BDC1718-40001

SPECIFICATIONS FOR SUPPLY OF BOS, ERECTION & COMMISSIONING AND 05 YEARS OF COMPREHENSIVE MAINTENANCE FOR TOTAL 400 KWp ROOF TOP GRID CONNECTED SPV POWER PLANT AT SIX BUILDING OF DARBHANGA HOUSE CAMPUS OF CCL- RANCHI.

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1 INTRODUCTION:

This specification defines the scope of the Bidder in **specifications for supply of balance of system (BoS), erection & commissioning, testing and 05 years of CMC (Biyearly Visit) for roof Top Grid connected solar power plant of total capacity 400 kWp at six no of buildings of Darbhanga house Campus of CCL Headquarter- Ranchi.**

1.1 Site Details:

Site is located at Ranchi and well connected through road and railway.

Sr. NO	Description	Details
1	Ambient Temperature	Minimum=8 DegC Maximum=40 DegC
2	Atmospheric Condition	Humid subtropical climate
3	Latitude	23.3441° N
4	Longitude	85.3096° E

Total 400 KWp system at Six Nos of roof tops as per below mentioned capacity are to be installed:

Sl. No	Location	No of Floors	SPV Capacity kWp
1	Swarnekha building	GF+FF+SF	80
2	Kaweri building	GF+FF+SF	90
3	Alakhnanda building	GF+FF+SF+TF	45
4	Damodar building	GF+FF+SF	60
5	Press building	GF	100
6	Sales building	GF	25

The roof capacities as above are indicative and a minor change in capacity considering design constraint is acceptable. However total capacity of SPV system shall be minimum 400 KWp. Bidders are advised that they should visit the site before quoting to fully understand the site conditions.

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2 BIDDER'S SCOPE:

2.1 System 1: 80 KWp System at Swarnrekha Building

a. Erection and commissioning of 300 Wp, 272 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001).
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

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List of Items for Supply & E&C for System 1: 80 KWp System at Swarnrekha Building

Sl. No.	ITEM DESCRIPTION	Qty	SUP PLY	E & C	MAKE/ REMARKS
1.	**Solar PV Module 300 Wp (272 Nos approx)**	272 Nos	x	✔	**SPV Modules shall be provided by BHEL.**
2.	Galvanized MS, Aluminium Module Mounting Structures with precast PCC pedestals along with accessories for 80KWp	1lot	✔	✔	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	Array Junction Box DCDB	1 lot	✔	✔	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	String Inverter (Total 80 KWp)	1 Lot	✔	✔	Make; SMA / KACO / ABB / SCHNEIDER / Delta / Refusol Test reports confirming to relevant standers shall be submitted
5	ACDB	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider.
6	LT box with MFM	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider. MFM: Rishabh, Secure
7	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and string Inverters (a). 1 core 4 sq. mm unarmored red cable from series string to string inverter for +ve side	600 Mtrs	✔	✔	Reputed makes viz., Polycab / Pagoda/ KEI / LAPP / Advance Cables / Equivalent. Test reports confirming to IS should be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 45/ meter.
	(b). 1 core 4 sq. mm Unarmored black cable from series string to string inverter for –ve side	600 Mtrs	✔	✔	
8	1.1kV grade heavy duty PVC insulated galvanized strip/wire XLPE stranded 4 core AC Cu conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or	1 lot	✔	✔	Reputed makes viz., Polycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to IS

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	IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 50 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	50 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standers shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 290/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the strng inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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2.2 System 2: 90 KWp System at Kaweri Building

a. Erection and commissioning of 300 Wp, 306 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001).
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

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List of Items for Supply & E&C for <u>System 2: 90 KWp System at Kaweri Building</u>

Sl. No.	ITEM DESCRIPTION	Qty	SUPPLY	E & C	MAKE/ REMARKS
1.	**Solar PV Module 300 Wp (306 Nos approx)**	306 Nos	x	✔	**SPV Modules shall be provided by BHEL.**
2.	Galvanized MS, Aluminium Module Mounting Structures with precast PCC pedestals along with accessories for 90KWp	1lot	✔	✔	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	Array Junction Box DCDB	1 lot	✔	✔	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	String Inverter (Total 90 KWp)	1 Lot	✔	✔	Make; SMA / KACO / ABB / SCHNEIDER / Delta / Refusol Test reports confirming to relevant standards shall be submitted
5	ACDB	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider.
6	LT box with MFM	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider. MFM: Rishabh, Secure
7	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and string Inverters (a). 1 core 4 sq. mm unarmored red cable from series string to string inverter for +ve side	650 Mtrs	✔	✔	Reputed makes viz., Polycab / Pagoda/ KEI / LAPP / Advance Cables / Equivalent. Test reports confirming to IS should be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 45/ meter.
	(b). 1 core 4 sq. mm Unarmored black cable from series string to string inverter for –ve side	650 Mtrs	✔	✔	
8	1.1kV grade heavy duty PVC insulated galvanized strip/wire XLPE stranded 4 core AC Cu conductor cables as per IS: 7098	1 lot	✔	✔	Reputed makes viz., Polycab/KEI/LAPP/Advance Cables/equivalent.

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	(Part I & II) – 1976 or IS 1554 or IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				Test reports confirming to IS should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 70 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	50 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standards shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs.400/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the string inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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2.3 System 3: 45 KWp System at Alakknanda Building

a. Erection and commissioning of 300 Wp, 153 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001).
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

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	(Part I & II) – 1976 or IS 1554 or IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				Test reports confirming to IS should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 25 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	65 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standards shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs.180/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the string inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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2.4 System 4: 60 KWp System at Damodar Building

a. Erection and commissioning of 300 Wp, 204 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001).
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

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List of Items for Supply & E&C for System 4: 60 KWp System at Damodar Building

Sl. No.	ITEM DESCRIPTION	Qty	SUPPLY	E & C	MAKE/ REMARKS
1.	**Solar PV Module 300 Wp (204 Nos approx)**	204 Nos	x	✔	**SPV Modules shall be provided by BHEL.**
2.	Galvanized MS, Aluminium Module Mounting Structures with precast PCC pedestals along with accessories for 60 KWp	1lot	✔	✔	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	Array Junction Box DCDB	1 lot	✔	✔	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	String Inverter (Total 60 KWp)	1 Lot	✔	✔	Make; SMA / KACO / ABB / SCHNEIDER / Delta / Refusol Test reports confirming to relevant standards shall be submitted
5	ACDB	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider.
6	LT box with MFM	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider. MFM: Rishabh, Secure
7	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and string Inverters (a). 1 core 4 sq. mm unarmored red cable from series string to string inverter for +ve side	450 Mtrs	✔	✔	Reputed makes viz., Polycab / Pagoda/ KEI / LAPP / Advance Cables / Equivalent. Test reports confirming to IS should be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 45/ meter.
	(b). 1 core 4 sq. mm Unarmored black cable from series string to string inverter for –ve side	450 Mtrs	✔	✔	
8	1.1kV grade heavy duty PVC insulated galvanized strip/wire XLPE stranded 4 core AC Cu conductor cables as per IS: 7098	1 lot	✔	✔	Reputed makes viz., Polycab/KEI/LAPP/Advance Cables/equivalent.

