MATOS, FONSECA & ASSOCIADOS
ESTUDOS E PROJECTOS LDA

Estudo de Impacte Ambiental das Centrais Fotovoltaicas de Rio Maior e de Torre Bela, e LMAT de ligação

Volume 3 - Anexos

Aura Power Rio Maior S.A. (Aura Power)

e

CRSTB Unipessoal Lda. (Neoen)

Julho 2020

ESTRUTURA DE VOLUMES

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VOLUME 2 – Peças Desenhadas

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Volume 2.2 – Desenhos do EIA

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ESTUDOS E PROJECTOS, LDA

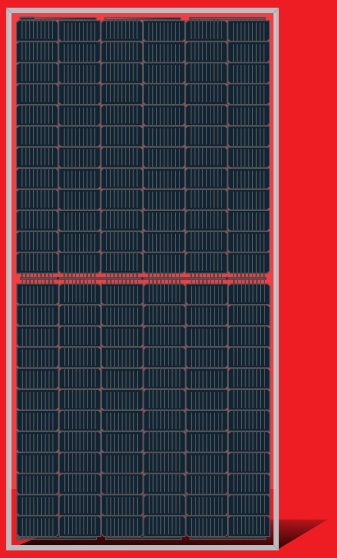
ANEXO 5

ELEMENTOS/FICHAS TÉCNICAS DO PROJETO

LR4-72HBD
425~455M

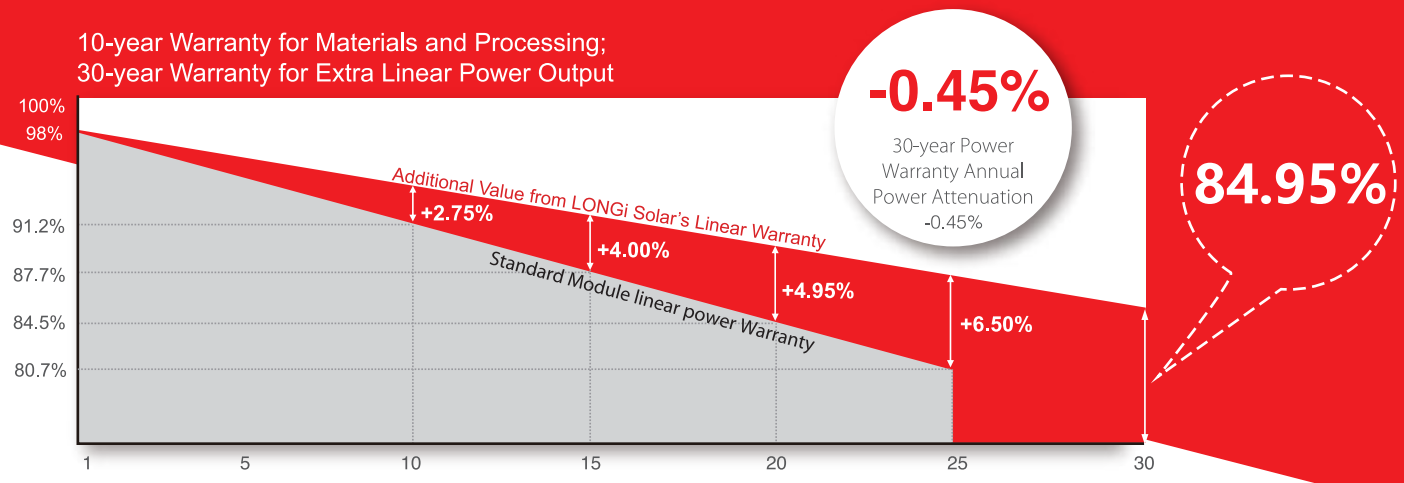
Hi-MO 4
NEW

High Efficiency
Low LID Bifacial PERC with
Half-cut Technology



*Both 6BB & 9BB are available

10-year Warranty for Materials and Processing;
30-year Warranty for Extra Linear Power Output



Complete System and Product Certifications

IEC 61215, IEC61730, UL61730

ISO 9001:2008: ISO Quality Management System

ISO 14001: 2004: ISO Environment Management System

TS62941: Guideline for module design qualification and type approval

OHSAS 18001: 2007 Occupational Health and Safety

* Specifications subject to technical changes and tests. LONGi Solar reserves the right of interpretation.

Front side performance equivalent to conventional low LID mono PERC:
- High module conversion efficiency (up to 20.9%)
- Better energy yield with excellent low irradiance performance and temperature coefficient
- First year power degradation <2%

Bifacial technology enables additional energy harvesting from rear side (up to 25%)

Glass/glass lamination ensures 30 year product lifetime, with annual power degradation < 0.45%, 1500V compatible to reduce BOS cost

Solid PID resistance ensured by solar cell process optimization and careful module BOM selection

Reduced resistive loss with lower operating current

Higher energy yield with lower operating temperature

Reduced hot spot risk with optimized electrical design and lower operating current

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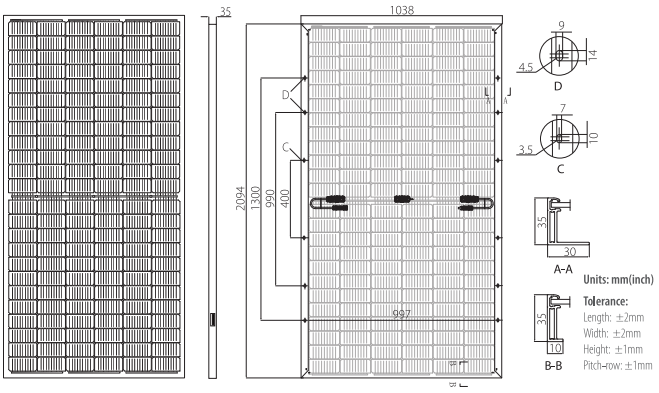
Room 801, Tower 3, Lujiazui Financial Plaza, No.826 Century Avenue, Pudong Shanghai, 200120, China
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

Note: Due to continuous technical innovation, R&D and improvement, technical data above mentioned may be of modification accordingly. LONGi have the sole right to make such modification at anytime without further notice; Demanding party shall request for the latest datasheet for such as contract need, and make it a consisting and binding part of lawful documentation duly signed by both parties.

20191227-Draft

LR4-72HBD 425~455M

Design （mm）



Mechanical Parameters

Cell Orientation: 144 （6×24）
Junction Box: IP68, three diodes
Output Cable: 4mm², 300mm in length, length can be customized
Glass: Dual glass
2.0mm coated tempered glass
Frame: Anodized aluminum alloy frame
Weight: 27.5kg
Dimension: 2094×1038×35mm
Packaging: 30pcs per pallet
150pcs per 20'GP
660pcs per 40'HC

Operating Parameters

Operational Temperature: -40℃~+85℃
Power Output Tolerance: 0~+5 W
Voc and Isc Tolerance: ±3%
Maximum System Voltage: DC1500V (IEC/UL)
Maximum Series Fuse Rating: 25A
Nominal Operating Cell Temperature: 45±2℃
Safety Class: Class Ⅱ
Fire Rating: UL type 3
Bifaciality: Glazing ≥70%

Electrical Characteristics

Test uncertainty for Pmax: ±3%

Model Number	LR4-72HBD-425M		LR4-72HBD-430M		LR4-72HBD-435M		LR4-72HBD-440M		LR4-72HBD-445M		LR4-72HBD-450M		LR4-72HBD-455M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	425	316.0	430	319.7	435	323.5	440	327.2	445	330.9	450	334.6	455	338.3
Open Circuit Voltage (Voc/V)	48.7	45.4	48.9	45.6	49.1	45.7	49.2	45.8	49.4	46.0	49.6	46.2	49.8	46.4
Short Circuit Current (Isc/A)	11.22	9.08	11.30	9.14	11.36	9.20	11.45	9.27	11.52	9.32	11.58	9.38	11.65	9.43
Voltage at Maximum Power (Vmp/V)	40.4	37.5	40.6	37.7	40.8	37.9	41.0	38.1	41.2	38.3	41.4	38.4	41.6	38.6
Current at Maximum Power (Imp/A)	10.52	8.42	10.60	8.49	10.66	8.54	10.73	8.60	10.80	8.65	10.87	8.70	10.93	8.76
Module Efficiency(%)	19.6		19.8		20.0		20.2		20.5		20.7		20.9	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25℃, Spectra at AM1.5

NOCT (Nominal Operating Cell Temperature): Irradiance 800W/m², Ambient Temperature 20℃, Spectra at AM1.5, Wind at 1m/S

Electrical characteristics with different rear side power gain (reference to 445W front)

Pmax /W	Voc/V	Isc /A	Vmp/V	Imp /A	Pmax gain
467	49.4	12.09	41.2	11.34	5%
490	49.4	12.67	41.2	11.88	10%
512	49.5	13.24	41.3	12.42	15%
534	49.5	13.82	41.3	12.96	20%
556	49.5	14.40	41.3	13.50	25%

Temperature Ratings（STC）

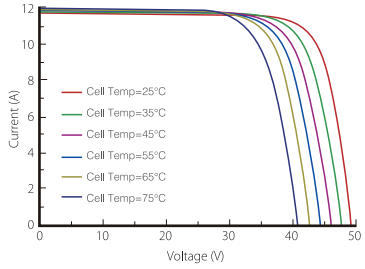
Temperature Coefficient of Isc	+0.060%/℃
Temperature Coefficient of Voc	-0.300%/℃
Temperature Coefficient of Pmax	-0.370%/℃

Mechanical Loading

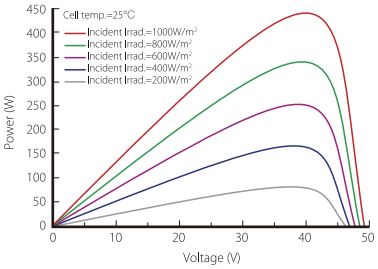
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

I-V Curve

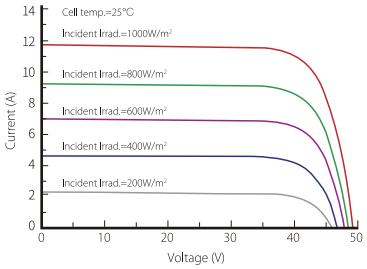
Current-Voltage Curve (LR4-72HBD-440M)



Power-Voltage Curve (LR4-72HBD-440M)



Current-Voltage Curve (LR4-72HBD-440M)



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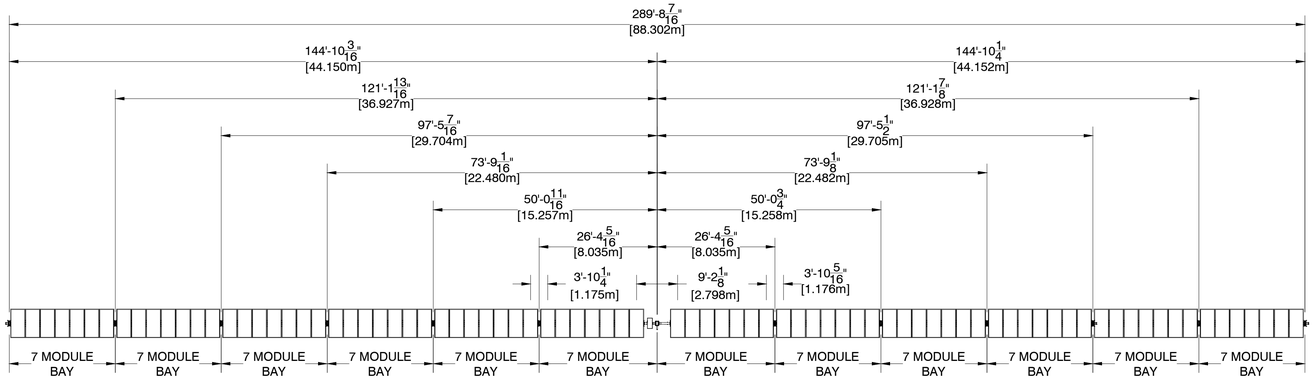
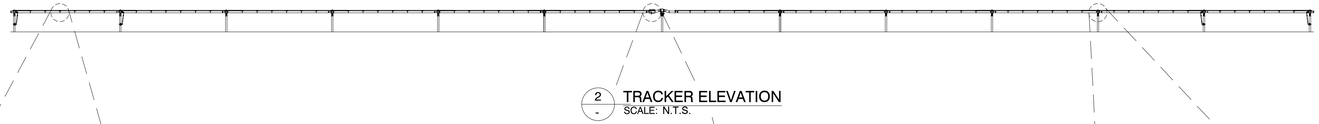
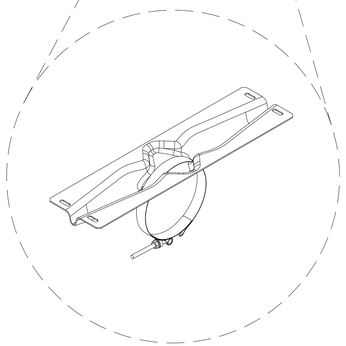


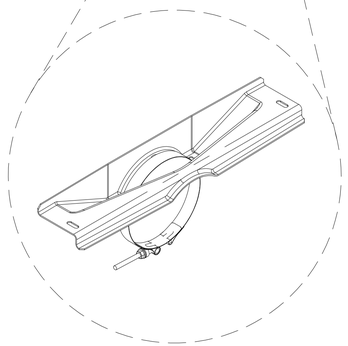
1 / - PIER SPACING
SCALE: N.T.S.



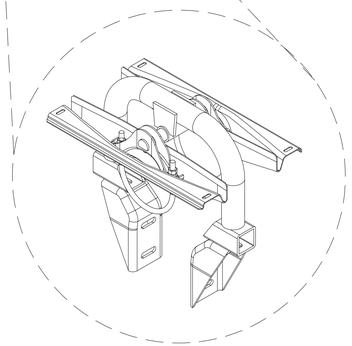
2 / - TRACKER ELEVATION
SCALE: N.T.S.



3 / - MODULE RAIL, TYP.
SCALE: N.T.S.



4 / - FIRST RAIL, TYP.
SCALE: N.T.S.



5 / - BHA, TYP.
SCALE: N.T.S.

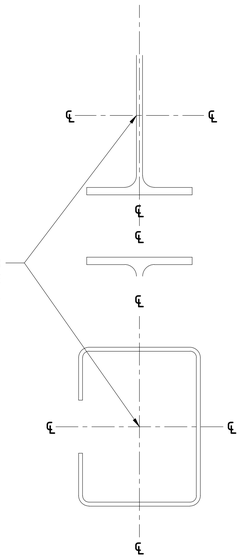
NOTES:

1) DETAILS ON THIS SHEET APPLY TO TRACKERS INDICATED ON THE SHEET TITLE ONLY. PIER PLAN INDICATES TRACKER LOCATIONS.

2) DETAILS 3-5 ARE TYPICAL AND APPLY TO ALL APPLICABLE LOCATIONS ON TRACKER.

3) PIER DISTANCES APPLY TO CENTER OF WEB, SEE DETAIL 6 FOR CENTER OF WEB LOCATION.

S-30X, DETAIL 3 DIMENSIONS FOR BAY AND TRACKER LENGTHS ARE TAKEN FROM CENTER OF BEAMS. SEE FOUNDATION DRAWING FOR IDENTIFICATION OF PIER TYPES.



6 / - CENTER OF WEB
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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NEXTracker Inc.
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Fremont, CA 94555

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PROJECT NUMBER:

SHEET TITLE:
84 MODULE EXT TRACKER

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE

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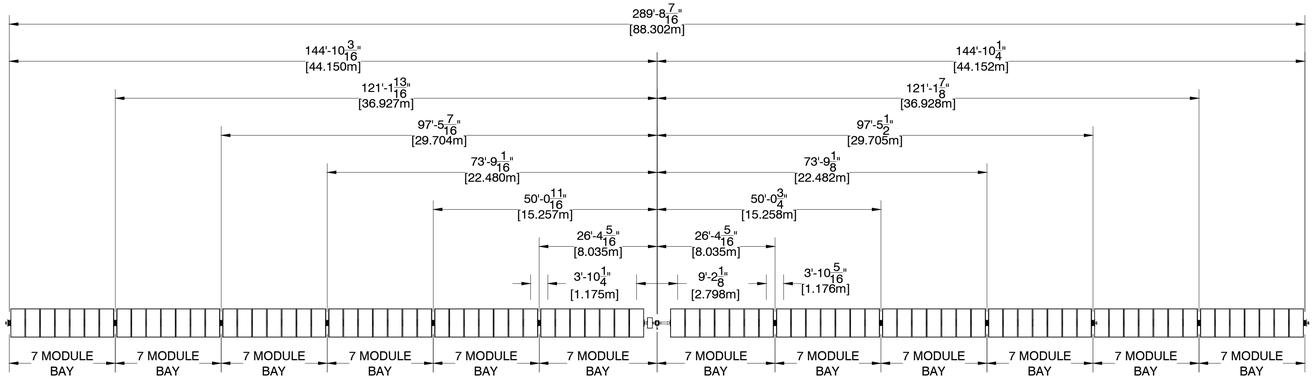
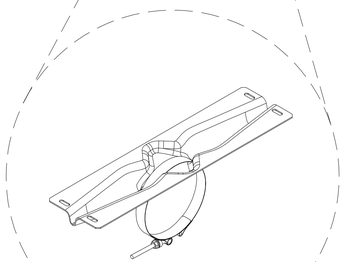
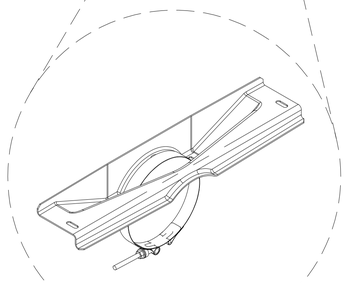


1 - PIER SPACING
SCALE: N.T.S.

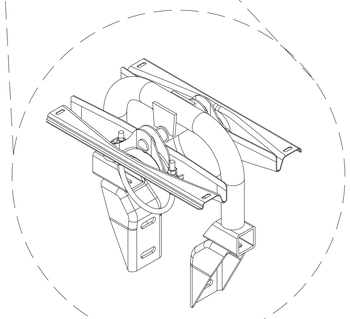
2 - TRACKER ELEVATION
SCALE: N.T.S.



3 - MODULE RAIL, TYP.
SCALE: N.T.S.

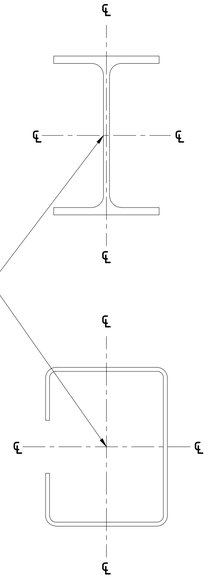


4 - FIRST RAIL, TYP.
SCALE: N.T.S.



5 - BHA, TYP.
SCALE: N.T.S.

S-30X, DETAIL 3 DIMENSIONS FOR BAY AND TRACKER LENGTHS ARE TAKEN FROM CENTER OF BEAMS. SEE FOUNDATION DRAWING FOR IDENTIFICATION OF PIER TYPES.



6 - CENTER OF WEB
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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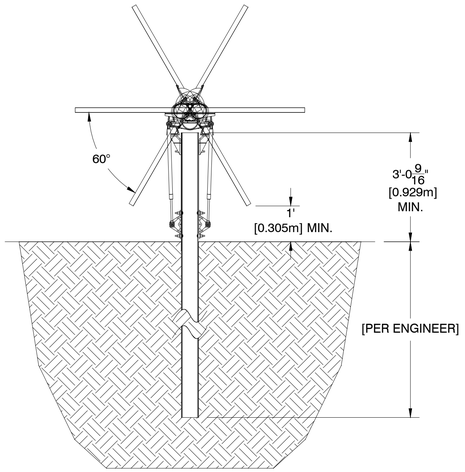
PROJECT NUMBER:

SHEET TITLE:
84 MODULE INT/EDGE TRACKER

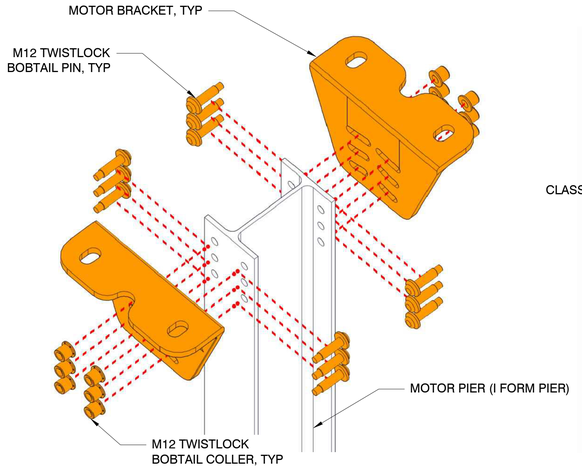
NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

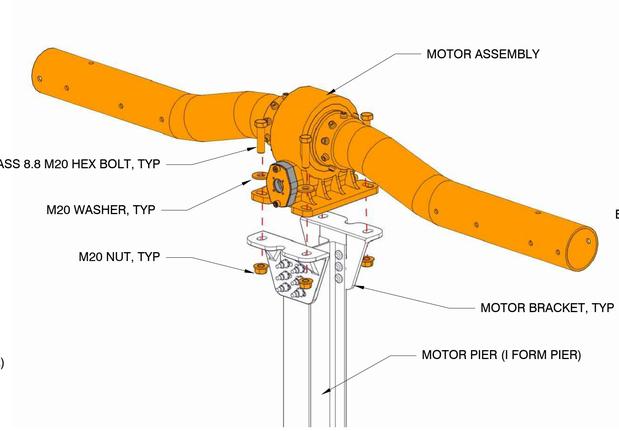
0 ½ 1
IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE



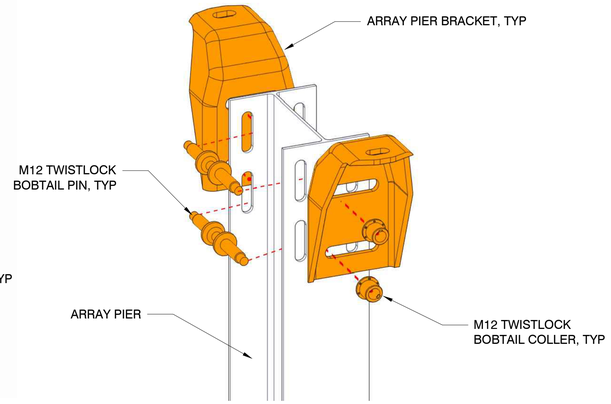
1 - TYPICAL PIER HEIGHT
SCALE: N.T.S.



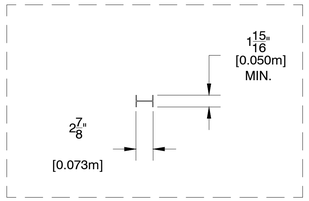
2 - MOTOR BRACKET TO MOTOR PIER
SCALE: N.T.S.



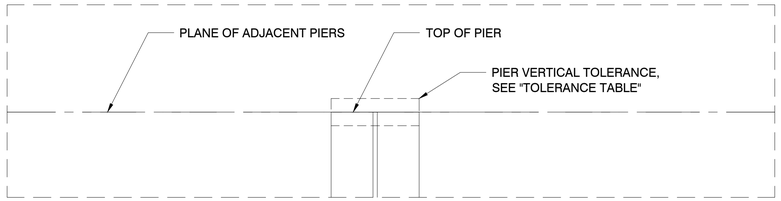
3 - MOTOR ASSEMBLY TO MOTOR BRACKET
SCALE: N.T.S.



4 - ARRAY PIER BRACKET TO ARRAY PIER
SCALE: N.T.S.



5 - I FORM PIER
SCALE: N.T.S.

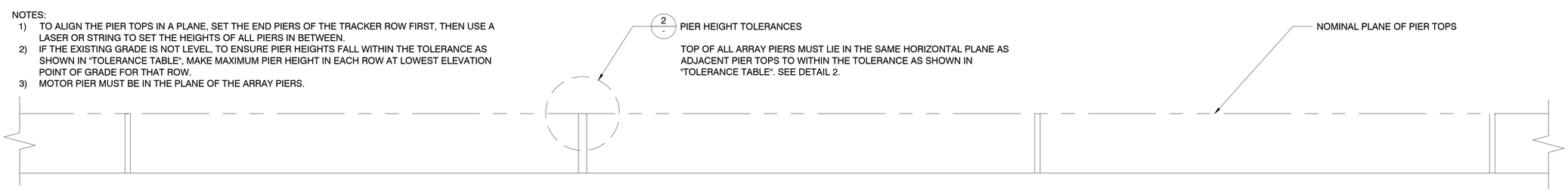


6 - PIER HEIGHT TOLERANCES
SCALE: N.T.S.

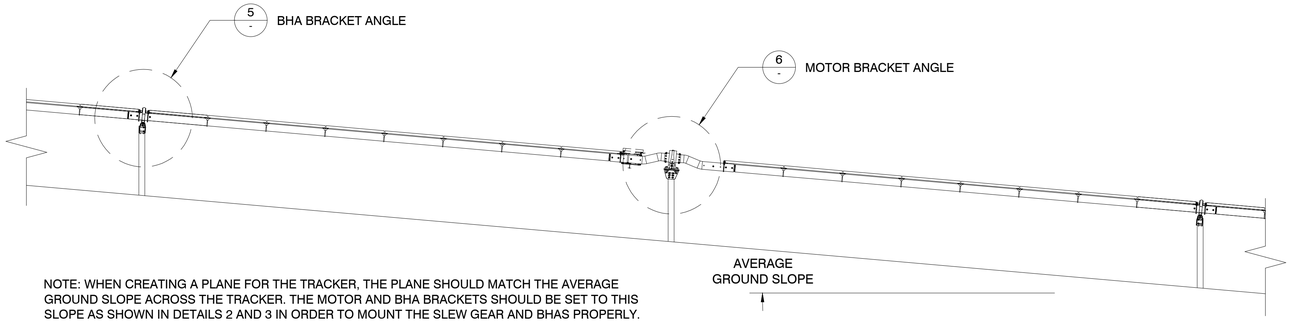
2.2 TOLERANCE TABLE

MEASUREMENT TYPE		0-6.1% (STANDARD SLOPE)	>6.1-15% (HIGH SLOPE)
TOP OF PIER E-W POSITION		+/- 1" (25.4 mm)	
TOP OF PIER N-S POSITION		+/- 1 3/4" (45.5 mm)	+/- 1 3/8" (34.9 mm)
PIER VERTICAL		+/- 11/16" (17.5 mm)	+/- 1/2" (12.7 mm)
PIER TWIST		+/- 5°	
0 - 3% TRACKER SLOPE	PIER PLUMB E-W	+/- 1.5°	-
	PIER PLUMB N-S	+/- 3°	-
>3 - 15% TRACKER SLOPE	PIER PLUMB E-W	+/- 1.5°	
	PIER PLUMB N-S	+/- 1.5°	

NOTES:
1) TO ALIGN THE PIER TOPS IN A PLANE, SET THE END PIERS OF THE TRACKER ROW FIRST, THEN USE A LASER OR STRING TO SET THE HEIGHTS OF ALL PIERS IN BETWEEN.
2) IF THE EXISTING GRADE IS NOT LEVEL, TO ENSURE PIER HEIGHTS FALL WITHIN THE TOLERANCE AS SHOWN IN "TOLERANCE TABLE", MAKE MAXIMUM PIER HEIGHT IN EACH ROW AT LOWEST ELEVATION POINT OF GRADE FOR THAT ROW.
3) MOTOR PIER MUST BE IN THE PLANE OF THE ARRAY PIERS.

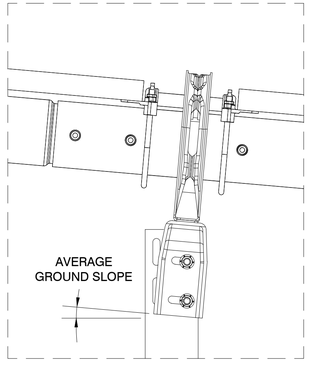


7 - TRACKER PLANAR TOLERANCES
SCALE: N.T.S.

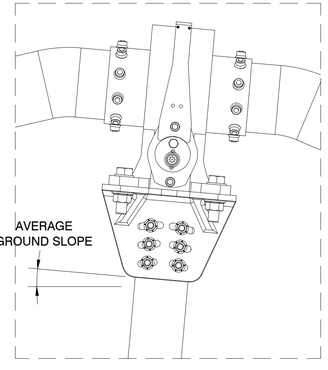


NOTE: WHEN CREATING A PLANE FOR THE TRACKER, THE PLANE SHOULD MATCH THE AVERAGE GROUND SLOPE ACROSS THE TRACKER. THE MOTOR AND BHA BRACKETS SHOULD BE SET TO THIS SLOPE AS SHOWN IN DETAILS 2 AND 3 IN ORDER TO MOUNT THE SLEW GEAR AND BHAS PROPERLY.

8 - PLANE PARALLEL W/ AVERAGE GROUND SLOPE
SCALE: N.T.S.



9 - BHA BRACKET ANGLE
SCALE: N.T.S.



10 - MOTOR BRACKET ANGLE
SCALE: N.T.S.

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A Flex Company
NEXTracker Inc.
6200 Paseo Padre Parkway
Fremont, CA 94555

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PROJECT NUMBER:

SHEET TITLE:

PIER TOLERANCES

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
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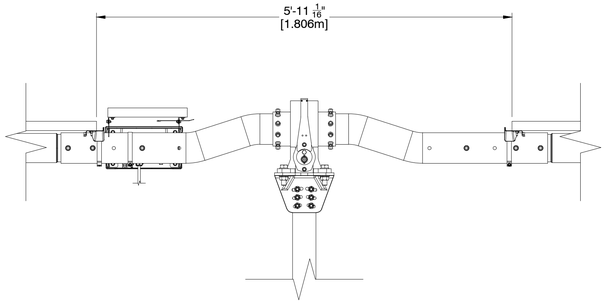
K			

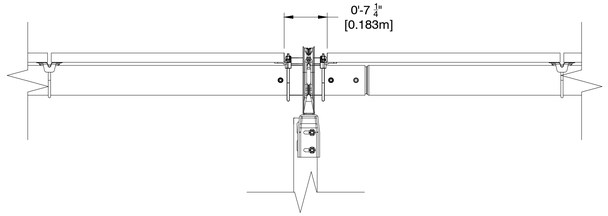
SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE

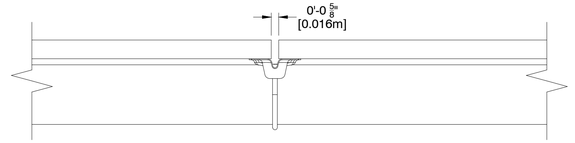
NOTES:
1. MODULE SPACING MAY VARY SLIGHTLY DEPENDING ON MODULE TYPE
2. INSTALL DAMPERS ON SIDE OF PIER CLOSEST TO MOTOR.
3. DAMPERS SHALL BE INSTALLED ROD END DOWN.



1 - TYPICAL MOTOR SPACING
SCALE: N.T.S.



2 - TYPICAL BHA SPACING
SCALE: N.T.S.



3 - TYPICAL MODULE SPACING
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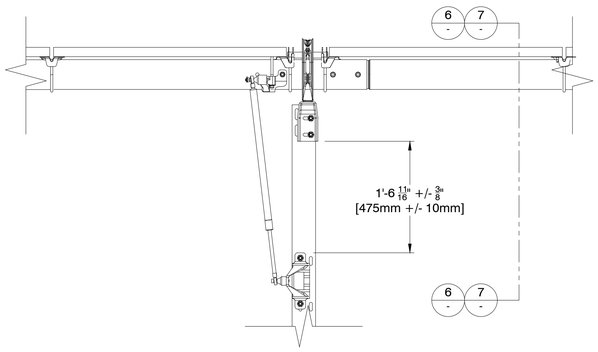
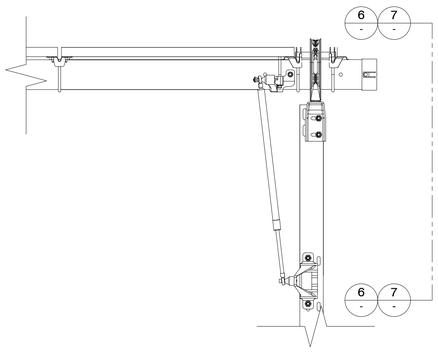
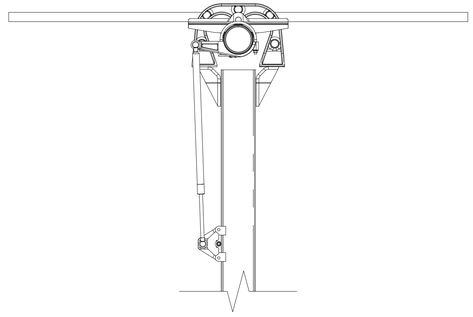


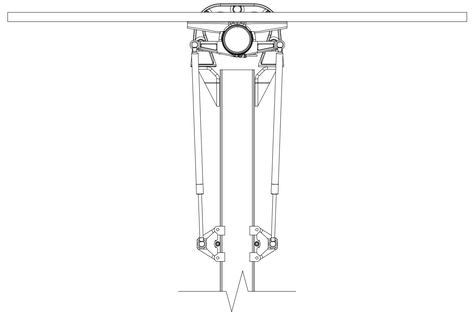
4 - INNER SINGLE/ DOUBLE DAMPER
SCALE: N.T.S.



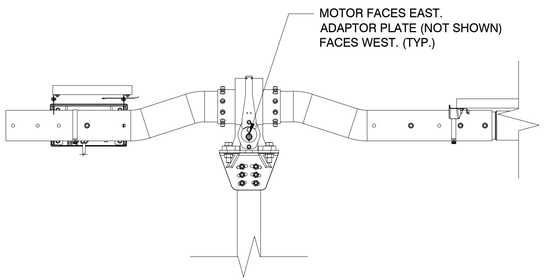
5 - OUTER SINGLE/DOUBLE DAMPER
SCALE: N.T.S.



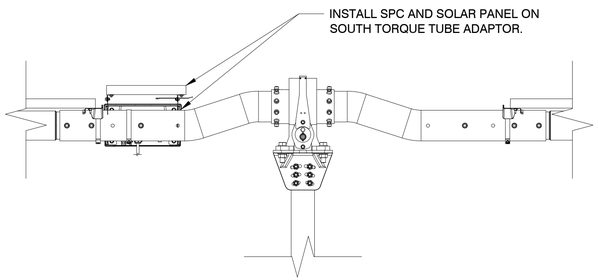
6 - SINGLE DAMPER
SCALE: N.T.S.



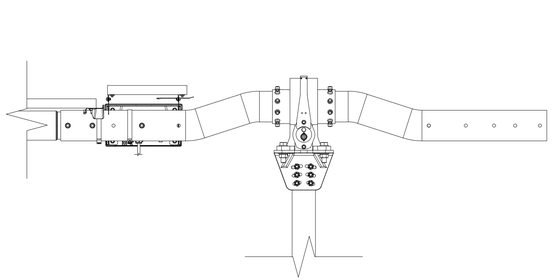
7 - DOUBLE DAMPER
SCALE: N.T.S.



7A - NORTH WING (ONLY) TRACKER
SCALE: N.T.S.



7B - 2-WING TRACKER
SCALE: N.T.S.



