	1	1	1	1	1		1	1	1
	100	1	1		1	2	2	1	1	2	1		1	2	1
	110	2	1		1	2	2	1	1	2	2		1	2	2
	120	2	2		1			2	1	2	2		2	2	2
	130	2	2		2			2	2	3	2		2		2
	140	3	2					2	2	3	3				3
20 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	90	1	1		1	1	1	1	1	1	1		1	1	1
	100	1	1		1	2	2	1	1	2	1		1	2	1
	110	2	1		1	2	2	2	1	2	2		1	2	2
	120	2	1		1			2	1	2	2		2	3	2
	130	2	2		2			2	2	3	2		2		2
	140	3	2					2	2	3	3				3
25 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	90	1	1	1	1	2	2	1	1	2	1	2	1	2	1
	100	2	1	1	1	2	2	1	1	2	2	2	1	2	2
	110	2	2	2	2			2	2				2		2
	120			2	2			2	2				2		
	130				2				2						
	140														
30 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	2	1	1	1	1	1	1	1	1	1
	90	1	1	1	1	2	2	1	1	2	2	2	1	2	2
	100	2	2	2	1	2	2	2	1	2	2	2	2	2	2
	110	2	2	2	2			2	2				2		2
	120			2	2			2	2				2		
	130				2				2						
	140														
35 Degree	70	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	80	1	1	1	1	2	1	1	1	1	1	1	1	1	1
	90	1	1	1	1	2	2	1	1	2	2	2	1	2	1
	100	2	2	1	1	2	2	1	1	2	2	2	2	2	2
	110	2	2	2	2			2	2				2		2
	120			2	2			2	2				2		
	130				2				2						
	140														

The OPR Max and LTE are for panel dimensions up to 95x45" and 85-40" respectively.
Numbers in black refer to systems up to 30PSF, White numbers up to 60PSF
Some arrangements will require up to 3 anchors on the rear legs based on loading, consult with a Nuance representative for details.

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

Spec Sheet – Standard Ground Mount

Key Specifications

- Solar panel manufacturer technology neutral with 3 designs: (OPR LTE, OPR LTE-HD and OPR MAX).
- Pre-engineered OSPREY holds (12, 16, 20 or 24) solar panels in landscape orientation.
- Total power output up to 12.96kW (24 x 540w solar modules).
- UL 2703 Compliant; Self-bonding mid clamps.
- ASCE 7-16; Category 1.
- Wind loads ≤ 130 mph and Snow loads ≤ 70+ psf. (custom available).
- Fixed tilt orientation (15° to 35°); custom to 45°.
- Engineered: N/S sloped terrain (up to 10°); E/W sloped terrain (up to 5°).
- Pre-assembled independently power adjustable (front) legs 24" – 51".
- Telescoping square tube (rear) legs to 101".
- Small footprint only (74" – 82.5") spacing between front and rear legs.
- ZAM275 or Galvanized (G90) steel finish standard; others available.
- 20-year limited product warranty protection.
- MADE in USA (available).

Sustainable Solution

- Geotechnical report usually not required. Real-time soil verification and anchor load (pull) test achieved using proprietary OSPREY PowerJack™.
- No concrete.
- Use up to 30 cubic feet of earth above each anchor installed. Soil and sediment act as a natural ballast holding OSPEY PowerRack™ to ground.
- Use of hand-held tools reduce need for heavy equipment or machinery.
- Less mobilization to site reduces a project's carbon emissions (Co2).
- 100% removable; no long term environmental impact after life of system.
- 100% transportable with "Lift and Shift" capability of renewable capital asset.

100% Modular, Scalable and Universal Table Design

- Pre-engineered solar arrays; patented earth anchor foundation technology.
- Install using handheld tools.
- Interchangeable components used to assemble multiple table sizes: (4x3x2,4x4x2, 4x5x3 and 4x6x4).
- Stock and inventory efficiency.
- Kitted and boxed hardware.
- Less # SKUs.
- Longest component 98".
- Stock on wooden pallets.
- Deliver in van or box truck, overhead or back of pickup truck.
- Easy and safe material handling.

Structural Engineering

- Structural Calculation and Professional Engineering Report with vertical and lateral analysis (dead load, live load, wind load, seismic load, etc.) for all 50 US states.
- Site-specific and stamped structural engineering report (SSM) is additional fee

Saving Time and Money - 2MW commercial project

- Average installation time: < 60 minutes with 3-4 person crews.
- Lowest labor cost: < $0.12/watt (includes: Racking, foundation, solar panels and anchor load testing).
- Save up to 416 man hours (52 days) per 2MW commercial project.
- Save up to $144,640 per 2MW.

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

OSPREY PowerRack™ MAX

4x3x2

4x5x3

4x4x3

4x6x4

OSPREY PowerRack™ LTE-HD

4x4x3

4x5x4

OSPREY PowerRack™ LTE

4x3x2

4x5x3

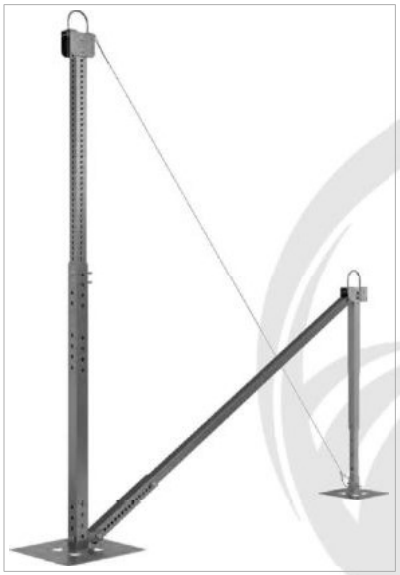
4x4x2

4x6x4

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack

Spec Sheet - Foundation Kit



Description

Front Leg Foundation

- Preassembled, independently power adjustable support
- Use standard hand-held impact tool
- 24" to 51" height adjustment
- 5,000 static / 2,500 dynamic load
- Reduces site prep and grading
- Install on uneven terrain
- No post hole digging

