CORRIGENDUM-I, DATED:10.02.2020

Subject: SCOPE OF WORK CUM TECHNICAL SPECIFICATION (BOS1) for 100MW – AC (145.5MW –DC) Floating Solar Photovoltaic Grid-connected Power plant for NTPC at Ramagundam, Telangana
(All listed works shall be Undertaken and executed)

Tender Ref.: EDN: PVENG:NTPC FSPV : 100MW: BOS1, Dt: 04.02.2020

Sl. No.	Clause No. / Pg. No.	Existing Tender document	'To read as'	Remarks / Reason
1	Page No. 70 to 84 (Annexure-VI)	Float Installation Manual - Adtech Systems Ltd (14 pages)	Float Installation Manual - Adtech Systems Ltd (16 Pages)	Installation Manual revised
2	Page No. 1 , LAST DATE AND TIME FOR THE SUBMISSION OF DULY FILLED IN TENDER DOCUMENT	14.02.2020 Before 01:00 P.M	21.02.2020 Before 01:00 P.M	Tender submission due date changed

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Float Installation Manual - Adtech Systems Ltd

ADTECH
SYSTEMS LIMITED

Version - 2 Date: 02nd December, 2019

Table of Contents

A. Float Specification:

1

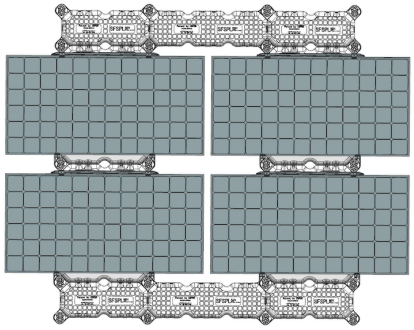
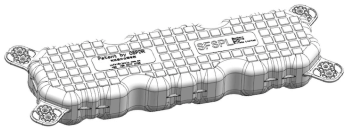
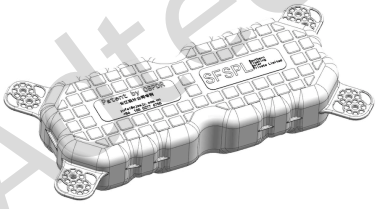
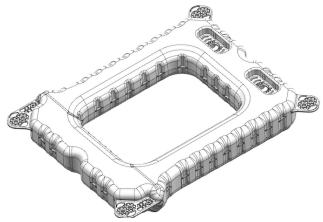


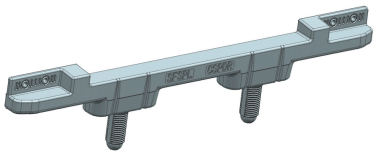
Figure 1

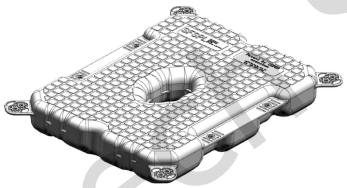
Big Walkway		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Average Wall Thickness (in mm)	3
	Design Weight (in kg)	4
	Max Use Buoyancy (in kg/sq.m)	180
	Dimension (in mm)	As per approved drawing
	Manufacturing Process	Blow Molding
	Function	• Forms maintenance walkways • Non-Slippery Surface

Small Walkway		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Average Wall Thickness (in mm)	3
	Design Weight (in kg)	3
	Max Use Buoyancy (in kg/sq.m)	180
	Dimension (in mm)	As per approved drawing
	Manufacturing Process	Blow Molding

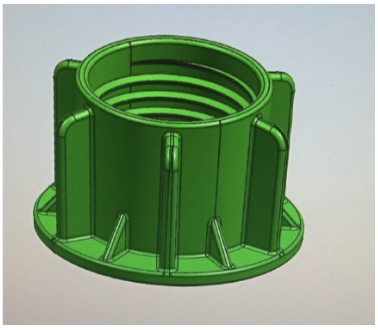
	Function	• Forms maintenance walkways • Non-Slippery Surface

Connecting Float		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Average Thickness	3mm
	Design Weight	7.5
	Max Design Buoyancy (in kg/sq.m)	180
	Dimension	As per approved drawing
	Manufacturing Process	Blow Molding
	Function	Give Support to the PV module