7C - SOUTH WING (ONLY) TRACKER
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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BHA & DAMPER DETAILS

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A	PRELIMINARY	-/--/----	
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SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
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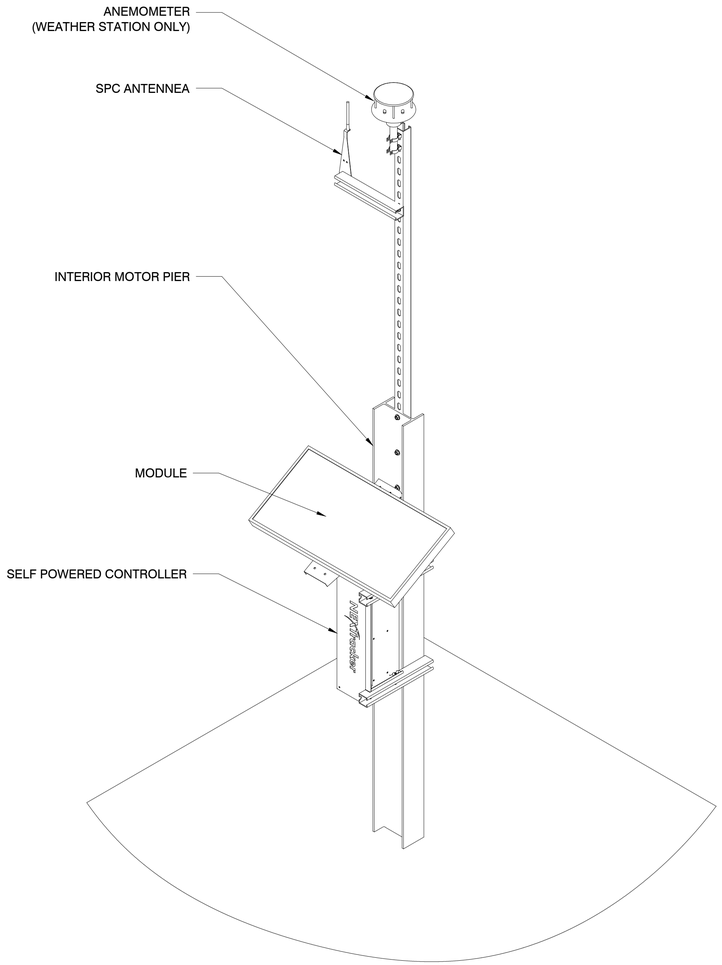
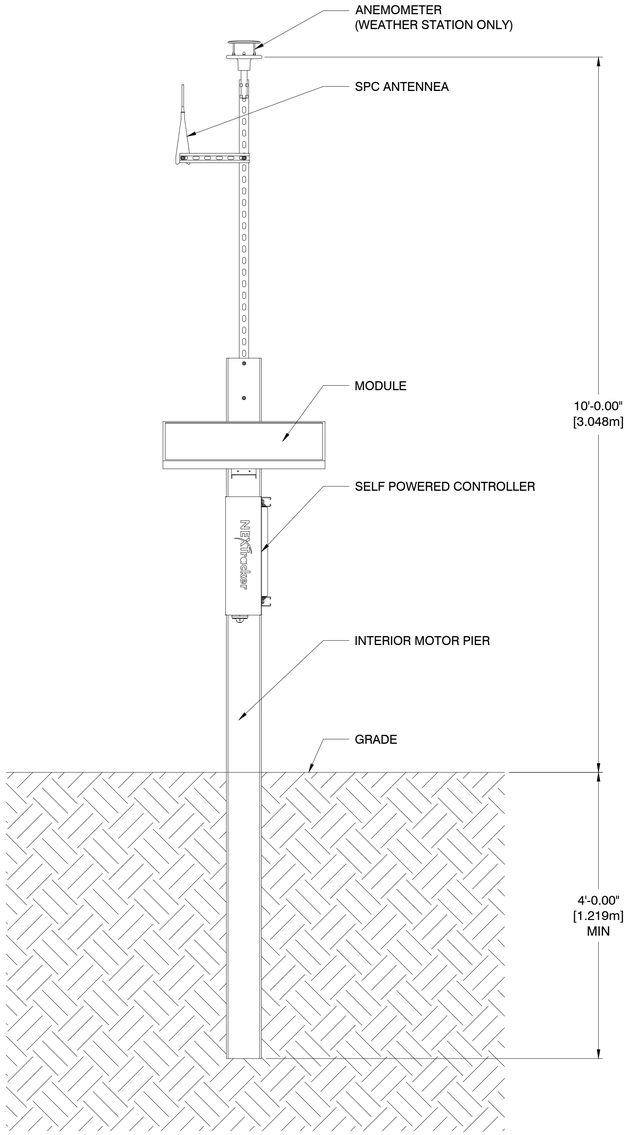


1 - SPT WEATHER STATION, ULTRASONIC WIND SENSOR & REPEATER
SCALE: N.T.S.



2 - SPT WEATHER STATION, ULTRASONIC WIND SENSOR & REPEATER
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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SHEET TITLE:
SPC & WEATHER STATION DETAILS

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SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
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NEXTracker
A Flex Company

NX HORIZON
SELF-POWERED TRACKER

THE MOST ADVANCED AND RELIABLE TRACKER ON THE MARKET

In our mission to make solar a mainstream energy source, NEXTracker has engineered the most intelligent and flexible tracking technology available today: the NX Horizon™ self-powered tracker.

NX Horizon brings self-contained motor power and control to each row, eliminating power wiring and trenching and enabling advanced energy yield optimization. With a balanced mechanical design and highly configurable, independent rows, NX Horizon improves reliability and design flexibility while lowering O&M costs. By offering more powerful systems at a greater value, NEXTracker is accelerating deployment of renewable energy worldwide.

NX HORIZON KEY FEATURES AND BENEFITS INCLUDE:

SELF-POWERED SYSTEM WITH SMART PERFORMANCE COMMUNICATION ARCHITECTURE:
Self-contained units on each row include a dedicated PV panel to provide power to the controller which drives the motor and hosts intelligent control electronics to position each tracker row for maximum yield.

INDEPENDENT BALANCED ROWS WITH 120 DEGREE ROTATIONAL RANGE:
Each NX Horizon row has its own controlled motor and a wide rotational range that delivers up to 2% more energy than typical linked row trackers.

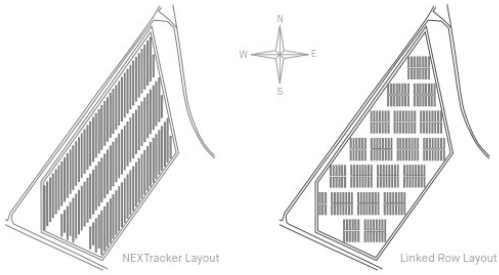
FAST AND SIMPLE INSTALLATION:
With less steel, no drive shafts, extra cabling, or welding required, NX Horizon allows for quick and easy installation. We also offer our PowerworX™ Academy to share hands-on best practices to ensure the highest quality installation and reliability for the life of the plant.

LOWEST LONG-TERM O+M COSTS:
NX Horizon's elegant design, independent rows, and smart, data-driven Digital O&M™ capability contribute to the lowest long-term ownership costs for our customers.

GENERAL	
Tracking Technology	Horizontal single-axis balanced-mass tracker
Tracking Range	120° (± 60°)
Drive System	One slew gear, 24 VDC motor and self-powered controller w/ dedicated solar panel per row
DC Capacity	23-35kWp per tracker row, depending on panel type. Row length up to 90 panels.
System Voltage	1,000 volt or 1,500 volt
Safety Stowing	Automated wind and snow stowing with self-contained backup power
Torsional Limiter	Included at each foundation/bearing for additional wind and snow load protection
Principal Materials	Galvanized and stainless steel
Compliance	Grounding/bonding: UL2703; structural design: ASCE7-10, T racker: UL 3703
Typical Dimensions	Height 1.4 m/4.5 ft, Width 2.0 m/6.4 ft, Length 85 m/283 ft
Module Frame Bonding	Integrated bonding to foundation pier. No additional copper wiring required

SITE CONDITIONS

The innovative NX Horizon is so flexible that we are able to build almost anywhere with minimum grading. While linked row systems need to pay attention to both north-south and east-west slopes, NX Horizon offers complete freedom in east-west slope tolerance. In the north-south direction, NEXTracker's unique design accommodates a generous 15% grade.

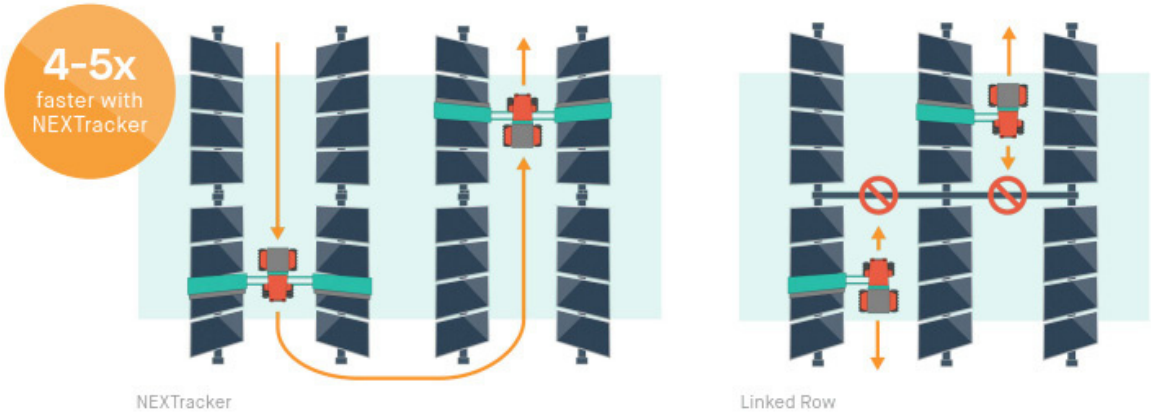


Power Consumption	Self-powered, no grid power required
Ground Coverage Ratio	No limitation. Typical range 33%-50% depending on site conditions
Foundations	I-beam and C-channel options
Maximum Site Slope	15% (8 degrees) North-South; Unlimited East-West
Maximum Wind Speed	Configurable up to 140 mph ASCE7-10
Flood Clearance	1.2m/4ft clearance for tracker electrical & controls standard. Increased array heights available

INSTALLATION & O&M

NX Horizon's efficient structural design uses less steel than conventional trackers, with fewer parts and quicker installation. You won't need drive shafts or extra cabling to power the tracker, speeding the process up even further. NX Horizon is self-grounded, so you won't have to pay costs and labor for installing grounding washers, braided straps, bare copper wire, and grounding rods. Furthermore, zero welding is required. Our patented fasteners make mounting the panels quick and easy. The fasteners are designed to hold their tensile strength indefinitely, so you won't have to waste time and money checking and re-torquing these connections.

Once installed, the tracker is easy to service. Because the rows are not linked with a drive shaft, maintenance vehicles can drive through the arrays freely. Plus, module cleaning and vegetation management becomes quick and effortless.



Installation Method	Rapid field installation of pre-manufactured components. No welding, cutting or drilling
Module Attachment	Shared mounting rails with integrated module frame grounding. Rails pre align to locating holes in torque tubes
Structural Connections	Vibration proof, permanent swaged fasteners. No re-torquing required
Commissioning Process	Automated commissioning with NEXTracker CX rapid system commissioning tool
Array Pivots	All metal, no lubrication required
Motor & Slew Drive	Fully sealed, lubricated for life. No annual maintenance
Scheduled Maintenance	Limited to annual inspections

CONTROL/MONITORING

As soon as the wireless controller is plugged in, tracking begins. Each controller has an integrated inclinometer, and can measure each row individually, sending its data through a wireless mesh network.

Each state-of-the-art NEXTracker row features real time data collection so you'll always know that it's working properly. You can review your entire portfolio, identify issues at a glance with flag alerts, and drill down to individual rows to see alert status, and a wide range of operational parameters. No other tracker technology offers this level of visibility. We know it's crucial for you to be able know about issues right when and where they happen, so you can react immediately. Use our NEXTracker monitoring tools to understand how your asset is performing at all times, from anywhere in the world.

Tracker Control	1 self-powered controller, DC motor and slew drive per tracker row
Communications	Wireless ZigBee© mesh network; no communication wiring required
Weather Monitoring	Wind measurement standard, snow and flood optional
Solar Tracking Method	Astronomical GPS based algorithm
Communications Architecture	One network control unit (NCU) per 100 trackers
SCADA Interface	Dedicated tracker system SCADA with HMI on dedicated industrial computer
Optimized Backtracking	Yes

SERVICE & WARRANTY

Exemplary customer service is tightly woven into NEXTracker's company DNA. We have 30 years of experience with boots on the ground, and we know how to best help you speed installation, lower project costs, insure proper maintenance, and answer every question you might have. We've got you covered with our on-site tech advisors and our PowerworX training. Customer service is value — one that we've always carried in our DNA, and always will.

Comprehensive Warranty	10 years on structural components; 5 years on drive and control systems. Extended terms available
Design Services	Site plan, topography review, detailed mechanical/structural sheet set (P.E. stamped)
Training	Regularly scheduled PowerworX Academy
On-site tech advisors	Standard

NEXTracker™
A Flex Company

MAXIMIZE YOUR ENERGY GENERATION AND INVESTMENT WITH NX HORIZON

Email us today for a quote: salesteam@nextracker.com

6200 Paseo Padre Pkwy Fremont, CA 94555

MKT-000060

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SG250HX New

Multi-MPPT String Inverter for 1500 Vdc System

SUNGROW
Clean power for all

HIGH YIELD

- 12 MPPTs with max. efficiency 99%
- Compatible with bifacial module
- Built-in Anti-PID and PID recovery function

SMART O&M

- Touch free commissioning and remote firmware upgrade
- Online IV curve scan and diagnosis*
- Fuse free design with smart string current monitoring

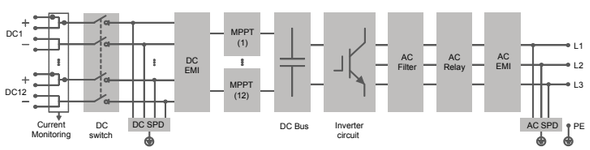
LOW COST

- Compatible with Al and Cu AC cables
- DC 2 in 1 connection enabled
- Power line communication (PLC)
- Q at night function

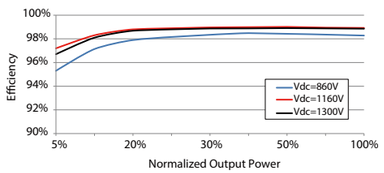
PROVEN SAFETY

- IP66 and C5 protection
- Type II SPD for both DC and AC
- Compliant with global safety and grid code

CIRCUIT DIAGRAM



EFFICIENCY CURVE



Type designation	SG250HX
Input (DC)	
Max. PV input voltage	1500 V
Min. PV input voltage / Startup input voltage	600 V / 600 V
Nominal PV input voltage	1160 V
MPP voltage range	600 V – 1500 V
MPP voltage range for nominal power	860 V – 1300 V
No. of independent MPP inputs	12
Max. number of input connectors per MPPT	2
Max. PV input current	26 A * 12
Max. current for input connector	30 A
Max. DC short-circuit current	50 A * 12
Output (AC)	
AC output power	250 kVA @ 30 ℃ / 225 kVA @40 ℃ / 200 KVA @ 50 ℃
Max. AC output current	180.5 A
Nominal AC voltage	3 / PE, 800 V
AC voltage range	680 – 880V
Nominal grid frequency / Grid frequency range	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % In
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / connection phases	3 / 3
Efficiency	
Max. efficiency	99.0 %
European efficiency	98.8 %
Protection	
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch	Yes
AC switch	No
PV String current monitoring	Yes
Q at night function	Yes
PID protection	Anti-PID or PID recovery
Overvoltage protection	DC Type II / AC Type II
General Data	
Dimensions (W*H*D)	1051 * 660 * 363 mm
Weight	95kg
Isolation method	Transformerless
Ingress protection rating	IP66
Night power consumption	< 2 W
Operating ambient temperature range	-30 to 60 ℃
Allowable relative humidity range (non-condensing)	0 – 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	Amphenol UTX (Max. 6 mm²)
AC connection type	OT terminal (Max. 300 mm²)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, IEC 61000-6-3, EN 50549, UNE 206007-1:2013, P.O.12.3, UTE C15-712-1:2013
Grid Support	Q at night function, LVRT, HVRT,active & reactive power control and power ramp rate control

*: Only compatible with Sungrow logger and iSolarCloud

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MVS6300-LV Preliminary

SUNGROW
Clean power for all

MV Turnkey Station for 1500 Vdc String Inverter SG250HX

HIGH YIELD

- High efficiency, max. efficiency 99.51%
- 1.1Pn longtime overloading capacity @30 ℃

EASY O&M

- All key components front accessible
- All pre-integrated, only external cable connection work needed onsite
- Online analysis for fast trouble shooting

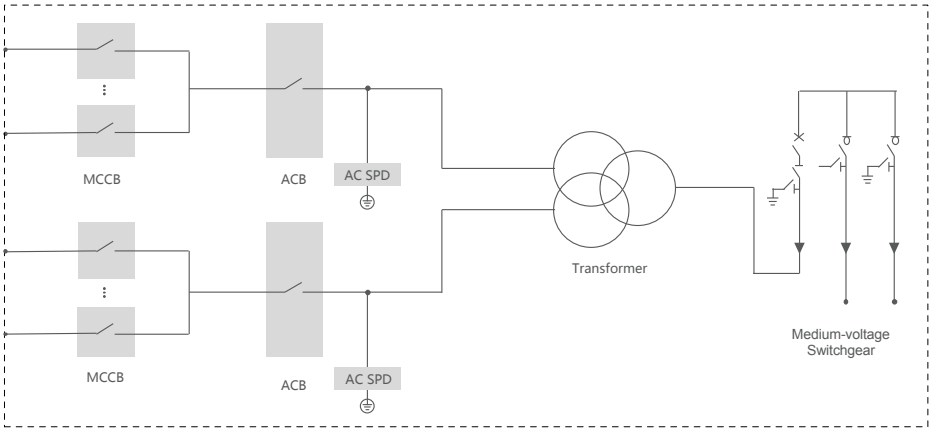
SAVED INVESTMENT

- Up to 6.3 MW block design
- Easy transportation and installation due to standard container design
- Integrated communication and aux. power supply

RELIABLE

- Compliance with standards: IEC 60076, IEC 62271, IEC 61439

CIRCUIT DIAGRAM



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Type designation	MVS6300-LV
Transformer	
Transformer type	Oil immersed
Rated power	6300 kVA @ 40 ℃
Max. power	7000 kVA @ 30 ℃
Vector group	Dy11y11
LV / MV voltage	0.8 kV / 20 – 35 kV
Maximun input current at nominal voltage	2525 A * 2
Frequency	50 Hz / 60 Hz
Tapping on HV	0, ±2 * 2.5 %
PEI efficiency	99.51%
Cooling type	ONAN (Oil Natural Air Natural)
Impedance	7 % (±10 %)
Oil type	Mineral oil (PCB free) or degradable oil on request
Winding material	Al / Al
Insulation class	A
MV Switchgear	
Insulation type	SF6
Rate voltage	24 – 36 kV
Rate current	630 A
Internal arcing fault	IAC AFL 20 kA / 1s
Qty. of feeder	3 feeder (2 LBS and 1 VCB or equivalent)
LV Panel	
ACB Specification	3200 A / 800 Vac / 3P, 2 pcs
MCCB Specification	250 A / 800 Vac / 3P, 28 pcs
Protection	
AC input protection	Circuit breaker
Transformer protection	Oil-temperature, oil-level, oil-pressure
Relay protection	50 / 51, 50N / 51N
Overvoltage protection (LV side)	AC Type I + II
General Data	
Dimensions (W*H*D)	6058*2896*2438 mm
Approximate Weight	22 T
Operating ambient temperature range	-35 to 60 ℃
Auxiliary power supply	5 kVA / 400 V (Optional: max. 40 kVA)
Degree of protection	IP54
Allowable relative humidity range (non-condensing)	0 – 95 %
Operating altitude	1000 m (standard) / > 1000 m (optional)
Communication	Standard: RS485, Ethernet, Optical fiber
Compliance	IEC 60076, IEC 62271-200, IEC 62271-202, IEC 61439-1, EN50588-1

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MVS2500–LV/MVS3000–LV/MVS3150–LV/MVS5000–LV/MVS6250–LV/ MVS6300–LV

MV Station

System Manual

SUNGROW

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1 About This Manual

1.1 Validity

This manual is intended for the following product:

- MVS2500-LV
- MVS3000-LV
- MVS3150-LV
- MVS5000-LV
- MVS6250-LV
- MVS6300-LV

Hereinafter it will be referred to as " MV Station" unless otherwise specified.

1.2 Demonstration of the Model

Model	Rated power	Devices can be connected
MVS2500-LV	2500 kVA	20 x SG125HV
MVS3000-LV	3000 kVA	24 x SG125HV
MVS3150-LV	3150 kVA	14 x SG250HX
MVS5000-LV	5000 kVA	40 x SG125HV
MVS6250-LV	6250 kVA	50 x SG125HV
MVS6300-LV	6300 kVA	28 x SG250HX

The function, appearance and wiring method of the models are the same, but the number of inverters is different.

This manual takes MVS6300-LV as an example to briefly introduce the installation and wiring instructions of MV Station.

1.3 Target Group

This manual is for technical personnel who are responsible for the transport, installation and other operations on the MV Station.

Only qualified personnel can perform the installation. Qualified personnel are:

- Equipped with certain electrical wiring and mechanical knowledge and familiar with electrical and mechanical principle diagram
- Familiar with theconstruction and working principle of the PV grid-connected power generation system; and familiar with the construction and working principle of the MV Station upstream and downstream equipment

- Trained especially in the installation of electrical devices
- Capable of coping with the dangerous and emergency situations during the installation and commissioning
- Familiar with the country/regional standards and specifications
- Familiar with this manual

1.4 How to Use This Manual

Read this manual carefully before installing the device. Keep this manual and other product component information together to ensure ease of access. In addition to this manual, the following documentations are provided:

- MV Switchgear manual
- MV Transformer manual
- Other enclosed manuals

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1.5 Symbols Explanation

This manual contains important safety and operational instructions that must be accurately understood and respected during the installation and maintenance of the equipment.
To ensure the optimum use of this manual, note the following explanations of the symbols used.

⚠ DANGER

DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

NOTICE
NOTICE indicates a situation which, if not avoided, could result in equipment or property damage.

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

The symbols below may be found on the electrical parts of the inverter. Make sure to read the following symbols and fully understand them before installing the equipment.

Symbol	Explanation
	Lethal voltage inside! Do not touch!
	Hot surface! Do not touch the hot surface of the device.
	Protective earth. Earthing securely to ensure personal safety.

1.6 Terminology

Name	For short
MV Station	MV Station / Container
COM100 Communication Box	COM100 / communication Box

The foregoing devices are expressed in the abbreviation form in this document unless otherwise specified.

2 Safety Instructions

Read the safety instructions carefully before installing the MV Station. Refer to corresponding manuals for the safety instructions on the internal devices.

2.1 General Safety Rules

⚠ DANGER

Touching the terminals or contactors connected to the grid may lead to electric shock!

- Do not touch the terminals or conductors connected to the grid.
- Respect all safety instructions on the grid connection.

⚠ DANGER

Lethal voltages are present inside the device!

- Pay attention to and follow the warning signs on the device.
- Respect all safety instructions in this manual and other pertinent documents.

⚠ DANGER

Electric shock or fire may occur due to device damage or system fault.

- Visually inspect the MV Station for device damages or other hazards.
- Check if the external devices and circuit connections are safe.
- Only operate the device when it is safe to do so.

⚠ WARNING

All installations and operations on the MV Station must be in full accordance with the national and local regulations and standards.

⚠ WARNING

Ensure that the installation environment (such as voltage, temperature, humidity, altitude, pollution level, water-proof and dust-proof level) is within the scope of equipment specifications.

⚠ WARNING

The locking device on the pressure relief valve must be removed before operation. refer to "7-1 Remove the locking device of the pressure relief valve".

⚠ WARNING

The installation, electrical connection, commissioning, maintenance, and troubleshooting must be carried out by professional electrical technicians conforming to local codes. Before performing operations, operators should have read this manual completely and mastered the safety issues related to the operation.

2.2 Ground Fault Protection

⚠ DANGER

If a ground fault occurs in the PV system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before performing operation and take proper protective measures.

2.3 Live Line Measurement

⚠ DANGER

Before electrical connection, please ensure that the substation and electrical equipment inside it are intact and hazard-free. All electrical connections must meet electrical standards of local country/region.

⚠ DANGER

High voltages are present inside the device. Death can result from burning and electric shock due to touching the live components of the MV Station. During live line measurement,

- use suitable protective equipment, for example, dielectric gloves, and
- accompanied by other persons.

2.4 Measuring Instrument

The instrument for measuring the electrical parameters should meet the following requirements:

⚠ WARNING

- The instrumentfor measuring the electrical parameters should be a high-quality instrument with sufficient measuring range.
- Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations.
- Use suitable protective equipment, for example, dielectric gloves during live line measurement.

2.5 Voltage-free Operations

Perform operations on the MV Station only when all devices inside the MV Station are completely voltage-free.

- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.
- Ensure sufficient escape room.
- After the MV Station stops, wait at least 5 minutes before operating it.
- Ensure that the MV Station is completely voltage-free.

2.6 ESD Protection

⚠ CAUTION

Devices may be damaged irreversibly by electrostatic discharge (ESD).

- Avoid unnecessary touching of the PCB.
- Observe all the ESD-related safety instructions. Wear proper personal protective equipment (PPE) such as wrist strap.

2.7 Symbols on the Device Body

Symbols on the device contain important information on safe operations of the MV Station and its internal devices. Do not tear or damage them!

NOTICE

Do not damage or tear the symbols.

- All symbols on the device body must be clearly legible.
- Replace the symbols once any damage or illegibility is detected.

2.8 Safety Warning Signs

During transport, installation, maintenance, and troubleshooting of the MV Station, keep unauthorized persons away.

- Post warning signs near the MV Station upstream and downstream switches to prevent inadvertent connection.
- Place necessary warning signs or barriers near the on-site operation areas.

2.9 Daily Operation and Maintenance

Make sure the doors of the MV Station are closed and locked during daily operation to prevent internal devices from damages caused by rain or rodents.
Regularly check and maintain the MV Station and internal devices to ensure long-term and reliable operation of the MV Station.

⚠ WARNING

Make proper insulation protection during live line operation. At least two persons are required until the operation is done.
Properfiled rescue facilities are necessary since locations of most power stations are far away from the urban areas.

⚠ WARNING

The equipment shall be operated in accordance with local laws and regulations and strictly follow the safety precautions specified in this document.

⚠ WARNING

Before maintenance or device replacement, please ensure that the substation has been powered off and the high-voltage side switch and low-voltage side switch are disconnected.

Take the followings into consideration during daily operation and maintenance:

- The nameplate is pasted on the MV Station body. It contains important parameter information of the devices. Protect the nameplate during all operations.
- Wear proper PPE, such as safety glasses, safety footwear, and safety gloves, if necessary.
- All necessary auxiliary measures are advisable to ensure personal and device safety.

2.10 Others

2.10.1 Manual Storage

Product manuals are an indispensable part of the product. Important information about the transport, installation of the MV Station is included in this manual. All the descriptions in this manual, especially those safety-related items, must be complied with. Please read all the instructions thoroughly prior to performing any operation work on the MV Station.

- Transport and install the MV Station strictly following the descriptions in this manual. Device damage, personal injury, or property loss may follow if otherwise.
- This manual and relevant documents should be available for relevant persons at all times.

2.10.2 Disposal of Waste

When the MV Station has come to the end of its service life, it cannot be disposed of together with household wastes. Some inside components can be recycled while some components can cause environmental pollution.
Please contact the local authorized collection point.

2.10.3 Manual Description

For user convenience, there are a large number of pictures in this manual. These pictures are indicative only. For details about the device, please refer to the actual product you receive.

Keep this manual at a convenient place near the device for future reference.

All the descriptions in this manual are for the standard MV Station. Please inform us in the purchase order if you have specific requirements. The actual product you receive may differ.

This manual may not cover all possible situations. Should a specific problem not explained in this manual occur, please contact Sungrow.

3 Product Description

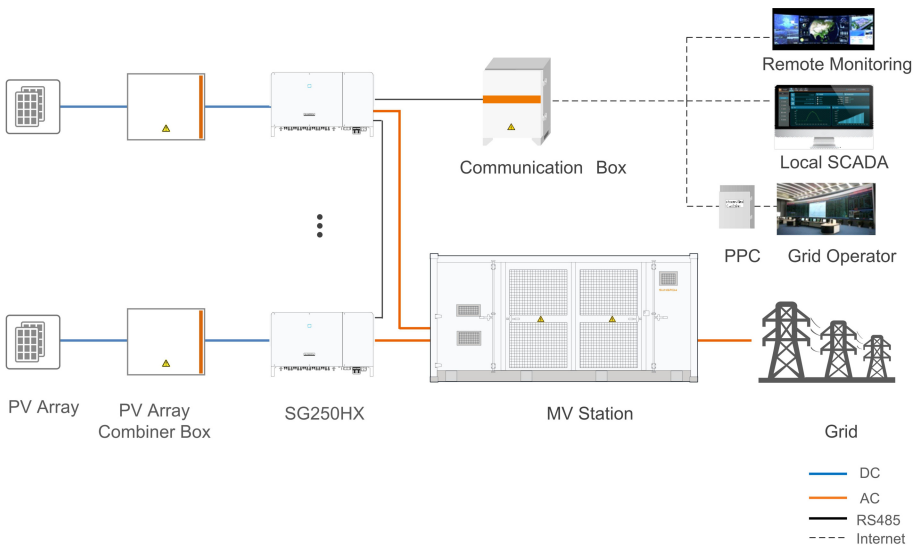
3.1 System Overview

The MV Station is mainly applied to large-and-medium PV power station. The MV Station can meet the modular design and quick installation requirements of the large-and-medium PV power station and can ensure the long-term, reliable, and safe power generation compliant with the grid.

MV Station is a booster device used in conjunction with the inverters. The main function is to convert the low-voltage from the inverters into medium-voltage and feed into the grid.

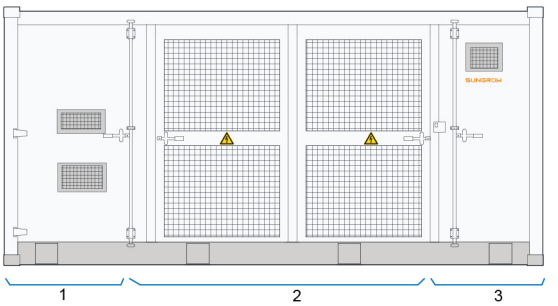
The MV Station integrates LV cabinet, MV transformer, MV switchgear, power distribution cabinet ,communication box and auxiliary transformer.

The PV power generation system with the MV Station is shown in the following figure.



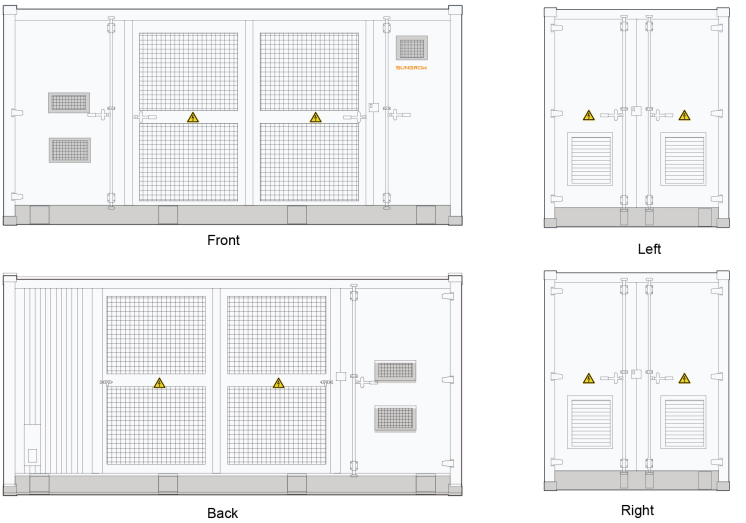
3.2 External Design

3.2.1 Composition

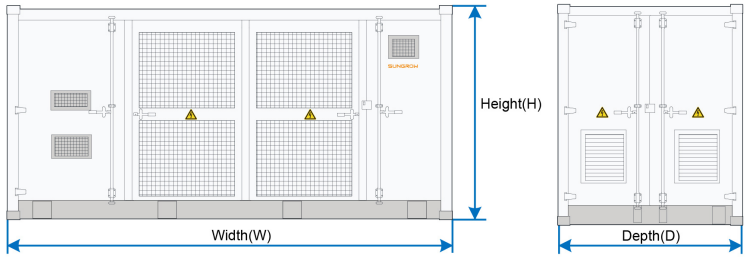


No.	Name	Description
1	LV room	Including low voltage connection area, low voltage cable entries, etc. It can be connected to the PV grid-connected inverters.
2	Transform-er room	Including a MV transformer. The MV transformer converts the inverter output low-voltage into grid-compatible medium-voltage.
3	MV room and power distribution room	The power distribution room is on the front side, with a communication box and an LV power distribution cabinet integrated inside. The MV room is on the back side, with one MV switchgear included inside.

3.2.2 MV Station Views



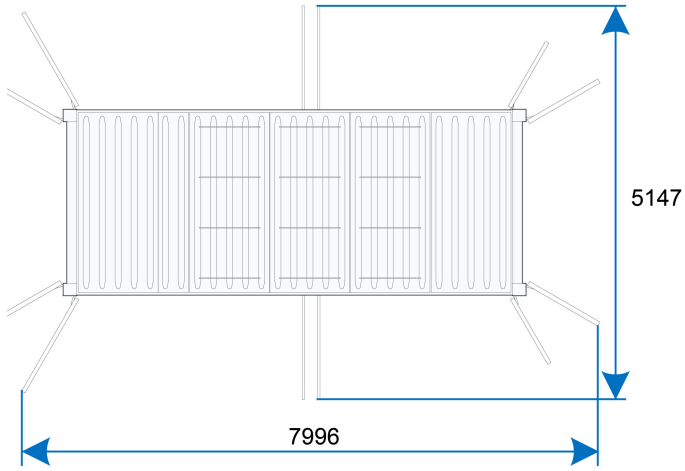
3.2.3 Exterior Dimensions



Width(W)	Height(H)	Depth(D)
6,058 mm	2,896 mm	2,438 mm

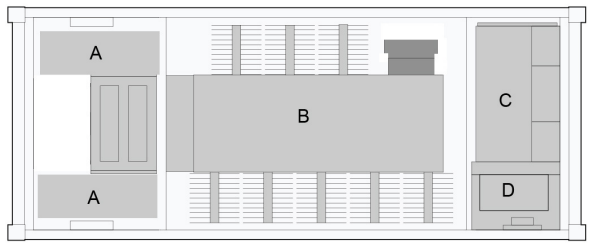
The Clearance Requirement

The clearances around the MV Station should be sufficient for the doors to be opened .



3.3 Internal Design

3.3.1 Internal Composition

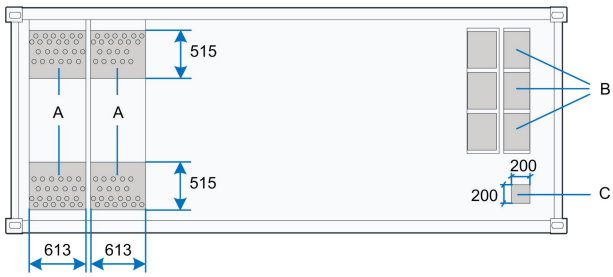


No.	Name
A	LV cabinet
B	MV Transformer

No.	Name
C	MV switchgear
D	Communication box and power distribution cabinet

3.3.2 Cable Entries

Taking the MVS6300 – LV as an example, the bottom entry hole is shown below.



No.	Name	Description
A	LV side cable entries	All LV side cables connecting the MV Station go inside through these entries.
B	MV side cable entries	All MV side cables connecting downstream MV grid go inside through these entries.
C	Communication & Power distribution cables entry	All communication cables and power distribution cables connecting external device go inside through this entry.

3.3.3 Internal Devices

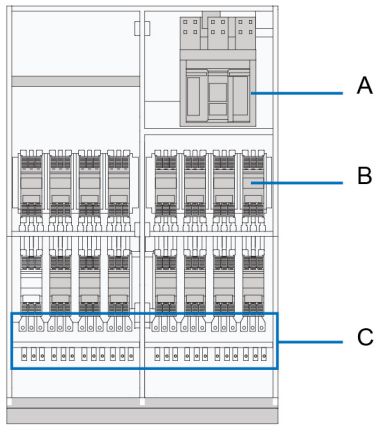
The MV Station consists of LV room, transformer room, MV room, and power distribution room.

3.3.3.1 LV Cabinet

The LV cabinet is located at the LV room inside the MV Station. It is used to converge and transmit low voltage from the inverter to the step-up transformer, and feed it into the MV grid.

The LV cabinet consists of LV cabinet A and LV cabinet B. The two cabinets are the same in design.

Taking the MVS6300 – LV as an example, the figure below shows the internal components of the LV cabinet.



No.	Name	Description
A	Air circut breaker	For LV cabinet A, used to connect/disconnect the LV cabinet A. For LV cabinet B, used to connect/disconnect the LV cabinet B.
B	Molded case circuit breaker	Used to connect/disconnect the corresponding wiring terminals
C	Low voltage connection area	Can be connected to the upstream inverters.

3.3.3.2 Transformer Room

The transformer room mainly includes a transformer inside.

The transformer integrates accessories such as pressure relief valve, tap changer, oil level indicator, pressure gauge, oil temperature indicator, oil filling valve, and oil drain valve. Positions and functions of the accessories are as follows:

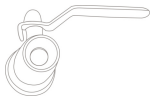
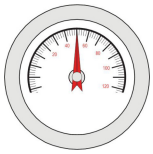
Figure	Name	Description
	Oil filling valve	when oil level of the MV transformer oil tank is low, open the valve for oil filling.
	Pressure Relief Valve	The valve automatically releases when the oil pressure inside the oil tank reaches 55kPa.
	Pressure Gauge	The pressure gauge is used to obtain the pressure inside the oil tank.

Figure	Name	Description
	Oil Level Indicator	The MV transformer will stop operating if the oil level falls below the lowest scale on the oil level indicator or below the oil level scale required for safe operation of the transformer. When the oil level is excessively high, open the drain valve to lower the oil level. When the oil level is excessively low, disconnect the transformer and check the oil tank for leakage.
	Oil Temperature Indicator	The alarm temperature is set to 90℃. When the oil temperature reaches the value, alarm signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the customer. The tripping temperature is set to 100℃. When the oil temperature reaches the value, tripping signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the customer. At the same time, the transformer will be disconnected from the upstream and downstream devices.
	Winding thermometer	—
	Oil drain valve	Open the valve for oil drainage when the oil level is excessively high or when operations such as maintenance are required.
	Tap changer	The tap changer has five tap positions: 1, 2 , 3, 4 , 5. For more details, refer to"figure 7-2 Adjust the voltage ratio via the tap changer".

Note: The figure above is for reference only, and the actual product may differ.

3.3.3.3 MV Room

The MV room includes a switchgear inside.

The switchgear consists of load switch cabinet, circuit breaker cabinet, and direct cable connection cabinet.

Names of the cabinets vary with switchgear manufacturers, as shown in the table below.