Rear Leg Foundation

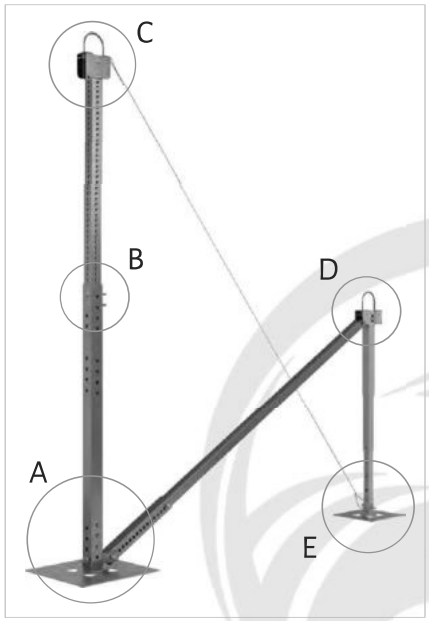
- Telescoping leg support to 101"
- North / south slope (up to 10°); East / west slope (to 5°) or staircase layout
- Foundations designed to fit any load criteria
- Support legs adjust to tilt from 15-35°

QTY.	PART DESCRIPTION	PART NUMBER
1.0	OPR 18" FOUNDATION MAX	UNV-011-03-345-018
1.0	OPR UNIVERSAL EXTERNAL LEG	OPR-821-14-215-054
1.0	OPR UNIVERSAL INTERNAL LEG	OPR-821-14-215-060
1.0	OPR NORTH BRACKET	OPR-821-10-115-012
1.0	OPR 12" FOUNDATION MAX	UNV-011-03-345-012
1.0	OPR FRONT LEG	OPR-810-11-530-051
1.0	OPR LATERAL BRACE EXTERNAL	OPR-821-14-215-018
1.0	OPR LATERAL BRACE INTERNAL	OPR-821-14-215-078
1.0	OPR LATERAL BRACKET	OPR-821-09-115-008
1.0	UNV CABLE BRACE	OPR-811-500-C18
5.0	OPR CARRIAGE BOLTS	OPR-831-050-X45
5.0	OPR BRACING BOLTS	OPR-831-050-B03
10.0	OPR 1/2" NUTS	OPR-831-050-N12
2.0	OPR EW U-BOLT	OPR-831-050-U04
4.0	OPR 3/8" NUTS	UNV-031-050-N38

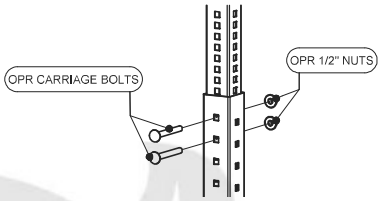
* Magni coated hardware

NUANCE ENERGY
Revolutionary Solar Racking Structures

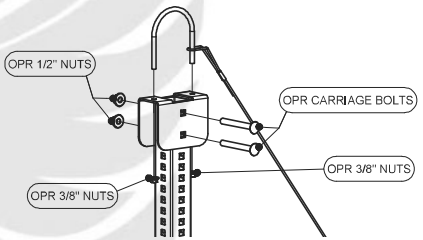
OSPREY
PowerRack



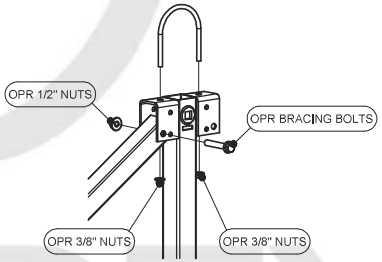
VIEW B



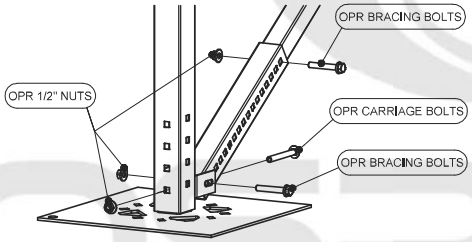
VIEW C



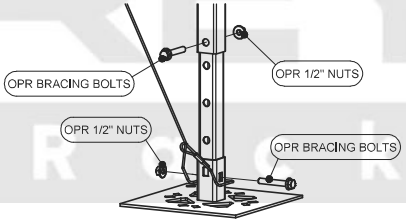
VIEW D



VIEW A

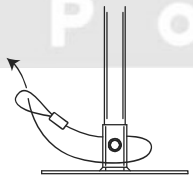


VIEW E

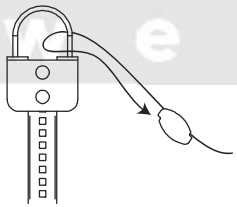


CABLE BRACES INSTALLATION

DETAIL E



DETAIL C

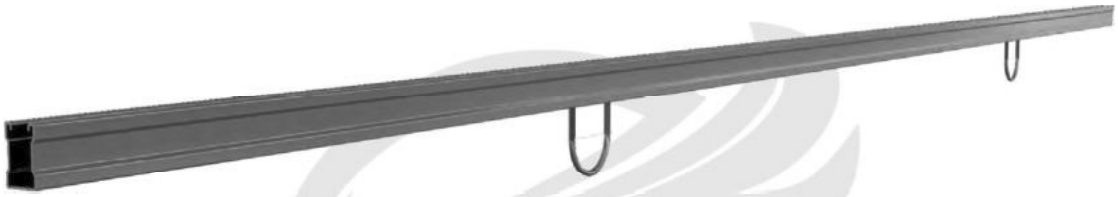


*Do not tension cable braces until structure is fully assembled.