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	(Part I & II) – 1976 or IS 1554 or IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				Test reports confirming to IS should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 35 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	50 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standards shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs.225/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the string inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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2.5 System 5: 100 KWp System at Pres Building

a. Erection and commissioning of 300 Wp, 340 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001).
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

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List of Items for Supply & E&C for <u>System 5: 100 KWp System at Press Building</u>

Sl. No.	ITEM DESCRIPTION	Qty	SUPPLY	E & C	MAKE/ REMARKS
1.	**Solar PV Module 300 Wp (340 Nos approx)**	340 Nos	x	✔	**SPV Modules shall be provided by BHEL.**
2.	Galvanized MS, Aluminium Module Mounting Structures with precast PCC pedestals along with accessories for 100KWp	1lot	✔	✔	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	Array Junction Box DCDB	1 lot	✔	✔	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	String Inverter (Total 100 KWp)	1 Lot	✔	✔	Make; SMA / KACO / ABB / SCHNEIDER / Delta / Refusol Test reports confirming to relevant standards shall be submitted
5	ACDB	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider.
6	LT box with MFM	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider. MFM: Rishabh, Secure
7	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and string Inverters (a). 1 core 4 sq. mm unarmored red cable from series string to string inverter for +ve side	750 Mtrs	✔	✔	Reputed makes viz., Polycab / Pagoda/ KEI / LAPP / Advance Cables / Equivalent. Test reports confirming to IS should be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 45/ meter.
	(b). 1 core 4 sq. mm Unarmored black cable from series string to string inverter for –ve side	750 Mtrs	✔	✔	
8	1.1kV grade heavy duty PVC insulated galvanized strip/wire XLPE stranded 4 core AC Cu conductor cables as per IS: 7098	1 lot	✔	✔	Reputed makes viz., Polycab/KEI/LAPP/Advance Cables/equivalent.

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	(Part I & II) – 1976 or IS 1554 or IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				Test reports confirming to IS should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 70 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	40 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standards shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs.400/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the string inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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2.6 System 6: 25KWp System at Sales Building

a. Erection and commissioning of 300 Wp, 85 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001):
b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
c. Supply, Erection and commissioning of Array junction box DCDB.
d. Supply, Erection and commissioning of string Inverters.
e. Supply, Erection and commissioning of ACDB
f. Supply, Erection and commissioning of LT Box with MFM.
g. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, array junction box DCDB and string Inverters.
h. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between string Inverters and ACDB.
i. Supply, Erection and commissioning of AC Al Cables with accessories for connections between ACDB and LT Box and Distribution panel on ground floor.
j. Supply, Erection and commissioning of Web Enabled Data Logging system and with 5 year services along with all accessories.
k. Supply, Erection and commissioning of Earthing & lightning protection of SPV area as per relevant IS.
l. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
m. Freight & Transit insurance
n. Comprehensive Maintenance contract of 05 years (half yearly Visit).

Signature and seal of Bidder

List of Items for Supply & E&C for System 6: 25 KWp System at Sales Building

Sl. No.	ITEM DESCRIPTION	Qty	SUPPLY	E & C	MAKE/ REMARKS
1.	**Solar PV Module 300 Wp (85 Nos approx)**	85 Nos	x	✔	**SPV Modules shall be provided by BHEL.**
2.	Galvanized MS, Aluminium Module Mounting Structures with precast PCC pedestals along with accessories for 25 KWp	1lot	✔	✔	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	Array Junction Box DCDB	1 lot	✔	✔	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	String Inverter (Total 25 KWp)	1 Lot	✔	✔	Make; SMA / KACO / ABB / SCHNEIDER / Delta / Refusol Test reports confirming to relevant standards shall be submitted
5	ACDB	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider.
6	LT box with MFM	1 Set	✔	✔	Make: MCB/MCCB- L&T, C&S, Legrand, ABB, Schnider. MFM: Rishabh, Secure
7	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and string Inverters (a). 1 core 4 sq. mm unarmored red cable from series string to string inverter for +ve side	190 Mtrs	✔	✔	Reputed makes viz., Polycab / Pagoda/ KEI / LAPP / Advance Cables / Equivalent. Test reports confirming to IS should be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs. 45/ meter.
	(b). 1 core 4 sq. mm Unarmored black cable from series string to string inverter for –ve side	190 Mtrs	✔	✔	
8	1.1kV grade heavy duty PVC insulated galvanized strip/wire XLPE stranded 4 core AC Cu conductor cables as per IS: 7098	1 lot	✔	✔	Reputed makes viz., Polycab/KEI/LAPP/Advance Cables/equivalent.

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	(Part I & II) – 1976 or IS 1554 or IS9537 of suitable size for connection between string Inverter to ACDB **Note**: The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.				Test reports confirming to IS should be submitted
9	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminium conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537. 4 C x 16 sq.mm cable (from ACDB to LT Box to existing Distribution Panel)	40 Mtrs	✔	✔	Make: olycab/KEI/LAPP/Advance Cables/equivalent. Test reports confirming to relevant standards shall be submitted Length is indicative and can vary upto ±10%. Any variation beyond 10% shall be payable/recoverable @ Rs.150/ meter.
10	Web Enabled Data Logging system	1 set.	✔	✔	Data logger should be compatible with the string inverter used in the RTS preferable same make as of String inverter. Data logging system for entire 400KWp shall be available at single login.
11	Lightning Arrestor with earthing for roof along with mounting arrangement as per relevant IS.	1 Set	✔	✔	
12	Pipe earthing with earth Bus bar for Structures, String inverter and LA earthing as per IS3043.	05 Nos	✔	✔	This includes 01 earthing for LA
13	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 set	✔	✔	Quantities as required for project completion, Bidder has to organize without any additional cost.

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Note:

a. Such Items, not listed but required for completion of the Project shall deemed to have been included in the scope of this contract.
b. SPV Modules shall be supplied by BHEL; However I&C of SPV modules shall be in scope of Bidder.
c. The technical particulars, installation procedures and drawings of the bought out items Listed above clause 2.1 to 2.6 shall be submitted for approval to BHEL before procuring.
d. Bidder has to procure materials as per listed make. Whenever equivalent make has to be procured prior approval has to be taken from BHEL submitting the make and technical particulars of the component.
e. Test Certificates of BOS material and dimensional test reports of structures confirming to IS should be submitted to BHEL after finalization of order.
f. Major BoS items (Inverter etc) shall be inspected by BHEL during manufacture and in assembled condition prior to dispatch.

2.7 Comprehensive Maintenance contract of 05 years.

All the equipment's to be installed for commissioning of solar PV power plant and the power plant in whole (Except SPV Modules) for each system shall be under Comprehensive Maintenance Contract for 05 (Five) years from the date of successful commissioning.