Support Piece		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Average Thickness	3mm
	Design Weight	1.2
	Design Buoyancy	-
	Dimension	As per approved drawing
	Manufacturing Process	Blow Molding
	Function	Give an Optimum degree 5 to the panel

Equipment Float		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Average Thickness	3mm
	Design Weight	8
	Design Buoyancy (in kg/sq.m)	180
	Dimension	As per approved drawing
	Manufacturing Process	Blow Molding
	Function	For the Cable arrangement and junction box location

Note - All dimensions and weights provided have a tolerance of +/- 5%

HDPE Nut		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Design Weight	55g
	Dimension	D80*50
	Manufacturing Process	Injection Molding
	Function	Holding the Support Float

Sleeve		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Design Weight	2g
	Dimension	D17*26
	Manufacturing Process	Injection Molding
	Function	Alignment of SS nut&bolt

HDPE Gasket		
	Raw material	High Density Polyethylene (HDPE),with UV stabilizer
	Design Weight	29g
	Dimension	D85*14
	Manufacturing Process	Injection Molding
	Function	Spacer between the walkway.

Note - All dimensions and weights provided have a tolerance of +/- 5%

B. Panel Fixing Hardware:

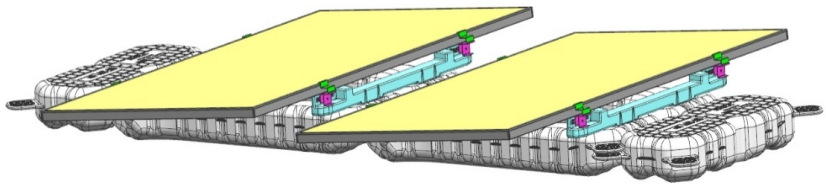
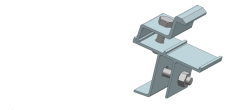
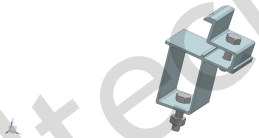


Figure 2

Upper clamp(Top Right and Left)		
	Raw material	Anodized Aluminum
	Count per panel	2 sets
	Technical Features	Length 50 mm Hole Ø9 mm
	Manufacturing Process	Aluminum Extrusion
	Function	Holding the Solar panels and it is connected to the “L” profile of the Support float

Lower clamp(Bottom Left and Right)		
	Raw material	Anodized Aluminum
	Technical Features	Length 50mm Hole Ø9 mm
	Count per Panel	2 sets
	Manufacturing Process	Aluminum Extrusion
	Function	Holding the Solar panels and it is connected to the “L” profile of the Connecting float

Nut ,Bolt and washer		
	Raw material	Stainless steel
	Count / module	Nut 8 Bolt 8 Plain Washer 16 Spring Washer 8

	Type	M8- SS 304
	Function	Holding the Solar panels and it is connected to the “L” profile of the Connecting float

C. Mooring clamps and Lines

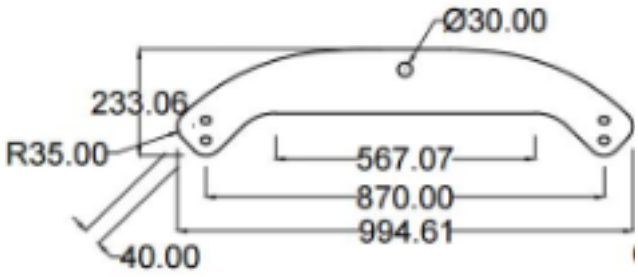


Figure 3

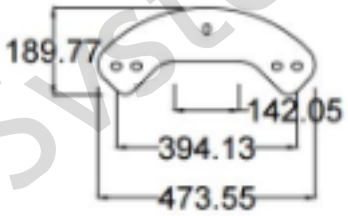


Figure 4

D. Tools and Tackles Required:

1. Injection Nut Wrench (drawing of Injection Nut can be provided on request)
2. M12 and M8 Nut Wrench
3. Drilling Machine

E. Instructions for Installation:

1. **Solar Panel Installation:**

The solar module is connected to the connecting float on the bottom side and support float on the top side. The panels are connected to the floats using Al. extruded clamps connected at the 4 designated points on the float using SS304 - M8 hardware.