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack

Spec Sheet - Rail Kit LTE



OPR NS PURLIN MAX x 2

OPR EW U-BOLT x 4

OPR 3/8" NUTS x 16

Description

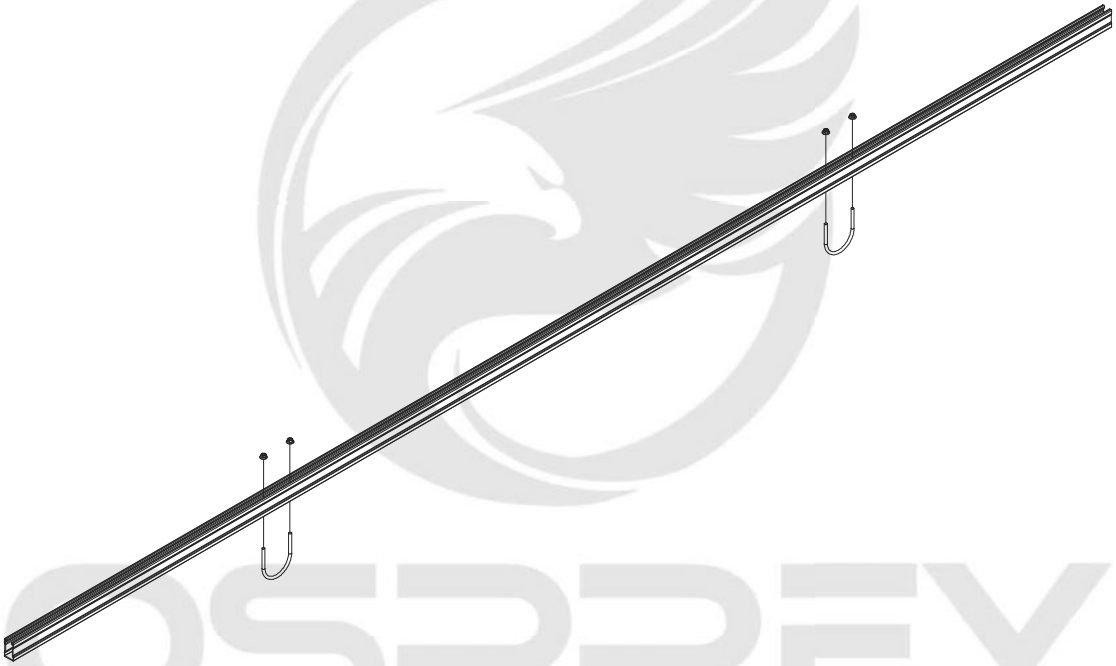
- Custom purlin design offers higher strength at a lower weight than comparable unistrut.
- Purlins connect to round tubes using U-bolts.
- Purlin profile designed for universal mid-clamps and end-clamps.
- U-bolt design allows purlins to adjust to any slope.
- Standard profile 1-5/8" x 2-7/16".
- Structural rail bracket connects purlins together.
- Splice design convenient for shipping in box trucks.

QTY.	PART DESCRIPTION	PART NUMBER
2.0	OPR NS PURLIN MAX	OPR-821-11-215-093
4.0	OPR EW U-BOLT	OPR-831-050-U04
8.0	OPR 3/8" NUTS	UNV-031-050-N38

* Magni coated hardware

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack



NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
PowerRack

Spec Sheet - Beam Kit

OPR EAST WEST BEAM x 2

OPR CARRIAGE BOLTS x 2

OPR 1/2" NUTS x 2

Description

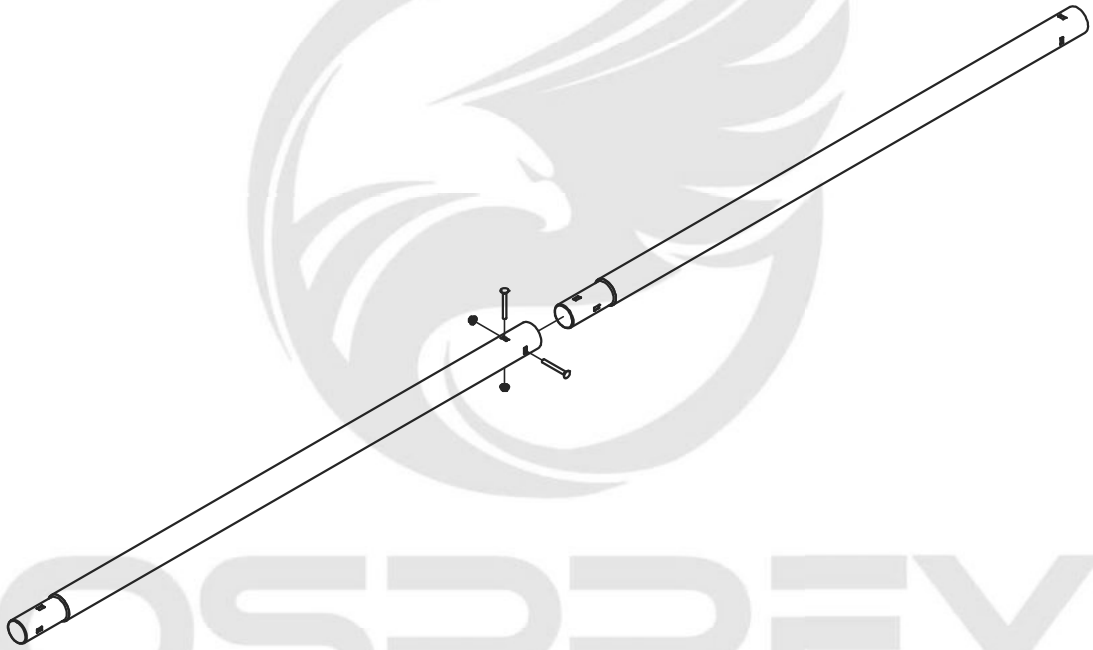
- 8" Swage feature allows tables to connect together.
- 4" Diameter structural tube and swage increase strength.
- Swage Tube is more reliable and repeatable than standard splice and set screw connections.
- Less components decrease assembly time.
- Faster installation reduces labor costs.
- Material coated to ASTM
- A123 for increased corrosion resistance, no exposed edges.