Manufacturer	Siemens	ABB	OMAZABAL
Load switch cabinet	R	C	L
Circuit breaker cabinet	L	V	V
Direct cable connection cabinet	K	D	Rb

For example, the appearance of the CCV cabinet of ABB is as follows:

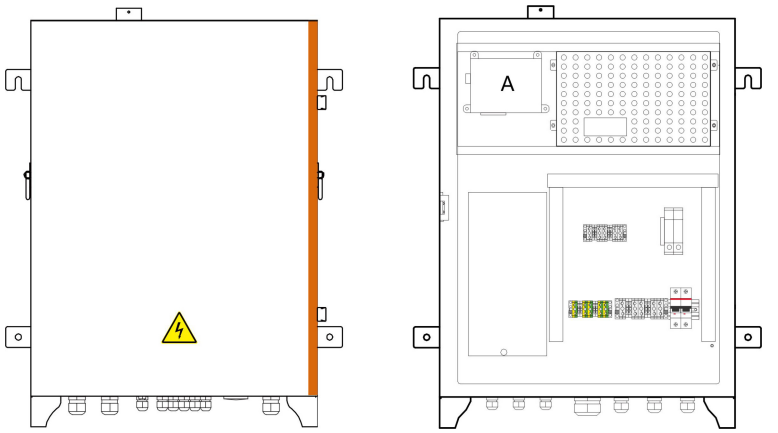
24kV 36kV

3.3.3.4 Power Distribution Room

The power distribution room integrates a communication box and a power distribution cabinet inside.

Communication Box

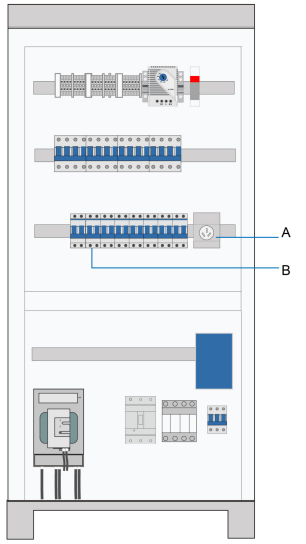
The exterior appearance and internal components of the communication box are shown in figure below.



No.	Description
A	Ethernet switch

Power Distribution Cabinet

The exterior appearance and internal components of the cabinet are shown in figure below.



The figure above is indicative only, and actual product may differ.

No.	Description
A	Power socket
B	Miniature circuit breaker

4 Identify and Store the MV Station

4.1 Identifying the MV Station

Identify the MV Station from its nameplate. The nameplate contains the following information: MV Station model, major technical parameters, marks of certification institutes, origins, and serial number.

⚠ WARNING

Very important technical parameters and MV Station-related parameters are displayed on the nameplate.
Protect the nameplate at all times!

4.2 Checking for Transport Damages

The MV Station has been strictly inspected and tested before delivery. Despite robust packaging, the container or inside devices may be damaged during transport. Therefore, once you receive the MV Station, a detailed inspection is necessary.
If any damage is detected, contact the forwarding company or Sungrow immediately.
Examine the contents of the shipment to check the scope of delivery described in the scope of delivery for completeness.

- Check to make sure the MV Station and inner devices are of the same models as those in your order;
- Check thoroughly the MV Station and inner devices for any possible damages during transport.

⚠ WARNING

Install and commission the MV Station only when it is technically faultless! Make sure before installing the MV Station that:

- **the MV Station is intact without any damage; and**
- **all devices inside the MV Station are intact without any damages.**

4.3 Storage

If the MV Station is not to be installed immediately after delivery, store it appropriately:

- Store the MV Station indoors, for example, large warehouse or workshop, to prevent possible condensation or damp.

- If the MV Station has to be stored outdoors, elevate the MV Station base according to the geological and ambient conditions.
- When the ambient temperature is too low, heat the MV Station internal devices. Temperature: -35 ° C~+70 ° C; Relative humidity: 0 to 95%, and non-condensation
- Ensure that all the doors of the MV Station are closed.
- Store the MV Station on a dry, clean, and solid ground with sufficient load-bearing capacity. The ground should be flat without water, bumps, or plantings.
- Lock the MV Station internal devices and the MV Station during storage.
- Take proper protective method to prevent the water and dust penetrating into the MV Station. Protect the MV Station air inlets and outlets at least.
- Consider the 8 support feet of the MV Station when selecting the temporary storage platform.

Regularly, once every half a month at least, check the MV Station and internal devices.

5 Mechanical Installation

⚠ WARNING

Respect all local standards and requirements during mechanical installation.

5.1 Transport

All devices are installed inside the MV Station before delivery. The MV Station should be transported as a whole. Transport the MV Station by a crane with sufficient load capacity.

The MV Station is delivered to the user by the forwarding company. After unloading, the MV Station will be transported to the installation site by the plant staff.

⚠ WARNING

Local standards and regulations on the transport and loading & unloading of the container, especially those safety instructions, should be observed at all times.

- **All the accessory appliances used during transport should be maintained beforehand.**
- **The MV Station must be transported by qualified personnel. Qualified personnel are those who have relevant training experience, especially safety-related experience.**

Keep in mind the dimensions and total weight of the MV Station at all times!

Ensure that the following requirements are met:

- All the doors are locked.
- Choose the appropriate crane or hoist to transport the MV Station. The crane or hoist must be sufficiently capable of bearing the MV Station weight.
- An additional traction vehicle may be required when the road has a gradient.
- Anything, which may hinder the transport, like trees, cables (or the like), should be removed.
- If possible, transport the MV Station on fine weather days.
- Warning signs or barriers must be posted near the transport areas to avoid accidental injuries.

Additionally, the following requirements should be met when the MV Station is placed on the ground:

- Place the MV Station carefully and gently. Do not pull or push the MV Station on any surface.
- The place should be firm and flat with good drainage and no obstacles or outshoots. The MV Station should be supported by the four feet.

5.2 Hoisting the MV Station

5.2.1 Safety Precautions

⚠ WARNING

- **Observe the safety operating rules of the crane at all times.**
- **Standing within 5 to 10 meters away from the hoisting areas is strictly prohibited! Anybody standing under the boom or MV Station is strictly prohibited in the whole hoisting process.**
- **The hoisting work must be stopped on violent weather days. For example, in strong wind, heavy rain, or thick fog conditions.**

Please observe the following items:

- All safety requirements must be met.
- A professional instructor is required in the whole hoisting process.
- All the used slings must have the load-bearing capacity of at least 30t.
- The crane should have sufficient arm length and radius of gyration.
- All the connection point must be firmly connected.
- The length of the slings can be adjusted appropriately according to on-site conditions.
- Transport the MV Station in a level, smooth, and steady way.
- Transport the MV Station by connecting the four top corner fittings.
- Some accessories may be required to ensure the safety during hoisting.
- All doors of the container are closed and locked.
- It is recommended that container is hoisted from left to right or from right to left to ensure smooth hoisting.

The following figure illustrates the hoisting operations. Circle A describes the work areas of the crane. Anybody standing inside the circle B is prohibited for safety considerations.

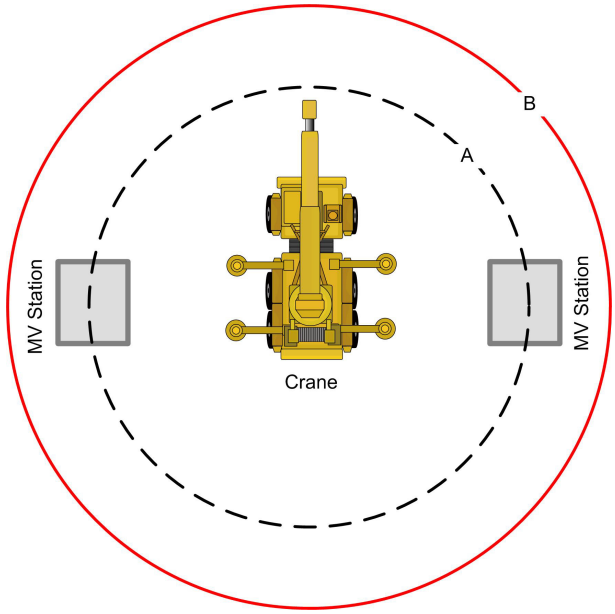


figure 5-1 Hoisting the MV Station

5.2.2 Hoisting

During the whole hoisting process, please observe the following rules:

- Hoist the MV Station in a vertical manner. Do not drag or drop the MV Station on any surface.
- Keep the container stable and horizontal during hoisting, and ensure that the diagonal gradient of the container is within 5 degrees.
- When the MV Station has been hoisted for about 300mm away from the ground, stop to check if all the connections are still firm. After confirmation, continue hoisting the MV Station.
- Lift and land the container slowly to prevent shock to the internal devices.
- When transported to the final location, the MV Station should be put down slowly and steadily.
- The final location should be firm, level, and well-drained. The MV Station is supported by four bottom fittings on the ground.
- Remove the ropes after ensuring that the container is placed evenly on the container bases.
- Secure the container hoisted before hoisting another one.

The MV Station should be hoisted by four top corner fittings as shown in the following figure.

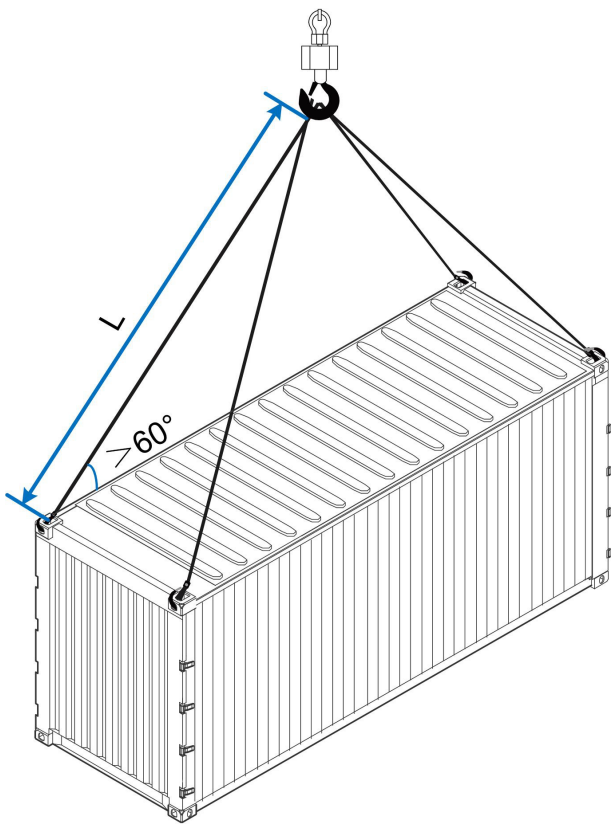


figure 5-2 Hoisting from top fittings

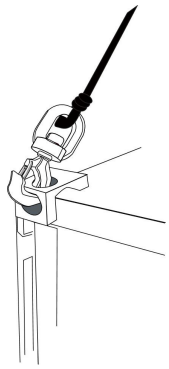
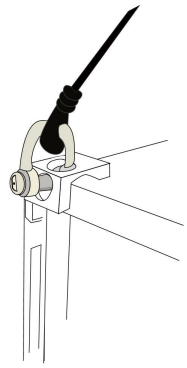
table 5-1 The Substation Hoisting Parameters

Item	Requirement
Steel Length(L)	> 6.5 m
Steel Rope Qty.	4 pieces

5.2.3 Fastening of Connectors

Use slings with hooks or U-hooks to hoist the MV Station.

The lifting devices should be correctly connected to the MV Station.

Lifting device	Hook	U-hook
Connections		
Notice	Insert the hook from inside to outside.	Lateral pin of the U-hook should be tightened.

WARNING

- **National and local safety rules should be observed at all times.**
- **Violating relevant safety rules may void pertinent warranty claims from Sungrow.**

5.3 Foundation

5.3.1 Selection of Installation Site

When selecting the installation site, consider the following requirements at least:

- Ambient and geological conditions, such as stress wave emissions, the level of underground water table and etc. should be taken into account.
- Far away from strong vibration, strong noise source and strong electromagnetic interference area.
- The ambient environment should be dry, well ventilated, and far away from inflammable materials.
- The ambient environment should be far away from dust, soot, harmful gases and the production or storage of corrosive, flammable, explosive places.
- The site location shall not be in a low-lying area and the site level shall be higher than the historical high water level in the area.
- Good soil condition, solid ground, no rubber soil, soft soil and other adverse geological conditions, do not choose the ground which is easy to get into water and easy to sink .
- The installation site should take the ventilation into account.
- Choose the open position, to ensure that there is no obstacles in 10 meters from the equipment surrounding.

- Keep at least 50 meters away from residential areas to avoid noise pollution.
- The ground at the installation site must be compacted enough. Relative compaction of the ground should be equal to or greater than 98%. Otherwise, take proper methods to strengthen the ground.

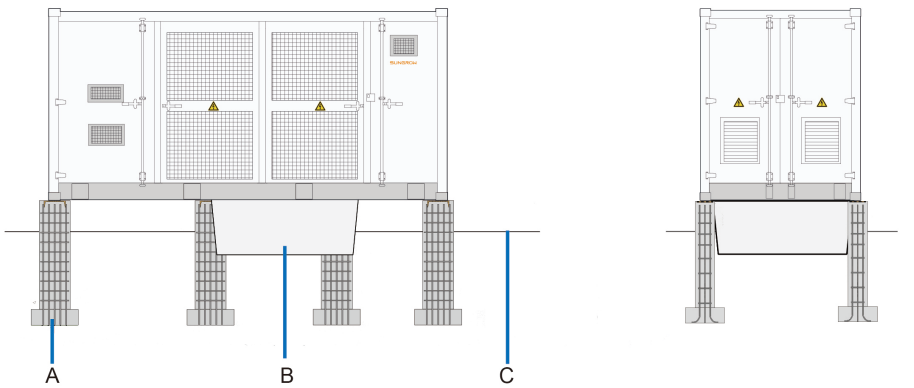
5.3.2 Recommended Foundation Construction Plan

The following conditions must be fulfilled:

- The bottom of the foundation should be firm enough.
- The foundations must be suitable for the weight of the MV Station.
- The foundation should be at least 100mm higher than the pea gravel ground on site to prevent the rain from damaging the base or penetrating into the MV Station.
- Sufficient cross-sectional area and depth of the foundation should be maintained. The depth is designed according to local soil conditions.
- Cable route should be taken into account.

Overall construction effect is shown below.

The foundation plan described in this chapter is for reference only.

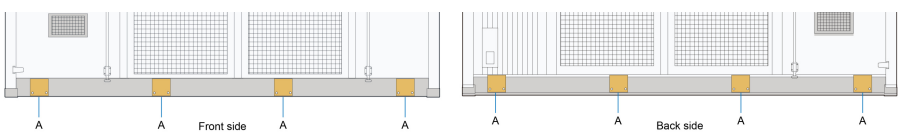


No	Name
A	Foundation
B	Pea gravel ground
C	Oil tray

5.3.3 Securing the MV Station(optional)

Overview

As shown by A in the figure below, the position for installing L-shape angle steel is reserved at the bottom of the container.

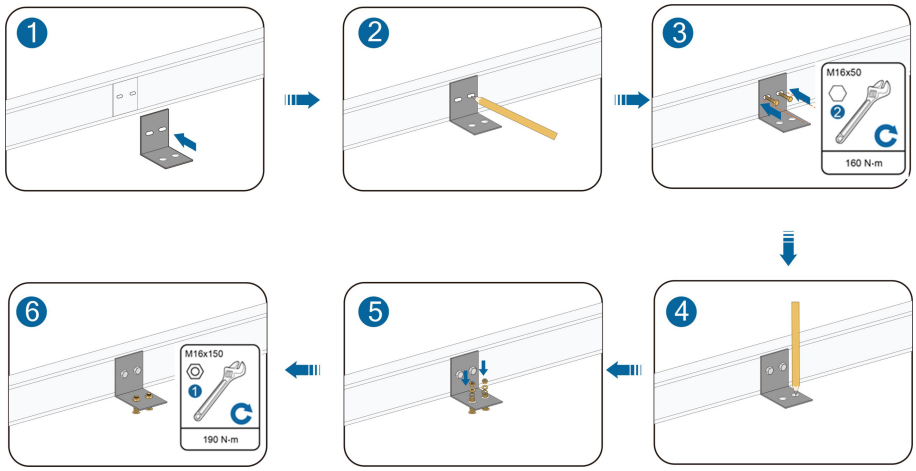


Preparing Installation Tools

The following tools may be used in installing the L-shape angle steel:

No.	Name	Resource
1	Marker	beyond the scope of delivery
2	φ22 percussion drill	beyond the scope of delivery
3	Angle steel	in the scope of delivery
4	M16 × 150 expansion bolts	in the scope of delivery
5	M16 × 50 screw	in the scope of delivery

Installation Method



Other Precautions

NOTICE

A drainage system should be designed on the installation site to prevent the MV Station from being immersed in water during heavy rainfalls.

NOTICE

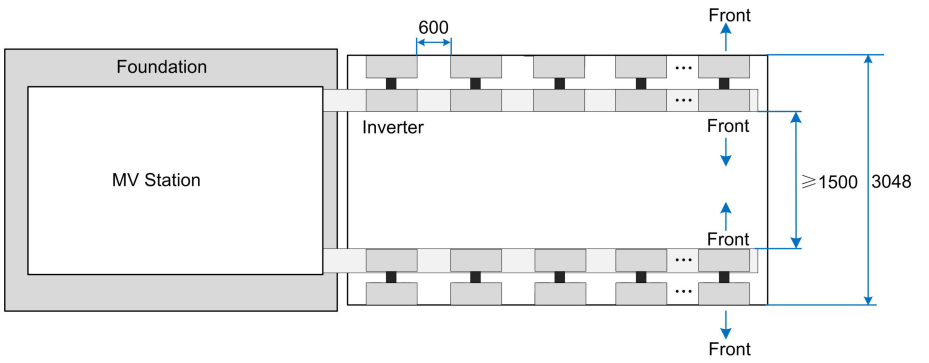
Do not plant any trees near the MV Station installation site to prevent the damage of the MV Station caused by tree leaves or stems.

5.4 Installation Verification

- Bolts and nuts are tightened.
- The container is in good contact with and evenly supported by the bases underneath.
- All container doors can be smoothly opened and closed.

5.5 Clearance Requirement

On site, MV Station works together with the inverter. Required clearances around MV Station and the inverter are shown in the figure below.

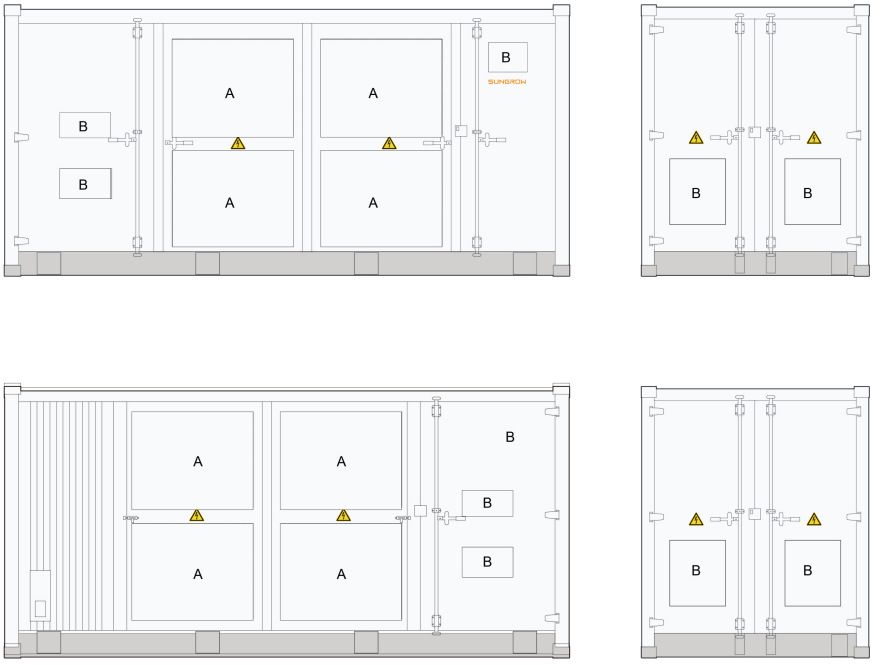


* The distance illustrated in this figure is the minimum values.

** This figure takes the inverter SG125HV as an example, and the inverter type may differ in actual project.

5.6 Removing Sealing Plates and Sealing Tapes

The sealing plates and sealing tapes (shown as A and B respectively in the following figure) are attached to the enclosure of the MV Station to prevent moisture penetration during transportation.



Remove the sealing tapes and sealing plates before commissioning.

6 Electrical Installation

6.1 Safety Instructions

6.1.1 Generals Rules

DANGER

High voltage! Electrical hazards!

- Do not touch the live components of the device.
- Make sure the MV Station are voltage-free before installation.
- Never put flammable materials in the vicinity of the MV Station.

DANGER

If a ground fault occurs in the PV system, some parts that were voltage-free before may contain lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before operation and take proper protective measures.

WARNING

Observe all the country-specific standards and regulations.
Connect the MV Station to public grid only after receiving authorization from the local network operator.

WARNING

Only professional electricians can perform the operations described in this chapter.
Observe all the instructions to connect the wires.

WARNING

Disconnect all the switches before electrical connection.

⚠ WARNING

Sand and moisture penetration may affect the performance of electric devices inside the MV Station!

- Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.
- Perform electrical connection on fine weather days.

⚠ WARNING

Improper torque used may cause a fire to the connection point!
Fix the bolts by strictly following the torque requirements in this manual during electrical connection.

⚠ WARNING

Too small bending radius or excessive intertwine may damage the fiber!
When selecting fiber as the communication cable, please follow the related requirements of the fiber manufacturer about the min. allowable bending radius.

⚠ WARNING

Only professional electricians can perform the electrical connection.
Professional electricians should meet the related requirements listed in 2 Safety Instructionsin this manual. Sungrow should hold no liability for any personal injury or property loss caused by ignorance of the safety instructions.

⚠ WARNING

Ensure the electrical insulation is satisfied before laying the cables. Follow the EMC regulation and lay the power cable and communication cable in different layers. Provide support and protection to the cables to reduce the stress of the cables when necessary.

⚠ WARNING

Strictly follow all the instructions when connecting the cables.

NOTICE

The installation and design of the MV Station must fulfill national and local standards and regulations.
Sungrow should hold no liability for the MV Station or system fault caused by ignorance of the description in this manual.

Select optical fibers as the external communication cable to lower the signal interference.

6.1.2 Five Safety Rules

During electrical connections and other operations on the inside device, observe the following Five Safety Rules:

- Disconnect all the external connections and disconnect the MV Station internal power supply
- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.

6.2 Circuit Diagram

Taking the MVS6300-LV as an example, the circuit diagram is as follows.

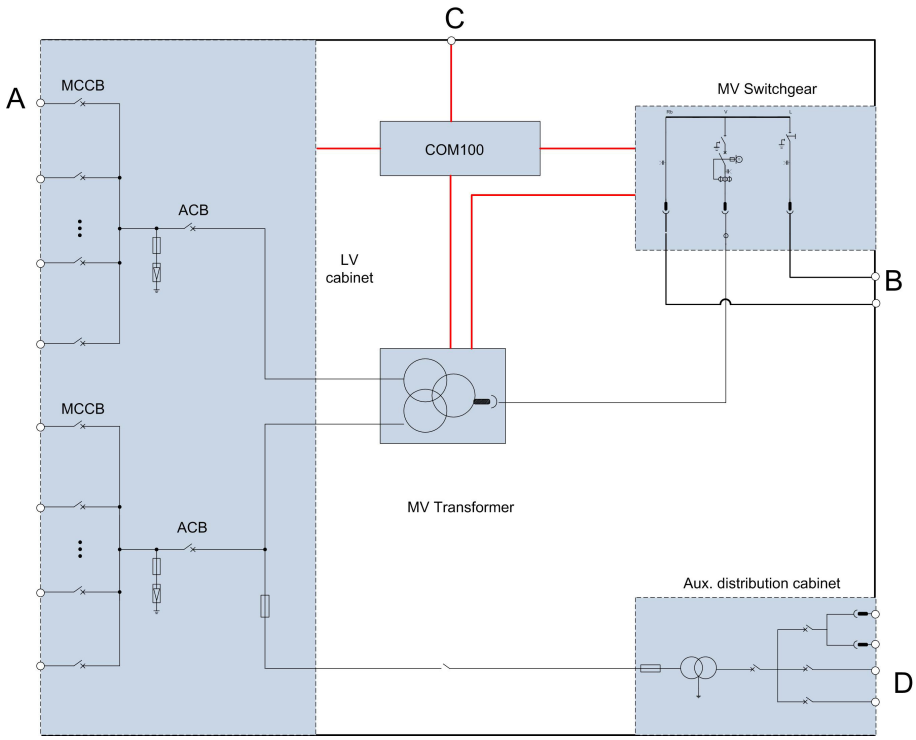


table 6-1 Items in figure

Item	Name	Recommended specifications
A	Connect to the inverter	Max. 180 mm² aluminum wire
B	Connect to MV grid	Depends on the switchgear type. Specifically, refer to the corresponding manual.
C	Ethernet port	-
D	Power distribution port	-

6.3 Cable Connection

External cable connections of the MV Station include grounding connection, cable connection on LV side, cable connection on MV side, communication connection, and auxiliary power supply connection.

6.3.1 Ground Connection

Brief Introduction

Generally, the ground connection includes equipotential connection of internal devices and external grounding.

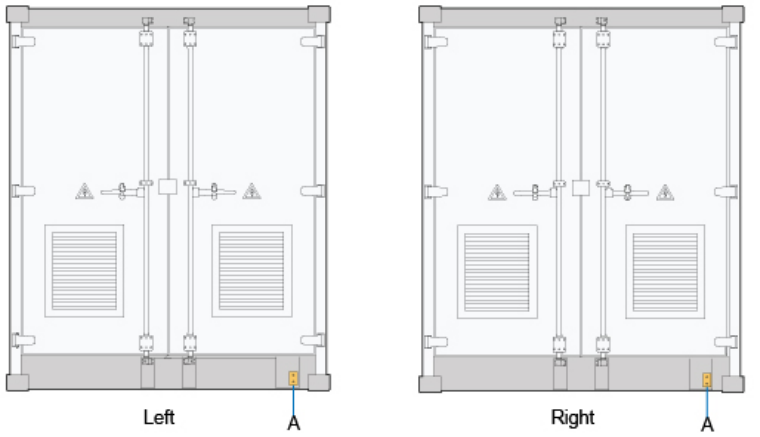
Equipotential Connection of MV Station Internal Devices

All electrical devices inside the MV Station should be connected equipotentially through the total equipotential connection copper bar inside the MV Station, i.e. the grounding terminal of all the main electrical devices should connect to the total equipotential connection copper bar.

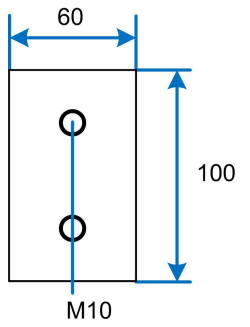
The connection of the internal main electrical devices to the grounding copper bar has been finished before delivery.

External Grounding

For ease of onsite cable connection, two grounding points are designed at the exterior of the MV Station, as shown in the figure below.



The dimensions of the grounding copper bar is shown in the following figure.



On site, reliably connect both or either of the two grounding points according to actual conditions. The external grounding points of the MV Station can be grounded in the following two manners:

- Connect the grounding cable to the external grounding points with M10 bolts, where the recommended cable is of 50 mm² to 95 mm².
- Weld the grounding steel flat onto the external grounding point, after which anti-corrosion processing needs to be performed.

It is recommended that two points of the MV Station should be connected to the ground system of the PV plant.

The MV Station needs to be grounded on site. The following operations should also be conducted on site:

Measure the electrical conductivity between the device ground terminals and the total equipotential connection copper bar to ensure the effectiveness of the internal ground connection.
Perform the external grounding according to on-site situation and instructions of the plant staff.

The grounding resistance should be no more than 4Ω.

The grounding resistance should be determined according to local standards and regulations.

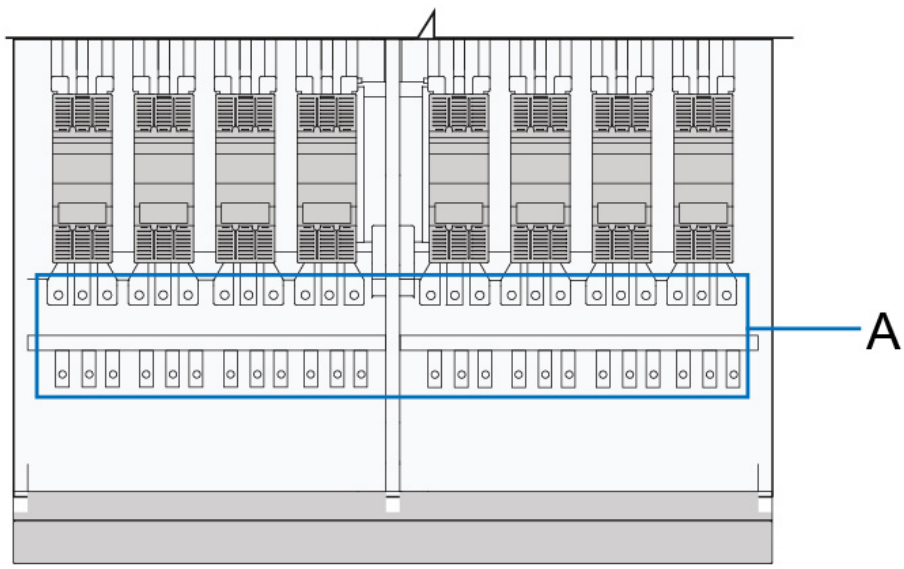
WARNING

The country-specific regulations and standards must be observed at all times!

6.3.2 LV Side Connection

LV wiring terminals are located at the lower part of the LV cabinet, as shown in the figure below.

Taking the MVS6300-LV as an example, the connection area is as follows.

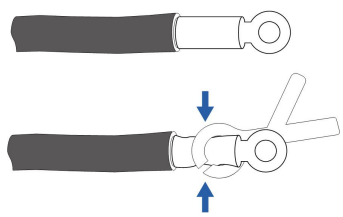


step 1 Make sure the upstream inverter is in the OFF position.

step 2 Make sure the air circut breaker and molded case circuit breakers are in the OFF position.

step 3 Pass the external cable through the cable entries.

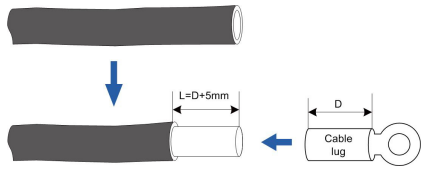
step 4 Strip off the insulation cover of the cable with the tripped length of 5mm longer than the depth of the cable lug.



step 5 Crimp the cable lug. It is advisable to select DT-××（×× is the cable cross-sectional area) cable lug.

1 Put the stripped cable inside the cable lug.

2 Tighten the cable lug with relevant tools. Crimp it at least twice.

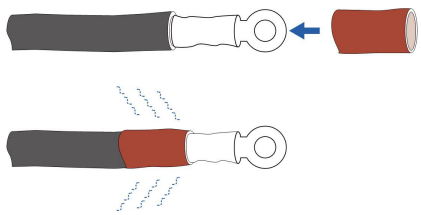


step 6 Wrap the heat-shrink tubing.

1 A tubing with length 2cm longer than the depth of the cable lug is recommended.

2 Wrap the cable lug with the heat-shrink tubing.

3 Shrink the tubing with hot air blower.



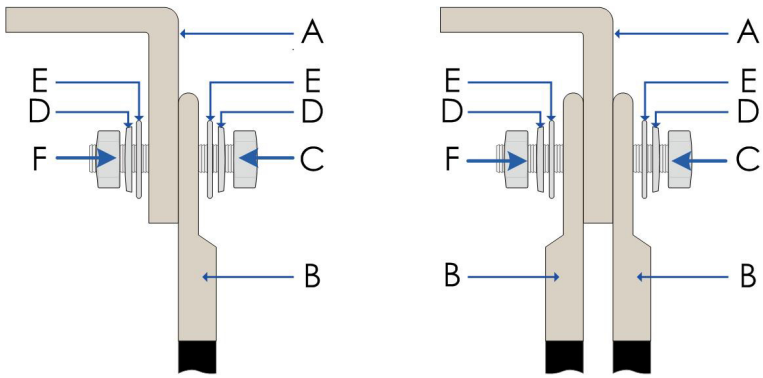
Cable protectors are advisable in the cable crosses if the multi-core cables are used.

step 7 Connect the cable.

1 Select bolts matching with the cable lug.

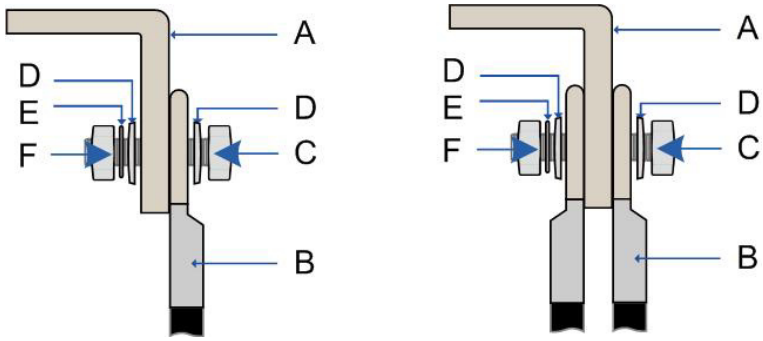
2 Attach the cable lug to the connection copper bar.

- If copper wires are used, connect the spare parts as described below:



No.	Name	No.	Name
A	Copper Bus	D	Flat washer
B	Cable Lug	E	Spring washer
C	Bolt	F	Nut

- If aluminum wire is selected, a copper-aluminum adapter terminal is required, as shown below:



No.	Name	No.	Name
A	Copper Bus	D	Flat washer
B	Copper-aluminum adapter terminal	E	Spring washer
C	Bolt	F	Nut

3 Fasten the bolts with screwdriver or spanner. For the M16x45 bolts, the fastening torque is 119~140N.m.

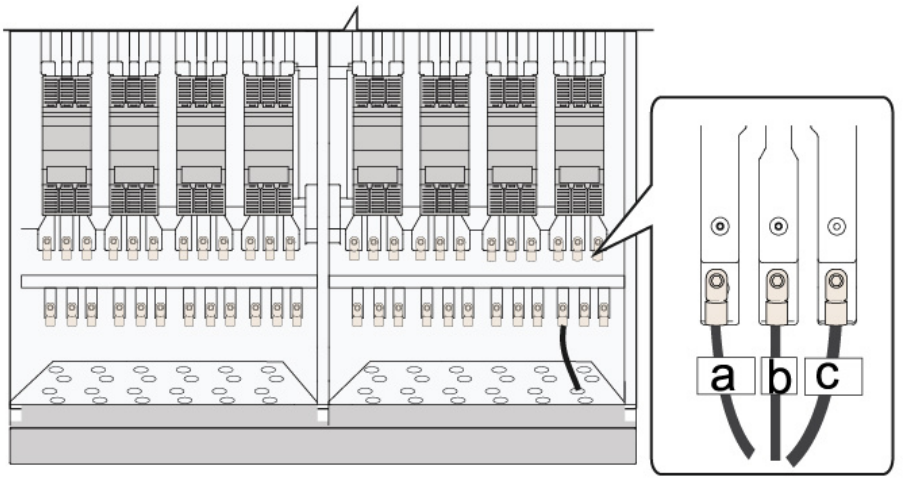
⚠ WARNING

- **Incorrect connection sequence may cause fire. Pay maximum attention to the connection sequence.**
- **Ensure the firmness of the cable connection. Poor connection or oxidation of the surface may cause over-heating or fire.**

NOTICE

- **Long bolts may affect the insulation and may cause short circuit.**
- **Remove the heat-shrink tubing between the cable lug and the copper bar if necessary. Poor contact or over-heating may follow if otherwise.**

step 8 Confirm that all cable connections are secure.



- - End

6.3.3 MV Side Connection

Terminals connecting the external devices on the MV side of the MV Station are located on the MV switchgear.

On site, perform cable connection according to the MV switchgear manual.

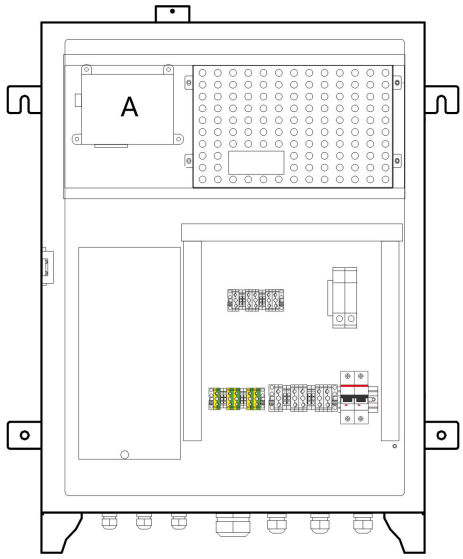
NOTICE

Ensure correct phase sequence during cable connection.

6.3.4 Communication Connection

All internal communication terminals of the MV Station have been connected to the communication box COM100 before delivery. The data of all internal devices of the MV Station is uploaded to background via the COM100.

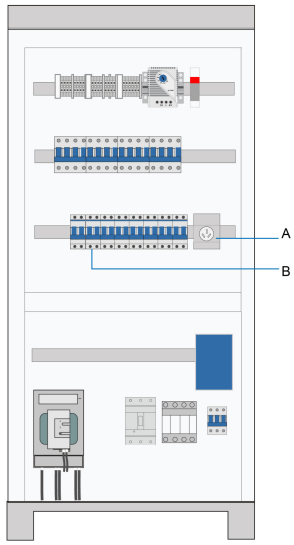
The external cable connection terminals of the COM100 are located at the Ethernet switch shown by A in the figure below.