The following are the components used for the connection:

A. L clamp (Bridge Clamp)
B. Upper Base Clamp
C. Lower Base Clamp
D. SS304 M8 - Nut, Bolt, Spring Washer and Plain Washer (2)

Installation Recommendations:

A. It is recommended to use a table for the module assembly on the float and to conduct the installation check for the same
B. Ensure the DC cables on the module are opened and loose before mounting the module on the float

Installation Procedure:

A. Place a rubber mat on top of the table
B. Place the Connecting Float on the rubber mat so that the portion where the Support Piece will be connected is exposed from the table
C. Connect the Support Piece on the Connecting Float and use the D80*50 nut to screw the Support Piece to the Connect Float (need to add torque info) (as shown)

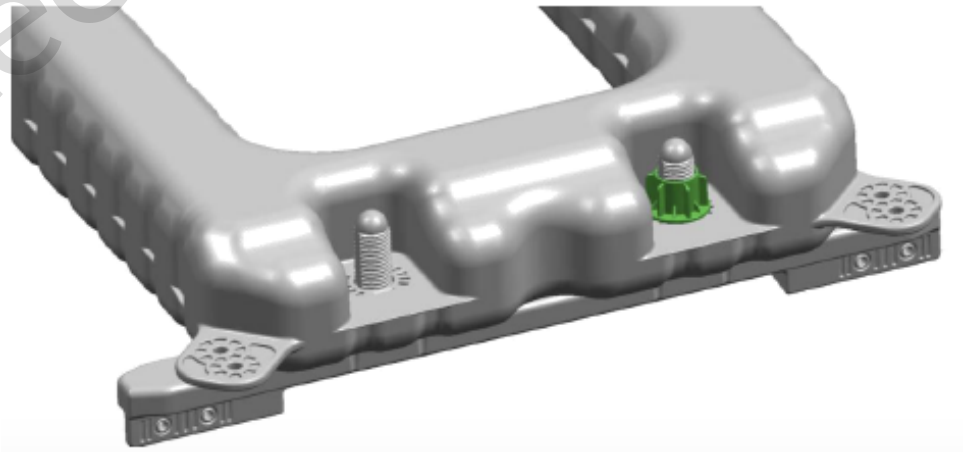


Figure 5

D. Connect the 2 Lower Base Clamps to the bottom of the Connecting Float (as shown) using SS304 M8

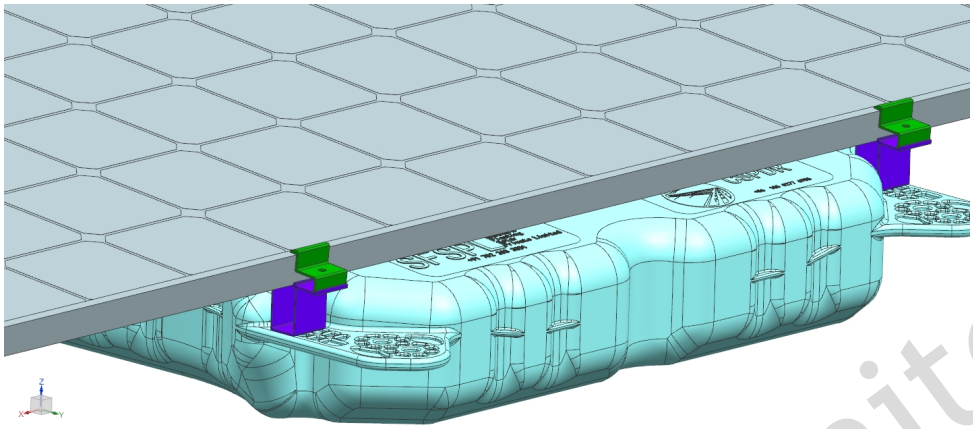


Figure 6

E. Connect the 2 Upper Base Clamps to the top of the Support Float (as shown) SS304 M8

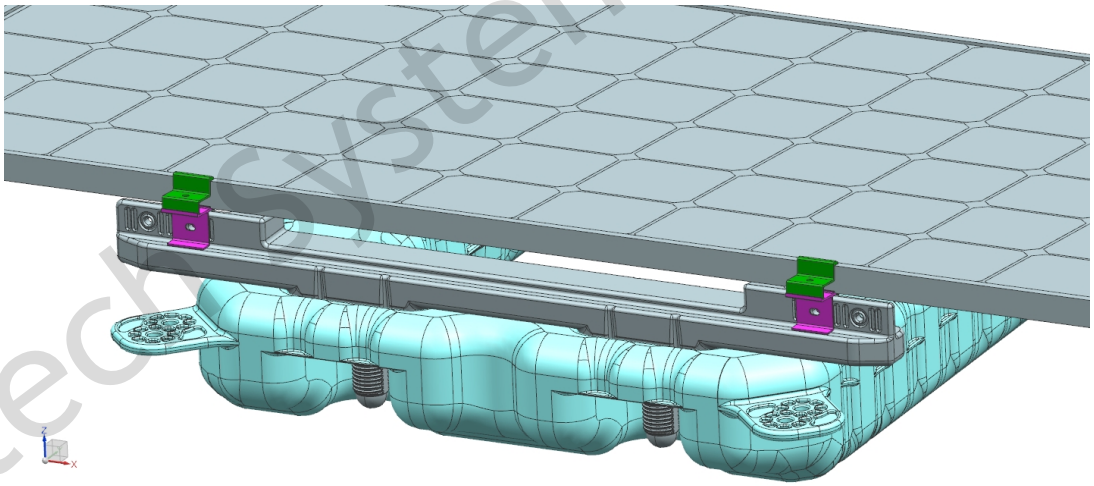


Figure 7

F. Connect the 4 L Clamp (Bridge Clamp) to the Lower Base Clamps and Upper Base Clamps loosely using SS304 M8

G. Take care to mount the panel on the float making sure that the midpoint of the panel is aligned with midpoint of the Connecting Float