QTY.	PART DESCRIPTION	PART NUMBER
2.0	OPR EAST WEST BEAM	OPR-821-11-235-098
2.0	OPR CARRIAGE BOLTS	OPR-831-050-X45
2.0	OPR 1/2" NUTS	OPR-831-050-N12

* Magni coated hardware

NUANCE ENERGY
Revolutionary Solar Racking Structures

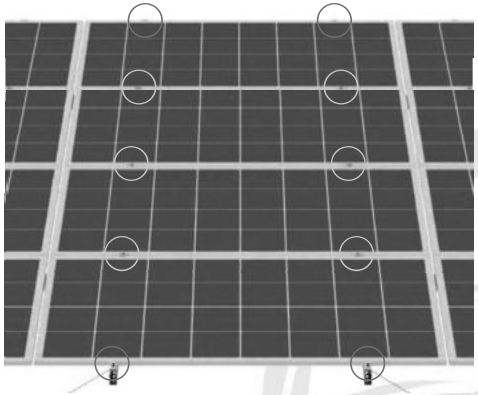
OSPREY
PowerRack



NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

CLAMP KIT



UNV END CLAMPS x 4

UNV MID CLAMPS x 6

QTY.	PART DESCRIPTION	PART NUMBER
6.0	UNV MID CLAMPS	UNV-051-050-M05
4.0	UNV END CLAMPS	UNV-051-050-E05

Table	# Mid Clamps	# End Clamps
4x3x2	18	12
4x4x2	24	16
4x3x3	18	12
4x5x3	30	20
4x6x4	36	24

C ETL LISTED US
Intertek
5020709

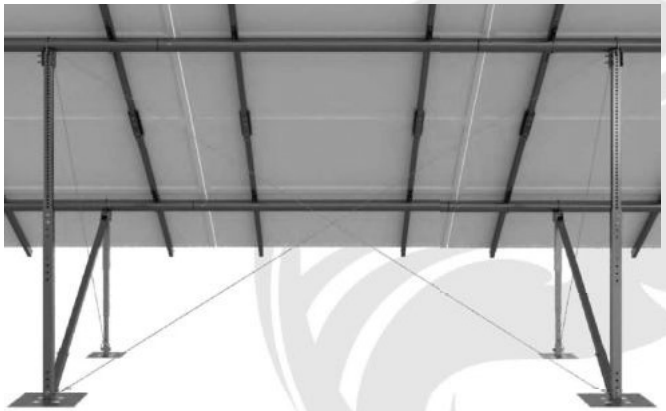
Description

- Adjustable self-bonding mid clamps hold any model and any size solar panel securely in place
- Universal clamps mount to any module with an aluminum frame
- End clamp average tensile test 511lbs.
- Mid clamp average tensile test 3171lbs.
- ASTM E8/E8M-16a
- Tested to ISO 17025
- Colorado Metallurgical Services tested

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY PowerRack

Spec Sheet - Cable Kit



UNV CABLE BRACE x 2

GRIPPLE MEDIUM x 2

CABLE TENSION TOOL (Sold Separately)