General:

- The Bidder shall carry out operation & maintenance related activities of SPV plant in a sustainable manner.
- The Bidder shall ensure scheduled and preventive maintenance, major overhauling of the equipments, cleaning of Module and maintaining log sheets/records of operational details so as to ensure trouble free operation & healthy condition of the entire system at the designed efficiency / performance level for the entire period of CAMC.
- Operation & Maintenance of evacuation system up to the point of interconnection with CCL grid shall be the responsibility of the Bidder.
- The Bidder shall be responsible for all the required activities for maintenance and successful running of the plant for optimum energy generation as well as maintenance of associated facilities of the solar PV plant.

The equipments or components, or any part thereof, so found defective/damage during Comprehensive Maintenance Contract period will be forthwith repaired or replaced within the scope of warrantee obligation to the satisfaction of the BHEL.

The maintenance of solar PV power plant includes routine & periodic maintenance, overhauling, breakdown maintenance, and repairing or replacement of defective invertors, and other components, providing of consumables shall be under CMC.

The Down-Time of PV system should not be more than 72 hours (03 days).

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The comprehensive CMC will include half yearly visits per year along with emergency/breakdown visits. CMC charges shall be inclusive of all to & from travel, lodging, boarding, etc.

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3 Technical Specification of BoS

3.1 Solar PV Modules

Around 1360 (272+306+153+204+340+85) Nos. SPV Modules shall be supplied by BHEL. Specifications of SPV modules is as per SPV Module drawing- 3-988-00-001-10 and SPV Module Data Sheet – EP-901-01-00001. Erection and commissioning of SPV Modules shall lie in Bidder's Scope.

3.2 MODULE MOUNTING STRUCTURE:

Wherever required, suitable number of PV panel structures shall be provided by vender. Structures shall be of flat-plate design either I, C or L sections.

Structural material shall be corrosion resistant and electrolytically compatible with the material used in module frame, fasteners, nuts and bolts. Galvanizing should meet ASTM A-123 hot dipped galvanizing or equivalent which provides at least spraying thickness of **80 microns** on steel as per IS-5905, if steel frame is used. Aluminum frame with adequate strength and in accordance with relevant BIS/ International standards.

Each structure shall have a provision to adjust its angle of inclination (seasonal tilt arrangement) to the horizontal as per the site conditions by the way of Manual operation for maximum Insulation.

The structure should be capable of withstanding a Wind load of minimum speed of **150 km/hr** after grouting and installation. Suitable fastening arrangement such as grouting and clamping should be provided to secure the installation against the wind load. The size of angle Iron shall not be less than **50 X 50 X 5mm**. The fasteners and Nuts, Bolts used shall be made up of good quality stainless steel of grade SS304 or higher.

Structural design of complete system shall be compatible with the structural strength and load baring capacity of the site. Regarding civil structures the bidder shall take care of Load Baring Capacity of the roof and shall arrange necessary suitable structures based on quality of roof. Each panel frame structure shall be so fabricated as to be grouted on roof on its legs. The legs of the structure shall be fixed and grouted in PCC foundation column made with **1:2:4** cement concrete. The foundation shall support SPV modules at a given orientation and transfer the mechanical loads to the ground properly and shall withstand maximum wind load. All nuts and bolts shall be of very good quality stainless steel.

The minimum clearance of the lowest part of the module structure and developed ground level shall not be less than 400mm.

The minimum clearance required from parapet wall of the roof and in-between rows of panels shall be minimum 2 feet for panel cleaning and servicing.

The bidder shall supply specify installation details of PV modules and the support structures with appropriate diagrams and drawings after finalization of order. Such details shall include, but not limited to the following:

- Determination of true south at the site.
- Array tilt angle to the horizontal, with permitted tolerance.
- Details with drawings for fixing the modules, junction/terminal boxes.
- Structure installation details and drawings.

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- Electrical grounding (earthing).

The support structure shall be free from corrosion when installed. PV modules shall be secured to support structure using screw fasteners. Screw fasteners shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frame. Module fasteners/clamps shall be adequately treated to resist corrosion. Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance. Zinc rich spray paint shall be applied in scratches of the structures for preventing corrosion.

Note: Bidder shall ensure the structure stability and shall submit the structure wind load calculations report along with drawings after finalization of order.

3.3 Array Junction Box DCDB (AJB DCDB):

The junction boxes DCDB are to be provided in the PV yard for connecting cables from solar string to string inverter. The junction boxes DCDB shall be dustproof, vermin and weatherproof and shall be made of FRP/ ABS plastic of IP 66 rating.

The junction boxes DCDB shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.

Terminals shall be connected to copper bus bar arrangement of proper sizes. Suitable markings shall be provided on Bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification.

The AJB DCDB must comprise of following:

- Arrangement for group array isolation.
- Test point for subgroup fault location.
- DC breaker, surge (Type II SPD, MOV) and fuse protection device
- Should have DC disconnect switch
- Should have installed Type II SPD and proper earthing arrangements.

The design and components of AJB DCDB must be approved by BHEL prior to ordering.

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3.4 String Inverter :

String inverter able to cater total 400 KWp power rating (80 KWp system 1, 90 KWp system 2, 45 KWp system 3, 60 KWp system 4, 100 KWp system 5 and 25 KWp system 6) shall be supplied. Individual inverter capacity shall not be less than 20 KWp. Bidder should ensure compatibility of inverter with SPV modules and system. The technical particulars of the inverter have to be submitted to BHEL for approval before procurement.

Sl. No	Technical parameter	Specification
1.	Type	Grid Connected String Inverter (transformer less).
2.	Make	SMA / KACO / ABB / SCHNEIDER / Delta / Refusol
3.0	Standards	
3.1	Efficiency Measurement	IEC 61683/ Equivalent BIS Std.
3.2	Environmental testing	IEC 60068-2 (1,2,14,30) / Equivalent BIS Std.
3.3	Interfacing with utility grid , EMC	IEC 61727, IEC 61000-6-2
3.4	Islanding Prevention Measurement	IEC 62116
3.5	MPPT	IEC 62093
3.5	Type Test certificate issuing authority **(for Sl. No. 3.1 , 3.2,3.3,3.4 and 3.5)**	NABL/ IEC Accredited Testing Laboratories or MNRE approved test centers.
4.0	**Input DC**	
4.1	Voltage range	Min 250-1000
4.2	MPP voltage range	Min 420-850
4.3	No of independent MPPT	Min 02
5.0	**Output AC**	
5.1	Output voltage and phase	Sine wave 3 Phase 415 V ±10% 50Hz AC, minimum 4 wire output RYBN or RYBN+PE
5.2	Reactive power	0.8 lagging to 0.8 leading
5.3	Total Harmonic Distortion (THD)	< 3% at rated power
5.4	Phase Load Imbalance at least 30 %	at least 30 %
5.5	Standby power consumption	Standby power consumption of Inverter shall not exceed 20 Watts
6.0	**Efficiency**	Min 98% at 75% load as per IEC 61683
7.0	**Protection**	
7.1	DC Side	1. Disconnection device 2. Reverse polarity protection 3. Reverse current to PV array protection over