H. Tighten the M8 fasters on the L Clamp after placing the module to ensure the module is tightened (mention torque)

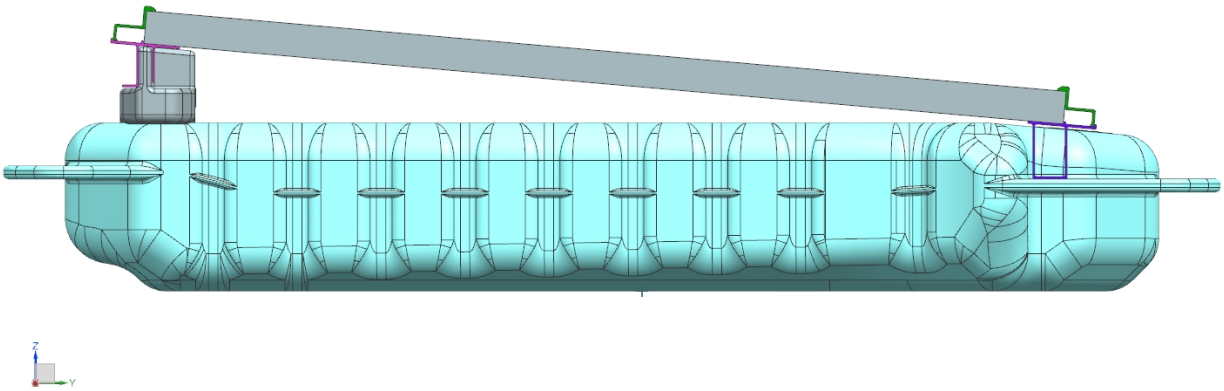


Figure 8

2. **Float Interconnection:**

Typically our floating structures are designed to have one row of Walkways at the periphery on the top and bottom portion and columns of Equipment Float at the periphery on the left and the right of the floating solar system. The Connecting Floats are installed inside the peripheral layers.

The following are the components used:

A. Connecting Float (CF)
B. Equipment Float (EF)
C. Small Walkway Float (SWF)
D. Big Walkway Float (BWF)
E. Support Piece (SP)
F. SS304 M12 - Nut, Bolt, Spring Washer and Plain Washer (2)

Installation Recommendations:

A. Ensure sufficient quantity of all floats are available to complete the portion of the total floating system which you wish to assemble

B. Ensure sufficient quantity of fasteners, sleeves and gaskets are available to complete the portion of the total floating system which you wish to assemble

C. Ensure that anchoring spreader bar is connected correctly to the outer peripheral floats before pushing into the water

D. Start the assembly from the last row onwards to ensure ease of installation while pushing into the water

E. While pushing the floats into the water, ensure not to exert excessive force on the ears of the float which may damage the same