Description

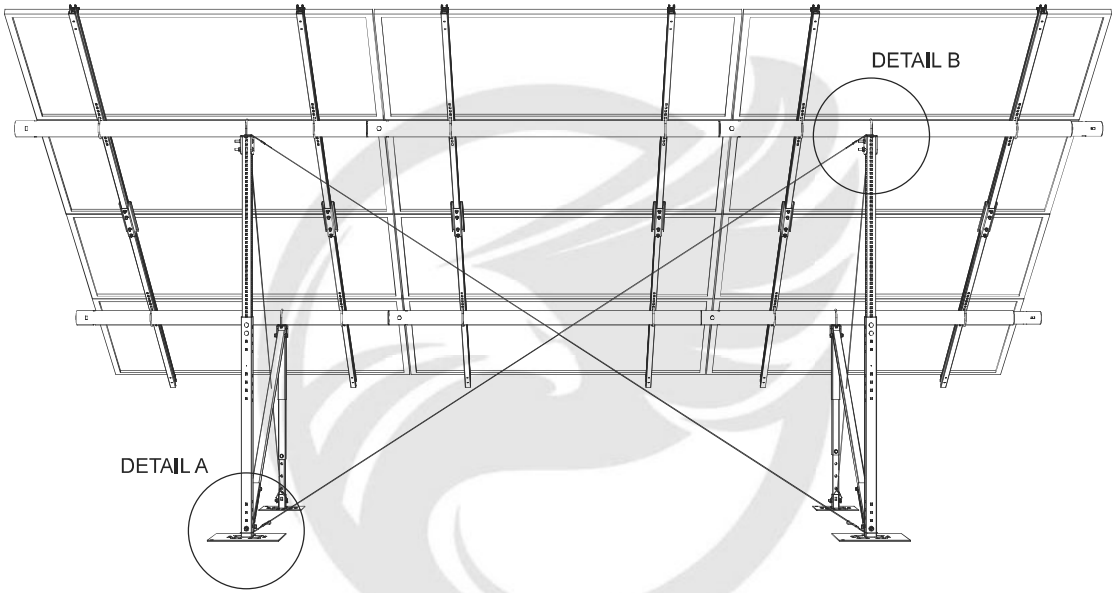
Cable Bracing

QTY.	PART DESCRIPTION	PART NUMBER
2.0	UNV CABLE BRACE	OPR-811-500-C18
2.0	GRIPPLE MEDIUM	

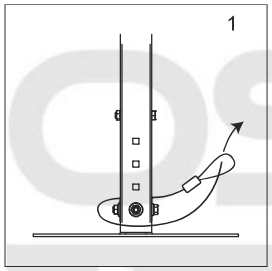
- Cross cables brace the table against lateral and seismic loads.
- Diagonal lateral braces transfer loads from high stress areas to the table to the foundation increasing stability.
- 3mm Aircraft high strength braided cable.
- Zinc Alluminized coating or Stainless depending on application.
- 20' length offers infinite adjustability.
- Cable Tension tool.

NUANCE ENERGY
Revolutionary Solar Racking Structures

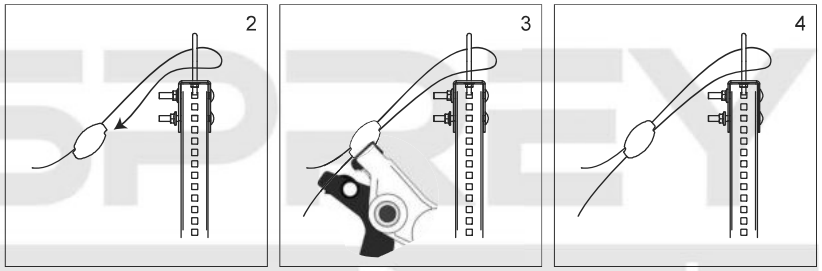
OSPREY
PowerRack



DETAIL A



DETAIL B



NUANCE ENERGY
Revolutionary Solar Racking Structures

HARDWARE OVERAGE KIT

ETL CLASSIFIED

CONFORMS TO
UL STD 2703
CERTIFIED TO
CSA LTR AE-001

OSPREY PowerRack

OPR SPLICE BOLTS x 2

OPR CARRIAGE BOLT

UNV MID CLAMP x 1

OPR 3/8" NUTS x 3

UNV END CLAMP x 1

OPR BRACING BOLT x 1

OPR 1/2" NUTS x 3

Description

One Overage Kit is included in each OSPREY PowerRack™ Sales Order.

Additional Overage Kits are available through our sales department or a regional solar distributor who carries Nuance Energy products.

QTY.	PART DESCRIPTION	PART NUMBER
2	OPR SPLICE BOLTS	OPR-831-050-B01
3	OPR 3/8" NUTS	UNV-031-050-N38
1	OPR CARRIAGE BOLT	OPR-831-050-X45
1	OPR BRACING BOLT	OPR-831-050-B03
3	OPR 1/2" NUTS	OPR-831-050-N12
1	UNV MID CLAMP	UNV-051-050-M05
1	UNV END CLAMP	UNV-051-050-E05

NUANCE ENERGY
Revolutionary Solar Racking Structures

Spec Sheet - OSPREY PowerJack™

OSPREY
POWERJACK

Included Parts:

- Osprey PowerJack
- Detachable Handle with Hardware
- Mounting Plate for Load Cell Indicator with Hardware
- 5k rated S-Beam Load Cell (3)AA Batteries Included
- Self locking Carabiner
- Cable and Drive Rod Puller Attachment
- Side Shelf
- Side Carry Handle
- Swivel Shoe Plate
- Locking Pin
- 1/2" Drive Socket
- Weather Proof Case

Recommended PPE and Tools for safe Operation:

- High Torque Impact Wrench withs 1/2" Drive
- High Speed/High Heat Grease
- Grease Gun
- Hard Hat
- Gloves
- Eye Protection
- Work Boots.

NUANCE ENERGY
Revolutionary Solar Racking Structures

OSPREY
POWERJACK

Nuance Energy's patented OSPREY PowerJack™ is a multi-purpose construction tool and powerful jack used to pull and measure in real time soil conditions, the uplift "load tension test" capacity of earth anchors. Proprietary earth anchors are the foundations that secure the patented OSPREY PowerRack ground mount solar racking system to the ground during installation. The OSPREY PowerJack may also be used to pull earth anchor drive rods from tough soil conditions before anchor testing is performed.

Recommended Best Practices:

- Use high torque Impact Wrench w/ 1/2" Drive (Figure 3)
- Insert a small piece of rubber into the top socket of the Osprey PowerJack™ to dampen the impact function of the drill.
- Make sure to add about 5-6oz of High speed/ High Heat Grease to the grease fitting at the top of the Jack before during and after testing to ensure threads don't overheat.
- Use pivot action of PowerJack Swivel Shoe Plate to match the angle in which Anchor was driven into ground.
- Once the Anchor pull test is achieved release tension on the Cable by reversing the Impact Drill. You do not want the anchors to remain at tension when locking the wedge grips down.
- Minimum Anchor depth is 30" or below your local frost depth whichever is deeper.
- Knowing the desired pull test amount for multiple anchors ahead of time will help when loose soils come into play.
- Place the PowerJack™ steel shelf under the supporting frame member if you need to level any soil under an Osprey Shoe Plate (Figure 5)
- Use the PowerJack™ Cable and Drive Rod Puller to remove a Drive Rod or Drill bit should they get stuck.
- Calibrate S-Beam annually
- Warranty: One (1) Year Warranty from date of purchase.