No.	Name
A	Ethernet switch

6.3.5 Auxiliary Power Supply Cable Connection

Standby power sockets are reserved in the power distribution cabinet, as shown in the figure below. On site, perform cable connection according to demands.



No.	Description
A	Standby power socket
B	Micro-circuit breaker, used to control the connection and disconnection of the standby power socket

6.4 Checking after Electrical Connection

Checking Item	Requirement
Equipment appearance	The equipment is intact, and free from rust and paint flake-off. Repaint areas with paint flake-off (if any). The labels on the equipment are legible. The damaged labels must be replaced in time.
Appearance of cable	Cable sheathings are properly wrapped and free from obvious damage. Hoses that contain cables are intact.
Cable connection	Cables are connected in the designed positions. Terminals are prepared as required and securely connected. Labels on both ends of each cable are clear and specific, and attached in the same direction.
Cable routing	Power cables and communication cables must be routed separately. Cables are neat and tidy. The joints of cable ties are evenly cut without burrs. Cables are placed properly and not tense at turning points. Cable routes are straight and smooth, and do not intersect inside a cabinet.
Container	The container is clean and tidy inside, without any unnecessary cables, cable heads, terminals, or tools. No obvious garbage is found outside the equipment.
Others	Check the bottom of the MV Station and seal the gaps between the cables with fireproof mud. If cable glands are used, make sure they are tightened. Seal the unused terminal. Reassemble the protective grid removed. Water-proof processing should be done on the foundation of the MV Station.

7 Power On the MV Station

NOTICE

The operations described in this chapter must be performed by professional personnel in accordance with local regulations/standards.

7.1 Checking before Power on

7.1.1 MV Station Container

No.	Checking item
1	The installation conforms to the design requirements.
2	The container is level, and each door can be opened properly.
3	There is no crack, dent, or scratch on the container surface. Repaint areas with paint flake-off (if any).
3	Each container has at least two ground points and is grounded securely with a ground resistance of 4Ωor less.
4	The number and positions of external accessories conform to the enclosed document.
5	All markings are correct, clear, and complete.

7.1.2 MV Switchgear

No.	Checking item
1	There is no crack, dent, or scratch on the cabinet surface.
2	The SF6 barometer pointer is in the green zone.
3	Rotate the current terminal, disconnect the scriber of the current terminal, and measure the resistance at both ends of the fracture. The value of three-phase resistance should be small and close. After the measurement, restore the current terminal to the connection position and tighten it. The standby current loop shall be shorted and grounded.
4	Apart the grounding wire of the secondary circuit and measure secondary loop to the ground resistance and resistance should be M Ω level. Recover the grounding wire and the resistance shall be 0 Ω.
5	If there is a relay protection tester or current source, check the value settings of the protective device, including the set value, control word, and soft clamping plate. The set value must match that provided by the user.

No.	Checking item
6	Check that the trip enable/disable slicer has been put into operation.
7	The door of power cable room is closed.
8	The auxiliary AC power circuit breaker in the cabinet is switched on.
9	The conversion switch is in the remote position.
10	The local operating switch has been padlocked.
11	The load switch is opening and the grounding switch is closing.
12	Remove all foreign matters in the medium-voltage ring main unit, such as tools, installation residual materials, etc.

7.1.3 MV Transformer

No.	Checking item
1	There is no crack, dent, or scratch on the transformer surface.
2	No oil leakage occurs on the transformer surface.
3	The indication of the oil level gauge of the transformer is in lower position of the normal operating range.
4	The oil temperature indicator of the transformer is close to the ambient temperature. The cover of the oil temperature meter is installed securely, the surface is clean, and the glass is intact. The temperature measurement loop is complete and intact.
5	The scale of transformer oil level indicator will show in 4 when temperature is 20℃.
6	The locking device of the pressure release valve has been removed, and the pressure release valve does not work. If not removed, follow the steps shown in the Fig.7-1 to remove the locking device.
7	The pressure gauge indicates a pressure of 0.
8	The tap changer is set according to the requirements of the user. If there is no special requirement, set it to the rated level (level 3).The methods to adjust the tap changer is shown in the Fig7-2. When setting the level, open the handle. After adjusting the level, close the handle to the slot. After the check is complete, tighten the protective cover for the level switch.
9	There is no packing residue on the transformer surface, and there is no foreign matter in the transformer room.

No.	Checking item
10	Check the external air insulation distance. Whether the air insulation distance between different voltage grade bushing and bushing to ground conforms to relevant standard.
11	The oil leak port of the transformer room is not blocked.
12	The screen door of the transformer room is closed and locked.

Remove the Locking Device

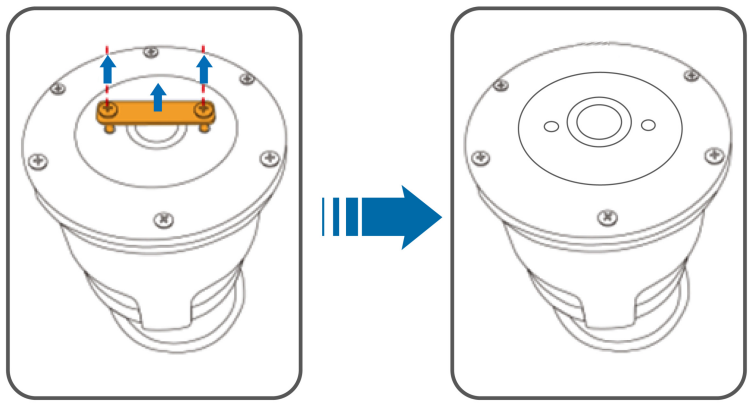


figure 7-1 Remove the locking device of the pressure relief valve

Adjust Voltage Ratio via Tap Changer

Tap changer can adjust transformer output voltage. When operating tap changer, ensure that transformer is in the no-excitation state, that is, the high and low voltage sides of transformer are not live. When voltage of the low-voltage side remains unchanged, the output voltage on high-voltage side at different taps are:

Tap position	Value
1	Nominal Value x 1.05
2	Nominal Value x 1.025
3	Nominal Value
4	Nominal Value x 0.975
5	Nominal Value x 0.95

Take tap position 1 as an example, the steps to adjust the voltage ratio is shown in the following figure.

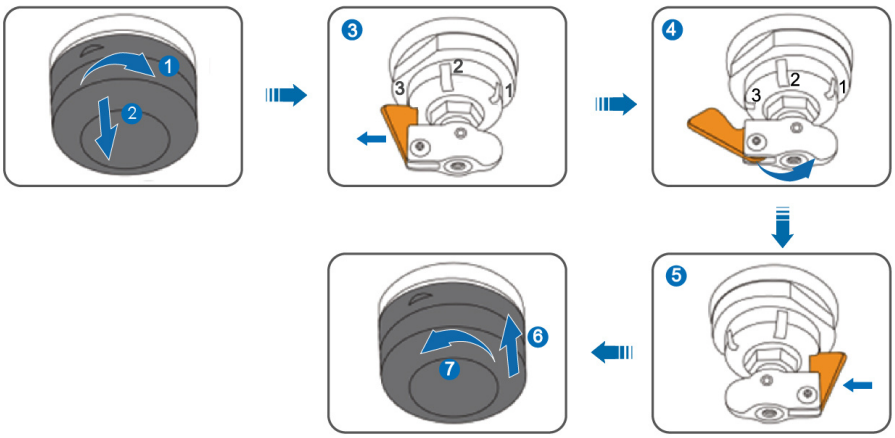


figure 7-2 Adjust the voltage ratio via the tap changer

7.1.4 LV Cabinet

No.	Checking item
1	MCCB are turned off.
2	The copper bar is not deformed, and no foreign matter is on the copper bar.
3	Measure the ground resistance of Circuit breaker in and out of the copper bar; in the system that neutral point of the transformer is not grounded, the input & output wiring to grounding resistance should be M Ω level; In the neutral point grounding system, outgoing wiring copper bar resistance shall be M Ω level and phase to phase resistance shall be M Ω level. (need to disconnect the auxiliary circuit breaker, or phase to phase resistance is generally 0 Ω).
4	Measure the fuse resistance. Resistances of three phases shall be small and the value is similar.
5	Lightning protection status indicates green.
6	Pull the current terminal chip to the open position and measure the resistance at both ends of the fracture. The value of three-phase resistance should be small and close. After the measurement, restore the current terminal to the connected position and tighten it. The standby current loop shall be shorted and grounded.
7	Apart the grounding yellow green wire of the secondary circuit and measure secondary loop to the ground resistance and resistance should be M Ω level. Recover the grounding wire and the resistance shall be 0 Ω.
8	The installation bolt of input cable has been tightened, and the cable is not loose after pulling.

No.	Checking item
9	The cable inlet hole has been sealed.
10	Each component is intact.
11	Clear all foreign matter in the switchgear, such as tools and remaining materials.

7.2 Power-on Steps

NOTICE

Before putting the MV Station into loaded operation, keep it running in the no-load state for 24 hours and ensure that there is no abnormality.

Operations such as handover test and system energization must be performed by locally qualified electricians according to the national/local standards.

8 Troubleshooting

This chapter only lists the common troubleshooting methods on the transformer side. For more specific information, refer to the relevant transformer and ring network cabinet user manual.

Fault	Possible Reason	Measures
Pressure relief trip	1. The internal short circuit of the transformer is faulty.	1. If it is a short circuit fault, take an oil sample for oil sample chromatography to further determine the cause of the fault. It is strictly forbidden to put the transformer into operation before the cause of the fault is not ascertained and the fault has not been resolved. (Note: If it is determined that the internal fault is serious, the inside of the transformer has been damaged, contact Sungrow for replacement.)
	2. The pressure relief valve is faulty.	2. The pressure relief valve elastic element expander internal jam, or the bolt torque of the fastening film is too large, resulting in damage to the film, contact Sungrow Power Co., Ltd. for replacement.
	3. Improper oiling operation before servicing or installing the transformer. If the pressure relief valve on the tank is not opened as required.	3. After power off, open the oil hole to release the pressure inside the tank.
Low oil level trip	1. The secondary circuit causes a false alarm of low oil level.	1. Check the secondary circuit to confirm if it is malfunctioning.

Fault	Possible Reason	Measures
	2. The transformer leaks oil or leaks for a long time. After the oil was drained due to maintenance or test reasons, the oil was not replenished to the normal oil level in time.	2. Fill the transformer with oil.
Oil temperature alarm	1. Transformer overload operation. Overload operation may result in a high oil temperature alarm.	1. Check if the transformer is overloaded.
	2. The heat dissipation channel is blocked.	2. Check the transformer heat dissipation channel for foreign matter jams.
	3. The secondary circuit causes a false alarm.	3. Check the actual oil temperature of the transformer to see if it is a false alarm.
Oil temperature trip	1. The transformer is overloaded.	1. Check if the transformer oil level is too low.
	2. Internal fault of the transformer.	2. Check if the temperature sensor is abnormal.
	3. Transformer secondary circuit failure. Long-term overload operation will cause the transformer temperature to continue to rise, resulting in overcurrent and high voltage tripping.	3. Check the load on the transformer. Check the load through the internal current meter of the low voltage cabinet. If the trip occurs due to an overload, it is recommended to reduce the running load.

9 Routine Maintenance

Due to ambient temperature, humidity, dust, and vibration, the MV Station and the inner components will age and wear. To ensure the system safety and maintain the efficiency of the MV Station, it is necessary to carry out routine and periodic maintenance.
All measures, which can help the MV Station work in good conditions, are within the maintenance scope.

9.1 Safety Instructions

⚠ WARNING

Lethal voltage inside the MV Station!
Wait at least 10 minutes after MV Station stops before opening the cabinet door.
Make sure the device internal is completely voltage free before any work on the MV Station.

⚠ WARNING

Only qualified personnel can perform the work described in this chapter.
Do not leave any screws, washers or other metallic parts inside the MV Station to avoid damages to the MV Station.

⚠ WARNING

Sand and moisture penetration may affect the performance of electric devices inside the MV Station!

- Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.
- Perform electrical connection at fine weather days.

⚠ WARNING

Voltages may still be present on cable connection terminals inside the MV Station even though the switches are disconnected. To avoid electric shock hazard, perform the following operations before starting maintenance work,

- Disconnect all the switches of the MV Station;
- Disconnect the upstream and downstream switches of the MV Station.

Safety Rules

Respect the following five rules in maintaining or servicing the MV Station to ensure the safety of the maintainer.

- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate measurement instrument.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.
- Ensure sufficient escape room.
- Wait at least 10 minutes after the device stop completely to operate the MV Station inside. Ensure that the MV Station is completely voltage-free.

9.2 Maintenance

9.2.1 Introduction

With IP54 protection degree, the MV Station can be installed outdoors. Harsh environment condition or long-time operation, however, may cause aging and damage to the MV Station. Check and maintain the MV Station periodically and replace the aged components, so as to effectively extend the service life and increase the device performance inside the MV Station.

Unschedulded maintenance is also required, especially when the system performance is poor.

9.2.2 Maintenance Interval

Maintain the MV Station and internal electric devices periodically to ensure the good performance of the MV Station.

The maintenance interval described in this chapter is indicative only. The actual interval depends on the on-site environment condition. If the MV Station is located in harsh environment places, for example desert arrears, the maintenance interval shall be shortened. Particularly, cleaning and anti-corrosion processing should be performed more frequently.

If the MV Station is located in desert areas, it is advisable to check thoroughly the MV Station inside and outside and clean completely after the sand storm.

WARNING

Before performing maintenance, remove the internal protective grid. Make sure to reassembly the grid and fasten all the screws after the maintenance work. Make sure all bolts are securely fixed.

⚠ WARNING

Repair immediately any anomalies found during routine maintenance. If there are any doubts, contact Sungrow.

9.3 Maintenance Items

Routine inspection and maintenance must comply with relevant regulations of the electric utility.

The inspection, maintenance, and repair can only be performed by trained personnel who are familiar with the equipment. The personnel must be certified and comply with the safety regulations issued by the electric utility.

Check Item	Check Method	Interval
System running status and cleanness	Check whether the equipment and internal equipment are damaged or deformed.	Monthly
	Check whether there is any abnormal sound or vibration when the equipment is running.	
	Check whether the temperature inside the equipment or the temperature of the equipment shell is too high.	
	Check whether warning labels are clear and replace them if necessary.	
	Check whether the humidity and dust in the equipment are heavy, and clean the equipment.	
	Check whether the surface of the container has been corroded. If so, repaint the corroded area by referring to"9.5 Painting Make-up Measures".	

Check Item	Check Method	Interval
Cable connection	Check whether power cables are loose. If so, properly connect them according to specified torques.	Once every six months after the first commissioning; once every two years after that.
	Check whether power cables and control cables are damaged and whether the cable exterior in contact with the metallic surface is scratched.	
	Check whether the insulation binding tapes on the wiring terminals of power cables are flaked.	
	Clean or replace the dust-proof network.	
Fan / heat exchanger	Check the working status of the fan / heat exchanger.	Once every six months after the first commissioning; once every half to one year after that.
	Check whether the fan/ heat exchanger produces abnormal sounds during operation.	
Device maintenance	For the maintenance of various equipment inside, refer to the related manuals.	–
MV switchgear	Check the SF6 air pressure meter to see whether the pointer is in the green range. If the pointer is close to red, stop running it in time and supply it with gas.	Monthly
	Check the electric indicator to see whether theL1/L2/L3 indicator is normal. If not, replace theL1/L2/L3 indicator under power off condition.	

Check Item	Check Method	Interval
Transformer	Check the oil level meter indication of the transformer. If the oil level is low, power off the transformer and refill it in time.	Once a month
	Check whether there is oil leakage around the pressure release valve. If yes, tighten the valve.	
	Check whether there is oil leakage on the phase bushings of the high-voltage and low-voltage cabinets. If yes, tighten the valve.	
	Check whether there is oil leakage on the joint between the heat sink of the transformer and the flange of the oil tank. If yes, tighten the valve in time.	
	Check whether the real-time temperature of the oil temperature indicator is normal. If abnormal, measure the resistance of PT1\PT2 and PT3 by multimeter. If the result is not qualified, the temperature controller is faulty and needs to be repaired in time.	
	Check whether the sound of the transformer is normal during operation.	
LV cabinet	Check whether the surge protection device indicator is normal (green) or faulty (red).	Monthly
	Check whether there is condensation on the internal side panel and top cover.	

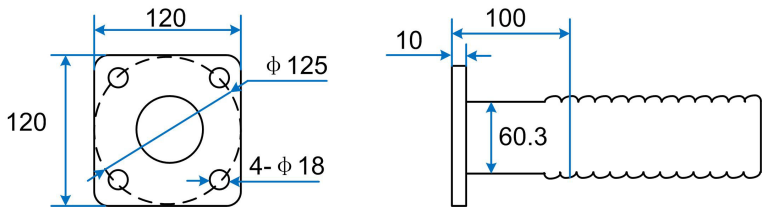
Check Item	Check Method	Interval
Other equipment	Replace the damaged lights in time.	If necessary
	Replace the damaged smoke sensor and fire extinguisher in time.	
	Replace the temperature and humidity controller in time.	

For more information, refer to the MV transformer manual and MV switchgear.

9.4 Oil Drain

Location

The oil drain valve is located at the bottom of transformer.



Tools Prepration

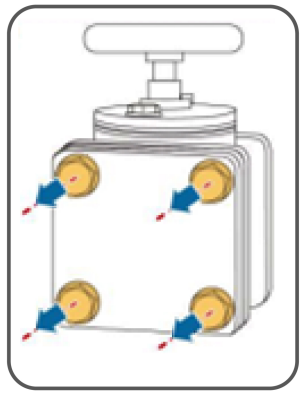
Tools may be used:

No.	Name	Source
1*	Clean steel hose and oil tank	Beyond the scope of delivery
2	Cleaning cloth	
3	Spanner	
4	300mmx38mm adjustable spanner	
5	Drain hose connector	
6	Pipe clip	

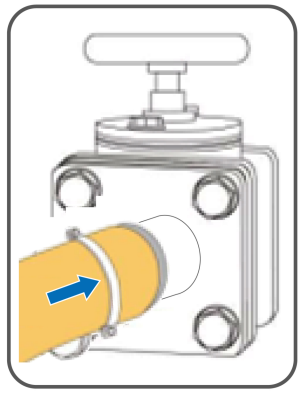
*The oil tank capacity of the transformer must be greater than Nx200L, where N is determined according to the amount of the oil needed to be released.

Operations

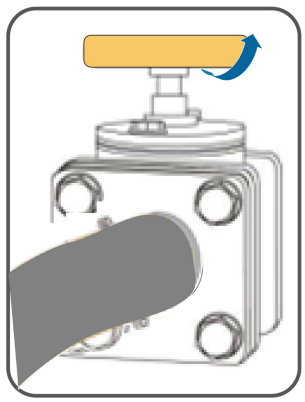
step 1 Remove cover plate of drain valve.



step 2 Fix the drain hose connector. Connect one end of the steel hose to the drain valve and the other end to the tank of the transformer.



step 3 Open the oil drain valve, and the transformer oil flows slowly into the oil tank.



step 4 When no transformer oil flows out, stop discharging oil.

step 5 Close the drain valve and remove the drain hose connector and the hose.

step 6 Reassemble the cover plate of the drain valve.

- - End

9.5 Painting Make-up Measures

Check for the damages of the MV Station appearance:

Situation 1: smudginess on the surface caused by water and dust that can be cleaned

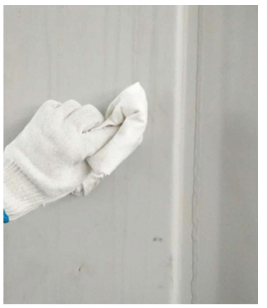
Situation 2: smudginess on the surface & damage to the finishing coat that cannot be cleaned

Situation 3: the undercoat is damaged and the primer is revealed

Maintenance and Operation Steps for Situation 1:

Materials:

- Cleaning cloth
- Water
- Alcohol or other non-corrosiveness detergent

Figure	Step
	1. Clean the smudginess on the surface by using a cleaning cloth (or other cleaning tool) with water. 2. If the smudginess cannot be cleaned by water, use 97% alcohol until the surface is clean enough to accept. (Or try other local frequently-used non-corrosiveness detergent)

Maintenance and Operation Steps for Situation 2:

Materials:

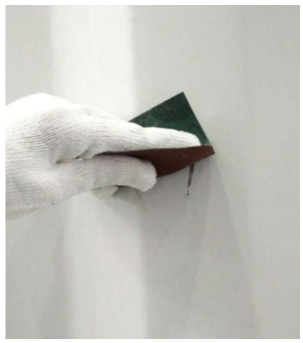
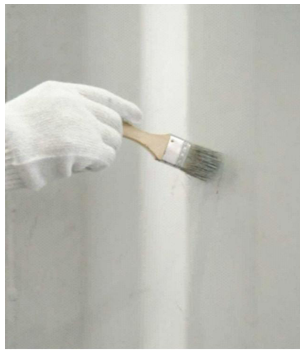
- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2

Figure	Step
	1. Polish the rough paint surface or the scratched parts by abrasive paper until the surface is smooth.
	2. Clean the target parts by cleaning cloth with water or use 97% alcohol.
	3. When the surface is clean and dry, paint the scratched parts of the paint by banister brush and make sure the painting is as uniform as possible

Maintenance and Operation Steps for Situation 3:

Materials:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Zinc primer
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2

Figure	Step
	1. Polish the damaged parts of the paint to remove the surface rust or other roughness.
	2. Clean the target parts by cleaning cloth with water or use 97% alcohol to clean the surface dust and dirty.
	3. When the surface is clean and dry, paint the base material revealed parts with zinc primer (or other local primers with the same function) for protection. The paints should cover the revealed primer completely.
	4. Paint the scratched parts by banister brush when the primer is dry, and make sure the painting is as uniform as possible.

Check the protective paint on the module surface for peeling off. re-paint the MV Station surface if necessary.

Re-spray the protective paint every 5 years to the MV Station surface.

10 Appendix

10.1 Technical Parameters

MVS2500 – LV

MV Station input	MVS2500-LV
Nominal voltage	600 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	2500 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	2500 kVA
Maximum power	2500 kVA
Voltage ratio	0.6 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	14,100 kg

MV Station input	MVS2500-LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS3000 – LV

MV Station input	MVS3000-LV
Nominal voltage	600 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	3000 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	3000 kVA
Maximum power	3000 kVA
Voltage ratio	0.6 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	15.500 kg

MV Station input	MVS3000-LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS3150 – LV

MV Station input	MVS3150 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	3150 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	3150 kVA
Maximum power	3500 kVA
Voltage ratio	0.8~0.8 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	15.500 kg

MV Station input	MVS3150 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS5000 – LV

MV Station input	MVS5000 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	5000 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	5000 kVA
Maximum power	5000 kVA
Voltage ratio	0.6~0.6 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	19.700 kg

MV Station input	MVS5000 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS6250 – LV

MV Station input	MVS6250 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	6250 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	6250 kVA
Maximum power	6250 kVA
Voltage ratio	0.6~0.6 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11y11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	22.000 kg

MV Station input	MVS6250 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS6300 – LV

MV Station input	MVS6300 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	6300 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	6300 kVA
Maximum power	7000 kVA
Voltage ratio	0.8~0.8 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11y11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	22.000 kg

MV Station input	MVS6300 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

10.2 Tightening Torques

Tighten the cable with proper torque shown below to prevent the poor contact, high contact resistance, or fire caused by the looseness of cable lugs:

Screw	Torque (N · m)	Screw	Torque (N · m)
M3	0.7~1	M8	18~23
M4	1.8~2.4	M10	34~40
M5	4~4.8	M12	60~70
M6	7~8	M16	119~140

Secure the cable in proper place to reduce the pressure of cable lug.

10.3 Contact Information

Should you have any question about this product, please contact us.
We need the following information to provide you the best assistance:

- Type of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

China (HQ) Sungrow Power Supply Co., Ltd Hefei +86 551 65327834 service@sungrowpower.com	Australia Sungrow Australia Group Pty. Ltd. Sydney +61 2 9922 1522 service@sungrowpower.com.au
Brazil SungrowDo Brasil Sao Paulo +55 11 2366 1957 latam.service@sa.sungrowpower.com	France Sungrow France – Siege Social Paris service.france@sungrow.co

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SUNGROW

Sungrow Power Supply Co., Ltd.

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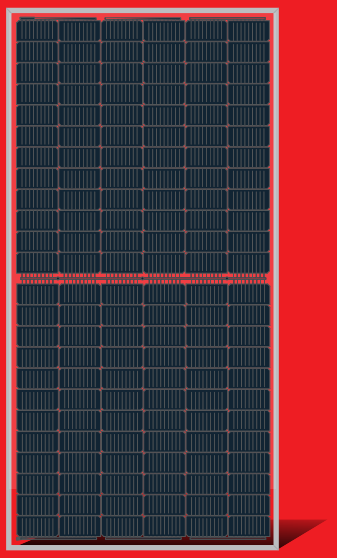
Specifications are subject to changes without advance notice.

LR4-72HBD
425~455M

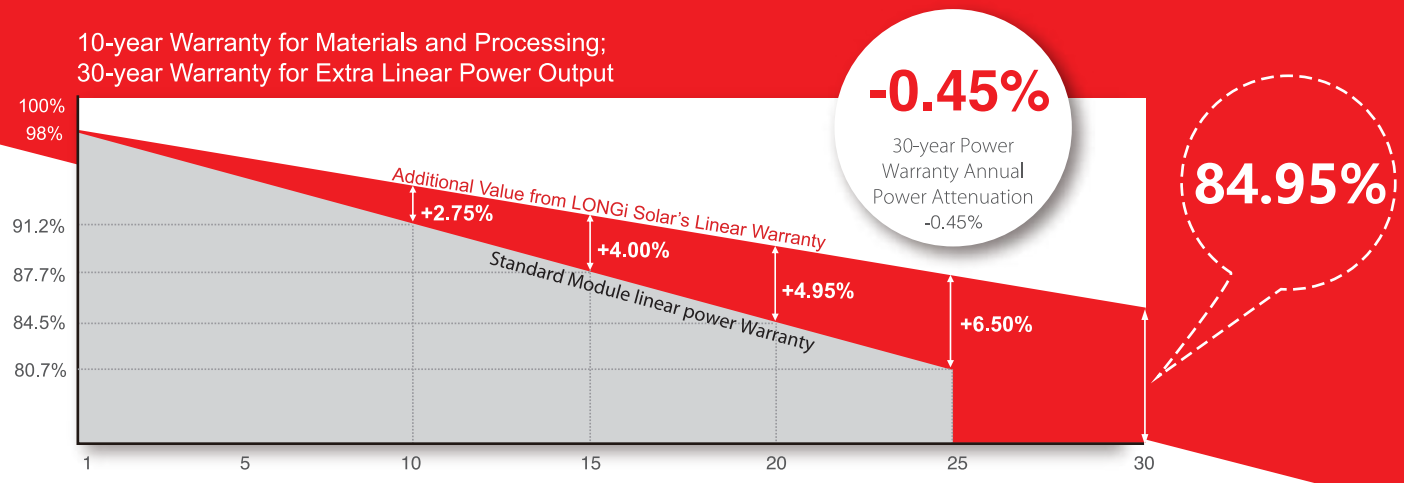
Hi-MO 4
NEW

High Efficiency
Low LID Bifacial PERC with
Half-cut Technology



*Both 6BB & 9BB are available

10-year Warranty for Materials and Processing;
30-year Warranty for Extra Linear Power Output



Complete System and Product Certifications

IEC 61215, IEC61730, UL61730

ISO 9001:2008: ISO Quality Management System

ISO 14001: 2004: ISO Environment Management System

TS62941: Guideline for module design qualification and type approval

OHSAS 18001: 2007 Occupational Health and Safety

* Specifications subject to technical changes and tests. LONGi Solar reserves the right of interpretation.

Front side performance equivalent to conventional low LID mono PERC:
- High module conversion efficiency (up to 20.9%)
- Better energy yield with excellent low irradiance performance and temperature coefficient
- First year power degradation <2%

Bifacial technology enables additional energy harvesting from rear side (up to 25%)

Glass/glass lamination ensures 30 year product lifetime, with annual power degradation < 0.45%, 1500V compatible to reduce BOS cost

Solid PID resistance ensured by solar cell process optimization and careful module BOM selection

Reduced resistive loss with lower operating current

Higher energy yield with lower operating temperature

Reduced hot spot risk with optimized electrical design and lower operating current

LONGi

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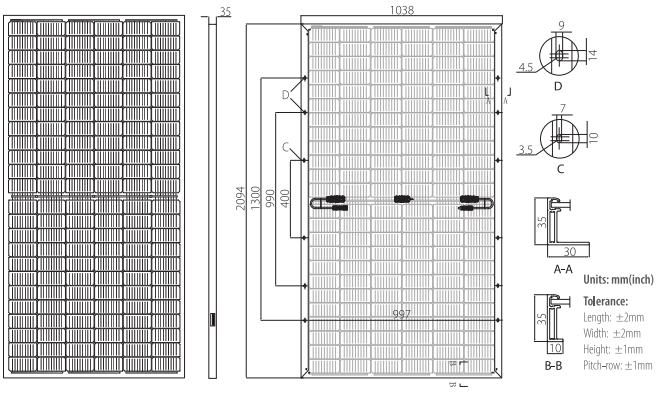
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

Note: Due to continuous technical innovation, R&D and improvement, technical data above mentioned may be of modification accordingly. LONGi have the sole right to make such modification at anytime without further notice; Demanding party shall request for the latest datasheet for such as contract need, and make it a consisting and binding part of lawful documentation duly signed by both parties.

20191227-Draft

LR4-72HBD 425~455M

Design （mm）



Mechanical Parameters

Cell Orientation: 144 （6×24）
Junction Box: IP68, three diodes
Output Cable: 4mm², 300mm in length, length can be customized
Glass: Dual glass
2.0mm coated tempered glass
Frame: Anodized aluminum alloy frame
Weight: 27.5kg
Dimension: 2094×1038×35mm
Packaging: 30pcs per pallet
150pcs per 20'GP
660pcs per 40'HC

Operating Parameters

Operational Temperature: -40℃~+85℃
Power Output Tolerance: 0~+5 W
Voc and Isc Tolerance: ±3%
Maximum System Voltage: DC1500V (IEC/UL)
Maximum Series Fuse Rating: 25A
Nominal Operating Cell Temperature: 45±2℃
Safety Class: Class Ⅱ
Fire Rating: UL type 3
Bifaciality: Glazing ≥70%

Electrical Characteristics

Test uncertainty for Pmax: ±3%

Model Number	LR4-72HBD-425M		LR4-72HBD-430M		LR4-72HBD-435M		LR4-72HBD-440M		LR4-72HBD-445M		LR4-72HBD-450M		LR4-72HBD-455M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	425	316.0	430	319.7	435	323.5	440	327.2	445	330.9	450	334.6	455	338.3
Open Circuit Voltage (Voc/V)	48.7	45.4	48.9	45.6	49.1	45.7	49.2	45.8	49.4	46.0	49.6	46.2	49.8	46.4
Short Circuit Current (Isc/A)	11.22	9.08	11.30	9.14	11.36	9.20	11.45	9.27	11.52	9.32	11.58	9.38	11.65	9.43
Voltage at Maximum Power (Vmp/V)	40.4	37.5	40.6	37.7	40.8	37.9	41.0	38.1	41.2	38.3	41.4	38.4	41.6	38.6
Current at Maximum Power (Imp/A)	10.52	8.42	10.60	8.49	10.66	8.54	10.73	8.60	10.80	8.65	10.87	8.70	10.93	8.76
Module Efficiency(%)	19.6		19.8		20.0		20.2		20.5		20.7		20.9	

STC (Standard Testing Conditions): Irradiance 1000W/m², Cell Temperature 25℃, Spectra at AM1.5

NOCT (Nominal Operating Cell Temperature): Irradiance 800W/m², Ambient Temperature 20℃, Spectra at AM1.5, Wind at 1m/S

Electrical characteristics with different rear side power gain (reference to 445W front)

Pmax /W	Voc/V	Isc /A	Vmp/V	Imp /A	Pmax gain
467	49.4	12.09	41.2	11.34	5%
490	49.4	12.67	41.2	11.88	10%
512	49.5	13.24	41.3	12.42	15%
534	49.5	13.82	41.3	12.96	20%
556	49.5	14.40	41.3	13.50	25%

Temperature Ratings（STC）

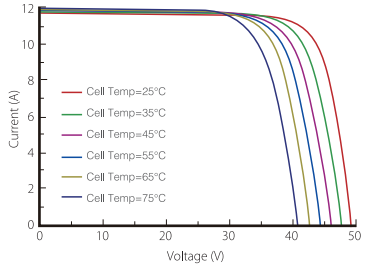
Temperature Coefficient of Isc	+0.060%/℃
Temperature Coefficient of Voc	-0.300%/℃
Temperature Coefficient of Pmax	-0.370%/℃

Mechanical Loading

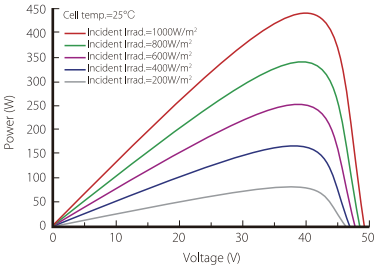
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

I-V Curve

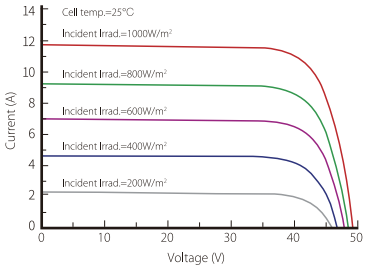
Current-Voltage Curve (LR4-72HBD-440M)



Power-Voltage Curve (LR4-72HBD-440M)



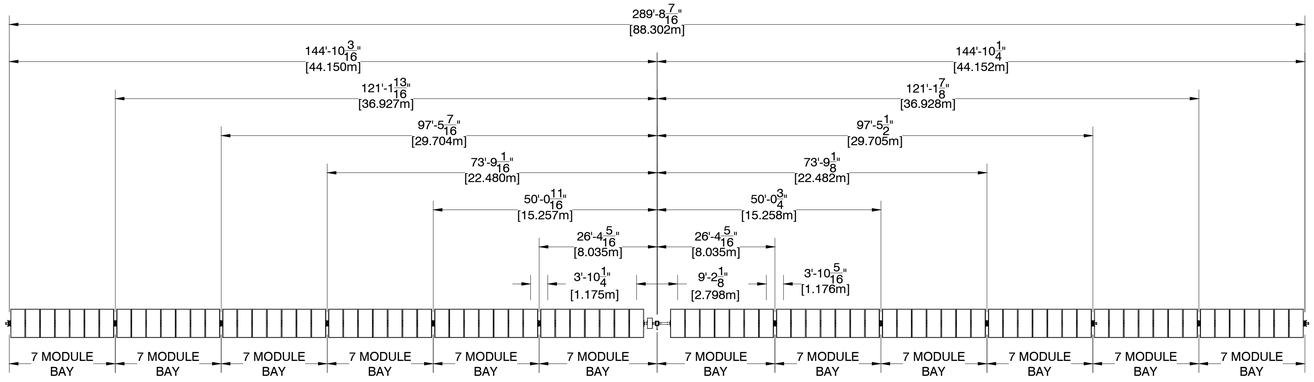
Current-Voltage Curve (LR4-72HBD-440M)



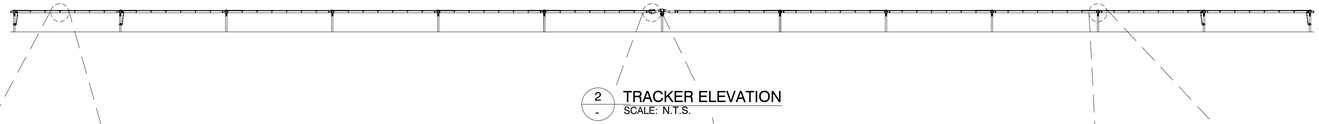
LONGi

Room 801, Tower 3, Lujiazui Financial Plaza, No.826 Century Avenue, Pudong Shanghai, 200120, China
Tel: +86-21-80162606 E-mail: module@longi-silicon.com Facebook: www.facebook.com/LONGi Solar

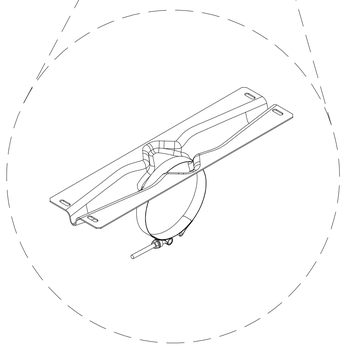
Note: Due to continuous technical innovation, R&D and improvement, technical data above mentioned may be of modification accordingly. LONGi have the sole right to make such modification at anytime without further notice; Demanding party shall request for the latest datasheet for such as contract need, and make it a consisting and binding part of lawful documentation duly signed by both parties.



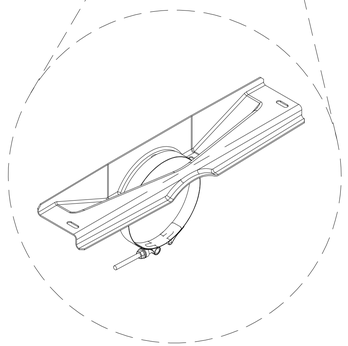
1 / - PIER SPACING
SCALE: N.T.S.