F. Split the total assembly into sections and complete each section on the ground and then connect the completed sections together in the water to ensure proper connectivity. We recommend connecting 2-3 rows at any point of time on the shore and tugging a maximum of 5 rows by connecting both ends to ropes connected to the tug boat (say with a 10 HP motor)

G. Create a smooth surface at an angle of approximately 20 degree to help sliding the connected floats into the water. The platform should be lined with smooth plates or rubber sheets to avoid scratching of the floats with the ground

H. Use the logo on the floats as well as orientation marking on each float to ensure the correct orientation of the floats is followed during interconnection of the same

Float Installation Procedure:

A. Check the design of each float to see the height differences of the ears marked on the side of each float (as marked in orange)

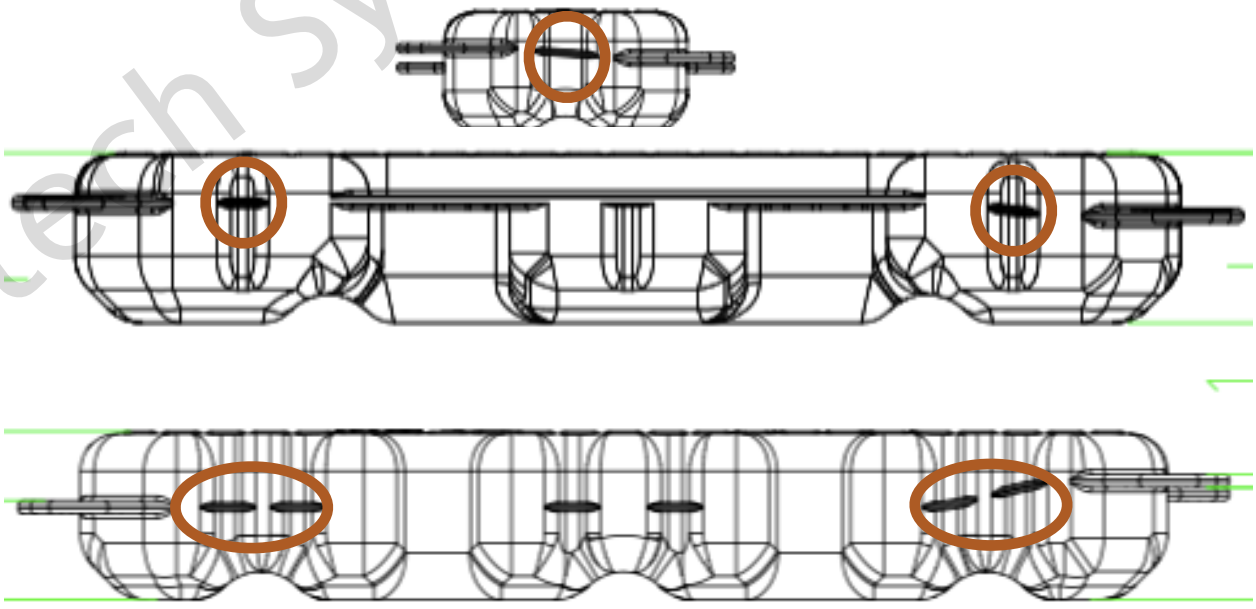


Figure 9

B. The assembly is to be started from the right most corner of the entire plant (with panels facing towards you - assume you are standing on south side facing north side with panels facing south (towards you)).

C. Test assemble 2 to 3 rows of floats first before tightening any fasteners to check alignment and use the sleeve in the holes of the ears to align the holes for inserting M12 nut

D. Connect the SWF such that the bottom right ear and the top right ear of the SWF always come on the bottom of the interconnecting ears. The bottom left ear of the SWF will be in the middle and top left ear of the SWF will be on the top

E. Connect the EF/CF in front of the SWF such that the top ears of EF/CF always come at the top of the interconnection of ears and the bottom ears always come at the middle of the interconnection of ears

F. Keep in mind that when 2 EF/CF are connected together the top ears of the second EF/CF will come on top of the bottom ears of the first EF/CF

G. Connect the BWF such that the right ears are always on the bottom of the interconnection of ears and the bottom left ear is in the middle and top left ear is in the top of the interconnection of ears