MATERIAL PROPERTY DATA SHEET

FALCON ANCHORS™

F120-SW-Z Series

PATENT PENDING

Specifications

Falcon Percussion Driven Anchors (PDAs) are designed to provide drive efficiency and maximize load capability across a wide range of applications. The F120-SW-Z assembly consists of a top plate that allows for vegetation establishment with one-way wire grip, tethered to a deep-seated earth anchor. Once the anchor is driven into the ground, typically 6 feet (1.8 m), the top plate is secured to the ground and held fast, holding an HPTRM or structure firmly in place. The anchor and cable grip of the F120-SW-Z are cast in the USA. The assembly is fabricated in the USA. The F120-SW-Z assembly allows for re-tensioning, negates the need for time consuming cable crimping and comes fully assembled.

Typical Pullout Resistance*		
Soil Type	Install Depth	
	3 ft	5 ft
Loose (SPT > 4)	300	450
Medium (SPT > 10)	750	1,250
Dense (SPT > 30)	1,750	3,250
Very Dense (SPT > 50)	3,250	> 5,000

System Performance	
Typical Anchor Load*	2,500 lbs
Maximum Working Load	2,700 lbs
Ultimate Assembly Strength	3,000 lbs
Ultimate Cable Strength	7,000 lbs

Components†		Physical Properties
Top Plate	Zinc-aluminum alloy inert with plastisol coated steel plate	Diameter: 6.0” (150 mm) Thickness: 0.13” (3.0 mm) Open Area: 50%
Grip	Spring-loaded crush roller	Ceramic
Cable	Zinc-aluminum coated steel	Diameter: 1/4” (6.35 mm)
Anchor	Zinc-aluminum alloy	4.7 L x 1.6 W x 1.3 H inches (120 L x 40 W x 32 H mm) Bearing Area: 6.0 in^2 (39 cm^2)
Length	Varies	F120-SW-Z3: 3ft (0.9 m) F120-SW-Z6: 6 ft (1.8 m) Additional Lengths available

Typical Use
Heavy duty assembly for standard ARVS systems

* Soil dependent value.

† Assembly is shown as standard configuration. Cable lengths and other components may be customized as required.

WESTERN GREEN

North American Green • 5401 St. Wendel-Cynthiana Rd • Poseyville, In. 47633 • (800) 772-2040
Western Excelsior • 4609 E. Boonville-New Harmony Rd • Evansville, In. 47725 • (866) 540-9810

nagreen.com • westernexcelsior.com

MATERIAL PROPERTY DATA SHEET

FALCON ANCHORS™

F170-SW-Z Series

PATENT PENDING

Specifications

Falcon Percussion Driven Anchors (PDAs) are designed to provide drive efficiency and maximize load capability across a wide range of applications. The F170-SW-Z assembly consists of a top plate that allows for vegetation establishment with one-way wire grip, tethered to a deep-seated earth anchor. Once the anchor is driven into the ground, typically 6 feet (1.8 m), the top plate is secured to the ground and held fast, holding an HPTRM or structure firmly in place. The anchor and cable grip of the F170-SW-Z are cast in the USA. The assembly is fabricated in the USA. The F170-SW-Z assembly allows for re-tensioning, negates the need for time consuming cable crimping and comes fully assembled.

Typical Pullout Resistance*		
Soil Type	Install Depth	
	3 ft	5 ft
Loose (SPT > 4)	550	950
Medium (SPT > 10)	1,250	2,250
Dense (SPT > 30)	2,500	5,500
Very Dense (SPT > 50)	3,500	8,000

System Performance	
Typical Anchor Load*	3,000 lbs
Maximum Working Load	3,500 lbs
Ultimate Assembly Strength	3,800 lbs
Ultimate Cable Strength	7,000 lbs

Components†		Physical Properties
Top Plate	Zinc-aluminum alloy inert with plastisol coated steel plate	Diameter: 6.0” (150 mm) Thickness: 0.13” (3.0 mm) Open Area: 55%
Grip	Spring-loaded crush roller	Ceramic
Cable	Zinc-aluminum coated steel	Diameter: 1/4” (6.35 mm)
Anchor	Zinc-aluminum alloy	6.7 L x 2.2 W x 1.5 H inches (170 L x 55 W x 39 H mm) Bearing Area: 12.2 in^2 (79 cm^2)
Length	Varies	F170-SW-Z3: 3 ft (0.9 m) F170-SW-Z6: 6 ft (1.8 m) Additional Lengths Available

Typical Use
Heavy duty assembly for soft soils in standard ARVS systems

* Soil dependent value.

† Assembly is shown as standard configuration. Cable lengths and other components may be customized as required.