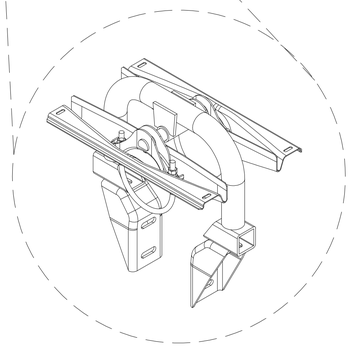
2 / - TRACKER ELEVATION
SCALE: N.T.S.



3 / - MODULE RAIL, TYP.
SCALE: N.T.S.



4 / - FIRST RAIL, TYP.
SCALE: N.T.S.



5 / - BHA, TYP.
SCALE: N.T.S.

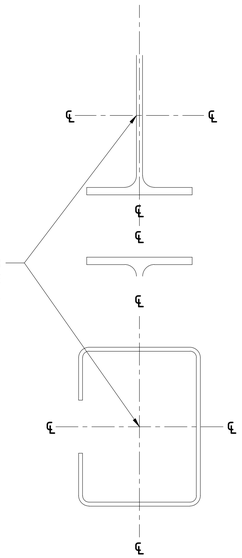
NOTES:

1) DETAILS ON THIS SHEET APPLY TO TRACKERS INDICATED ON THE SHEET TITLE ONLY. PIER PLAN INDICATES TRACKER LOCATIONS.

2) DETAILS 3-5 ARE TYPICAL AND APPLY TO ALL APPLICABLE LOCATIONS ON TRACKER.

3) PIER DISTANCES APPLY TO CENTER OF WEB, SEE DETAIL 6 FOR CENTER OF WEB LOCATION.

S-30X, DETAIL 3 DIMENSIONS FOR BAY AND TRACKER LENGTHS ARE TAKEN FROM CENTER OF BEAMS. SEE FOUNDATION DRAWING FOR IDENTIFICATION OF PIER TYPES.



6 / - CENTER OF WEB
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

NOT FOR CONSTRUCTION

NEXTracker A Flex Company
NEXTracker Inc.
6200 Paseo Padre Parkway
Fremont, CA 94555

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PROJECT NUMBER:

SHEET TITLE:
84 MODULE EXT TRACKER

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE

NOTES:

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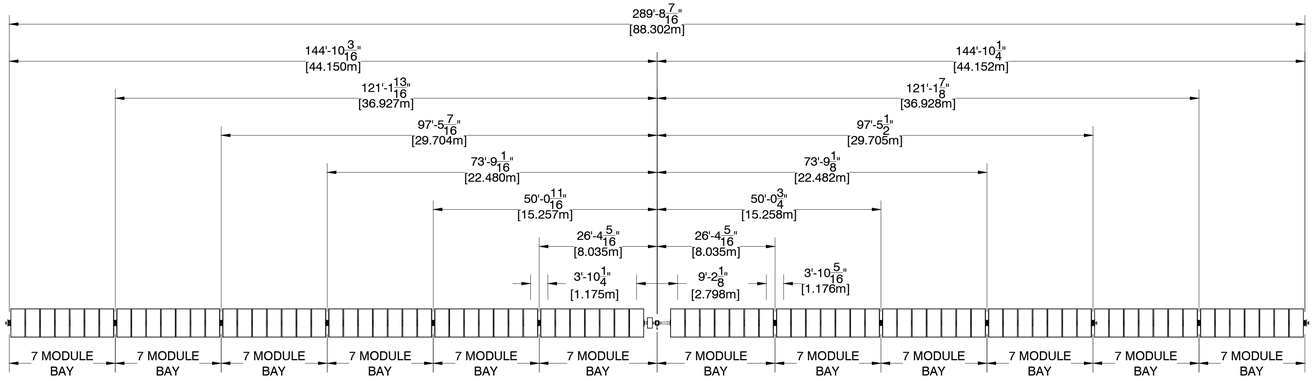
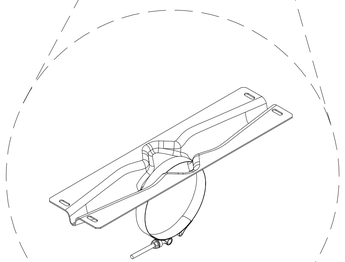
3) PIER DISTANCES APPLY TO CENTER OF WEB, SEE DETAIL 6 FOR CENTER OF WEB LOCATION.

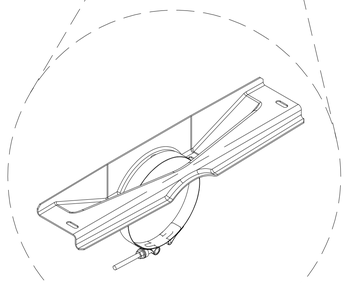


1 - PIER SPACING
SCALE: N.T.S.

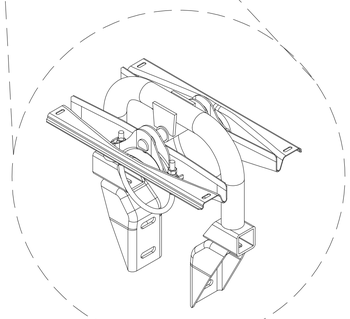
2 - TRACKER ELEVATION
SCALE: N.T.S.



3 - MODULE RAIL, TYP.
SCALE: N.T.S.

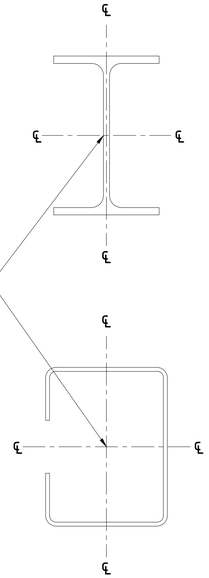


4 - FIRST RAIL, TYP.
SCALE: N.T.S.



5 - BHA, TYP.
SCALE: N.T.S.

S-30X, DETAIL 3 DIMENSIONS FOR BAY AND TRACKER LENGTHS ARE TAKEN FROM CENTER OF BEAMS. SEE FOUNDATION DRAWING FOR IDENTIFICATION OF PIER TYPES.



6 - CENTER OF WEB
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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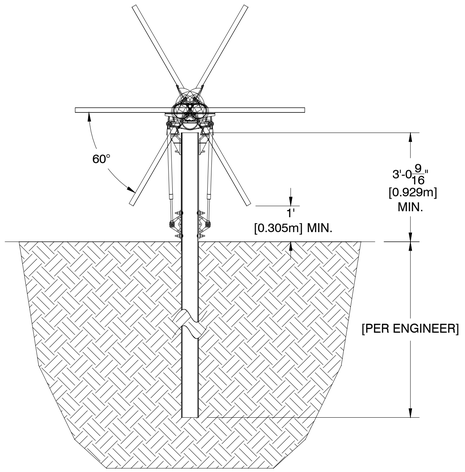
PROJECT NUMBER:

SHEET TITLE:
84 MODULE INT/EDGE TRACKER

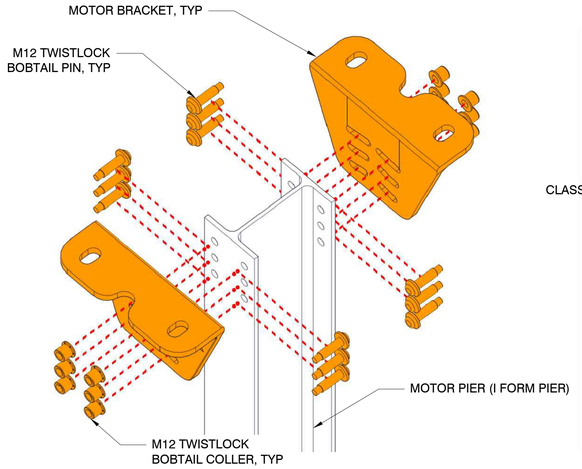
NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

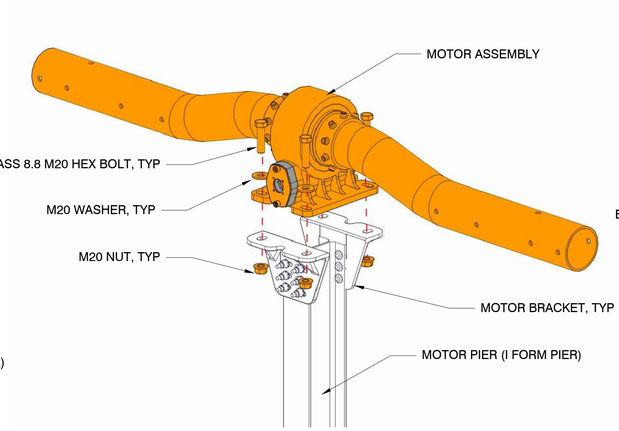
0 ½ 1
IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE



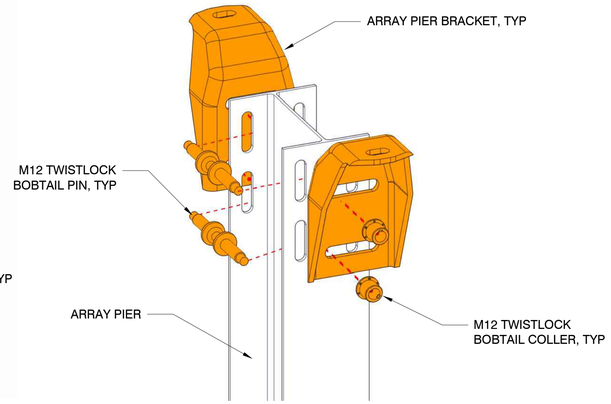
1 - TYPICAL PIER HEIGHT
SCALE: N.T.S.



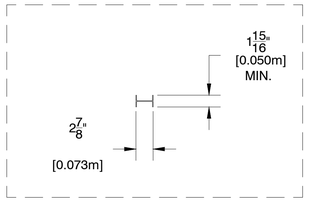
2 - MOTOR BRACKET TO MOTOR PIER
SCALE: N.T.S.



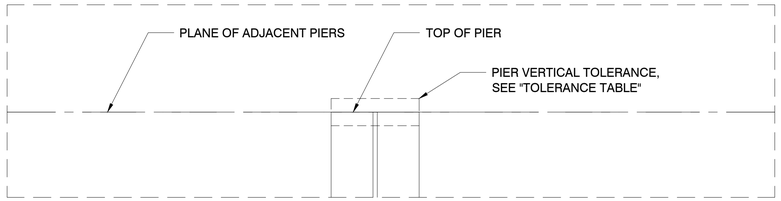
3 - MOTOR ASSEMBLY TO MOTOR BRACKET
SCALE: N.T.S.



4 - ARRAY PIER BRACKET TO ARRAY PIER
SCALE: N.T.S.



5 - I FORM PIER
SCALE: N.T.S.

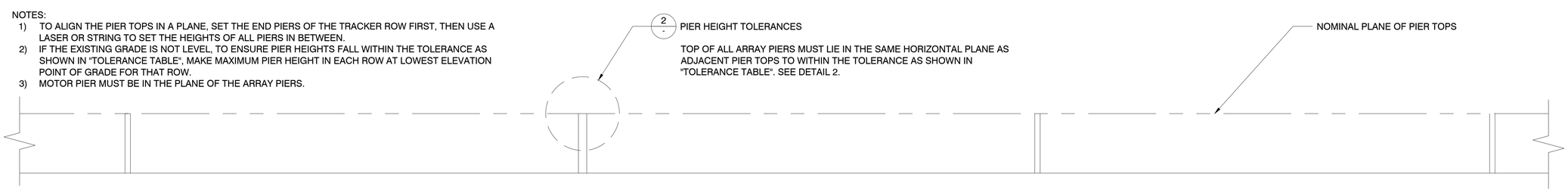


6 - PIER HEIGHT TOLERANCES
SCALE: N.T.S.

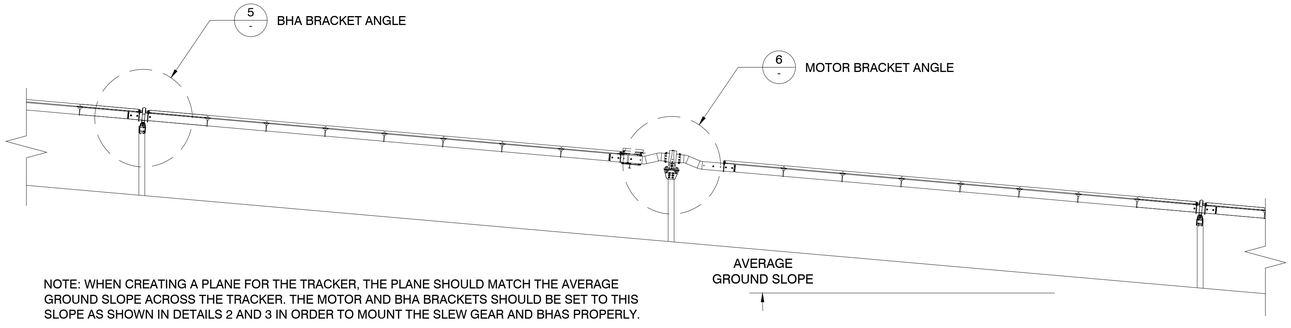
2.2 TOLERANCE TABLE

MEASUREMENT TYPE		0-6.1% (STANDARD SLOPE)	>6.1-15% (HIGH SLOPE)
TOP OF PIER E-W POSITION		+/- 1" (25.4 mm)	
TOP OF PIER N-S POSITION		+/- 1 3/4" (45.5 mm)	+/- 1 3/8" (34.9 mm)
PIER VERTICAL		+/- 11/16" (17.5 mm)	+/- 1/2" (12.7 mm)
PIER TWIST		+/- 5°	
0 - 3% TRACKER SLOPE	PIER PLUMB E-W	+/- 1.5°	-
	PIER PLUMB N-S	+/- 3°	-
>3 - 15% TRACKER SLOPE	PIER PLUMB E-W	+/- 1.5°	
	PIER PLUMB N-S	+/- 1.5°	

NOTES:
1) TO ALIGN THE PIER TOPS IN A PLANE, SET THE END PIERS OF THE TRACKER ROW FIRST, THEN USE A LASER OR STRING TO SET THE HEIGHTS OF ALL PIERS IN BETWEEN.
2) IF THE EXISTING GRADE IS NOT LEVEL, TO ENSURE PIER HEIGHTS FALL WITHIN THE TOLERANCE AS SHOWN IN "TOLERANCE TABLE", MAKE MAXIMUM PIER HEIGHT IN EACH ROW AT LOWEST ELEVATION POINT OF GRADE FOR THAT ROW.
3) MOTOR PIER MUST BE IN THE PLANE OF THE ARRAY PIERS.

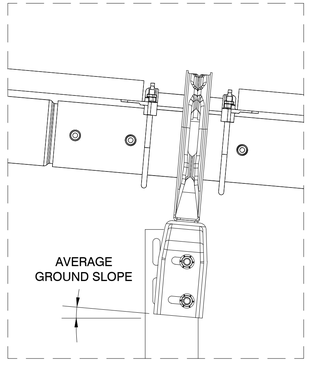


7 - TRACKER PLANAR TOLERANCES
SCALE: N.T.S.

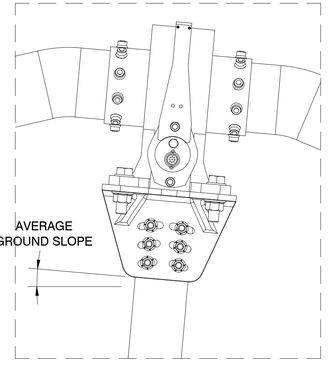


NOTE: WHEN CREATING A PLANE FOR THE TRACKER, THE PLANE SHOULD MATCH THE AVERAGE GROUND SLOPE ACROSS THE TRACKER. THE MOTOR AND BHA BRACKETS SHOULD BE SET TO THIS SLOPE AS SHOWN IN DETAILS 2 AND 3 IN ORDER TO MOUNT THE SLEW GEAR AND BHAS PROPERLY.

8 - PLANE PARALLEL W/ AVERAGE GROUND SLOPE
SCALE: N.T.S.



9 - BHA BRACKET ANGLE
SCALE: N.T.S.



10 - MOTOR BRACKET ANGLE
SCALE: N.T.S.

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PROJECT NUMBER:

SHEET TITLE:

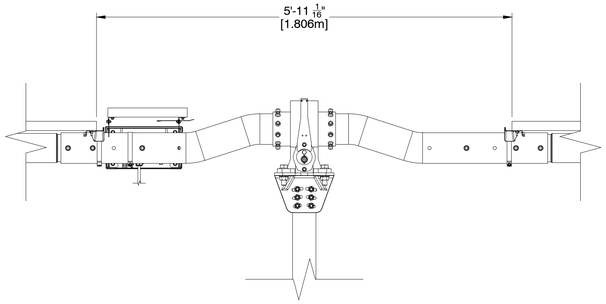
PIER TOLERANCES

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

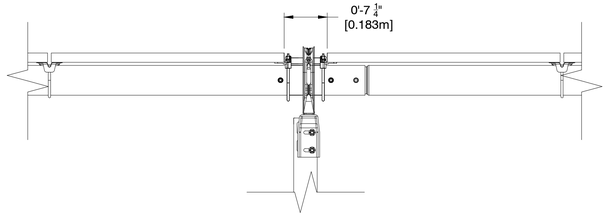
SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

IF BAR IS NOT ONE INCH, PRINT IS NOT TO SCALE

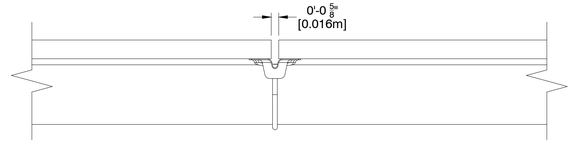
NOTES:
1. MODULE SPACING MAY VARY SLIGHTLY DEPENDING ON MODULE TYPE
2. INSTALL DAMPERS ON SIDE OF PIER CLOSEST TO MOTOR.
3. DAMPERS SHALL BE INSTALLED ROD END DOWN.



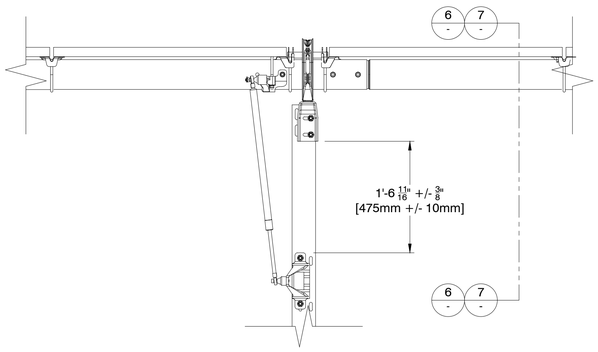
1 - TYPICAL MOTOR SPACING
SCALE: N.T.S.



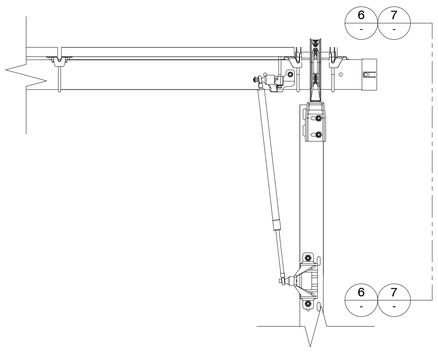
2 - TYPICAL BHA SPACING
SCALE: N.T.S.



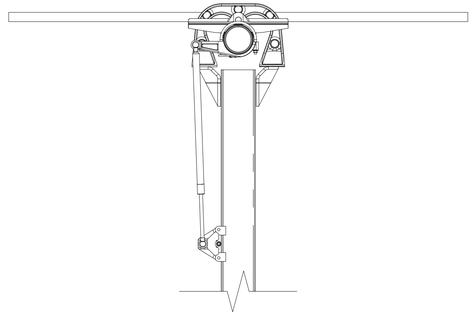
3 - TYPICAL MODULE SPACING
SCALE: N.T.S.



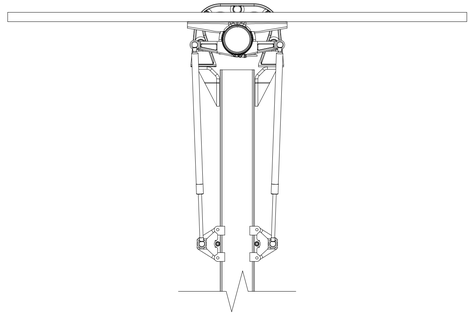
4 - INNER SINGLE/ DOUBLE DAMPER
SCALE: N.T.S.



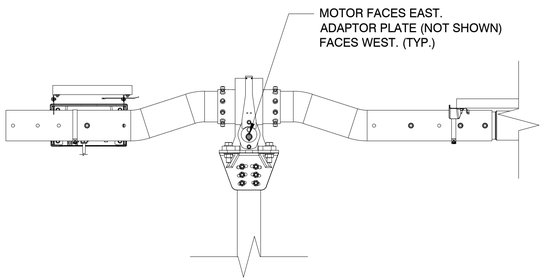
5 - OUTER SINGLE/DOUBLE DAMPER
SCALE: N.T.S.



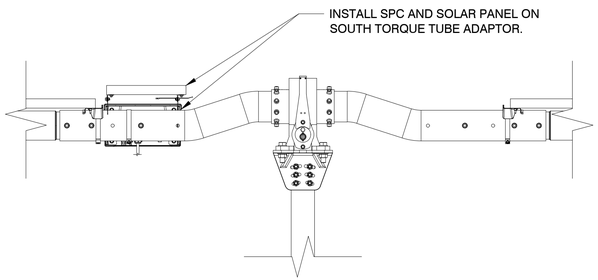
6 - SINGLE DAMPER
SCALE: N.T.S.



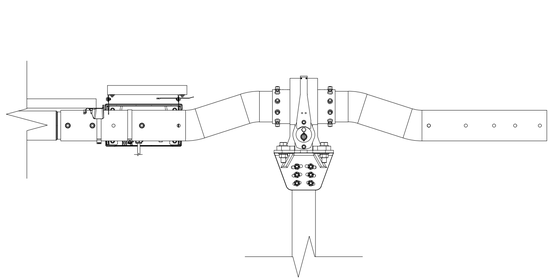
7 - DOUBLE DAMPER
SCALE: N.T.S.



7A - NORTH WING (ONLY) TRACKER
SCALE: N.T.S.



7B - 2-WING TRACKER
SCALE: N.T.S.



7C - SOUTH WING (ONLY) TRACKER
SCALE: N.T.S.

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NEXTracker Inc.
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Fremont, CA 94555

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SEAL

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PROJECT NUMBER:

SHEET TITLE:

BHA & DAMPER DETAILS

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
G			
H			
I			
J			
K			

SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
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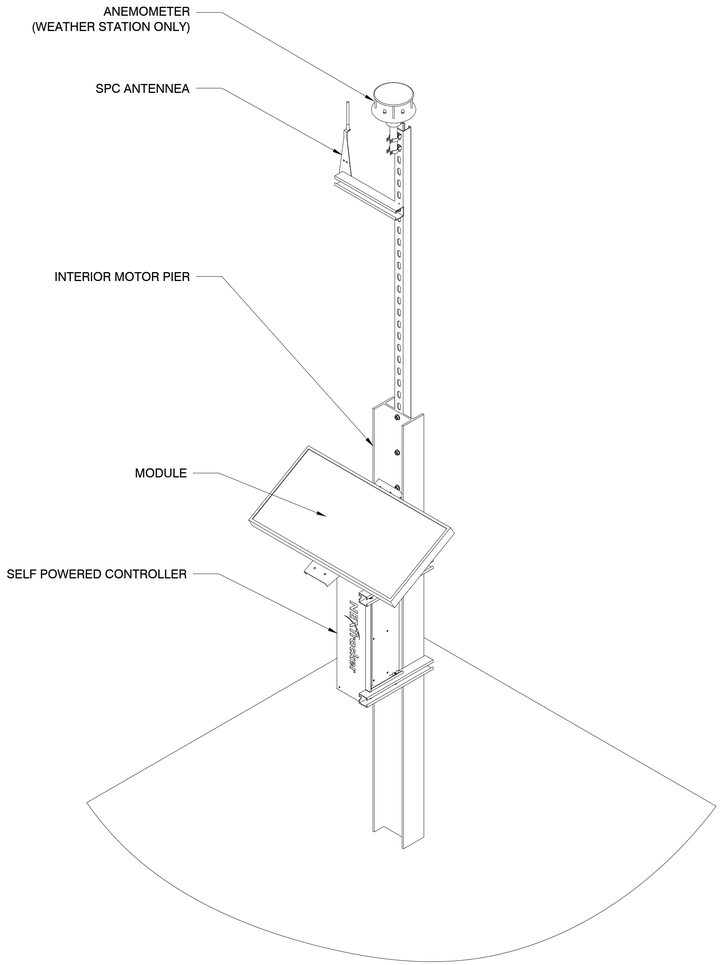
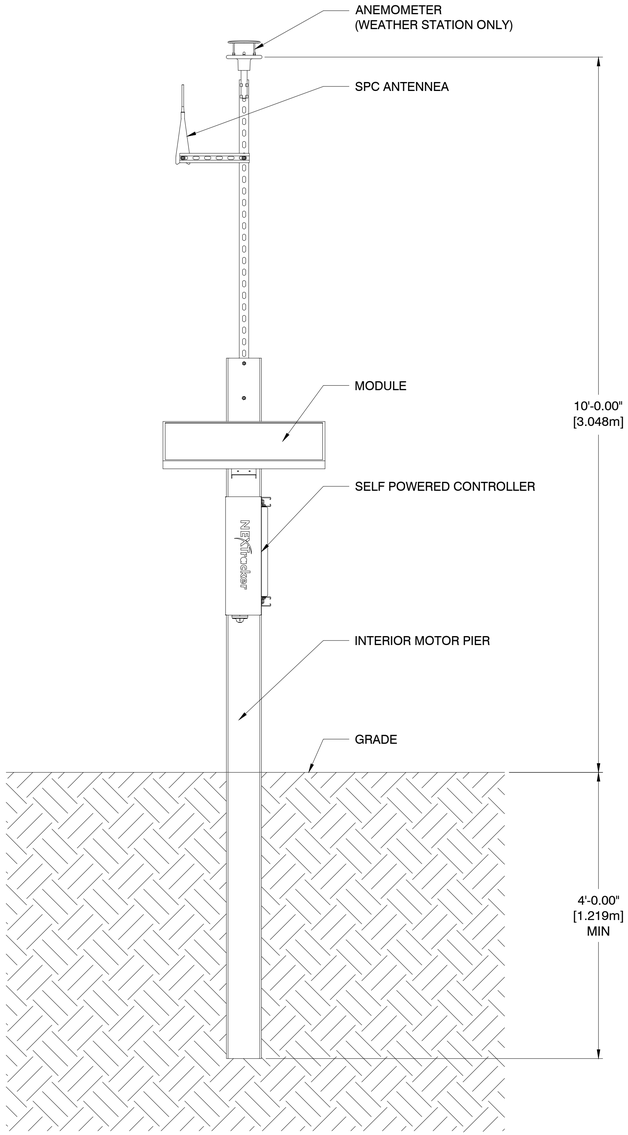
IF BAR IS NOT ONE INCH,
PRINT IS NOT TO SCALE



1 - SPT WEATHER STATION, ULTRASONIC WIND SENSOR & REPEATER
SCALE: N.T.S.



2 - SPT WEATHER STATION, ULTRASONIC WIND SENSOR & REPEATER
SCALE: N.T.S.

ACTUAL DIMENSIONS AND DETAILS DEPEND ON SPECIFIC CONDITIONS OF THE SITE.

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NEXTracker Inc.
6200 Paseo Padre Parkway
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PROJECT NUMBER:

SHEET TITLE:
SPC & WEATHER STATION DETAILS

NO.	REVISION	DATE	INIT.
A	PRELIMINARY	-/--/----	
B			
C			
D			
E			
F			
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SITE DETAILS	
LATITUDE	-
LONGITUDE	-
SNOW LOAD	0 PSF
WIND LOAD	115MPH ASCE 7-10
STOW STRAT.	30 STOW
NEXTRACKER	2.2.1 I M-7-8-8-8-7-7
DATE	--/--/----
DRAWN BY	-
CHECKED BY	-
SHEET NO.:	

0 ½ 1
IF BAR IS NOT ONE INCH,
PRINT IS NOT TO SCALE

NEXTracker
A Flex Company

NX HORIZON
SELF-POWERED TRACKER

THE MOST ADVANCED AND RELIABLE TRACKER ON THE MARKET

In our mission to make solar a mainstream energy source, NEXTracker has engineered the most intelligent and flexible tracking technology available today: the NX Horizon™ self-powered tracker.

NX Horizon brings self-contained motor power and control to each row, eliminating power wiring and trenching and enabling advanced energy yield optimization. With a balanced mechanical design and highly configurable, independent rows, NX Horizon improves reliability and design flexibility while lowering O&M costs. By offering more powerful systems at a greater value, NEXTracker is accelerating deployment of renewable energy worldwide.

NX HORIZON KEY FEATURES AND BENEFITS INCLUDE:

SELF-POWERED SYSTEM WITH SMART PERFORMANCE COMMUNICATION ARCHITECTURE:
Self-contained units on each row include a dedicated PV panel to provide power to the controller which drives the motor and hosts intelligent control electronics to position each tracker row for maximum yield.

INDEPENDENT BALANCED ROWS WITH 120 DEGREE ROTATIONAL RANGE:
Each NX Horizon row has its own controlled motor and a wide rotational range that delivers up to 2% more energy than typical linked row trackers.

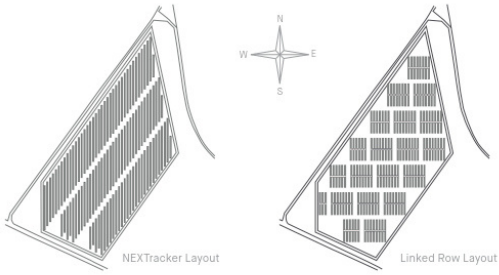
FAST AND SIMPLE INSTALLATION:
With less steel, no drive shafts, extra cabling, or welding required, NX Horizon allows for quick and easy installation. We also offer our PowerworX™ Academy to share hands-on best practices to ensure the highest quality installation and reliability for the life of the plant.

LOWEST LONG-TERM O+M COSTS:
NX Horizon's elegant design, independent rows, and smart, data-driven Digital O&M™ capability contribute to the lowest long-term ownership costs for our customers.

GENERAL	
Tracking Technology	Horizontal single-axis balanced-mass tracker
Tracking Range	120° (± 60°)
Drive System	One slew gear, 24 VDC motor and self-powered controller w/ dedicated solar panel per row
DC Capacity	23-35kWp per tracker row, depending on panel type. Row length up to 90 panels.
System Voltage	1,000 volt or 1,500 volt
Safety Stowing	Automated wind and snow stowing with self-contained backup power
Torsional Limiter	Included at each foundation/bearing for additional wind and snow load protection
Principal Materials	Galvanized and stainless steel
Compliance	Grounding/bonding: UL2703; structural design: ASCE7-10, T racker: UL 3703
Typical Dimensions	Height 1.4 m/4.5 ft, Width 2.0 m/6.4 ft, Length 85 m/283 ft
Module Frame Bonding	Integrated bonding to foundation pier. No additional copper wiring required

SITE CONDITIONS

The innovative NX Horizon is so flexible that we are able to build almost anywhere with minimum grading. While linked row systems need to pay attention to both north-south and east-west slopes, NX Horizon offers complete freedom in east-west slope tolerance. In the north-south direction, NEXTracker's unique design accommodates a generous 15% grade.

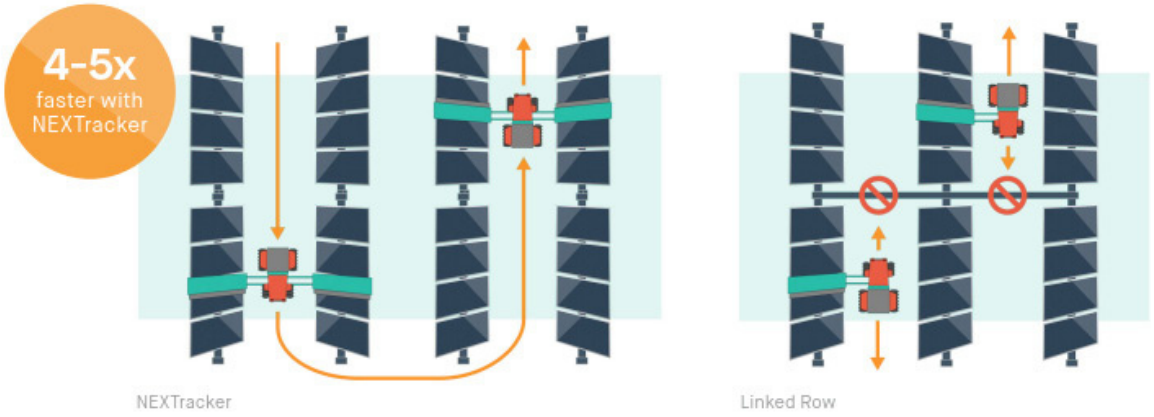


Power Consumption	Self-powered, no grid power required
Ground Coverage Ratio	No limitation. Typical range 33%-50% depending on site conditions
Foundations	I-beam and C-channel options
Maximum Site Slope	15% (8 degrees) North-South; Unlimited East-West
Maximum Wind Speed	Configurable up to 140 mph ASCE7-10
Flood Clearance	1.2m/4ft clearance for tracker electrical & controls standard. Increased array heights available

INSTALLATION & O&M

NX Horizon's efficient structural design uses less steel than conventional trackers, with fewer parts and quicker installation. You won't need drive shafts or extra cabling to power the tracker, speeding the process up even further. NX Horizon is self-grounded, so you won't have to pay costs and labor for installing grounding washers, braided straps, bare copper wire, and grounding rods. Furthermore, zero welding is required. Our patented fasteners make mounting the panels quick and easy. The fasteners are designed to hold their tensile strength indefinitely, so you won't have to waste time and money checking and re-torquing these connections.

Once installed, the tracker is easy to service. Because the rows are not linked with a drive shaft, maintenance vehicles can drive through the arrays freely. Plus, module cleaning and vegetation management becomes quick and effortless.



Installation Method	Rapid field installation of pre-manufactured components. No welding, cutting or drilling
Module Attachment	Shared mounting rails with integrated module frame grounding. Rails pre align to locating holes in torque tubes
Structural Connections	Vibration proof, permanent swaged fasteners. No re-torquing required
Commissioning Process	Automated commissioning with NEXTracker CX rapid system commissioning tool
Array Pivots	All metal, no lubrication required
Motor & Slew Drive	Fully sealed, lubricated for life. No annual maintenance
Scheduled Maintenance	Limited to annual inspections

CONTROL/MONITORING

As soon as the wireless controller is plugged in, tracking begins. Each controller has an integrated inclinometer, and can measure each row individually, sending its data through a wireless mesh network.

Each state-of-the-art NEXTracker row features real time data collection so you'll always know that it's working properly. You can review your entire portfolio, identify issues at a glance with flag alerts, and drill down to individual rows to see alert status, and a wide range of operational parameters. No other tracker technology offers this level of visibility. We know it's crucial for you to be able know about issues right when and where they happen, so you can react immediately. Use our NEXTracker monitoring tools to understand how your asset is performing at all times, from anywhere in the world.

Tracker Control	1 self-powered controller, DC motor and slew drive per tracker row
Communications	Wireless ZigBee© mesh network; no communication wiring required
Weather Monitoring	Wind measurement standard, snow and flood optional
Solar Tracking Method	Astronomical GPS based algorithm
Communications Architecture	One network control unit (NCU) per 100 trackers
SCADA Interface	Dedicated tracker system SCADA with HMI on dedicated industrial computer
Optimized Backtracking	Yes

SERVICE & WARRANTY

Exemplary customer service is tightly woven into NEXTracker's company DNA. We have 30 years of experience with boots on the ground, and we know how to best help you speed installation, lower project costs, insure proper maintenance, and answer every question you might have. We've got you covered with our on-site tech advisors and our PowerworX training. Customer service is value — one that we've always carried in our DNA, and always will.