Connection Points Table

Small Walkway	**Interconnection Ear Position**		**Interconnection Ear Position**
Top Right Ear	Bottom	**Top Left Ear**	Top
Bottom Right Ear	Bottom	**Bottom Left Ear**	Middle
Big Walkway	**Interconnection Ear Position**		**Interconnection Ear Position**
Top Right Ear	Bottom	**Top Left Ear**	Top
Bottom Right Ear	Bottom	**Bottom Left Ear**	Middle
Panel Float/ Equipment Float	**Interconnection Ear Position**		**Interconnection Ear Position**
Top Right Ear	Top	**Top Left Ear**	Top
Bottom Right Ear	Middle	**Bottom Left Ear**	Middle

H. The above procedure can be repeated to connect all the floats together
I. Take care to align all holes with sleeve before connecting M12 fasters

Figure 10

J. Connect 3 rows on the shore and then push the assembly such that the floats touch the water surface
K. Connect the adjacent rows on the shore and push the assembly into the water
L. Tow the portion of assembly complete to the project location

M. Repeat the steps given above for the next portion of the assembly and then tow this assembly to the project location and interconnect at the location
N. The ears for the interconnecting points will align as provided above during the interconnection of the 2 floating portions
O. These steps may then be repeated to complete the entire assembly

3. Junction Box Installation Procedure:

A. Place the Equipment Float on the table
B. Mount the additional structure on the equipment float using the 4 M12 holes
C. Now mount your junction box on the structure and connect the equipment float on the array as described above

Figure 11

4. Electrical Connections Procedure:

A. While forming each row of the array of floaters, one must interconnect the module to module looping of DC Cables and use UV resistant cable ties on the hole provided on the supporting float or on the modules based on the available cabling length
B. Ensure to complete the module to module earthing looping during the connection of each row on the ground

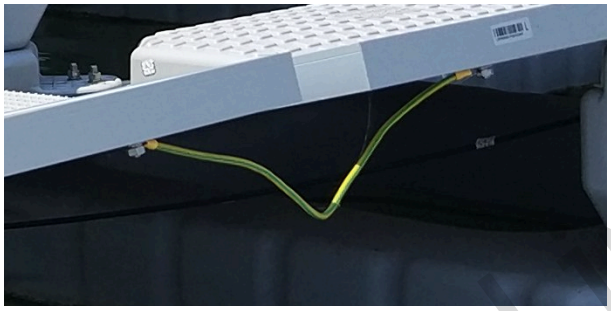


Figure 12

C. Take care to ensure that the loose ends of the cables do not touch with water when floated out and also to ensure the cables are properly tied using UV resistant cable ties to ensure no cables touch the water surface

Figure 13

D. The cables can then be taken on either cable tray or flexible conduits to the shore through equipment floats

Figure 14

5. Installation Checklist:

- Check the connection of the injection nut with support piece on the connecting float
- Check if the solar panel is aligned to the centre of each connecting float so as to have equal overhang on both sides
- Check if aluminium clamps are tightened properly using the M8 hardware to the panel
- Check if aluminium clamps are tightened properly using the M8 hardware with the float
- Check that all interconnection ears are connected as per this manual
- Check the correct tightening of the M12 hardware at each interconnecting point
- Check the if the anchoring / mooring spreader bars are connected as per design to the peripheral floats using interconnection ears
- Check to ensure that the module to module looping of the DC cable and Earthing is done properly before pushing the floats into the water
- Check to ensure the cables are sufficiently spaced above the water by use of cable ties to ensure no damages to the cable
- Check the floats for any damages during assembly before pushing the arrangement into the water

6. Safety Recommendations:

A. It is recommended to always use life jackets while boarding and walking on the floating platform
B. While connecting the floats please ensure to always connect the floats properly before floating into the water
C. During regular maintenance ensure that the connections of the floats are checked for any disparity
D. All cables being used in the solar system must have sufficient slack to prevent damage due to motions and variations in level of water
E. Follow the relevant standards for lighting protection and system earthing
F. All cables used must be water proof as complete contact with water may not be avoided. Having this in mind, please ensure cable management systems are used to provide sufficient distance from water by use of cable ties
G. Cable conduits used to take cables from the floating island to the shore shall be water proof to avoid unnecessary risk during evacuation

H. The floating structure shall not be approached by untrained manpower and shall not be approached without personal safety equipment such as jackets and helmets