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		voltage, under voltage over current protection. 4. Short circuit protection: PV fuse 5. Surge protection: SPD type II
7.2	AC Side	1. Short circuit protection 2. Over voltage, under voltage over current protection over and under Grid frequency protection. 3. Anti Islanding protection 4. AC surge protection
7.3	Ground fault / Grid Monitoring	Yes
7.4	Over Temperature protection	Yes
8.0	**Display**	
8.1	Display type	LCD/LED
8.2	Display parameter	Voltage, current, power, line status, grid voltage grid frequency, export power and export energy.
9.0	**Communication**	
9.1	Communication port	RS485, port for web based remote monitoring system and should match with data logger.
10.0	**General**	
10.1	Operating Temperature	-20 Deg. C to + 55 De. C
10.2	Dimensions	Shall be provided by the Bidder.
10.3	Weight	Shall be provided by the Bidder.
10.4	Cooling	Cooling arrangement (if any) details shall be furnished by the Bidder.
10.5	Ingress protection (IP)	IP 54 or better (Out Door Installation)
10.6	Maximum altitude	Bidder to mention up to what altitude above sea level inverters will work without de-rating.
10.7	Noise level	<70dBA

Note:

Bidder shall provide for installation & commissioning of the string inverters. Bidder shall depute their service engineer to site during E&C of the string inverters. If Bidder engineers are not competent, Bidder has to arrange engineers from Inverter supplier during commissioning of the plant.

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3.5 ACDB

AC power output of inverters shall be fed to ACDB panel consisting of surge arresters, suitable no of incoming MCCBs (depending upon the string inverter rating) & outgoing MCCB as per following rating:

1. System 1, 80 KWp System at Swarnrekha Building: 125 Amprs
2. System 2, 90 KWp System at Kaveri Building: 150 Amprs
3. System 3, 45 KWp System at Alakhnanda Building: 80 Amprs
4. System 4, 60 KWp System at Damodar Building: 100 Amprs
5. System 5, 100 KWp System at Press Building: 150
6. System 6, 25 KWp System at Sales Building: 40 Amprs

ACDB shall be floor mounted type, Panel should confirm IP65 and shall be made of min.16 Gauge powder coated MS Sheet metal, totally enclosed, rigid, floor mounted, and cubical type suitable for operation on three phase 415 V, 50 Hz.
All power cables shall be taken through top or bottom of panel as per site requirement.
Distribution Board shall be fitted with suitable rating and size Al/Cu bus, lugs, cable glands, MCBs, ferrules, indicating lamps Accessories etc.
Outgoing of ACDB panel shall feed to LT Box with MFM on ground floor which in turn shall feed to existing supply panel of respective building.

3.6 LT Box with MFM

AC power output of ACDB panel shall feed to LT Box with MFM on ground floor which in turn shall feed to existing supply panel of respective building. The LT Box with MFM shall consist of suitable rating MCCB and Digital MFM- with CTs, communication interface and all accessories on each LT box as per following:

1. System 1, 80 KWp System at Swarnrekha Building: 125 Amprs
2. System 2, 90 KWp System at Kaveri Building: 150 Amprs
3. System 3, 45 KWp System at Alakhnanda Building: 80 Amprs
4. System 4, 60 KWp System at Damodar Building: 100 Amprs
5. System 5, 100 KWp System at Press Building: 150
6. System 6, 25 KWp System at Sales Building: 40 Amprs

LT Box with MFM shall be floor mounted type, Panel should confirm IP65 and shall be made of min.16 Gauge powder coated MS Sheet metal, totally enclosed, rigid, floor mounted, and cubical type suitable for operation on three phase 415 V, 50 Hz.
All power cables shall be taken through top or bottom of panel as per site requirement.
Distribution Board shall be fitted with suitable rating and size Al/Cu bus, lugs, cable glands, MCBs, ferrules, HRC fuses, Accessories etc.
Connection & termination of Cables of main supply line & solar PV Power to DB Panel shall be in scope of bidder. Bidders are encouraged to Visit site before quoting.

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3.7 Cables

a. The Specification of wiring material of PV Power plant shall include but not limited to the following:

Sl. No	Item	Description
1.0	**DC Cable**	From PV module to AJB DCDB to inverter
1.1	Type	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537
1.2	Size	1 core 4 sq. mm Unarmored
1.3	Laying	The cable must be laid through PVC conduit /GI pipe/ cable tray on roof and indoor. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
2.0	**AC Cable**	From inverter to ACDB **Note:** The length and size of the cable shall be decided by the bidder depending upon the safe placement of String Inverters and ACDB.
2.1	Type	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Cu conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537.
2.2	Laying	The cable must be laid through PVC conduit /GI pipe/ cable tray on roof and indoor. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
3.0	**AC Cable**	From ACDB to LT Box with MFM to Distribution Panel.
3.1	Type	1.1kV grade heavy duty PVC insulated galvanized strip/wire armored XLPE stranded Aluminum conductor cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537.
3.2	Laying	The cable must be laid through PVC conduit /GI pipe/ cable tray on roof and indoor. In case of using metallic pipe as conduit proper grounding of the conduit must be done.

b. **Procedure of cable laying**:

1. Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and cables shall be provided with dry type compression glands wherever they enter junction boxes/ panels/ enclosures at the entry & exit point of the cubicles. The panels bottoms should be properly sealed to prevent entry of snakes/lizard etc. inside the panel. All cables shall be adequately supported. Outside of the terminals / panels / enclosures, shall be protected by conduits. Cables and wire connections shall be soldered, crimp-on type or thimble or bottle type. Cabling/wiring shall be done as per IS:375.
2. Only terminal cable joints shall be accepted. Cable joint to join two cable ends shall not be accepted
3. All cable/wires/control cable shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.

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4. All fasteners will be made of Stainless steel or Aluminum or UV Protected PVC.

3.8 Web Enabled Data monitoring

All the relevant parameters of PCU should be available for remote monitoring over internet using GPRS based monitoring solution. PCU shall have GPRS inability based on SIM card which shall be provided by the bidder. The monthly charge of SIM card will be borne by bidder. The list of parameters should include:

- PV Voltage, PV Current, PV power
- Daily Generation
- Total Generation.

All above parameters to be included for all MPPT channels individually)

- Inverter Voltage, Current, Frequency
- Main Voltage, Current, Frequency
- Active Faults

Web based Remote Monitoring system must be compatible with data logger. The system shall be provided with required accessories and **required SIM card** for wireless communication. The server shall be arranged by the bidder. The rental and other costs of the SIM cards, IP address, Server charge (storage, access charge and other charges if any), and Rental charge of data communication for remote monitoring system for a period of Five (05) years shall be in bidders scope.