Comprehensive Warranty	10 years on structural components; 5 years on drive and control systems. Extended terms available
Design Services	Site plan, topography review, detailed mechanical/structural sheet set (P.E. stamped)
Training	Regularly scheduled PowerworX Academy
On-site tech advisors	Standard

NEXTracker™
A Flex Company

MAXIMIZE YOUR ENERGY GENERATION AND INVESTMENT WITH NX HORIZON

Email us today for a quote: salesteam@nextracker.com

6200 Paseo Padre Pkwy Fremont, CA 94555

MKT-000060

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SG250HX New

Multi-MPPT String Inverter for 1500 Vdc System

SUNGROW
Clean power for all

HIGH YIELD

- 12 MPPTs with max. efficiency 99%
- Compatible with bifacial module
- Built-in Anti-PID and PID recovery function

SMART O&M

- Touch free commissioning and remote firmware upgrade
- Online IV curve scan and diagnosis*
- Fuse free design with smart string current monitoring

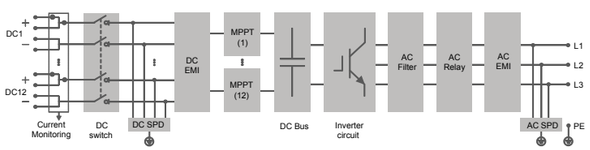
LOW COST

- Compatible with Al and Cu AC cables
- DC 2 in 1 connection enabled
- Power line communication (PLC)
- Q at night function

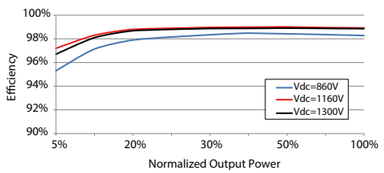
PROVEN SAFETY

- IP66 and C5 protection
- Type II SPD for both DC and AC
- Compliant with global safety and grid code

CIRCUIT DIAGRAM



EFFICIENCY CURVE



Type designation	SG250HX
Input (DC)	
Max. PV input voltage	1500 V
Min. PV input voltage / Startup input voltage	600 V / 600 V
Nominal PV input voltage	1160 V
MPP voltage range	600 V – 1500 V
MPP voltage range for nominal power	860 V – 1300 V
No. of independent MPP inputs	12
Max. number of input connectors per MPPT	2
Max. PV input current	26 A * 12
Max. current for input connector	30 A
Max. DC short-circuit current	50 A * 12
Output (AC)	
AC output power	250 kVA @ 30 ℃ / 225 kVA @40 ℃ / 200 KVA @ 50 ℃
Max. AC output current	180.5 A
Nominal AC voltage	3 / PE, 800 V
AC voltage range	680 – 880V
Nominal grid frequency / Grid frequency range	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % In
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / connection phases	3 / 3
Efficiency	
Max. efficiency	99.0 %
European efficiency	98.8 %
Protection	
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
DC switch	Yes
AC switch	No
PV String current monitoring	Yes
Q at night function	Yes
PID protection	Anti-PID or PID recovery
Overvoltage protection	DC Type II / AC Type II
General Data	
Dimensions (W*H*D)	1051 * 660 * 363 mm
Weight	95kg
Isolation method	Transformerless
Ingress protection rating	IP66
Night power consumption	< 2 W
Operating ambient temperature range	-30 to 60 ℃
Allowable relative humidity range (non-condensing)	0 – 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating)
Display	LED, Bluetooth+APP
Communication	RS485 / PLC
DC connection type	Amphenol UTX (Max. 6 mm²)
AC connection type	OT terminal (Max. 300 mm²)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE-AR-N 4110:2018, VDE-AR-N 4120:2018, IEC 61000-6-3, EN 50549, UNE 206007-1:2013, P.O.12.3, UTE C15-712-1:2013
Grid Support	Q at night function, LVRT, HVRT,active & reactive power control and power ramp rate control

*: Only compatible with Sungrow logger and iSolarCloud

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MVS6300-LV Preliminary

SUNGROW
Clean power for all

MV Turnkey Station for 1500 Vdc String Inverter SG250HX

HIGH YIELD

- High efficiency, max. efficiency 99.51%
- 1.1Pn longtime overloading capacity @30 ℃

EASY O&M

- All key components front accessible
- All pre-integrated, only external cable connection work needed onsite
- Online analysis for fast trouble shooting

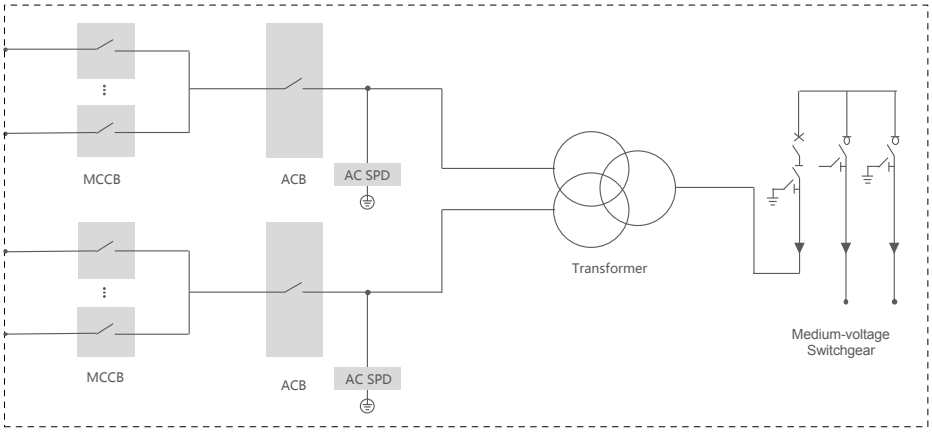
SAVED INVESTMENT

- Up to 6.3 MW block design
- Easy transportation and installation due to standard container design
- Integrated communication and aux. power supply

RELIABLE

- Compliance with standards: IEC 60076, IEC 62271, IEC 61439

CIRCUIT DIAGRAM



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Type designation	MVS6300-LV
Transformer	
Transformer type	Oil immersed
Rated power	6300 kVA @ 40 ℃
Max. power	7000 kVA @ 30 ℃
Vector group	Dy11y11
LV / MV voltage	0.8 kV / 20 – 35 kV
Maximun input current at nominal voltage	2525 A * 2
Frequency	50 Hz / 60 Hz
Tapping on HV	0, ±2 * 2.5 %
PEI efficiency	99.51%
Cooling type	ONAN (Oil Natural Air Natural)
Impedance	7 % (±10 %)
Oil type	Mineral oil (PCB free) or degradable oil on request
Winding material	Al / Al
Insulation class	A
MV Switchgear	
Insulation type	SF6
Rate voltage	24 – 36 kV
Rate current	630 A
Internal arcing fault	IAC AFL 20 kA / 1s
Qty. of feeder	3 feeder (2 LBS and 1 VCB or equivalent)
LV Panel	
ACB Specification	3200 A / 800 Vac / 3P, 2 pcs
MCCB Specification	250 A / 800 Vac / 3P, 28 pcs
Protection	
AC input protection	Circuit breaker
Transformer protection	Oil-temperature, oil-level, oil-pressure
Relay protection	50 / 51, 50N / 51N
Overvoltage protection (LV side)	AC Type I + II
General Data	
Dimensions (W*H*D)	6058*2896*2438 mm
Approximate Weight	22 T
Operating ambient temperature range	-35 to 60 ℃
Auxiliary power supply	5 kVA / 400 V (Optional: max. 40 kVA)
Degree of protection	IP54
Allowable relative humidity range (non-condensing)	0 – 95 %
Operating altitude	1000 m (standard) / > 1000 m (optional)
Communication	Standard: RS485, Ethernet, Optical fiber
Compliance	IEC 60076, IEC 62271-200, IEC 62271-202, IEC 61439-1, EN50588-1

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Draft_MVS2500_3000_3150_5000_6250_6300-LV-SEN-Ver11-201910

MVS2500–LV/MVS3000–LV/MVS3150–LV/MVS5000–LV/MVS6250–LV/ MVS6300–LV

MV Station

System Manual

SUNGROW

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1 About This Manual

1.1 Validity

This manual is intended for the following product:

- MVS2500-LV
- MVS3000-LV
- MVS3150-LV
- MVS5000-LV
- MVS6250-LV
- MVS6300-LV

Hereinafter it will be referred to as " MV Station" unless otherwise specified.

1.2 Demonstration of the Model

Model	Rated power	Devices can be connected
MVS2500-LV	2500 kVA	20 x SG125HV
MVS3000-LV	3000 kVA	24 x SG125HV
MVS3150-LV	3150 kVA	14 x SG250HX
MVS5000-LV	5000 kVA	40 x SG125HV
MVS6250-LV	6250 kVA	50 x SG125HV
MVS6300-LV	6300 kVA	28 x SG250HX

The function, appearance and wiring method of the models are the same, but the number of inverters is different.

This manual takes MVS6300-LV as an example to briefly introduce the installation and wiring instructions of MV Station.

1.3 Target Group

This manual is for technical personnel who are responsible for the transport, installation and other operations on the MV Station.

Only qualified personnel can perform the installation. Qualified personnel are:

- Equipped with certain electrical wiring and mechanical knowledge and familiar with electrical and mechanical principle diagram
- Familiar with theconstruction and working principle of the PV grid-connected power generation system; and familiar with the construction and working principle of the MV Station upstream and downstream equipment

- Trained especially in the installation of electrical devices
- Capable of coping with the dangerous and emergency situations during the installation and commissioning
- Familiar with the country/regional standards and specifications
- Familiar with this manual

1.4 How to Use This Manual

Read this manual carefully before installing the device. Keep this manual and other product component information together to ensure ease of access. In addition to this manual, the following documentations are provided:

- MV Switchgear manual
- MV Transformer manual
- Other enclosed manuals

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1.5 Symbols Explanation

This manual contains important safety and operational instructions that must be accurately understood and respected during the installation and maintenance of the equipment.
To ensure the optimum use of this manual, note the following explanations of the symbols used.

⚠ DANGER

DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

NOTICE
NOTICE indicates a situation which, if not avoided, could result in equipment or property damage.

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

The symbols below may be found on the electrical parts of the inverter. Make sure to read the following symbols and fully understand them before installing the equipment.

Symbol	Explanation
	Lethal voltage inside! Do not touch!
	Hot surface! Do not touch the hot surface of the device.
	Protective earth. Earthing securely to ensure personal safety.

1.6 Terminology

Name	For short
MV Station	MV Station / Container
COM100 Communication Box	COM100 / communication Box

The foregoing devices are expressed in the abbreviation form in this document unless otherwise specified.

2 Safety Instructions

Read the safety instructions carefully before installing the MV Station. Refer to corresponding manuals for the safety instructions on the internal devices.

2.1 General Safety Rules

⚠ DANGER

Touching the terminals or contactors connected to the grid may lead to electric shock!

- Do not touch the terminals or conductors connected to the grid.
- Respect all safety instructions on the grid connection.

⚠ DANGER

Lethal voltages are present inside the device!

- Pay attention to and follow the warning signs on the device.
- Respect all safety instructions in this manual and other pertinent documents.

⚠ DANGER

Electric shock or fire may occur due to device damage or system fault.

- Visually inspect the MV Station for device damages or other hazards.
- Check if the external devices and circuit connections are safe.
- Only operate the device when it is safe to do so.

⚠ WARNING

All installations and operations on the MV Station must be in full accordance with the national and local regulations and standards.

⚠ WARNING

Ensure that the installation environment (such as voltage, temperature, humidity, altitude, pollution level, water-proof and dust-proof level) is within the scope of equipment specifications.

⚠ WARNING

The locking device on the pressure relief valve must be removed before operation. refer to "7-1 Remove the locking device of the pressure relief valve".

⚠ WARNING

The installation, electrical connection, commissioning, maintenance, and troubleshooting must be carried out by professional electrical technicians conforming to local codes. Before performing operations, operators should have read this manual completely and mastered the safety issues related to the operation.

2.2 Ground Fault Protection

⚠ DANGER

If a ground fault occurs in the PV system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before performing operation and take proper protective measures.

2.3 Live Line Measurement

⚠ DANGER

Before electrical connection, please ensure that the substation and electrical equipment inside it are intact and hazard-free. All electrical connections must meet electrical standards of local country/region.

⚠ DANGER

High voltages are present inside the device. Death can result from burning and electric shock due to touching the live components of the MV Station. During live line measurement,

- use suitable protective equipment, for example, dielectric gloves, and
- accompanied by other persons.

2.4 Measuring Instrument

The instrument for measuring the electrical parameters should meet the following requirements:

⚠ WARNING

- The instrumentfor measuring the electrical parameters should be a high-quality instrument with sufficient measuring range.
- Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations.
- Use suitable protective equipment, for example, dielectric gloves during live line measurement.

2.5 Voltage-free Operations

Perform operations on the MV Station only when all devices inside the MV Station are completely voltage-free.

- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.
- Ensure sufficient escape room.
- After the MV Station stops, wait at least 5 minutes before operating it.
- Ensure that the MV Station is completely voltage-free.

2.6 ESD Protection

⚠ CAUTION

Devices may be damaged irreversibly by electrostatic discharge (ESD).

- Avoid unnecessary touching of the PCB.
- Observe all the ESD-related safety instructions. Wear proper personal protective equipment (PPE) such as wrist strap.

2.7 Symbols on the Device Body

Symbols on the device contain important information on safe operations of the MV Station and its internal devices. Do not tear or damage them!

NOTICE

Do not damage or tear the symbols.

- All symbols on the device body must be clearly legible.
- Replace the symbols once any damage or illegibility is detected.

2.8 Safety Warning Signs

During transport, installation, maintenance, and troubleshooting of the MV Station, keep unauthorized persons away.

- Post warning signs near the MV Station upstream and downstream switches to prevent inadvertent connection.
- Place necessary warning signs or barriers near the on-site operation areas.

2.9 Daily Operation and Maintenance

Make sure the doors of the MV Station are closed and locked during daily operation to prevent internal devices from damages caused by rain or rodents.
Regularly check and maintain the MV Station and internal devices to ensure long-term and reliable operation of the MV Station.

⚠ WARNING

Make proper insulation protection during live line operation. At least two persons are required until the operation is done.
Properfiled rescue facilities are necessary since locations of most power stations are far away from the urban areas.

⚠ WARNING

The equipment shall be operated in accordance with local laws and regulations and strictly follow the safety precautions specified in this document.

⚠ WARNING

Before maintenance or device replacement, please ensure that the substation has been powered off and the high-voltage side switch and low-voltage side switch are disconnected.

Take the followings into consideration during daily operation and maintenance:

- The nameplate is pasted on the MV Station body. It contains important parameter information of the devices. Protect the nameplate during all operations.
- Wear proper PPE, such as safety glasses, safety footwear, and safety gloves, if necessary.
- All necessary auxiliary measures are advisable to ensure personal and device safety.

2.10 Others

2.10.1 Manual Storage

Product manuals are an indispensable part of the product. Important information about the transport, installation of the MV Station is included in this manual. All the descriptions in this manual, especially those safety-related items, must be complied with. Please read all the instructions thoroughly prior to performing any operation work on the MV Station.

- Transport and install the MV Station strictly following the descriptions in this manual. Device damage, personal injury, or property loss may follow if otherwise.
- This manual and relevant documents should be available for relevant persons at all times.

2.10.2 Disposal of Waste

When the MV Station has come to the end of its service life, it cannot be disposed of together with household wastes. Some inside components can be recycled while some components can cause environmental pollution.
Please contact the local authorized collection point.

2.10.3 Manual Description

For user convenience, there are a large number of pictures in this manual. These pictures are indicative only. For details about the device, please refer to the actual product you receive.

Keep this manual at a convenient place near the device for future reference.

All the descriptions in this manual are for the standard MV Station. Please inform us in the purchase order if you have specific requirements. The actual product you receive may differ.

This manual may not cover all possible situations. Should a specific problem not explained in this manual occur, please contact Sungrow.

3 Product Description

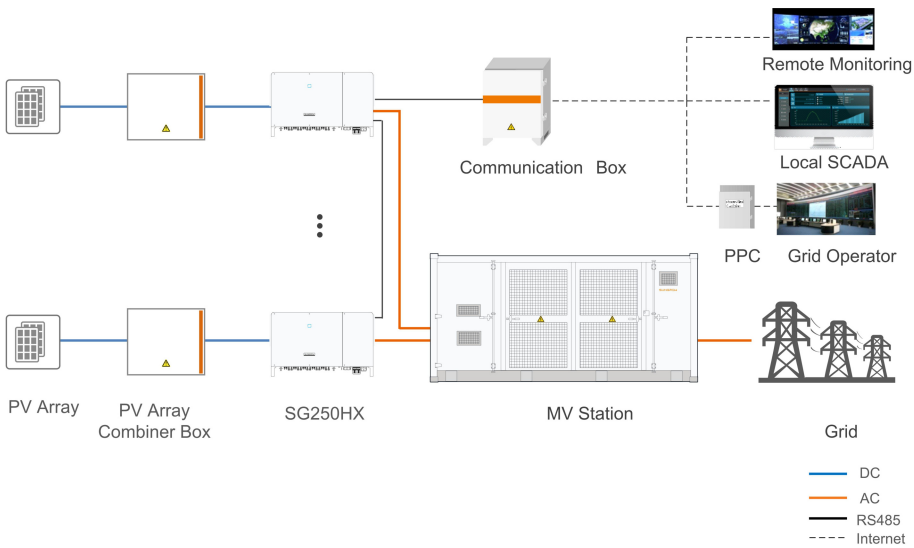
3.1 System Overview

The MV Station is mainly applied to large-and-medium PV power station. The MV Station can meet the modular design and quick installation requirements of the large-and-medium PV power station and can ensure the long-term, reliable, and safe power generation compliant with the grid.

MV Station is a booster device used in conjunction with the inverters. The main function is to convert the low-voltage from the inverters into medium-voltage and feed into the grid.

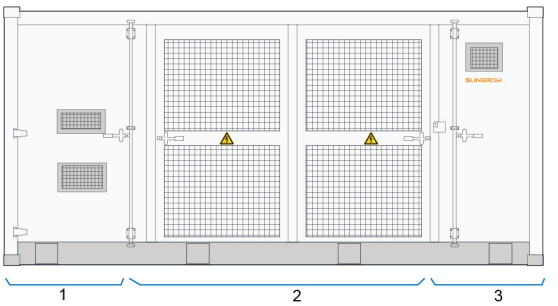
The MV Station integrates LV cabinet, MV transformer, MV switchgear, power distribution cabinet ,communication box and auxiliary transformer.

The PV power generation system with the MV Station is shown in the following figure.



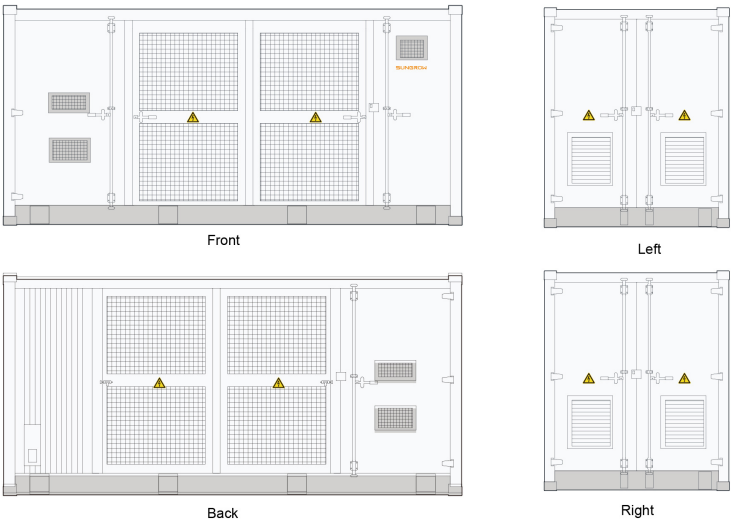
3.2 External Design

3.2.1 Composition

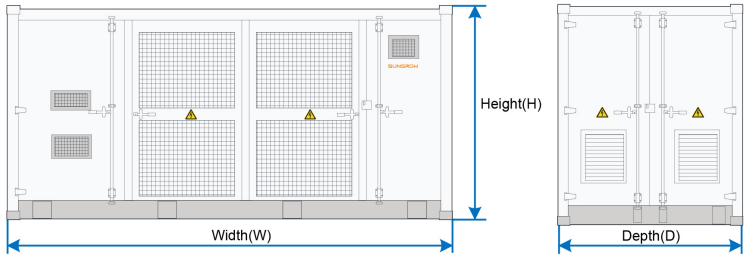


No.	Name	Description
1	LV room	Including low voltage connection area, low voltage cable entries, etc. It can be connected to the PV grid-connected inverters.
2	Transform-er room	Including a MV transformer. The MV transformer converts the inverter output low-voltage into grid-compatible medium-voltage.
3	MV room and power distribution room	The power distribution room is on the front side, with a communication box and an LV power distribution cabinet integrated inside. The MV room is on the back side, with one MV switchgear included inside.

3.2.2 MV Station Views



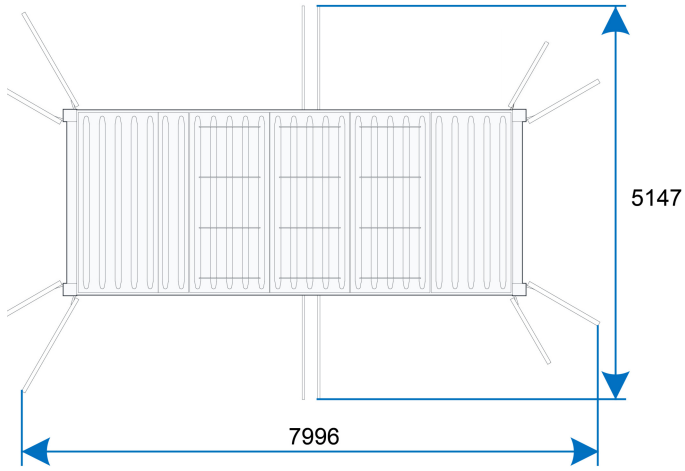
3.2.3 Exterior Dimensions



Width(W)	Height(H)	Depth(D)
6,058 mm	2,896 mm	2,438 mm

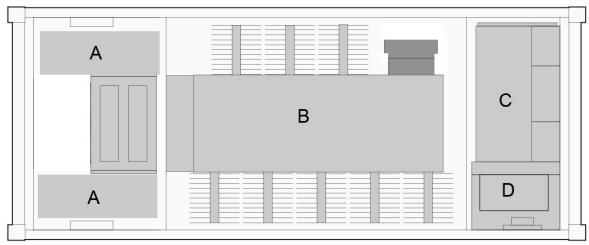
The Clearance Requirement

The clearances around the MV Station should be sufficient for the doors to be opened .



3.3 Internal Design

3.3.1 Internal Composition

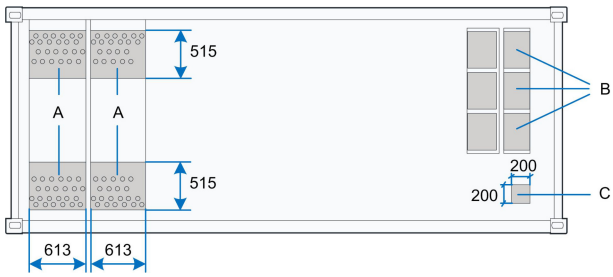


No.	Name
A	LV cabinet
B	MV Transformer

No.	Name
C	MV switchgear
D	Communication box and power distribution cabinet

3.3.2 Cable Entries

Taking the MVS6300 – LV as an example, the bottom entry hole is shown below.



No.	Name	Description
A	LV side cable entries	All LV side cables connecting the MV Station go inside through these entries.
B	MV side cable entries	All MV side cables connecting downstream MV grid go inside through these entries.
C	Communication & Power distribution cables entry	All communication cables and power distribution cables connecting external device go inside through this entry.

3.3.3 Internal Devices

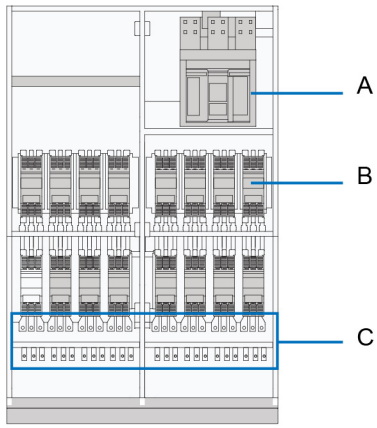
The MV Station consists of LV room, transformer room, MV room, and power distribution room.

3.3.3.1 LV Cabinet

The LV cabinet is located at the LV room inside the MV Station. It is used to converge and transmit low voltage from the inverter to the step-up transformer, and feed it into the MV grid.

The LV cabinet consists of LV cabinet A and LV cabinet B. The two cabinets are the same in design.

Taking the MVS6300 – LV as an example, the figure below shows the internal components of the LV cabinet.



No.	Name	Description
A	Air circut breaker	For LV cabinet A, used to connect/disconnect the LV cabinet A. For LV cabinet B, used to connect/disconnect the LV cabinet B.
B	Molded case circuit breaker	Used to connect/disconnect the corresponding wiring terminals
C	Low voltage connection area	Can be connected to the upstream inverters.

3.3.3.2 Transformer Room

The transformer room mainly includes a transformer inside.

The transformer integrates accessories such as pressure relief valve, tap changer, oil level indicator, pressure gauge, oil temperature indicator, oil filling valve, and oil drain valve. Positions and functions of the accessories are as follows:

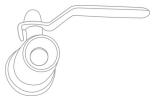
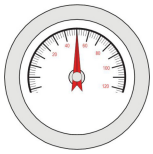
Figure	Name	Description
	Oil filling valve	when oil level of the MV transformer oil tank is low, open the valve for oil filling.
	Pressure Relief Valve	The valve automatically releases when the oil pressure inside the oil tank reaches 55kPa.
	Pressure Gauge	The pressure gauge is used to obtain the pressure inside the oil tank.

Figure	Name	Description
	Oil Level Indicator	The MV transformer will stop operating if the oil level falls below the lowest scale on the oil level indicator or below the oil level scale required for safe operation of the transformer. When the oil level is excessively high, open the drain valve to lower the oil level. When the oil level is excessively low, disconnect the transformer and check the oil tank for leakage.
	Oil Temperature Indicator	The alarm temperature is set to 90℃. When the oil temperature reaches the value, alarm signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the customer. The tripping temperature is set to 100℃. When the oil temperature reaches the value, tripping signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the customer. At the same time, the transformer will be disconnected from the upstream and downstream devices.
	Winding thermometer	—
	Oil drain valve	Open the valve for oil drainage when the oil level is excessively high or when operations such as maintenance are required.
	Tap changer	The tap changer has five tap positions: 1, 2 , 3, 4 , 5. For more details, refer to"figure 7-2 Adjust the voltage ratio via the tap changer".

Note: The figure above is for reference only, and the actual product may differ.

3.3.3.3 MV Room

The MV room includes a switchgear inside.

The switchgear consists of load switch cabinet, circuit breaker cabinet, and direct cable connection cabinet.

Names of the cabinets vary with switchgear manufacturers, as shown in the table below.

Manufacturer	Siemens	ABB	OMAZABAL
Load switch cabinet	R	C	L
Circuit breaker cabinet	L	V	V
Direct cable connection cabinet	K	D	Rb

For example, the appearance of the CCV cabinet of ABB is as follows:

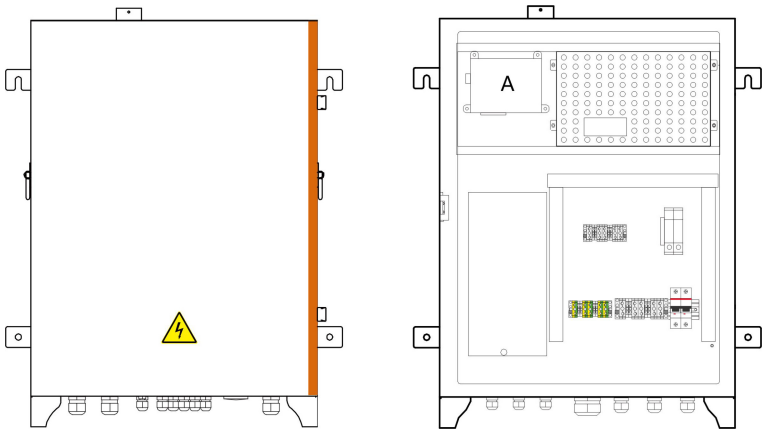
24kV 36kV

3.3.3.4 Power Distribution Room

The power distribution room integrates a communication box and a power distribution cabinet inside.

Communication Box

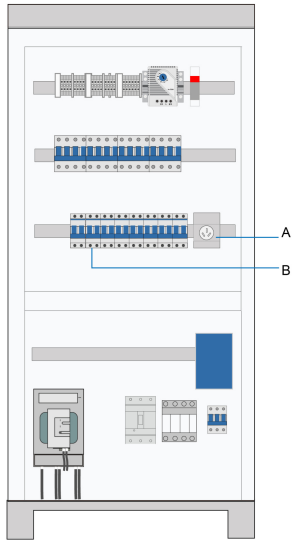
The exterior appearance and internal components of the communication box are shown in figure below.



No.	Description
A	Ethernet switch

Power Distribution Cabinet

The exterior appearance and internal components of the cabinet are shown in figure below.



The figure above is indicative only, and actual product may differ.

No.	Description
A	Power socket
B	Miniature circuit breaker

4 Identify and Store the MV Station

4.1 Identifying the MV Station

Identify the MV Station from its nameplate. The nameplate contains the following information: MV Station model, major technical parameters, marks of certification institutes, origins, and serial number.

⚠ WARNING

Very important technical parameters and MV Station-related parameters are displayed on the nameplate.
Protect the nameplate at all times!

4.2 Checking for Transport Damages

The MV Station has been strictly inspected and tested before delivery. Despite robust packaging, the container or inside devices may be damaged during transport. Therefore, once you receive the MV Station, a detailed inspection is necessary.
If any damage is detected, contact the forwarding company or Sungrow immediately.
Examine the contents of the shipment to check the scope of delivery described in the scope of delivery for completeness.

- Check to make sure the MV Station and inner devices are of the same models as those in your order;
- Check thoroughly the MV Station and inner devices for any possible damages during transport.

⚠ WARNING

Install and commission the MV Station only when it is technically faultless! Make sure before installing the MV Station that:

- **the MV Station is intact without any damage; and**
- **all devices inside the MV Station are intact without any damages.**

4.3 Storage

If the MV Station is not to be installed immediately after delivery, store it appropriately:

- Store the MV Station indoors, for example, large warehouse or workshop, to prevent possible condensation or damp.

- If the MV Station has to be stored outdoors, elevate the MV Station base according to the geological and ambient conditions.
- When the ambient temperature is too low, heat the MV Station internal devices. Temperature: -35 ° C~+70 ° C; Relative humidity: 0 to 95%, and non-condensation
- Ensure that all the doors of the MV Station are closed.
- Store the MV Station on a dry, clean, and solid ground with sufficient load-bearing capacity. The ground should be flat without water, bumps, or plantings.
- Lock the MV Station internal devices and the MV Station during storage.
- Take proper protective method to prevent the water and dust penetrating into the MV Station. Protect the MV Station air inlets and outlets at least.
- Consider the 8 support feet of the MV Station when selecting the temporary storage platform.

Regularly, once every half a month at least, check the MV Station and internal devices.

5 Mechanical Installation

⚠ WARNING

Respect all local standards and requirements during mechanical installation.

5.1 Transport

All devices are installed inside the MV Station before delivery. The MV Station should be transported as a whole. Transport the MV Station by a crane with sufficient load capacity.

The MV Station is delivered to the user by the forwarding company. After unloading, the MV Station will be transported to the installation site by the plant staff.

⚠ WARNING

Local standards and regulations on the transport and loading & unloading of the container, especially those safety instructions, should be observed at all times.

- **All the accessory appliances used during transport should be maintained beforehand.**
- **The MV Station must be transported by qualified personnel. Qualified personnel are those who have relevant training experience, especially safety-related experience.**

Keep in mind the dimensions and total weight of the MV Station at all times!

Ensure that the following requirements are met:

- All the doors are locked.
- Choose the appropriate crane or hoist to transport the MV Station. The crane or hoist must be sufficiently capable of bearing the MV Station weight.
- An additional traction vehicle may be required when the road has a gradient.
- Anything, which may hinder the transport, like trees, cables (or the like), should be removed.
- If possible, transport the MV Station on fine weather days.
- Warning signs or barriers must be posted near the transport areas to avoid accidental injuries.

Additionally, the following requirements should be met when the MV Station is placed on the ground:

- Place the MV Station carefully and gently. Do not pull or push the MV Station on any surface.
- The place should be firm and flat with good drainage and no obstacles or outshoots. The MV Station should be supported by the four feet.

5.2 Hoisting the MV Station

5.2.1 Safety Precautions

⚠ WARNING

- **Observe the safety operating rules of the crane at all times.**
- **Standing within 5 to 10 meters away from the hoisting areas is strictly prohibited! Anybody standing under the boom or MV Station is strictly prohibited in the whole hoisting process.**
- **The hoisting work must be stopped on violent weather days. For example, in strong wind, heavy rain, or thick fog conditions.**

Please observe the following items:

- All safety requirements must be met.
- A professional instructor is required in the whole hoisting process.
- All the used slings must have the load-bearing capacity of at least 30t.
- The crane should have sufficient arm length and radius of gyration.
- All the connection point must be firmly connected.
- The length of the slings can be adjusted appropriately according to on-site conditions.
- Transport the MV Station in a level, smooth, and steady way.
- Transport the MV Station by connecting the four top corner fittings.
- Some accessories may be required to ensure the safety during hoisting.
- All doors of the container are closed and locked.
- It is recommended that container is hoisted from left to right or from right to left to ensure smooth hoisting.

The following figure illustrates the hoisting operations. Circle A describes the work areas of the crane. Anybody standing inside the circle B is prohibited for safety considerations.

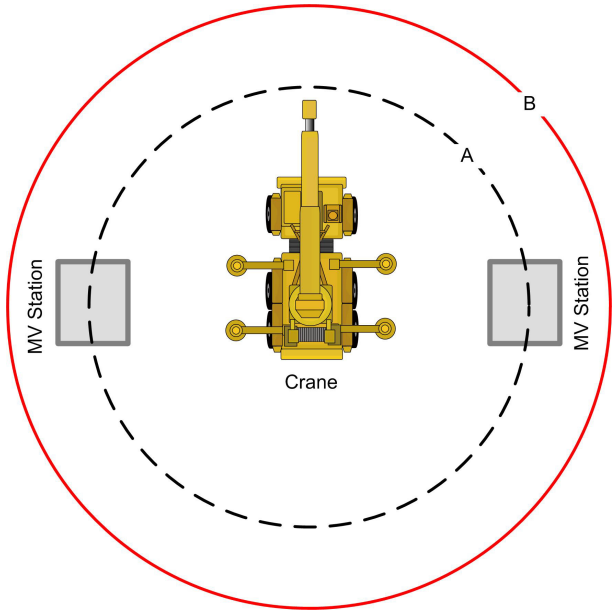


figure 5-1 Hoisting the MV Station

5.2.2 Hoisting

During the whole hoisting process, please observe the following rules:

- Hoist the MV Station in a vertical manner. Do not drag or drop the MV Station on any surface.
- Keep the container stable and horizontal during hoisting, and ensure that the diagonal gradient of the container is within 5 degrees.
- When the MV Station has been hoisted for about 300mm away from the ground, stop to check if all the connections are still firm. After confirmation, continue hoisting the MV Station.
- Lift and land the container slowly to prevent shock to the internal devices.
- When transported to the final location, the MV Station should be put down slowly and steadily.
- The final location should be firm, level, and well-drained. The MV Station is supported by four bottom fittings on the ground.
- Remove the ropes after ensuring that the container is placed evenly on the container bases.
- Secure the container hoisted before hoisting another one.

The MV Station should be hoisted by four top corner fittings as shown in the following figure.

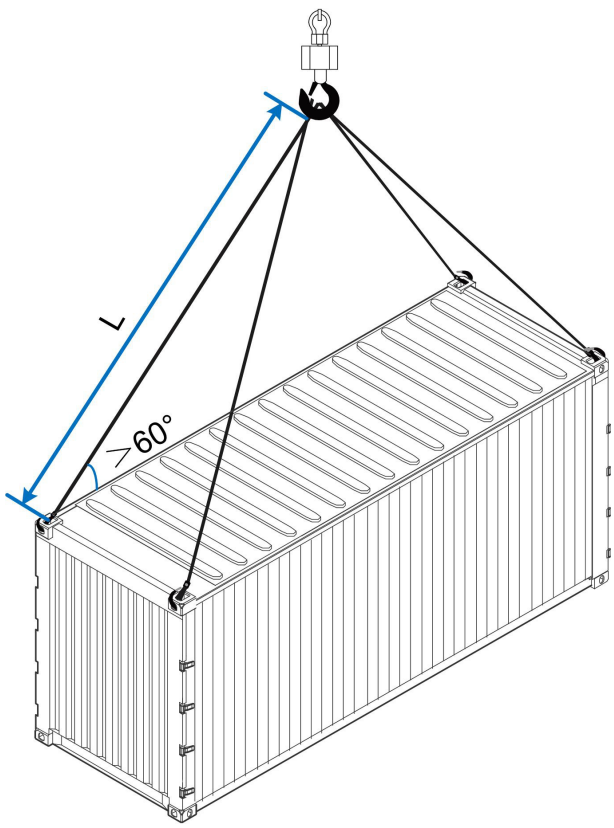


figure 5-2 Hoisting from top fittings

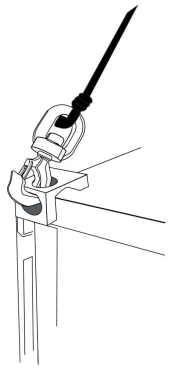
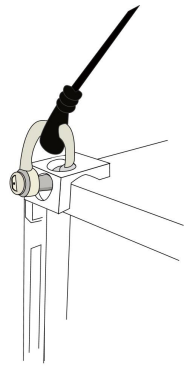
table 5-1 The Substation Hoisting Parameters

Item	Requirement
Steel Length(L)	> 6.5 m
Steel Rope Qty.	4 pieces

5.2.3 Fastening of Connectors

Use slings with hooks or U-hooks to hoist the MV Station.

The lifting devices should be correctly connected to the MV Station.

Lifting device	Hook	U-hook
Connections		
Notice	Insert the hook from inside to outside.	Lateral pin of the U-hook should be tightened.