WESTERN GREEN

North American Green • 5401 St. Wendel-Cynthiana Rd • Poseyville, In. 47633 • (800) 772-2040
Western Excelsior • 4609 E. Boonville-New Harmony Rd • Evansville, In. 47725 • (866) 540-9810

nagreen.com • westernexcelsior.com

TLA3 Anchor Ultimate Strength

Product Data Sheet

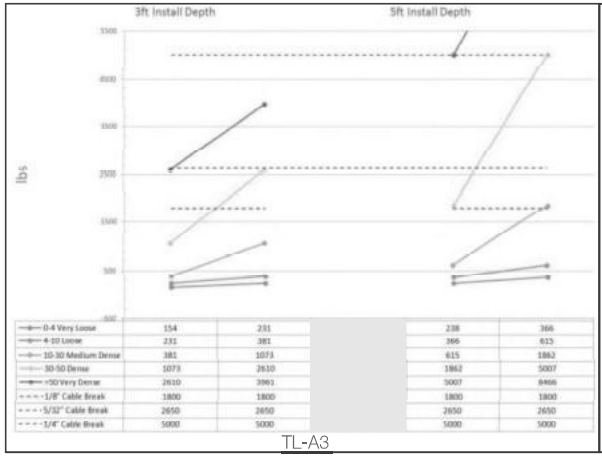
Terra-Lock™ Earth Percussion Anchors are designed to provide drive efficiency and maximize load capacity across a wide range of applications. The Terra-A3 Anchor is made of Corrosion resistant Zinc Aluminum and will provide the holding capacity your project needs for many years.

Component	Type	Material	Test Method	Physical Properties
Anchor Head	TLA3	Zinc-Aluminum Alloy - ZA 2 (1)	ASTM B-240-10	5.00" x 1.62" x 1.23" (L x W x H) Bearing Area: 6 in^2

(1) Corrosion resistant pressure die cast zinc alloy

Performance Properties	Value	Data
Ultimate Anchor Pull Out(3)	lbs	5,000

(3) Value based on an install depth of 5ft in very dense soil.



TL-A3

SPT Count & Gripple Anchor Performance

General information

The Standard penetration test (SPT) is widely used to determine the strength and deformation properties of the course soil.

Approximate correlation of properties of drained granular soil are:

Very Loose	**SPT 0–4**
Loose	**SPT 4-10**
Medium Dense	**SPT 10-30**
Dense	**SPT 30-50**
Very Dense	**> 50**

These figures can then be used to obtain typical shear strength and bulk unit weight for each soil.

This information is then used to predict Gripple Anchor Performance in relation to the conditions described.

The following graphs are derived from idealized theoretical calculations and should be used as a guide only. The variability of soil types should always be taken into account and on-site testing should always be carried out in order to obtain more accurate results.

Gripple Inc | 1611 Emily Lane | Aurora | IL 60502 USA
Tel +1 866 474 7753 Fax +1 800 654 0689 email grippleinc@gripple.com

TLA4 Anchor Ultimate Strength

Product Data Sheet

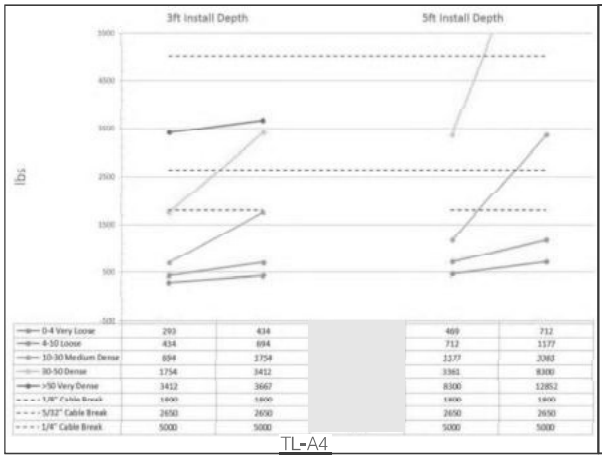
Terra-Lock™ Earth Percussion Anchors are designed to provide drive efficiency and maximize load capacity across a wide range of applications. The Terra-Lock™ A4 Anchor is Gripple's largest anchor. It is made of corrosion resistant Zinc Aluminum and will provide the holding capacity your project needs for many years.

Component	Type	Material	Test Method	Physical Properties
Anchor Head	TLA4	Zinc-Aluminum Alloy - ZA 2 (1)	ASTM B-240-10	6.50" x 2.36" x 1.40" (L x W x H) Bearing Area: 12 in^2

(1) Corrosion resistant pressure die cast zinc alloy

Performance Properties	Value	Data
Ultimate Anchor Pull Out(3)	lbs	8,300

(3) Value based on an install depth of 5ft in very dense soil.



TL-A4

SPT Count & Gripple Anchor Performance

General information

The Standard penetration test (SPT) is widely used to determine the strength and deformation properties of the course soil.

Approximate correlation of properties of drained granular soil are:

Very Loose	**SPT 0-4**
Loose	**SPT 4-10**
Medium Dense	**SPT 10-30**
Dense	**SPT 30-50**
Very Dense	**> 50**

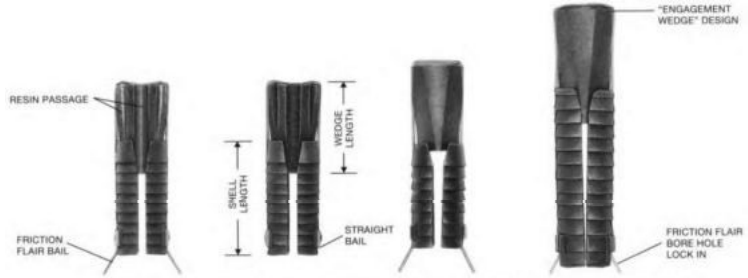
These figures can then be used to obtain typical shear strength and bulk unit weight for each soil.

This information is then used to predict Gripple Anchor Performance in relation to the conditions described.