SPD (surge protection device) Type II suitable for communication network, as much number at suitable locations are required must be provided with the system.

Note: The data logger facility of INVERTER can be used. Overall data of each INVERTER system shall be available for analysis on single login ID.

3.9 LA and EARTHING

- The earthing for lightning arrestor, plant equipment and LT power system shall be required as per provisions of IS: 3043. It must be ensured that all the Solar Modules and Dc circuits are covered under Protection against Lighting.

Earth stations and Earthing System:

- Two separate Main earthings will be provided by CPCL and Bidder shall take earthing from that point.
- The earthing for LT side (Solar Power Plant side) array and LT power system shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and code of practices and the local statutory authority regulations.

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- Neutral points of system metallic enclosures and frame works, not forming part of electric supply shall be connected to main earthing system. All metal casing/shielding of the plant should be thoroughly grounded.
- Each array structure of the SPV Yard/shed shall be grounded properly as per IS: 3043- 1987. The array structure are to be connected to earth pits as per IS standards.
- 25x5mm GI Flats shall be run on both sides of each Array and Ensure that these flats are inter connected and a close Loop is formed, along the strip support rail of Each Row, by connecting the frames of Module to Module and Module to strip support Rail.
- The Earth Flats Used for Earthing of Solar Modules and Inverters shall be connected to two separate and independent Earth Electrodes, by bringing down 2 Nos. 25X5mm GI flats separately.
- The Earth Flats shall be properly welded where ever joints were made and properly connected where they are connected at Earth Electrodes to have more contact area avoiding air gaps to maintain the Continuity of the Earth Path from Modules, DC Circuits and Inverters to Earth Electrodes.
- The Earth Terminals of the DC Circuits in Inverters shall be connected to Earth with the same size of Wires used for Phase.
- Provision should be kept for shorting and grounding of the PV array at the time of maintenance work.
- The complete earthing system shall be mechanically & electrically connected to provide independent return to earth. All equipments shall have two distinct earth connections.
- In compliance to Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date) all noncurrent carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.
- It shall be ensured that all the earth's are bonded together to prevent the development of potential difference between ant two earths

3.10 Miscellaneous Equipment

Miscellaneous items like Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage boards, MC4 connectors etc.) and Civil Works required for E&C shall be provided by the bidder. Such Items, not listed but required for completion of the Project shall deemed to have been included in the scope of the Bidder.

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4 Special Terms and conditions:

4.1 Freight & Transit insurance:

Price quoted by the bidder for each system is inclusive of the freight.

The Bidder shall take Insurance for transit of materials to the site and for the installation period.

Insurance of work at site

The Goods supplied by Bidder shall be insured fully against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery.

Bidder shall also take storage insurance for BHEL supplied items (1360 Nos PV Module).

Insurance during installation at site:

The Bidder shall so far as reasonably practicable insure against the Bidder's liability in respect of any loss or damage occurring whilst the Bidder is at EMPLOYER'S site for the purpose of making good a defect or carrying out the tests on completion during the installation & commissioning of the equipment at employer's site or for the purpose of completing any outstanding work and against any loss or damage arising during the defects liability period from a cause occurring prior to the taking over of new solar PV plant by the employer. For all practical purpose such insurance, during Defect Liability Period, shall be from an Indian Insurance Company.

4.2 System Warranty

The bidder must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.

The complete BoS items supplied, workmanship for each system shall be under warranty of 60 **calendar** months from the date of successful commissioning. The equipments or components, or any part thereof of the Power Plant, if so found defective during warrantee period, the bidder will remain liable to repair or replace immediately under warrantee obligation to the satisfaction of the Purchaser in order to ensure trouble free operation of the Power Plant. Within the scope of warranty, the Bidder will repair or replace of any defective part of the Plant & Equipment supplied, Works done and services rendered under the Contract and render periodic maintenance as a preventive measure to up keep performance of the power plant and also to attend breakdown maintenance as and whenever needed.

4.3 Inspection

Major BoS items (Inverter etc) shall be inspected by BHEL during manufacture and in assembled condition prior to dispatch.

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4.4 Testing and commissioning

The testing and commissioning for all electrical equipment at site shall be according to the procedures listed below:

- All electrical equipment shall be tested, installed and commissioned in accordance with the latest relevant standards and code of practices published by Indian Standards Institution wherever applicable and stipulations made in relevant general specifications.
- The testing of all electrical equipment as well as the system as a whole shall be carried out to ensure that the equipment and its components are in satisfactory condition and will successfully perform its functional operations. The inspection of the equipment shall be carried out to ensure that all materials, workmanship and installations conform to the accepted design, engineering and construction standards, as well as accepted code of practices and stipulations made in the relevant general specifications.
- BHEL or its authorized representative reserves the right to witness tests conducted by the contractor using contractor's own calibrated instruments, testing equipment as well as qualified testing personnel.
- The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalization of the contract.
- After completion of the installation at site and for the preparation of plant commissioning, the contractor shall check all the equipment and installation in accordance with the agreed standards, latest relevant code of practices of Indian Standards and specific instructions furnished by the particular equipment manufacturer as well as BHEL Engineer In-Charge.
- Checking required to be made on all equipment and installations at site shall comprise, but not limited to, the following:
    - Physical inspection for removal of any foreign bodies, external defects, such as damaged insulators, loose connecting bolts, loose foundation bolts etc.
    - Check for tightness of all cable joints and busbar termination ends as well as earth connections in the main earthing network
    - Check for clearance of live bus bars and connectors from the metal enclosure
    - Check for proper alignment of all draw out devices, if any
    - Continuity checks in case of power and control cables
    - Check for proper connection to earth network of all non-current carrying parts of the equipment and installation
- CABLE TESTS:
    - Insulation resistance test with 1,000 V megger for cables rated up to 1.1kV grade.
    - All 1.1 kV cables shall be subjected to high voltage test after joining and terminating but before commissioning as per relevant standards.
    - In each test, the metallic sheath / screen / armour should be connected to earth.

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- Continuity of all the phases, correctness of all connections as per wiring diagram, correctness of polarity and phasing of power cables and proper earth connection of cable glands, cable boxes, armour and metallic sheath, shall be checked.

- EARTHING SYSTEM TESTS:
  - Tests to ensure continuity of all earth connections.
  - Tests to obtain earth resistance of the complete network by using earth tester. The test values obtained shall be within the limits. Earth tester shall be arranged by Bidder.

4.5 Electrical License-

The bidder or his authorized representative (In whose guidance work will be executed) should submit valid Electrical Contractor's License issued by Electrical Licensing Board/Authority of any Indian State/UT, in accordance with IE Rule-45 within 10 days of issue of letter of acceptance.

4.6 O&M Manual and TEST CERTIFICATES

a) 03 copy of O&M Manual along with as build drawing and project report shall be submitted within 10 days of E&C.
b) Test certificates/Test Reports for structures (along with galvanization) and inverters.
c) Equipment shall not be dispatched until BHEL issues a "Dispatch clearance" to Bidder.
c) Warranty certificates shall be submitted for all bought-out items.