WARNING

- **National and local safety rules should be observed at all times.**
- **Violating relevant safety rules may void pertinent warranty claims from Sungrow.**

5.3 Foundation

5.3.1 Selection of Installation Site

When selecting the installation site, consider the following requirements at least:

- Ambient and geological conditions, such as stress wave emissions, the level of underground water table and etc. should be taken into account.
- Far away from strong vibration, strong noise source and strong electromagnetic interference area.
- The ambient environment should be dry, well ventilated, and far away from inflammable materials.
- The ambient environment should be far away from dust, soot, harmful gases and the production or storage of corrosive, flammable, explosive places.
- The site location shall not be in a low-lying area and the site level shall be higher than the historical high water level in the area.
- Good soil condition, solid ground, no rubber soil, soft soil and other adverse geological conditions, do not choose the ground which is easy to get into water and easy to sink .
- The installation site should take the ventilation into account.
- Choose the open position, to ensure that there is no obstacles in 10 meters from the equipment surrounding.

- Keep at least 50 meters away from residential areas to avoid noise pollution.
- The ground at the installation site must be compacted enough. Relative compaction of the ground should be equal to or greater than 98%. Otherwise, take proper methods to strengthen the ground.

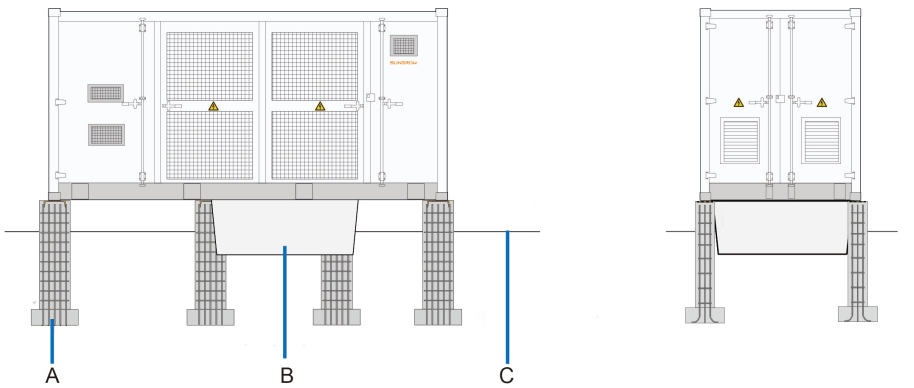
5.3.2 Recommended Foundation Construction Plan

The following conditions must be fulfilled:

- The bottom of the foundation should be firm enough.
- The foundations must be suitable for the weight of the MV Station.
- The foundation should be at least 100mm higher than the pea gravel ground on site to prevent the rain from damaging the base or penetrating into the MV Station.
- Sufficient cross-sectional area and depth of the foundation should be maintained. The depth is designed according to local soil conditions.
- Cable route should be taken into account.

Overall construction effect is shown below.

The foundation plan described in this chapter is for reference only.

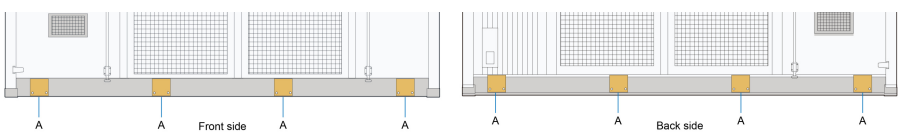


No	Name
A	Foundation
B	Pea gravel ground
C	Oil tray

5.3.3 Securing the MV Station(optional)

Overview

As shown by A in the figure below, the position for installing L-shape angle steel is reserved at the bottom of the container.

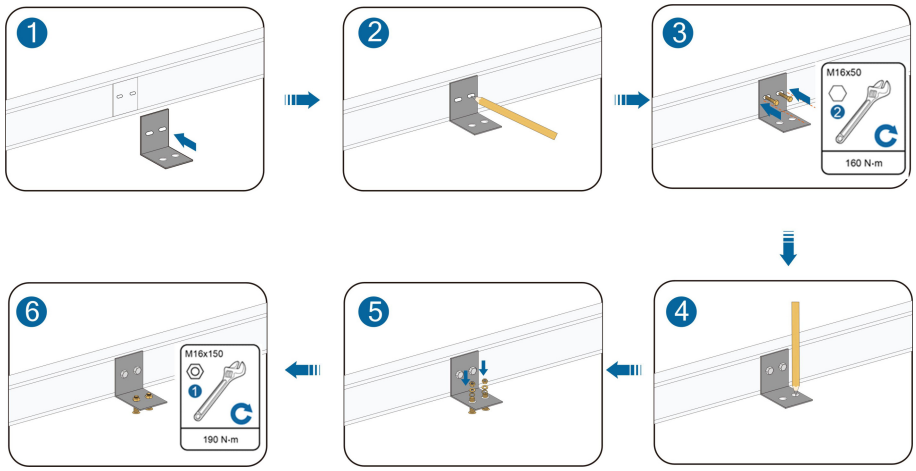


Preparing Installation Tools

The following tools may be used in installing the L-shape angle steel:

No.	Name	Resource
1	Marker	beyond the scope of delivery
2	φ22 percussion drill	beyond the scope of delivery
3	Angle steel	in the scope of delivery
4	M16 × 150 expansion bolts	in the scope of delivery
5	M16 × 50 screw	in the scope of delivery

Installation Method



Other Precautions

NOTICE

A drainage system should be designed on the installation site to prevent the MV Station from being immersed in water during heavy rainfalls.

NOTICE

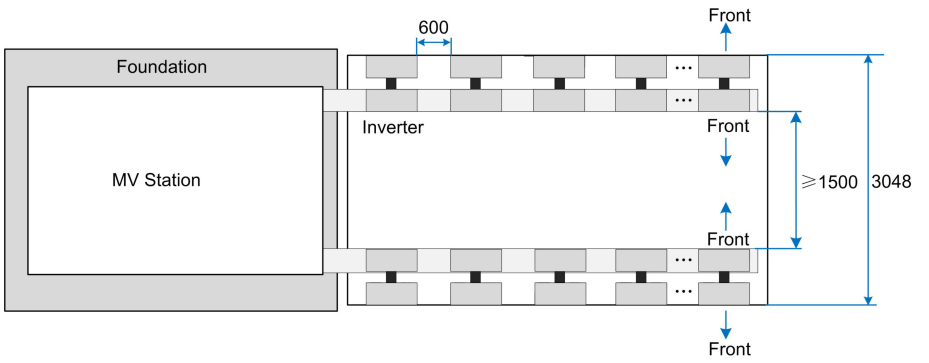
Do not plant any trees near the MV Station installation site to prevent the damage of the MV Station caused by tree leaves or stems.

5.4 Installation Verification

- Bolts and nuts are tightened.
- The container is in good contact with and evenly supported by the bases underneath.
- All container doors can be smoothly opened and closed.

5.5 Clearance Requirement

On site, MV Station works together with the inverter. Required clearances around MV Station and the inverter are shown in the figure below.

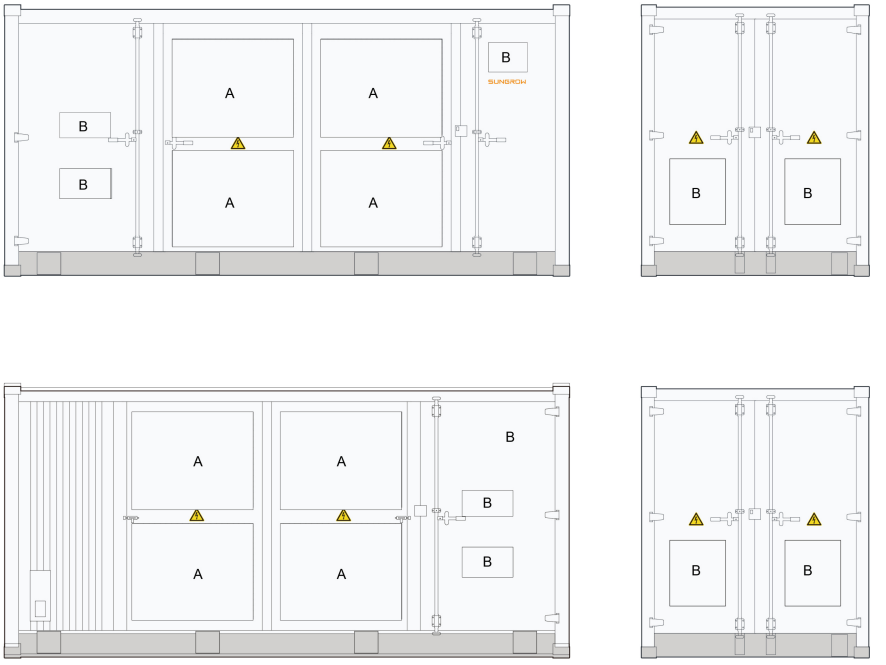


* The distance illustrated in this figure is the minimum values.

** This figure takes the inverter SG125HV as an example, and the inverter type may differ in actual project.

5.6 Removing Sealing Plates and Sealing Tapes

The sealing plates and sealing tapes (shown as A and B respectively in the following figure) are attached to the enclosure of the MV Station to prevent moisture penetration during transportation.



Remove the sealing tapes and sealing plates before commissioning.

6 Electrical Installation

6.1 Safety Instructions

6.1.1 Generals Rules

DANGER

High voltage! Electrical hazards!

- Do not touch the live components of the device.
- Make sure the MV Station are voltage-free before installation.
- Never put flammable materials in the vicinity of the MV Station.

DANGER

If a ground fault occurs in the PV system, some parts that were voltage-free before may contain lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before operation and take proper protective measures.

WARNING

Observe all the country-specific standards and regulations.
Connect the MV Station to public grid only after receiving authorization from the local network operator.

WARNING

Only professional electricians can perform the operations described in this chapter.
Observe all the instructions to connect the wires.

WARNING

Disconnect all the switches before electrical connection.

⚠ WARNING

Sand and moisture penetration may affect the performance of electric devices inside the MV Station!

- Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.
- Perform electrical connection on fine weather days.

⚠ WARNING

Improper torque used may cause a fire to the connection point!
Fix the bolts by strictly following the torque requirements in this manual during electrical connection.

⚠ WARNING

Too small bending radius or excessive intertwine may damage the fiber!
When selecting fiber as the communication cable, please follow the related requirements of the fiber manufacturer about the min. allowable bending radius.

⚠ WARNING

Only professional electricians can perform the electrical connection.
Professional electricians should meet the related requirements listed in 2 Safety Instructionsin this manual. Sungrow should hold no liability for any personal injury or property loss caused by ignorance of the safety instructions.

⚠ WARNING

Ensure the electrical insulation is satisfied before laying the cables. Follow the EMC regulation and lay the power cable and communication cable in different layers. Provide support and protection to the cables to reduce the stress of the cables when necessary.

⚠ WARNING

Strictly follow all the instructions when connecting the cables.

NOTICE

The installation and design of the MV Station must fulfill national and local standards and regulations.
Sungrow should hold no liability for the MV Station or system fault caused by ignorance of the description in this manual.

Select optical fibers as the external communication cable to lower the signal interference.

6.1.2 Five Safety Rules

During electrical connections and other operations on the inside device, observe the following Five Safety Rules:

- Disconnect all the external connections and disconnect the MV Station internal power supply
- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.

6.2 Circuit Diagram

Taking the MVS6300-LV as an example, the circuit diagram is as follows.

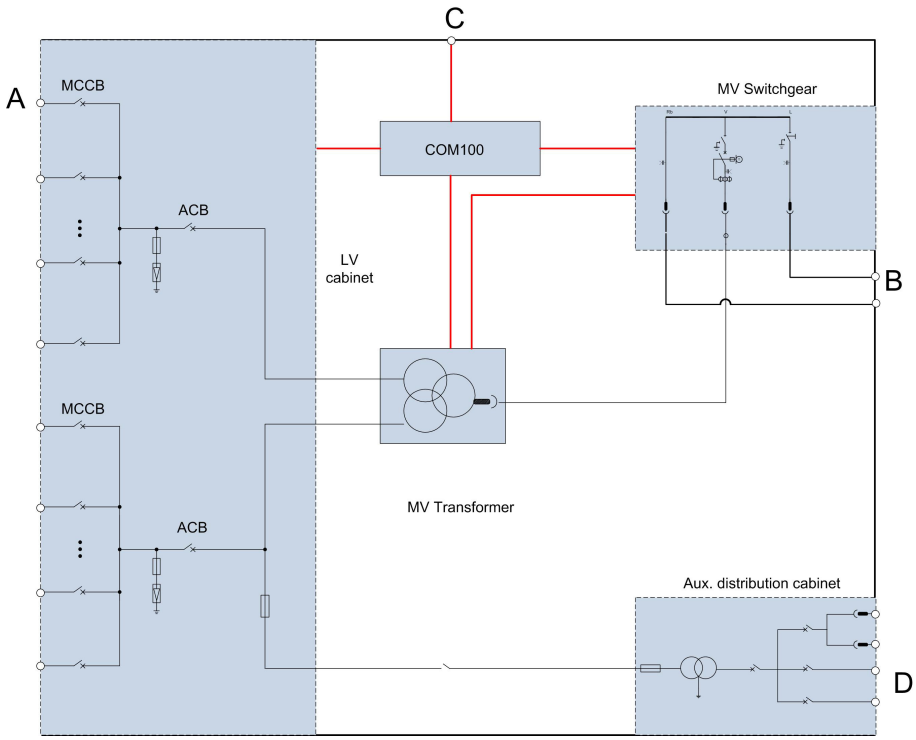


table 6-1 Items in figure

Item	Name	Recommended specifications
A	Connect to the inverter	Max. 180 mm² aluminum wire
B	Connect to MV grid	Depends on the switchgear type. Specifically, refer to the corresponding manual.
C	Ethernet port	-
D	Power distribution port	-

6.3 Cable Connection

External cable connections of the MV Station include grounding connection, cable connection on LV side, cable connection on MV side, communication connection, and auxiliary power supply connection.

6.3.1 Ground Connection

Brief Introduction

Generally, the ground connection includes equipotential connection of internal devices and external grounding.

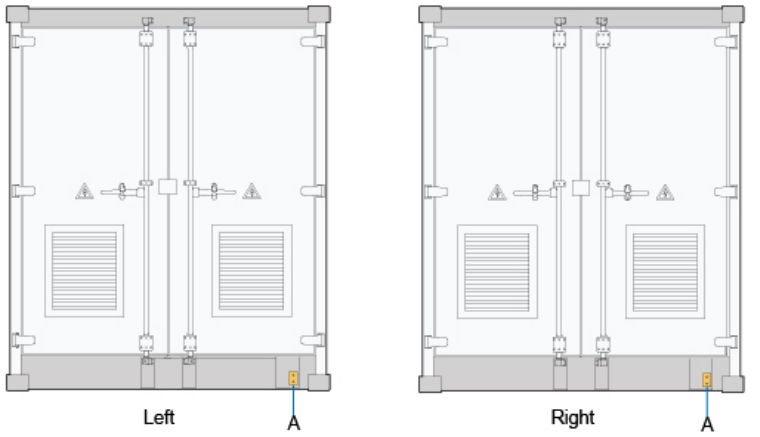
Equipotential Connection of MV Station Internal Devices

All electrical devices inside the MV Station should be connected equipotentially through the total equipotential connection copper bar inside the MV Station, i.e. the grounding terminal of all the main electrical devices should connect to the total equipotential connection copper bar.

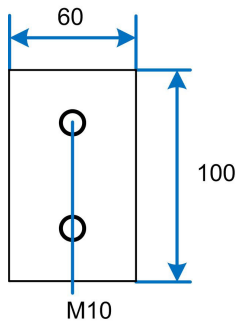
The connection of the internal main electrical devices to the grounding copper bar has been finished before delivery.

External Grounding

For ease of onsite cable connection, two grounding points are designed at the exterior of the MV Station, as shown in the figure below.



The dimensions of the grounding copper bar is shown in the following figure.



On site, reliably connect both or either of the two grounding points according to actual conditions. The external grounding points of the MV Station can be grounded in the following two manners:

- Connect the grounding cable to the external grounding points with M10 bolts, where the recommended cable is of 50 mm² to 95 mm².
- Weld the grounding steel flat onto the external grounding point, after which anti-corrosion processing needs to be performed.

It is recommended that two points of the MV Station should be connected to the ground system of the PV plant.

The MV Station needs to be grounded on site. The following operations should also be conducted on site:

Measure the electrical conductivity between the device ground terminals and the total equipotential connection copper bar to ensure the effectiveness of the internal ground connection.
Perform the external grounding according to on-site situation and instructions of the plant staff.

The grounding resistance should be no more than 4Ω.

The grounding resistance should be determined according to local standards and regulations.

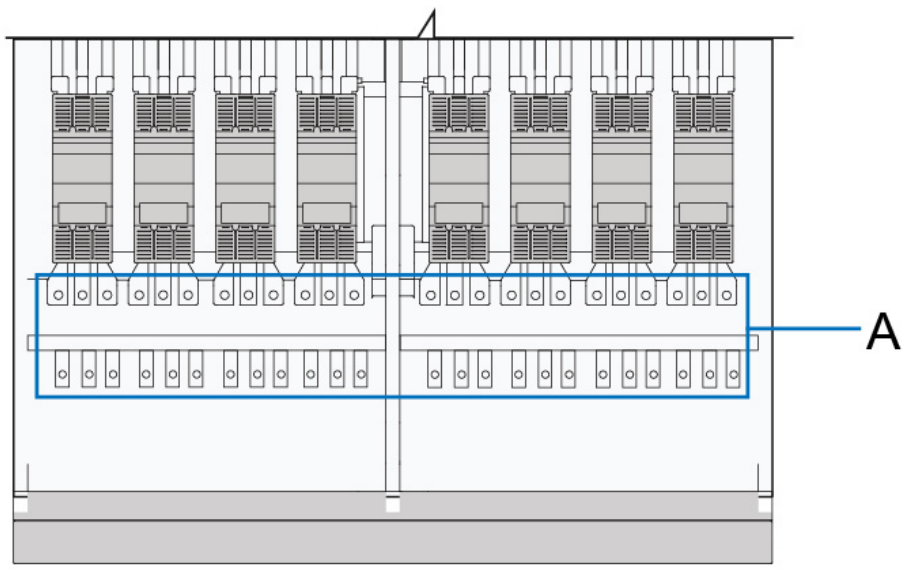
WARNING

The country-specific regulations and standards must be observed at all times!

6.3.2 LV Side Connection

LV wiring terminals are located at the lower part of the LV cabinet, as shown in the figure below.

Taking the MVS6300-LV as an example, the connection area is as follows.

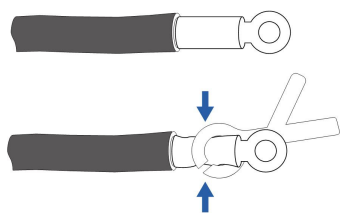


step 1 Make sure the upstream inverter is in the OFF position.

step 2 Make sure the air circut breaker and molded case circuit breakers are in the OFF position.

step 3 Pass the external cable through the cable entries.

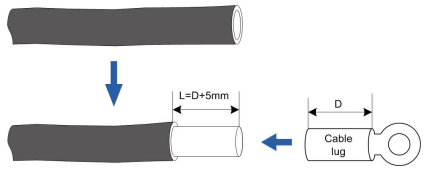
step 4 Strip off the insulation cover of the cable with the tripped length of 5mm longer than the depth of the cable lug.



step 5 Crimp the cable lug. It is advisable to select DT-××（×× is the cable cross-sectional area) cable lug.

1 Put the stripped cable inside the cable lug.

2 Tighten the cable lug with relevant tools. Crimp it at least twice.

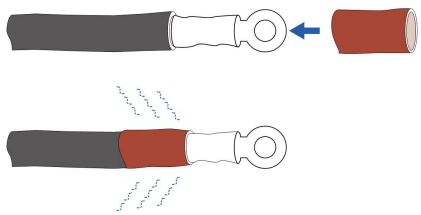


step 6 Wrap the heat-shrink tubing.

1 A tubing with length 2cm longer than the depth of the cable lug is recommended.

2 Wrap the cable lug with the heat-shrink tubing.

3 Shrink the tubing with hot air blower.



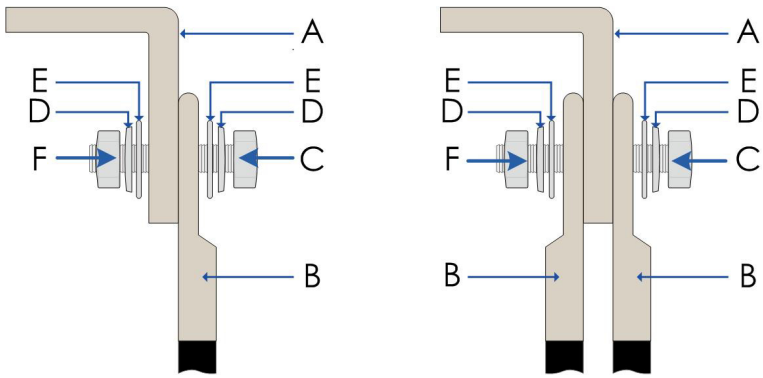
Cable protectors are advisable in the cable crosses if the multi-core cables are used.

step 7 Connect the cable.

1 Select bolts matching with the cable lug.

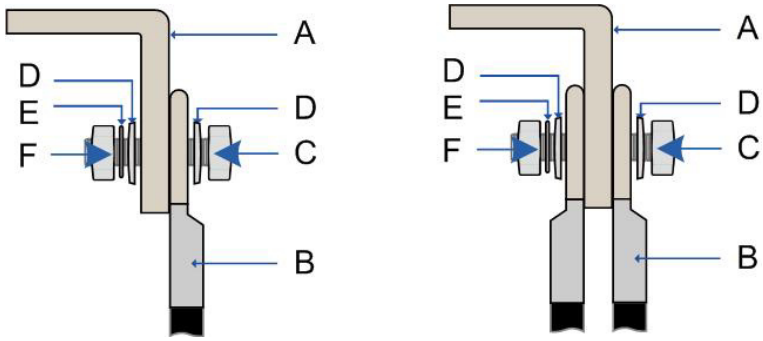
2 Attach the cable lug to the connection copper bar.

- If copper wires are used, connect the spare parts as described below:



No.	Name	No.	Name
A	Copper Bus	D	Flat washer
B	Cable Lug	E	Spring washer
C	Bolt	F	Nut

- If aluminum wire is selected, a copper-aluminum adapter terminal is required, as shown below:



No.	Name	No.	Name
A	Copper Bus	D	Flat washer
B	Copper-aluminum adapter terminal	E	Spring washer
C	Bolt	F	Nut

3 Fasten the bolts with screwdriver or spanner. For the M16x45 bolts, the fastening torque is 119~140N.m.

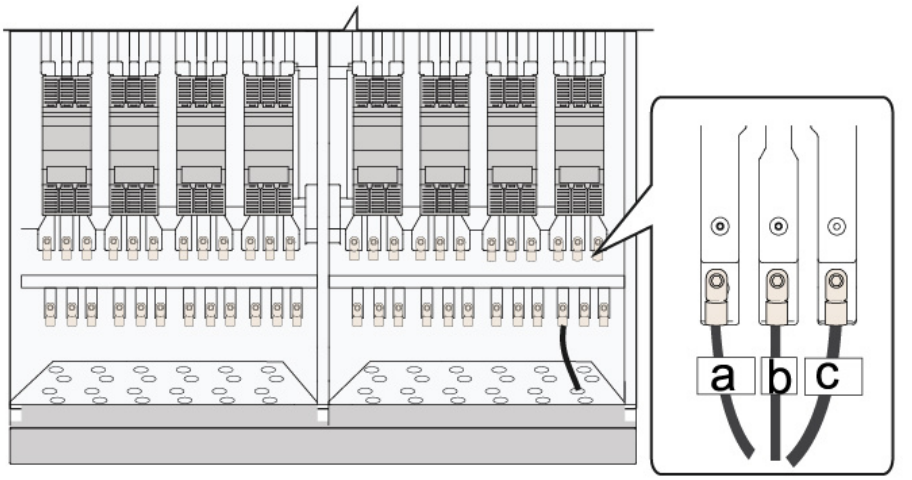
⚠ WARNING

- **Incorrect connection sequence may cause fire. Pay maximum attention to the connection sequence.**
- **Ensure the firmness of the cable connection. Poor connection or oxidation of the surface may cause over-heating or fire.**

NOTICE

- **Long bolts may affect the insulation and may cause short circuit.**
- **Remove the heat-shrink tubing between the cable lug and the copper bar if necessary. Poor contact or over-heating may follow if otherwise.**

step 8 Confirm that all cable connections are secure.



- - End

6.3.3 MV Side Connection

Terminals connecting the external devices on the MV side of the MV Station are located on the MV switchgear.

On site, perform cable connection according to the MV switchgear manual.

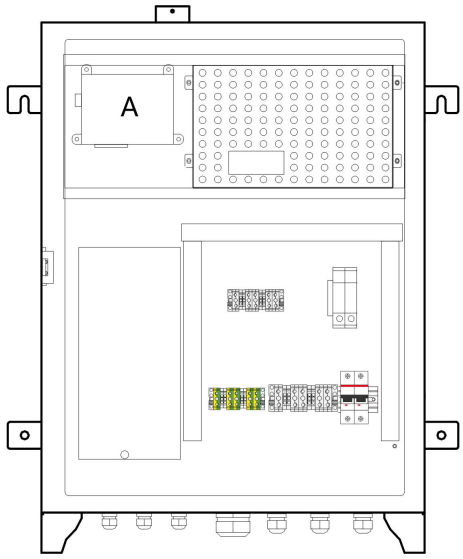
NOTICE

Ensure correct phase sequence during cable connection.

6.3.4 Communication Connection

All internal communication terminals of the MV Station have been connected to the communication box COM100 before delivery. The data of all internal devices of the MV Station is uploaded to background via the COM100.

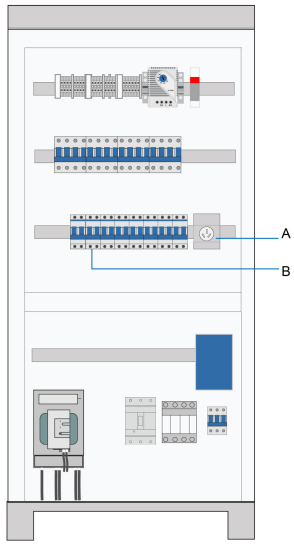
The external cable connection terminals of the COM100 are located at the Ethernet switch shown by A in the figure below.



No.	Name
A	Ethernet switch

6.3.5 Auxiliary Power Supply Cable Connection

Standby power sockets are reserved in the power distribution cabinet, as shown in the figure below. On site, perform cable connection according to demands.



No.	Description
A	Standby power socket
B	Micro-circuit breaker, used to control the connection and disconnection of the standby power socket

6.4 Checking after Electrical Connection

Checking Item	Requirement
Equipment appearance	The equipment is intact, and free from rust and paint flake-off. Repaint areas with paint flake-off (if any). The labels on the equipment are legible. The damaged labels must be replaced in time.
Appearance of cable	Cable sheathings are properly wrapped and free from obvious damage. Hoses that contain cables are intact.
Cable connection	Cables are connected in the designed positions. Terminals are prepared as required and securely connected. Labels on both ends of each cable are clear and specific, and attached in the same direction.
Cable routing	Power cables and communication cables must be routed separately. Cables are neat and tidy. The joints of cable ties are evenly cut without burrs. Cables are placed properly and not tense at turning points. Cable routes are straight and smooth, and do not intersect inside a cabinet.
Container	The container is clean and tidy inside, without any unnecessary cables, cable heads, terminals, or tools. No obvious garbage is found outside the equipment.
Others	Check the bottom of the MV Station and seal the gaps between the cables with fireproof mud. If cable glands are used, make sure they are tightened. Seal the unused terminal. Reassemble the protective grid removed. Water-proof processing should be done on the foundation of the MV Station.

7 Power On the MV Station

NOTICE

The operations described in this chapter must be performed by professional personnel in accordance with local regulations/standards.

7.1 Checking before Power on

7.1.1 MV Station Container

No.	Checking item
1	The installation conforms to the design requirements.
2	The container is level, and each door can be opened properly.
3	There is no crack, dent, or scratch on the container surface. Repaint areas with paint flake-off (if any).
3	Each container has at least two ground points and is grounded securely with a ground resistance of 4Ωor less.
4	The number and positions of external accessories conform to the enclosed document.
5	All markings are correct, clear, and complete.

7.1.2 MV Switchgear

No.	Checking item
1	There is no crack, dent, or scratch on the cabinet surface.
2	The SF6 barometer pointer is in the green zone.
3	Rotate the current terminal, disconnect the scriber of the current terminal, and measure the resistance at both ends of the fracture. The value of three-phase resistance should be small and close. After the measurement, restore the current terminal to the connection position and tighten it. The standby current loop shall be shorted and grounded.
4	Apart the grounding wire of the secondary circuit and measure secondary loop to the ground resistance and resistance should be M Ω level. Recover the grounding wire and the resistance shall be 0 Ω.
5	If there is a relay protection tester or current source, check the value settings of the protective device, including the set value, control word, and soft clamping plate. The set value must match that provided by the user.

No.	Checking item
6	Check that the trip enable/disable slicer has been put into operation.
7	The door of power cable room is closed.
8	The auxiliary AC power circuit breaker in the cabinet is switched on.
9	The conversion switch is in the remote position.
10	The local operating switch has been padlocked.
11	The load switch is opening and the grounding switch is closing.
12	Remove all foreign matters in the medium-voltage ring main unit, such as tools, installation residual materials, etc.

7.1.3 MV Transformer

No.	Checking item
1	There is no crack, dent, or scratch on the transformer surface.
2	No oil leakage occurs on the transformer surface.
3	The indication of the oil level gauge of the transformer is in lower position of the normal operating range.
4	The oil temperature indicator of the transformer is close to the ambient temperature. The cover of the oil temperature meter is installed securely, the surface is clean, and the glass is intact. The temperature measurement loop is complete and intact.
5	The scale of transformer oil level indicator will show in 4 when temperature is 20℃.
6	The locking device of the pressure release valve has been removed, and the pressure release valve does not work. If not removed, follow the steps shown in the Fig.7-1 to remove the locking device.
7	The pressure gauge indicates a pressure of 0.
8	The tap changer is set according to the requirements of the user. If there is no special requirement, set it to the rated level (level 3).The methods to adjust the tap changer is shown in the Fig7-2. When setting the level, open the handle. After adjusting the level, close the handle to the slot. After the check is complete, tighten the protective cover for the level switch.
9	There is no packing residue on the transformer surface, and there is no foreign matter in the transformer room.

No.	Checking item
10	Check the external air insulation distance. Whether the air insulation distance between different voltage grade bushing and bushing to ground conforms to relevant standard.
11	The oil leak port of the transformer room is not blocked.
12	The screen door of the transformer room is closed and locked.

Remove the Locking Device

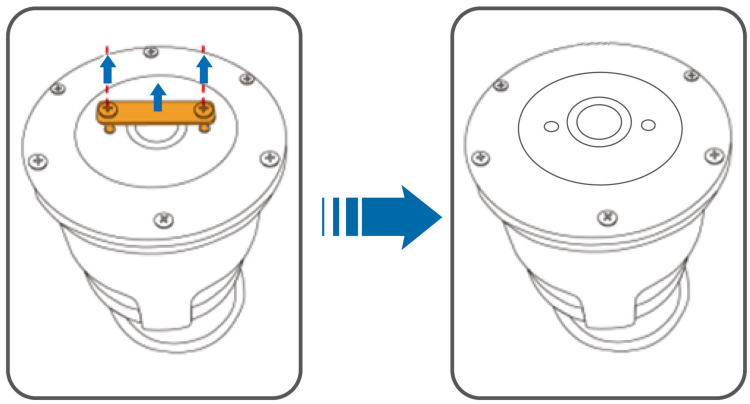


figure 7-1 Remove the locking device of the pressure relief valve

Adjust Voltage Ratio via Tap Changer

Tap changer can adjust transformer output voltage. When operating tap changer, ensure that transformer is in the no-excitation state, that is, the high and low voltage sides of transformer are not live. When voltage of the low-voltage side remains unchanged, the output voltage on high-voltage side at different taps are:

Tap position	Value
1	Nominal Value x 1.05
2	Nominal Value x 1.025
3	Nominal Value
4	Nominal Value x 0.975
5	Nominal Value x 0.95

Take tap position 1 as an example, the steps to adjust the voltage ratio is shown in the following figure.

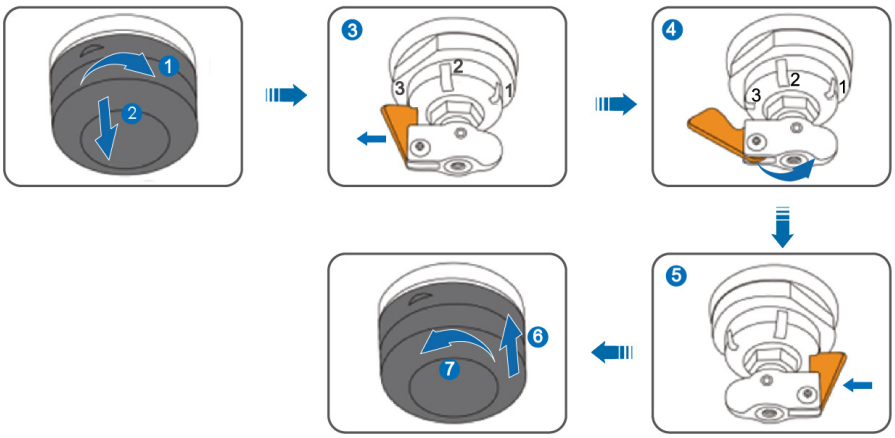


figure 7-2 Adjust the voltage ratio via the tap changer

7.1.4 LV Cabinet

No.	Checking item
1	MCCB are turned off.
2	The copper bar is not deformed, and no foreign matter is on the copper bar.
3	Measure the ground resistance of Circuit breaker in and out of the copper bar; in the system that neutral point of the transformer is not grounded, the input & output wiring to grounding resistance should be M Ω level; In the neutral point grounding system, outgoing wiring copper bar resistance shall be M Ω level and phase to phase resistance shall be M Ω level. (need to disconnect the auxiliary circuit breaker, or phase to phase resistance is generally 0 Ω).
4	Measure the fuse resistance. Resistances of three phases shall be small and the value is similar.
5	Lightning protection status indicates green.
6	Pull the current terminal chip to the open position and measure the resistance at both ends of the fracture. The value of three-phase resistance should be small and close. After the measurement, restore the current terminal to the connected position and tighten it. The standby current loop shall be shorted and grounded.
7	Apart the grounding yellow green wire of the secondary circuit and measure secondary loop to the ground resistance and resistance should be M Ω level. Recover the grounding wire and the resistance shall be 0 Ω.
8	The installation bolt of input cable has been tightened, and the cable is not loose after pulling.

No.	Checking item
9	The cable inlet hole has been sealed.
10	Each component is intact.
11	Clear all foreign matter in the switchgear, such as tools and remaining materials.

7.2 Power-on Steps

NOTICE

Before putting the MV Station into loaded operation, keep it running in the no-load state for 24 hours and ensure that there is no abnormality.

Operations such as handover test and system energization must be performed by locally qualified electricians according to the national/local standards.

8 Troubleshooting

This chapter only lists the common troubleshooting methods on the transformer side. For more specific information, refer to the relevant transformer and ring network cabinet user manual.

Fault	Possible Reason	Measures
Pressure relief trip	1. The internal short circuit of the transformer is faulty.	1. If it is a short circuit fault, take an oil sample for oil sample chromatography to further determine the cause of the fault. It is strictly forbidden to put the transformer into operation before the cause of the fault is not ascertained and the fault has not been resolved. (Note: If it is determined that the internal fault is serious, the inside of the transformer has been damaged, contact Sungrow for replacement.)
	2. The pressure relief valve is faulty.	2. The pressure relief valve elastic element expander internal jam, or the bolt torque of the fastening film is too large, resulting in damage to the film, contact Sungrow Power Co., Ltd. for replacement.
	3. Improper oiling operation before servicing or installing the transformer. If the pressure relief valve on the tank is not opened as required.	3. After power off, open the oil hole to release the pressure inside the tank.
Low oil level trip	1. The secondary circuit causes a false alarm of low oil level.	1. Check the secondary circuit to confirm if it is malfunctioning.

Fault	Possible Reason	Measures
	2. The transformer leaks oil or leaks for a long time. After the oil was drained due to maintenance or test reasons, the oil was not replenished to the normal oil level in time.	2. Fill the transformer with oil.
Oil temperature alarm	1. Transformer overload operation. Overload operation may result in a high oil temperature alarm.	1. Check if the transformer is overloaded.
	2. The heat dissipation channel is blocked.	2. Check the transformer heat dissipation channel for foreign matter jams.
	3. The secondary circuit causes a false alarm.	3. Check the actual oil temperature of the transformer to see if it is a false alarm.
Oil temperature trip	1. The transformer is overloaded.	1. Check if the transformer oil level is too low.
	2. Internal fault of the transformer.	2. Check if the temperature sensor is abnormal.
	3. Transformer secondary circuit failure. Long-term overload operation will cause the transformer temperature to continue to rise, resulting in overcurrent and high voltage tripping.	3. Check the load on the transformer. Check the load through the internal current meter of the low voltage cabinet. If the trip occurs due to an overload, it is recommended to reduce the running load.

9 Routine Maintenance

Due to ambient temperature, humidity, dust, and vibration, the MV Station and the inner components will age and wear. To ensure the system safety and maintain the efficiency of the MV Station, it is necessary to carry out routine and periodic maintenance.
All measures, which can help the MV Station work in good conditions, are within the maintenance scope.

9.1 Safety Instructions

⚠ WARNING

Lethal voltage inside the MV Station!
Wait at least 10 minutes after MV Station stops before opening the cabinet door.
Make sure the device internal is completely voltage free before any work on the MV Station.