The following graphs are derived from idealized theoretical calculations and should be used as a guide only. The variability of soil types should always be taken into account and on-site testing should always be carried out in order to obtain more accurate results.

Gripple Inc | 1611 Emily Lane | Aurora | IL 60502 USA
Tel +1 866 474 7753 Fax +1 800 654 0689 email grippleinc@gripple.com

New Technology: Friction Flair Rock Anchors



F1FR® Reccommended for resin. Available with straight or friction flair bail.

F1F® Recommended for general use. Available with straight or friction flair bail.

F3F® Recommended for general use. Available with straight or friction flair bail.

FLF® Recommended for soft or friable strata. Available with friction flair and popout bail features.

F5F® Recommended for general use. Available with straight or friction flair bail.

F8F® Recommended for general use. Available with straight or friction flair bail.

F9F® Recommended for general use. Available with straight or friction flair bail.

Style	Thread Size UNC or (metric)	Drill Hole Size in. (mm)	Shell Length In.	Wedge Length In.	Non-Seizure Load Lbs.
F1FR*	5/8 (M16)	1-1/32 (26) & 1-1/16 (27)	2-1/8	1-5/8	18000
F1F*	5/8 (M16)	1-1/32 (26) & 1-1/16 (27)	2-1/8	1-5/8	18000
F3F*	5/8 (M16)	1-3/16 (30) & 1-1/4 (32)	2-1/8	1-3/4	22500
FLF*	5/8 (M16)	1-1/4 (32)	3-1/4	2-1/8	18000
F5F*	5/8 (M16)	1-3/8 (35)	2-7/8	2	22500
F5F*	3/4 (M20)	1-3/8 (35)	2-7/8	2	30000
F8F*	3/4 (M20)	1-5/8 (41)	3-1/4	2-1/4	30000
F8F*	7/8 (M22)	1-5/8 (41)	3-1/4	2-1/4	39500
F9F*	3/4 (M20)	1-3/4 (44)	3-1/4	2-1/4	30000
F9F*	7/8 (M22)	1-3/4 (44)	3-1/4	2-1/4	40000
F9F*	1 (M24)	1-3/4 (44)	3-1/4	2-1/4	40000

® Registered trademark * Patented item

Valkyrie Engineering & Design, LLC

Site Specific Ground Anchor Load Letter

Date: 7/14/23

Project: Freedom Forever - Sunil Patel

Andres Londono,

Regarding the Osprey PowerRack, a structural analysis was carried out on the specified configuration. The analysis identified the maximum uplift values on both the front and rear legs of the rack. A 1.5 safety factor was applied, and the required loads for the rear and front legs were determined after rounding up. It is important to note that anchor load testing needs to exceed the factored load but should not exceed the manufacturers' specifications for the TLA3 or TLA4 anchors. These anchors have a breaking limit of 5,000lbs(Ultimate 3,300lbs allowable. The purpose of this letter is to address the structural stability of the design.

Racking Configuration:

- Rack Configuration: 4x5
- Number of Leg Pairs: 4
- Tilt: 30°

Panel Size:

- Height: 67.8"
- Width: 44.65"

Site Loading:

- Wind(V): 120 mph
- Snow(Pg): 5 psf

Calculated Loads From Risa Analysis:

- Maximum Uplift on Rear Legs: 4096 lbs
- Maximum Uplift on Front Legs: 26 lbs

Factored Loads (Rounded):

- Rear Legs: 6200 lbs
- Front Legs: 750 lbs

- Required Anchors for Rear Legs: 2

Respectfully,
Joshua M. Bice, PE

THIS DOCUMENT HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY JOSHUA M. BICE, P.E. ON 7/14/2023 USING A CA-1 AUTHENTICATION CODE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE CA-1 AUTHENTICATION CODE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

1122 Amber Lake Ct., Cape Coral, FL 33909 - 239.314.6593 (ph) josh.m.bice@gmail.com (e)

Valkyrie Engineering & Design, LLC

Site Specific Ground Anchor Load Letter

Date: 7/14/23

Project: Freedom Forever - Sunil Patel

Andres Londono,

Regarding the Osprey PowerRack, a structural analysis was carried out on the specified configuration. The analysis identified the maximum uplift values on both the front and rear legs of the rack. A 1.5 safety factor was applied, and the required loads for the rear and front legs were determined after rounding up. It is important to note that anchor load testing needs to exceed the factored load but should not exceed the manufacturers' specifications for the TLA3 or TLA4 anchors. These anchors have a breaking limit of 5,000lbs(Ultimate 3,300lbs allowable. The purpose of this letter is to address the structural stability of the design.

Racking Configuration:

- Rack Configuration: 4x6
- Number of Leg Pairs: 5
- Tilt: 30°

Panel Size:

- Height: 67.8"
- Width: 44.65"

Site Loading:

- Wind(V): 120 mph
- Snow(Pg): 5 psf

Calculated Loads From Risa Analysis:

- Maximum Uplift on Rear Legs: 3797 lbs
- Maximum Uplift on Front Legs: 46 lbs

Factored Loads (Rounded):

- Rear Legs: 5800 lbs
- Front Legs: 750 lbs

- Required Anchors for Rear Legs: 3

Respectfully,
Joshua M. Bice, PE

THIS DOCUMENT HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY JOSHUA M. BICE, P.E. ON 7/14/2023 USING A CA-1 AUTHENTICATION CODE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE CA-1 AUTHENTICATION CODE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

1122 Amber Lake Ct., Cape Coral, FL 33909 - 239.314.6593 (ph) josh.m.bice@gmail.com (e)