Note:

1. **It is advised that bidder should visit site and ascertain what type of equipment/machines needed at site for execution.**
2. **Supply shall be made directly to the site.**
3. **Water and electricity during E&C shall be provided by BHEL**
4. **Space for Storage of supplied material as well as BHEL supplied materials (1360 Nos PV Module) shall be arranged by the bidder.**
5. The Unloading and shifting of all the materials viz., BHEL supplied material and Bidder supplied materials from stores/storage location to the site (building rooftop) lies in the scope of Bidder.
6. All tools and tackles, like power drilling machine, cutting machine, digging tools, complete set of crimping tools etc, required for installation, wiring, crimping, assembly, digging of cable trenches, if required, earth pits & Megger for checking insulation resistance of cable prior to commissioning etc., have to be organized by the bidder.
7. The storage, watch & ward responsibility of all the materials including BHEL supplies at site will be in Bidder's scope until the commissioning of the plant. Any deficit occurring due to misplacement/mishandling will be borne by the Bidder at no extra cost. The

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shifting of all the materials to the roof-top from storage location for erection will be in the scope of the Bidder and he has to make necessary arrangements for the same.

8. Before mounting the PV modules on to the structures, each PV module have to be tested during peak sunshine period. Short circuit current (Isc) & Open circuit voltage (Voc) of the module has to be checked & recorded using multimeter and Clamp meter. Ensure the modules are electrically OK. Special crimping tools required for crimping to be arranged by Bidder as per this specification, have to be used to crimp 4 sq.mm cables to quick connects for connecting output of series strings to INVERTER/junction Box. **This crimping tool has to be kept at site permanently even after completion of project.**
9. Each string Open circuit Voltage & Short Circuit Current (with a testing jig having appropriate load) to be checked and recorded as directed by the BHEL site engineer at site.
10. All the terminations required for SPV plant viz., at the inverter and DB panel etc., will be in the scope of the Bidder. The necessary lugs and hardware required for the termination have to be arranged by the Bidder. Bidder has to ensure that terminations have been made without any tension.

Note: Bidder have to carefully measure twice the exact length of cables required for the connection before cutting the cable from cable drum. Any short fall in length of cable arising out of Bidder works should be borne by the Bidder. Bidder is required to assist BHEL and associate with the other Bidder's technical team during pre-commissioning checks and in commissioning of the power plant.

4.7 Delivery Schedule

For Supply of BOQ and E&C: The total time period for Supply and E&C is within 60 days from the date of PO.

Satya Jain

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5 GENERAL TERMS AND CONDITIONS:

1) Bidder's responsibility, right and liabilities under this project will commence from the date of acceptance of the purchase order.
2) The installation activity will have to be carried out in such a manner that will not cause any inconvenience to the other agencies working in the site. Any permits from the customer, if required, are to be arranged by the Bidder for his personnel.
3) After completion of the E&C, the entire site/area will be cleaned of debris etc. by the Bidder prior to handing over of the site to BHEL.
4) All the materials brought to site has to have proper paper work like DC, Invoice etc. duly verified & signed by BHEL/BHEL's customer to be submitted to BHEL for payment.
5) Any damage to the buildings/structures/area made by Bidder's work men or by Bidder's agent will be made good by Bidder at Bidder's cost.
6) Bidder shall take work permit before commencement of all types of non-routine works as per the statutory procedures followed at the work place.
7) Bidder shall explain the job, associated hazards and precautions to his workmen.
8) Bidder shall ensure deployment of at least one person who should have the skill, knowledge and experience of performing the allotted task and shall be able to guide his team.
9) Bidder shall ensure safe procedure is followed during execution of the job.
10) Bidder shall ensure that his workmen wear appropriate safety Personal Protective Equipment.
11) Bidder shall ensure adequate supervision of the activity by his supervisor.
12) Bidder has to adhere to necessary legal/safety requirements and BHEL shall be kept indemnified against any untoward events taking place during the course of work.
13) No child labor should be employed for executing the project.
14) In case project is not completed as per BHEL scope due to reasons arising out of materials from BHEL end/Bidder's end, bidder has to complete the job at later stage without any extra charges. No overrun charges shall be paid in case of extension of project schedules.
15) Any miscellaneous materials that have not been mentioned specifically in the specification/tender which are required for E&C of the plant shall be deemed to be included in the specification and shall be supplied by the Bidder without any extra charges. Any scope of activities which are not specifically mentioned in this specification but required for the completion of the E&C of the SPV plant for safe, trouble free, normal operation shall be provided at no extra cost by the Bidder, unless explicitly excluded in the specification.
16) **Bidder must meet statutory/HSE compliance as per Annexure C enclosed along with this tender document.**
17) The design and operational features of the equipment offered shall also comply with the provisions of latest issue of the Indian Electricity Rules and other statutory regulations.
18) **Statutory obligation**: Bidder is required to meet all the statutory obligations/ legal requirement with regard to workmen deployed by Bidder for the project such as ESI, PF, Minimum wage act, Work man compensation act/Accident/medical insurance, Income Tax act, Employees Insurance act etc.

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19) The installation should strictly conform to this specification. All the works shall be executed strictly as per the direction of BHEL engineer at site.

6 LIST OF ENCLOSURES:

Following enclosure makes the part of BDC1718-40001.

6.1 SPV Module drawing- 3-988-00-001-10
6.2 SPV Module Data Sheet – EP-901-01-00001
6.3 LA-3-679-05-00037
6.4 Annexure – A includes Qualifying Criteria, Payment terms, bidder's information, and declaration by Bidder etc.
6.5 Annexure – B format for certificate by chartered accountant
6.6 Annexure – C Statutory compliance by Bidder.

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Annexure A

1. Qualifying Criteria

Sl. No	Description		Required
1	Acceptance to BDC1718-40001, Annexure-A, B, and C. Attach signed & stamped copies of each page.	**Applicable**	
2	Copy of project completion certificate with Order copy of having experience in Supply and E&C of solar PV power plant of minimum 01 project of 100 KWp capacitiy with aggregate capacity of minimum 500 KWp in last two years.	**Applicable**	
3.	The Average financial turnover of last Three year should be minimum 27 lakhs. Bidder have to submit audited balance sheet & profit and loss account of last three financial years.	**Applicable**	
4	EMD of **Rs.2,00,000/-(Two lakh Only)** shall be submitted in form of cash, pay order or demand draft/ NEFT/RTGS to BHEL account in favor to BHEL along with Offer. EMD is exempted for micro & small scale enterprises (MSE) Included. Note: submit attested documentary Evidence/ Govt. Certificate etc. in support of the same along with their Techno-commercial offer. MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM – II certificate having deemed validity (Five years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM-II certificate along with attested copy of a CA certificate (**Format enclosed as per Annexure- B)** where deemed validity of EM-II certificate of five years has expired) applicable for the relevant financial year (last audited). EMD to unsuccessful bidders shall be returned after finalisation of PO. EMD to successful bidder shall be returned only after submission of PBG as per Cl. 9.	**Applicable** Bank Details are as follow: Bank: HDFC Bank Beneficiary Name: Bharat Heavy Electricals Limited A/C NO: 02830310000080 Account Type: Cash Credit BRANCH: Shop 1 & 2, NAINITAL ROAD RUDRAPUR, U. S. Nagar PIN CODE-263153 Tel: 05944 - 241756 / 241368 MICR CODE: 263240002 IFSC CODE: HDFC0000283	