⚠ WARNING

Only qualified personnel can perform the work described in this chapter.
Do not leave any screws, washers or other metallic parts inside the MV Station to avoid damages to the MV Station.

⚠ WARNING

Sand and moisture penetration may affect the performance of electric devices inside the MV Station!

- Do not perform electrical connection in sandy season or when the ambient relative humidity is above 95%.
- Perform electrical connection at fine weather days.

⚠ WARNING

Voltages may still be present on cable connection terminals inside the MV Station even though the switches are disconnected. To avoid electric shock hazard, perform the following operations before starting maintenance work,

- Disconnect all the switches of the MV Station;
- Disconnect the upstream and downstream switches of the MV Station.

Safety Rules

Respect the following five rules in maintaining or servicing the MV Station to ensure the safety of the maintainer.

- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate measurement instrument.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.
- Ensure sufficient escape room.
- Wait at least 10 minutes after the device stop completely to operate the MV Station inside. Ensure that the MV Station is completely voltage-free.

9.2 Maintenance

9.2.1 Introduction

With IP54 protection degree, the MV Station can be installed outdoors. Harsh environment condition or long-time operation, however, may cause aging and damage to the MV Station. Check and maintain the MV Station periodically and replace the aged components, so as to effectively extend the service life and increase the device performance inside the MV Station.

Unschedulded maintenance is also required, especially when the system performance is poor.

9.2.2 Maintenance Interval

Maintain the MV Station and internal electric devices periodically to ensure the good performance of the MV Station.

The maintenance interval described in this chapter is indicative only. The actual interval depends on the on-site environment condition. If the MV Station is located in harsh environment places, for example desert arrears, the maintenance interval shall be shortened. Particularly, cleaning and anti-corrosion processing should be performed more frequently.

If the MV Station is located in desert areas, it is advisable to check thoroughly the MV Station inside and outside and clean completely after the sand storm.

WARNING

Before performing maintenance, remove the internal protective grid. Make sure to reassembly the grid and fasten all the screws after the maintenance work. Make sure all bolts are securely fixed.

⚠ WARNING

Repair immediately any anomalies found during routine maintenance. If there are any doubts, contact Sungrow.

9.3 Maintenance Items

Routine inspection and maintenance must comply with relevant regulations of the electric utility.

The inspection, maintenance, and repair can only be performed by trained personnel who are familiar with the equipment. The personnel must be certified and comply with the safety regulations issued by the electric utility.

Check Item	Check Method	Interval
System running status and cleanness	Check whether the equipment and internal equipment are damaged or deformed.	Monthly
	Check whether there is any abnormal sound or vibration when the equipment is running.	
	Check whether the temperature inside the equipment or the temperature of the equipment shell is too high.	
	Check whether warning labels are clear and replace them if necessary.	
	Check whether the humidity and dust in the equipment are heavy, and clean the equipment.	
	Check whether the surface of the container has been corroded. If so, repaint the corroded area by referring to"9.5 Painting Make-up Measures".	

Check Item	Check Method	Interval
Cable connection	Check whether power cables are loose. If so, properly connect them according to specified torques.	Once every six months after the first commissioning; once every two years after that.
	Check whether power cables and control cables are damaged and whether the cable exterior in contact with the metallic surface is scratched.	
	Check whether the insulation binding tapes on the wiring terminals of power cables are flaked.	
	Clean or replace the dust-proof network.	
Fan / heat exchanger	Check the working status of the fan / heat exchanger.	Once every six months after the first commissioning; once every half to one year after that.
	Check whether the fan/ heat exchanger produces abnormal sounds during operation.	
Device maintenance	For the maintenance of various equipment inside, refer to the related manuals.	–
MV switchgear	Check the SF6 air pressure meter to see whether the pointer is in the green range. If the pointer is close to red, stop running it in time and supply it with gas.	Monthly
	Check the electric indicator to see whether theL1/L2/L3 indicator is normal. If not, replace theL1/L2/L3 indicator under power off condition.	

Check Item	Check Method	Interval
Transformer	Check the oil level meter indication of the transformer. If the oil level is low, power off the transformer and refill it in time.	Once a month
	Check whether there is oil leakage around the pressure release valve. If yes, tighten the valve.	
	Check whether there is oil leakage on the phase bushings of the high-voltage and low-voltage cabinets. If yes, tighten the valve.	
	Check whether there is oil leakage on the joint between the heat sink of the transformer and the flange of the oil tank. If yes, tighten the valve in time.	
	Check whether the real-time temperature of the oil temperature indicator is normal. If abnormal, measure the resistance of PT1\PT2 and PT3 by multimeter. If the result is not qualified, the temperature controller is faulty and needs to be repaired in time.	
	Check whether the sound of the transformer is normal during operation.	
LV cabinet	Check whether the surge protection device indicator is normal (green) or faulty (red).	Monthly
	Check whether there is condensation on the internal side panel and top cover.	

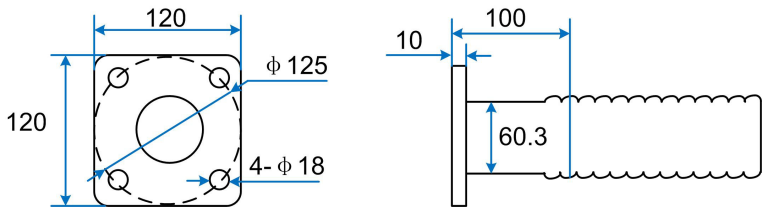
Check Item	Check Method	Interval
Other equipment	Replace the damaged lights in time.	If necessary
	Replace the damaged smoke sensor and fire extinguisher in time.	
	Replace the temperature and humidity controller in time.	

For more information, refer to the MV transformer manual and MV switchgear.

9.4 Oil Drain

Location

The oil drain valve is located at the bottom of transformer.



Tools Prepration

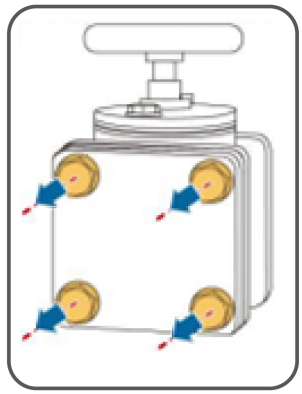
Tools may be used:

No.	Name	Source
1*	Clean steel hose and oil tank	Beyond the scope of delivery
2	Cleaning cloth	
3	Spanner	
4	300mmx38mm adjustable spanner	
5	Drain hose connector	
6	Pipe clip	

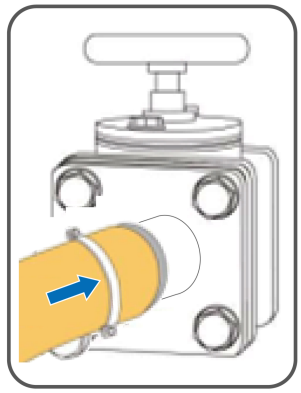
*The oil tank capacity of the transformer must be greater than Nx200L, where N is determined according to the amount of the oil needed to be released.

Operations

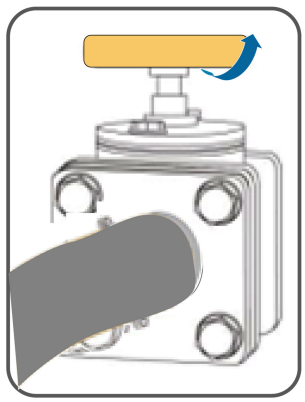
step 1 Remove cover plate of drain valve.



step 2 Fix the drain hose connector. Connect one end of the steel hose to the drain valve and the other end to the tank of the transformer.



step 3 Open the oil drain valve, and the transformer oil flows slowly into the oil tank.



step 4 When no transformer oil flows out, stop discharging oil.

step 5 Close the drain valve and remove the drain hose connector and the hose.

step 6 Reassemble the cover plate of the drain valve.

- - End

9.5 Painting Make-up Measures

Check for the damages of the MV Station appearance:

Situation 1: smudginess on the surface caused by water and dust that can be cleaned

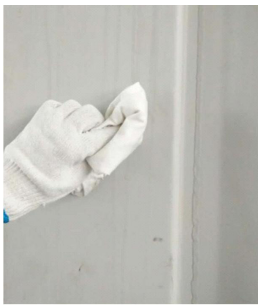
Situation 2: smudginess on the surface & damage to the finishing coat that cannot be cleaned

Situation 3: the undercoat is damaged and the primer is revealed

Maintenance and Operation Steps for Situation 1:

Materials:

- Cleaning cloth
- Water
- Alcohol or other non-corrosiveness detergent

Figure	Step
	1. Clean the smudginess on the surface by using a cleaning cloth (or other cleaning tool) with water. 2. If the smudginess cannot be cleaned by water, use 97% alcohol until the surface is clean enough to accept. (Or try other local frequently-used non-corrosiveness detergent)

Maintenance and Operation Steps for Situation 2:

Materials:

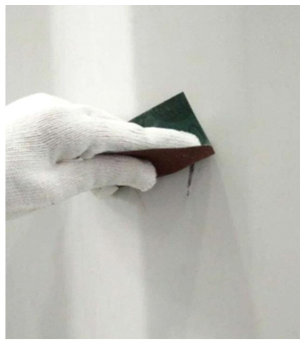
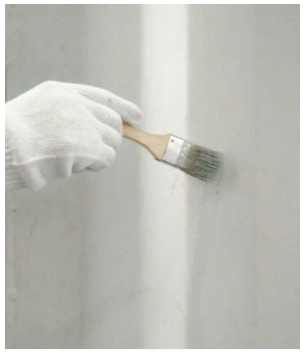
- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2

Figure	Step
	1. Polish the rough paint surface or the scratched parts by abrasive paper until the surface is smooth.
	2. Clean the target parts by cleaning cloth with water or use 97% alcohol.
	3. When the surface is clean and dry, paint the scratched parts of the paint by banister brush and make sure the painting is as uniform as possible

Maintenance and Operation Steps for Situation 3:

Materials:

- Abrasive paper
- Cleaning cloth
- Water
- Alcohol
- Zinc primer
- Hairbrush
- Paint RAL7035 / Munsell color JN-82 N8.2

Figure	Step
	1. Polish the damaged parts of the paint to remove the surface rust or other roughness.
	2. Clean the target parts by cleaning cloth with water or use 97% alcohol to clean the surface dust and dirty.
	3. When the surface is clean and dry, paint the base material revealed parts with zinc primer (or other local primers with the same function) for protection. The paints should cover the revealed primer completely.
	4. Paint the scratched parts by banister brush when the primer is dry, and make sure the painting is as uniform as possible.

Check the protective paint on the module surface for peeling off. re-paint the MV Station surface if necessary.

Re-spray the protective paint every 5 years to the MV Station surface.

10 Appendix

10.1 Technical Parameters

MVS2500 – LV

MV Station input	MVS2500-LV
Nominal voltage	600 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	2500 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	2500 kVA
Maximum power	2500 kVA
Voltage ratio	0.6 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	14,100 kg

MV Station input	MVS2500-LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS3000 – LV

MV Station input	MVS3000-LV
Nominal voltage	600 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	3000 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	3000 kVA
Maximum power	3000 kVA
Voltage ratio	0.6 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	15.500 kg

MV Station input	MVS3000-LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS3150 – LV

MV Station input	MVS3150 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	3150 kVA
Nominal voltage	10~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	3150 kVA
Maximum power	3500 kVA
Voltage ratio	0.8~0.8 / 10~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	15.500 kg

MV Station input	MVS3150 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS5000 – LV

MV Station input	MVS5000 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	5000 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	5000 kVA
Maximum power	5000 kVA
Voltage ratio	0.6~0.6 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	19.700 kg

MV Station input	MVS5000 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS6250 – LV

MV Station input	MVS6250 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	6250 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	6250 kVA
Maximum power	6250 kVA
Voltage ratio	0.6~0.6 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11y11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	22.000 kg

MV Station input	MVS6250 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

MVS6300 – LV

MV Station input	MVS6300 – LV
Nominal voltage	800 V
Grid frequency	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
MV Station output	
Rated power	6300 kVA
Nominal voltage	20~35 kV
MV Switchgear	
Nominal voltage	24 kV / 36 kV
Nominal current	630 A
Short circuit breaking current	16 kA / 20 kA
MV protection	50 / 51, 50 N / 51 N
MV Transformer	
Rated power	6300 kVA
Maximum power	7000 kVA
Voltage ratio	0.8~0.8 / 20~35 kV
Tap changer	0,2x ± 2.5%
Vector Group	Dy11y11
No Load Loss/Load Loss	EU548/2014
	99%(customized)
Cooling	ONAN
Type of Oil	Mineral oil(PCB free) or degradable
General Data	
Dimensions(L x H x W)	6058 mm x 2896 mm x 2438 mm
Weight(Approx.)	22.000 kg

MV Station input	MVS6300 – LV
Operating temperature range	-35 ° C ~+60 ° C
Relative humidity	0% to 95%(no condensing)
Max. operating altitude	1000m(standard) / >1000m(optional)
Degree of protection	IP54

10.2 Tightening Torques

Tighten the cable with proper torque shown below to prevent the poor contact, high contact resistance, or fire caused by the looseness of cable lugs:

Screw	Torque (N · m)	Screw	Torque (N · m)
M3	0.7~1	M8	18~23
M4	1.8~2.4	M10	34~40
M5	4~4.8	M12	60~70
M6	7~8	M16	119~140

Secure the cable in proper place to reduce the pressure of cable lug.

10.3 Contact Information

Should you have any question about this product, please contact us.
We need the following information to provide you the best assistance:

- Type of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

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Specifications are subject to changes without advance notice.

LINHA CENTRAL FOTOVOLTAICA DA TORRE BELA - RIO MAIOR

A 400kV

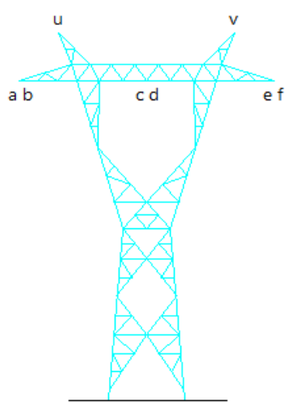
ANEXO A.11.1 - CAMPO ELÉCTRICO À TENSÃO NOMINAL

Campo Eléctrico a 0 m e 1,8 m do solo

Dist.(m)	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0
E (0m)	0,556	0,639	0,738	0,856	0,999	1,170	1,375	1,621	1,909	2,241	2,607	2,982	3,322	3,560	3,620	3,455	3,086	2,627	2,250	2,062	2,018
Eh (1,8m)	0,555	0,638	0,736	0,855	0,997	1,168	1,374	1,621	1,912	2,249	2,624	3,015	3,376	3,639	3,724	3,574	3,204	2,729	2,341	2,178	2,156

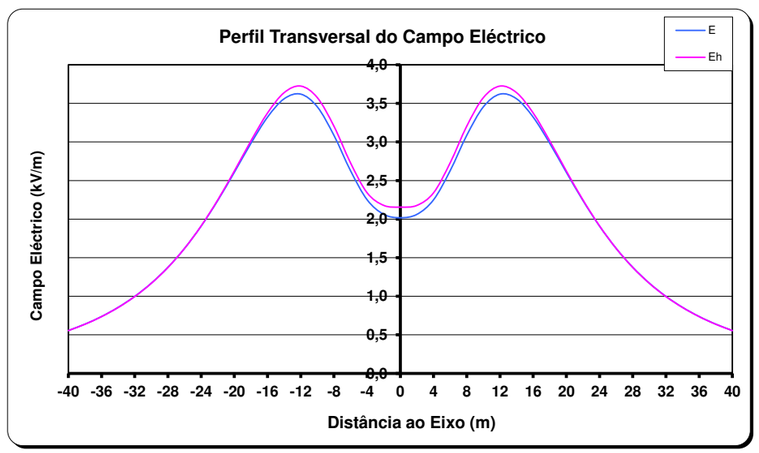
Dist.(m)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
E (0m)	2,018	2,062	2,250	2,627	3,086	3,455	3,620	3,560	3,322	2,982	2,607	2,241	1,909	1,621	1,375	1,170	0,999	0,856	0,738	0,639	0,556
Eh (1,8m)	2,156	2,178	2,341	2,729	3,204	3,574	3,724	3,639	3,376	3,015	2,624	2,249	1,912	1,621	1,374	1,168	0,997	0,855	0,736	0,638	0,555

Sequência de Fases



Tipo de Apoio	QS
Altura do condutor inferior ao solo	14,0 m
Tensão	400 kV
Nº de Ternos	1
Nº de Condutores por fase	2
Condutor-ACSR 595 (ZAMBEZE)	
Campo Eléctrico Máximo a 50Hz* (Publico Permanente) - 5,0 [kV/m]	

* Segundo Portaria nº1421/2004 de 23 de Novembro



Geometria dos Cabos(m) e sequência de fases

	a	b	c	d	e	f	g	h	i	j	k	l	u	v
S.fases	0	0	4	4	8	8	0	0	0	0	0	0	-1	-1
X	-10,20	-9,80	-0,20	0,20	9,80	10,20	-	-	-	-	-	-	-6,85	6,85
Y	14,00	14,00	14,00	14,00	14,00	14,00	-	-	-	-	-	-	17,95	17,95

Cond.	a	b	c	d	e	f	g	h	I	j	k	l	u	v
Emáx. (kV/cm)	14,62	14,89	15,50	15,50	14,89	14,62	0,00	0,00	0,00	0,00	0,00	0,00	7,33	7,33

LINHA CENTRAL FOTOVOLTAICA DA TORRE BELA - RIO MAIOR

A 400kV

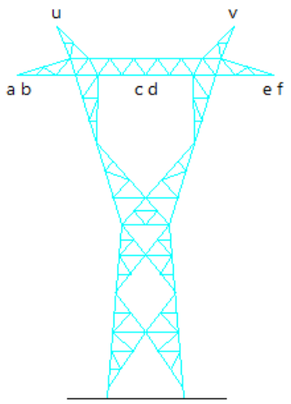
ANEXO A.11.2 - CAMPO ELÉCTRICO À TENSÃO MÁXIMA

Campo Eléctrico a 0 m e 1,8 m do solo

Dist.(m)	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0
E (0m)	0,584	0,671	0,775	0,899	1,049	1,228	1,444	1,702	2,005	2,353	2,737	3,131	3,488	3,738	3,801	3,627	3,240	2,758	2,363	2,165	2,119
Eh (1,8m)	0,583	0,670	0,773	0,897	1,047	1,226	1,443	1,702	2,008	2,361	2,755	3,165	3,545	3,821	3,910	3,753	3,364	2,865	2,458	2,287	2,264

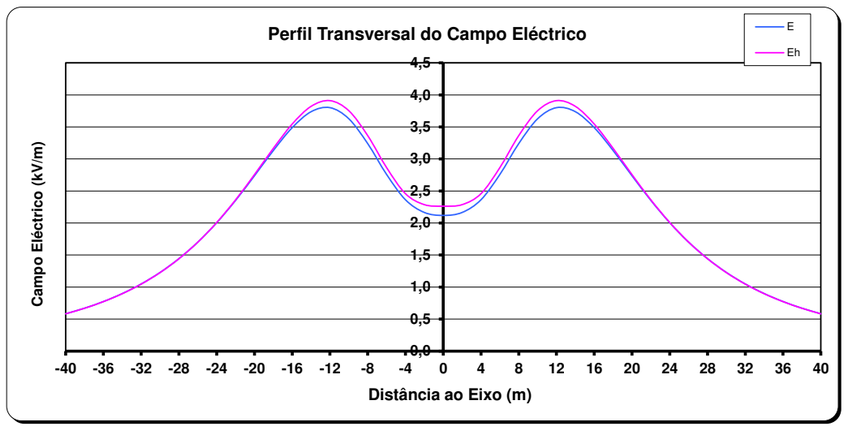
Dist.(m)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
E (0m)	2,119	2,165	2,363	2,758	3,240	3,627	3,801	3,738	3,488	3,131	2,737	2,353	2,005	1,702	1,444	1,228	1,049	0,899	0,775	0,671	0,584
Eh (1,8m)	2,264	2,287	2,458	2,865	3,364	3,753	3,910	3,821	3,545	3,165	2,755	2,361	2,008	1,702	1,443	1,226	1,047	0,897	0,773	0,670	0,583

Sequência de Fases



Tipo de Apoio	QS
Altura do condutor inferior ao solo	14,0 m
Tensão	420 kV
Nº de Ternos	1
Nº de Condutores por fase	2
Condutor-ACSR 595 (ZAMBEZE)	
Campo Eléctrico Máximo a 50Hz* (Publico Permanente) - 5,0 [kV/m]	

* Segundo Portaria nº1421/2004 de 23 de Novembro



Geometria dos Cabos(m) e sequência de fases

	a	b	c	d	e	f	g	h	i	j	k	l	u	v
S.fases	0	0	4	4	8	8	0	0	0	0	0	0	-1	-1
X	-10,20	-9,80	-0,20	0,20	9,80	10,20	-	-	-	-	-	-	-6,85	6,85
Y	14,00	14,00	14,00	14,00	14,00	14,00	-	-	-	-	-	-	17,95	17,95

Cond.	a	b	c	d	e	f	g	h	l	j	k	l	u	v
Emáx. (kV/cm)	15,36	15,63	16,28	16,28	15,63	15,36	0,00	0,00	0,00	0,00	0,00	0,00	7,69	7,69

LINHA CENTRAL FOTOVOLTAICA DA TORRE BELA - RIO MAIOR

A 400kV

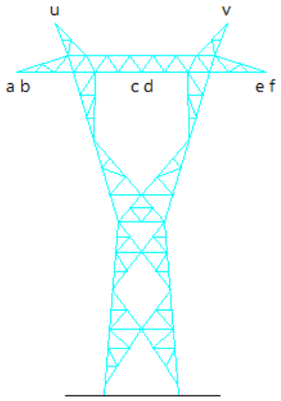
ANEXO A.12 INDUÇÃO MÁGNETICA

Densidade de Fluxo Magnético B a uma distância h=1,8 m do Solo

Dist.(m)	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2	0
Bmax	5,623	6,201	6,868	7,644	8,549	9,613	10,867	12,350	14,104	16,174	18,591	21,358	24,421	27,631	30,736	33,428	35,444	36,679	37,226	37,339	37,328
Bx	3,321	3,836	4,457	5,212	6,133	7,264	8,654	10,363	12,452	14,968	17,908	21,161	24,416	27,096	28,431	27,787	25,201	21,702	18,936	17,810	17,654
By	4,542	4,879	5,235	5,606	5,977	6,328	6,620	6,794	6,754	6,368	5,488	4,192	4,065	7,602	13,608	20,622	27,302	32,476	35,614	36,994	37,328

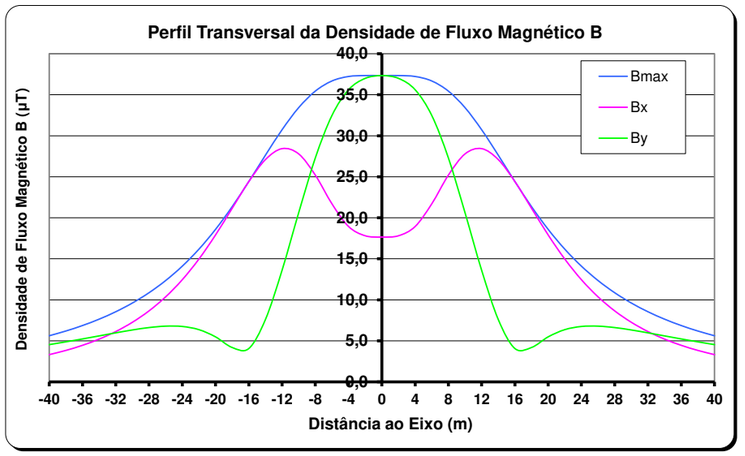
Dist.(m)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Bmax	37,328	37,339	37,226	36,679	35,444	33,428	30,736	27,631	24,421	21,358	18,591	16,174	14,104	12,350	10,867	9,613	8,549	7,644	6,868	6,201	5,623
Bx	17,654	17,810	18,936	21,702	25,201	27,787	28,431	27,096	24,416	21,161	17,908	14,968	12,452	10,363	8,654	7,264	6,133	5,212	4,457	3,836	3,321
By	37,328	36,994	35,614	32,476	27,302	20,622	13,608	7,602	4,065	4,192	5,488	6,368	6,754	6,794	6,620	6,328	5,977	5,606	5,235	4,879	4,542

Sequência de Fases



Tipo de Apoio	QS
Altura do condutor inferior ao solo	14,0 m
Tensão	400 kV
Corrente por fase (15ºC)	1341 A
Nº de Ternos	1
Nº de Condutores por fase	2
Condutor-ACSR 595 (ZAMBEZE)	
Fluxo Magnético Máximo a 50Hz* (Publico Permanente) - 100 [µT]	

* Segundo Portaria nº1421/2004 de 23 de Novembro



Geometria dos Cabos(m) e sequência de fases

	a	b	c	d	e	f	g	h	i	j	k	l	u	v
S.fases	0	0	4	4	8	8	0	0	0	0	0	0	-1	-1
X	-10,20	-9,80	-0,20	0,20	9,80	10,20	-	-	-	-	-	-	-6,85	6,85
Y	14,00	14,00	14,00	14,00	14,00	14,00	-	-	-	-	-	-	17,95	17,95

LISTA DE APOIOS DA LMAT

													Dimensões do Cabouco (m)			
Nº Apoio	Tipo Apoio	Fixação CC	Altura Útil [m]	Altura Total [m]	Dist. Origem [m]	X [m]	Y [m]	Z [m]	Vão [m]	Angulo [grd]	Area contrução [m2]	Area exploração [m2]	Tipo de Fundação	a	b	h	V esca
PRT 1	PAL4	AP20	17,00	28,00	0,00	-69662,03	-53471,28	71,44	54,05	-	-	-	-	-	-	-	-
1	QT3	AD20	30,60	35,60	54,05	-69688,70	-53424,26	67,36	386,40	0,00	400	63,39	DRE 135	2,50	2,50	3,50	89,25
2	QA5	AD20	40,60	45,60	440,45	-69879,34	-53088,17	68,30	493,66	-21,49	400	73,61	DRE 101	2,10	2,10	3,30	59,60
3	QRS5	SD20	36,67	45,60	934,12	-70251,36	-52763,66	84,00	379,16	0,00	400	71,04	DRE 066	1,80	1,80	2,85	37,98
4	QS4	SD20	31,67	35,62	1313,28	-70537,09	-52514,42	80,00	371,55	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
5	QS5	SD20	36,67	40,62	1684,83	-70817,08	-52270,18	78,58	421,12	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
6	QS4	SD20	31,67	35,62	2105,94	-71134,43	-51993,36	77,55	335,12	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
7	QRA3	AD20	30,60	35,60	2441,07	-71386,97	-51773,07	96,30	335,32	8,11	400	49,03	DRE 066	1,80	1,80	2,85	37,98
8	QS5	SD20	36,67	40,62	2776,38	-71609,61	-51522,32	94,70	433,50	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
9	QT4	AD20	35,60	40,60	3209,89	-71897,43	-51198,15	122,30	370,18	40,23	400	77,09	DRE 135	2,50	2,50	3,50	89,25
10	QS5	SD20	36,67	40,62	3580,06	-71932,23	-50829,62	140,17	365,80	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
11	QS4	SD20	31,67	35,62	3945,86	-71966,61	-50465,44	143,15	435,42	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
12	QS5	SD20	36,67	40,62	4381,28	-72007,55	-50031,95	82,00	286,14	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
13	QS4	SD20	31,67	35,62	4667,42	-72034,44	-49747,07	75,41	326,39	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
14	QRA4	AD20	35,60	40,60	4993,81	-72065,13	-49422,13	77,31	465,76	5,23	400	59,55	DRE 066	1,80	1,80	2,85	37,98
15	QRA3	AD20	30,60	35,60	5459,57	-72070,72	-48956,40	85,57	454,82	0,00	400	49,03	DRE 066	1,80	1,80	2,85	37,98
16	QS2	SD20	21,67	25,62	5914,39	-72076,19	-48501,61	157,16	173,54	0,00	400	32,52	DRE 040	1,50	1,50	2,40	22,35
17	QS2	SD20	21,67	25,62	6087,93	-72078,27	-48328,09	158,33	350,64	0,00	400	32,52	DRE 040	1,50	1,50	2,40	22,35
18	QRA3	AD20	30,60	35,60	6438,57	-72082,49	-47977,47	110,62	399,04	0,00	400	49,03	DRE 066	1,80	1,80	2,85	37,98
19	QS5	SD20	36,67	40,62	6837,61	-72087,28	-47578,46	119,45	400,96	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
20	QRA5	AD20	40,60	45,60	7238,57	-72092,10	-47177,53	172,25	594,69	0,00	400	71,04	DRE 066	1,80	1,80	2,85	37,98
21	QRA5	AD20	40,60	45,60	7833,27	-72099,25	-46582,88	103,62	390,72	0,00	400	71,04	DRE 066	1,80	1,80	2,85	37,98
22	QS5	SD20	36,67	40,62	8223,99	-72103,94	-46192,18	91,99	397,03	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
23	QS4	SD20	31,67	35,62	8621,02	-72108,71	-45795,18	111,31	366,51	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
24	QS5	SD20	36,67	40,62	8987,54	-72113,12	-45428,69	109,88	390,31	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
25	QS5	SD20	36,67	40,62	9377,85	-72117,81	-45038,41	85,66	375,52	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
26	QS4	SD20	31,67	35,62	9753,37	-72122,32	-44662,92	90,90	424,36	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
27	QS5	SD20	36,67	40,62	10177,72	-72127,42	-44238,59	119,67	396,91	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
28	QS5	SD20	36,67	40,62	10574,64	-72132,19	-43841,71	132,33	379,06	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
29	QS5	SD20	36,67	40,62	10953,69	-72136,74	-43462,68	116,49	398,71	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
30	QS4	SD20	31,67	35,62	11352,40	-72141,53	-43064,00	116,83	399,85	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
31	QA3	AD20	30,60	35,60	11752,25	-72146,34	-42664,18	122,57	364,13	32,77	400	50,94	DRE 101	2,10	2,10	3,30	59,60
32	QS5	SD20	36,67	40,62	12116,38	-71970,89	-42345,10	125,31	420,53	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
33	QS5	SD20	36,67	40,62	12536,91	-71768,27	-41976,61	123,90	421,54	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
34	QA2	AD20	25,60	30,60	12958,45	-71565,15	-41607,23	100,25	590,12	-29,86	400	41,17	DRE 101	2,10	2,10	3,30	59,60
35	QRA6	AD20	45,60	50,60	13548,58	-71545,31	-41017,43	106,44	255,90	0,00	400	83,66	DRE 066	1,80	1,80	2,85	37,98
36	QS5	SD20	36,67	40,62	13804,48	-71536,70	-40761,68	123,22	493,40	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
37	QRS5	SD20	36,67	45,60	14297,88	-71520,11	-40268,56	104,48	433,77	0,00	400	71,04	DRE 066	1,80	1,80	2,85	37,98
38	QA5	AD20	40,60	45,60	14731,64	-71505,52	-39835,04	88,31	414,45	-29,44	400	73,61	DRE 101	2,10	2,10	3,30	59,60
39	QS4	SD20	31,67	35,62	15146,09	-71677,86	-39458,12	97,64	357,39	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
40	QS4	SD20	31,67	35,62	15503,48	-71826,48	-39133,10	103,61	391,78	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
41	QS5	SD20	36,67	40,62	15895,27	-71989,40	-38776,79	120,26	255,90	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
42	QS4	SD20	31,67	35,62	16151,17	-72095,81	-38544,07	138,13	289,25	0,00	400	49,81	DRE 040	1,50	1,50	2,40	22,35
43	QS5	SD20	36,67	40,62	16440,42	-72216,09	-38281,01	120,38	345,46	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
44	QS5	SD20	36,67	40,62	16785,87	-72359,75	-37966,84	128,41	366,09	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
45	QS3	SD20	26,67	30,62	17151,96	-72511,98	-37633,90	169,69	233,36	0,00	400	40,70	DRE 040	1,50	1,50	2,40	22,35
46	QT3	AD20	30,60	35,60	17385,32	-72609,02	-37421,68	162,71	276,83	-43,48	400	63,39	DRE 135	2,50	2,50	3,50	89,25
47	QS5	SD20	36,67	40,62	17662,15	-72857,21	-37299,05	151,82	304,28	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
48	QS3	SD20	26,67	30,62	17966,43	-73130,00	-37164,26	137,56	358,06	0,00	400	40,70	DRE 040	1,50	1,50	2,40	22,35
49	QRA2	AD20	25,60	30,60	18324,49	-73451,01	-37005,65	136,39	334,79	0,00	400	39,53	DRE 066	1,80	1,80	2,85	37,98
50	QRA9	AD20	60,60	65,60	18659,28	-73751,17	-36857,34	173,17	412,37	0,00	400	127,47	DRE 066	1,80	1,80	2,85	37,98
51	QS5	SD20	36,67	40,62	19071,65	-74120,87	-36674,67	163,67	305,04	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
52	QS5	SD20	36,67	40,62	19376,69	-74394,35	-36539,54	134,23	328,95	0,00	400	59,84	DRE 040	1,50	1,50	2,40	22,35
53	QT4	AD20	35,60	40,60	19705,64	-74689,26	-36393,82	125,72	146,99	-6,07	400	77,09	DRE 135	2,50	2,50	3,50	89,25
PRT RM_REN	PAL4	AP20	17,00	28,00	19852,63	-74826,65	-36341,55	132,57		-	-	-	-	-	-	-	-
											21200,0	***3103,1***					***1773,1***

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	X (m)	Y (m)	Área (m2)	Hutil (m)	Htotal (m)	Hutil (m)	Lcad (m)	Fundação	a	b	h	Vcab	Vbet	Armadura
QS1	1,93	2,53	25,23	16,67	20,62	20,60	3,93	DRE 040	1,5	1,5	2,4	22,352	7,56	360
QS2	2,22	2,93	32,52	21,67	25,62	25,60	3,93	DRE 040	1,5	1,5	2,4	22,352	7,56	360
QS3	2,51	3,32	40,70	26,67	30,62	30,60	3,93	DRE 040	1,5	1,5	2,4	22,352	7,56	360
QS4	2,81	3,71	49,81	31,67	35,62	35,60	3,93	DRE 040	1,5	1,5	2,4	22,352	7,56	360
QS5	3,10	4,10	59,84	36,67	40,62	40,60	3,93	DRE 040	1,5	1,5	2,4	22,352	7,56	360
QA1	2,22	2,93	32,48	20,60	25,60	20,60	0,00	DRE 101	2,1	2,1	3,3	59,599	17,355	1040
QA2	2,53	3,34	41,17	25,60	30,60	25,60	0,00	DRE 101	2,1	2,1	3,3	59,599	17,355	1040
QA3	2,85	3,75	50,94	30,60	35,60	30,60	0,00	DRE 101	2,1	2,1	3,3	59,599	17,355	1040
QA4	3,16	4,16	61,76	35,60	40,60	35,60	0,00	DRE 101	2,1	2,1	3,3	59,599	17,355	1040
QA5	3,48	4,58	73,61	40,60	45,60	40,60	0,00	DRE 101	2,1	2,1	3,3	59,599	17,355	1040
QT1	2,86	2,86	40,02	20,60	25,60	20,60	0,00	DRE 135	2,5	2,5	3,5	89,245	24,947	1160
QT2	3,27	3,27	51,04	25,60	30,60	25,60	0,00	DRE 135	2,5	2,5	3,5	89,245	24,947	1160
QT3	3,68	3,68	63,39	30,60	35,60	30,60	0,00	DRE 135	2,5	2,5	3,5	89,245	24,947	1160
QT4	4,09	4,09	77,09	35,60	40,60	35,60	0,00	DRE 135	2,5	2,5	3,5	89,245	24,947	1160
QT5	4,50	4,50	91,97	40,60	45,60	40,60	0,00	DRE 135	2,5	2,5	3,5	89,245	24,947	1160
QRA1	2,16	2,86	31,06	20,60	25,60	20,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA2	2,47	3,27	39,53	25,60	30,60	25,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA3	2,78	3,68	49,03	30,60	35,60	30,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA4	3,09	4,09	59,55	35,60	40,60	35,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA5	3,40	4,50	71,04	40,60	45,60	40,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA6	3,72	4,91	83,66	45,60	50,60	45,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA7	4,03	5,32	97,24	50,60	55,60	50,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA8	4,34	5,73	111,85	55,60	60,60	55,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA9	4,65	6,14	127,47	60,60	65,60	60,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRA10	4,99	6,58	145,56	65,60	70,60	65,60	0,00	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS1	2,16	2,86	31,06	16,67	25,60	20,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS2	2,47	3,27	39,53	21,67	30,60	25,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS3	2,78	3,68	49,03	26,67	35,60	30,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS4	3,09	4,09	59,55	31,67	40,60	35,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS5	3,40	4,50	71,04	36,67	45,60	40,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS6	3,72	4,91	83,66	41,67	50,60	45,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS7	4,03	5,32	97,24	46,67	55,60	50,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS8	4,34	5,73	111,85	51,67	60,60	55,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS9	4,65	6,14	127,47	56,67	65,60	60,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
QRS10	4,99	6,58	145,56	61,67	70,60	65,60	3,93	DRE 066	1,8	1,8	2,85	37,981	11,749	640
PAL4	1,00	13,00	69,16	17,00	28,00	17,00	0,00							
DLT1	1,96	1,96	20,34	24,00	46,60	24,00	0,00							
DLT3	2,30	2,30	27,04	30,00	52,60	30,00	0,00							