2. **Price basis:** Firm i.e from date of PO to completion of E&C.
3. **Delivery:** The total time period for Supply and E&C is within 60 days from the date of PO.
4. **Term of Delivery: FOR CCL Darbhanga House,Ranchi.**
5. **Inspection:** Inspection shall be carried out for BoS and E&C after successful commissioning of system. A joint report shall be signed by BHEL and vendor. TC/GC of major BOS items shall be furnished by vender before dispatch. Field quality plan shall be submitted after issue of PO but

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before commissioning of system. As build drawing of system/civil work shall be submitted within 10 days of E&C.

6. **Payment terms:**
   a. 100% Payment of supply of BoS and E&C (as per BDC1718-40001) shall be made to Bidder's account within 45 days through e-payment on submission of final bill along with commissioning report and handing over memorandum by BHEL. Bidder shall provide its bank A/c details for making e-payment.
   b. Payment of Comprehensive Maintenance (CMC) shall be made on annual prorate basis after the end of each year after satisfactory operation and maintenance of the plant.

   All payments to be made to the Contractor under the contract will be in Indian rupees only. Payment shall be released on furnishing performance Bank Guarantee.
7. **Liquidity Damage:** An unconditional penalty of 0.5% (Half percent) in arrears per week subject to maximum of 10% of PO value for delayed period.

8. **Warranty:**
   The bidder must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.
   The complete BoS items supplied, workmanship for each system shall be under warranty of 60 **calendar** months from the date of successful commissioning. The equipments or components, or any part thereof of the Power Plant, if so found defective during warrantee period, the bidder will remain liable to repair or replace immediately under warrantee obligation to the satisfaction of the Purchaser in order to ensure trouble free operation of the Power Plant. Within the scope of warranty, the Bidder will repair or replace of any defective part of the Plant & Equipment supplied, Works done and services rendered under the Contract and render periodic maintenance as a preventive measure to up keep performance of the power plant and also to attend breakdown maintenance as and whenever needed.

9. **PBG:** A performance bank Guarantee of 10% of PO value including CMC charges valid for warranty period of 05 years from the date of successful commissioning with a claim period of 6 months thereafter by the successful Tenderer shall be furnished within 10 days of successful commissioning to the Employer (BHEL). The performance Guarantee can be in the form of a Bank Guarantee (B.G) as per BHEL format, from a Nationalized/ Scheduled Bank. The Bank Guarantee towards Performance Guarantee will be released after completion of CMC period.
10. The total 05 years of CMC charges shall be at least 7.5% of the BoS (Supply +E&C cost). In case CMC charges found lower than 7.5% of the BoS (Supply +E&C cost) BHEL reserves the right to re-appropriate the CMC charges out of total value.

Note: Non acceptance/submission of any of the above requirements will render the offer for rejection.

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DECLARATION BY THE BIDDER

I/We .....

(Hereinafter referred to as Bidder) being desirous of participating for tender, having fully understood the scope of tender and having carefully noted all the terms and conditions, specifications etc. as mentioned in the tender document (BDC1718-40001) do hereby declare that-

1. The Bidder is fully aware of all the requirements of the tender document (BDC1718-40001) and agrees with all provisions of the tender document and accepts all risks, responsibilities and obligations directly or indirectly connected with the performance of the tender.
2. The Bidder is fully aware of all the relevant information for proper execution of the proposed scope of work, with respect to the proposed place of works/ site, its local environment, approach road and connectivity etc. and is well acquainted with actual and other prevailing working conditions, availability of required materials and labour etc. at site.
3. The Bidder is capable of executing and completing the work as required in the tender and is financially solvent and sound to execute the tendered work. The Bidder is sufficiently experienced and competent to perform the contract to the satisfaction of BHEL The Bidder gives the assurance to execute the tendered work as per specifications, terms and conditions of the tender on award of work.
4. The Bidder has no collusion with other Bidders, any employee of BHEL or with any other person or firm in the preparation of the tender.
5. The Bidder has not been influenced by any statement or promises by BHEL or any of its employees but only by the tender document.
6. The Bidder is familiar with all general and special laws, acts, ordinances, rules and regulations of the Municipal, District, State and Central Government that may affect the work, its performance or personnel employed therein.
7. The Bidder has never been debarred from similar type of work by any Government undertaking /Department. (An undertaking on Stamp paper in this regard shall have to be submitted)
8. The Bidder accepts that the earnest money may be absolutely forfeited by BHEL if the Bidder fails to sign the contract or to undertake the work within stipulated time.
9. All the information and the statements submitted with the tender are true.

Signature and seal of Bidder

Details of Bidder

Name of the Party: _____

Address of the Party: _____

_____

Email ID: _____

Bank A/c No: _____

Bank Name: _____

Bank Address: _____

_____

IFS Code: _____

Contact Person (Name of a suitable qualified person who will act as project manager during execution of system & shall be single point contact for BHEL.): _____

Phone No of
Contact Person: _____

Signature and seal of Bidder

Annexure-B

CERTIFICATE BY CHARTERED ACCOUNTANT ON LETTER HEAD

This is to certify that M/s .....
.....(Hereinafter referred to as `Company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No ((Part-II) ..... dtd ..... Category: ..... (Micro/Small). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the latest audited financial year ..... **as per MSMED Act 2006 is as follows:**

1. For Manufacturing Enterprises: Investment in plant and machinery (i.e., original cost excluding land and building and the items specified by the Ministry of Small Industries vide its notification No.S.O.1722 (E) dated October 5, 2006:
Rs. .....Lacs.

2. For Service Enterprises: Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:
Rs. .....Lacs.
The above investment of Rs. ..... Lacs in within permissible limit of Rs..... Lacs for.....Micro / Small (Strike off which is not applicable) Category under MSMED Act 2006.

(or)

The company has been graduated from its original category (Micro/Small) (Strike off which is not applicable) and the date of graduation of such enterprise from its original category is .....(dd/mm/yy) which is within the period of 3 years from the date of graduation of such enterprise from its original category as notified vide S.O.No.3322(E) dated 01.11.2013 published in the gazette notification dated 04.11.2013 by Ministry of MSME.

Date:
(Signature)
Name -
Membership Number -

Seal of Chartered Accountant

Annexure –C

Bidders are required to comply Statutory and HSE standards as mentioned in Annexure-C

Bidder shall ensure that their work area is kept clean tidy and free from debris. The work areas must be cleaned on a daily basis. Any disposal of waste shall be done by the Bidder.
All equipment, materials and vehicles shall be stored in an orderly manner. Access to emergency equipment, exits, telephones, safety showers, eye washes, fire extinguishers, pull boxes, fire hoses, etc. shall not be blocked or disturbed.

Confined Space
Before commencing Work in a confined space the Bidder must obtain from Owner a Permit to Work, the Permit to Work will define the requirements to be followed.
As minimum Bidder must ensure the following:
- Confined spaces are kept identified and marked by a sign near the entrance(s).
- Adequate ventilation is provided
- Adequate emergency provisions are in place
- Persons are provided with Confined Space training.
- All necessary equipment and support personnel required to enter a Confined Space is provided.

Tools, Equipment and Machinery
The Bidder must ensure that all tools & equipment provided for use during the Work is:
- Suitable for its intended use;
- Safe for use, maintained in a safe condition and where necessary inspected to ensure this remains the case (any inspection must be carried out by a competent person and records shall be available);
- Used only by people who have received adequate information, instruction and training to use the tool or equipment.
- Provided with Earth leakage circuit breaker (ELCBs) at all times when using electric power cords.

Use of electrical tape for temporary repairs is prohibited.

Working at Height
Any Work undertaken where there is a risk of fall and injury is considered to be working at height.
For any bidder Personnel working at height, bidder shall provide fall prevention whenever possible and fall protection only when prevention fall is not practicable. Before commencing Work in a height the bidder must obtain from Owner a Permit to Work, the Permit to Work will define the requirements to be followed. Supervisor must be present at all point of time, to ensure no deviation occur during the course of work at site.

Fall Prevention System
Fall prevention systems (e.g. fixed guardrails, scaffolds, elevated work platforms) must provide protection for areas with open sides, including exposed floor openings.

Fall Protection Systems
Where fall protection systems are used then the Bidder must ensure the following is applied:
- Only approved full body harness and two shock-absorbing lanyards are used,

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• Prior establishment of a rescue plan for the immediate rescue of an employee in the event they experience a fall while using the system,
• Anchorage points must be at waist level or higher; and capable of supporting at least the attached weight,
• Lifeline systems must be approved by Owner before use.
• Use of ISI marked industrial helmet at all point of time.

Scaffolding

All scaffolds shall subject to a documented inspection by a competent person and clearly marked prior to use. The footings or anchorage for scaffolds shall be sound, rigid and capable of carrying the maximum intended load without settling or displacement. All scaffolding materials should be of MS tubular type.

Guardrails and toe-boards shall be installed on all open sides and ends of scaffold platforms. Scaffolds shall be provided with an access ladder or equivalent safe access. Bidder Personnel shall not climb or work from scaffold handrails, mid-rails or brace members.

Stairways and Ladders

Ladders should only be used for light duty, short-term work or access in line with the below and the Site Requirements.

• Fabricated ladders are prohibited.
• Ladders will be secured to keep them from shifting, slipping, being knocked or blown over.
• Ladders will never be tied to facility services piping, conduits, or ventilation ducting.
• Ladders will be lowered and securely stored at the end of each workday.
• Ladders shall be maintained free of oil, grease and other slipping hazards
• Ladders will be visually inspected by a competent person and approved for use before being put into service. Each user shall inspect ladders visually before using.
• Ladders with structural defects shall be tagged "Do Not Use," immediately taken out of service, and removed from the Site by the end of the day.

Lifting Operations

Cranes and Hoisting Equipment

Bidder will operate and maintain cranes and hoisting equipment in accordance with manufacturer's specifications and legal requirements.

Only Bidder Personnel trained in the use of cranes and hoists are permitted to use them.

Lifting Equipment and Accessories

All lifting equipment / accessories e.g., slings, chains, webbing, chain blocks, winches, jacks etc shall be indicated with their safe working load have an identification number visible on the unit and be inspected and tested in accordance with legal requirements.

Damaged equipment / accessories and equipment shall be tagged "out of use" and immediately removed from Site.

Lockout Tag out ("LOTO")

Prior to performing work on machines or equipment, the Bidder shall ensure that it is familiar with LOTO and Permit to Work procedures and that all of its affected Bidder Personnel receive the necessary training.

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Barricades

Floor openings, stairwells, platforms and walkways, and trenching where a person can fall any distance shall be adequately barricaded and where necessary, well lit. Where there is a risk of injury from a fall then rigid barriers must be used.

Barricades must also be used to prevent personnel entering an area where risk of injury is high e.g., during overhead work activity or electrical testing etc. Such barricading must provide clear visual warning.

Compressed Gas Cylinders

Gas cylinder shall be securely stored and transported, and identified and used in line with the local requirements. Hose lines shall be inspected and tested for leaks in line with local requirements. Flash Black arrestor to be used to prevent any explosion due to back fire.

Electrical Safety

Prior to undertaking any work on live electrical equipment the Bidder must obtain a Permit to Work from Owner. Where ever possible live work should be avoided. Any control measures highlighted shall be implemented prior to work commencing.

The below measures will be taken:

- Work practices must protect against direct or indirect body contact by means of tools or materials and be suitable for work conditions and the exposed voltage level.
- Energized panels will be closed after normal working hours and whenever they are unattended. Temporary wiring will be de-energized when not in use.
- Only qualified electrical Bidder Personnel may enter substations and/or transformer and only after being specifically authorized by Owner.

Hot Works

A Permit to Work must be obtained from Owner prior to any hot works (welding, grinding, open flame work). Suitable fire extinguishing equipment shall be immediately available. Objects to be welded, cut or heated shall be moved to a designated safe location, or, if they cannot be readily moved, all movable fire hazards in the vicinity shall be taken to a safe place. Personnel working around or below the hot works shall be protected from falling or flying objects. Prior to the use of temporary propane or resistance heating devices approval must be obtained from Owner.

Trenching, Excavating, Drilling and Concreting

A Permit to Work must be obtained from Owner and all underground lines, equipment and electrical cables shall be identified and located prior to beginning the work. The Bidder shall assign a competent Bidders Personnel to all trenching and excavation work.

Safe means of access and egress shall be located in trench excavations. Daily inspections shall be conducted by a competent Bidder Personnel for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems or other hazardous conditions. Physical barriers shall be placed around or over trenches and excavations. Flashing light barriers shall be provided at night.

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Environmental Requirements

Waste Management

The Bidder is responsible to remove any waste generated by the work being done on the Site. The Bidder must dispose of the waste in line with the relevant local legislative requirements. The waste disposal route shall be documented and made available for Owner to review at any time and may be subject to Owner's prior approval. Wastes (includes rinse from washing of equipment, PPE, tools, etc) are not to be poured into sinks, drains, toilets, or storm sewers, or onto the ground. Solid or liquid wastes that are hazardous or regulated in any way are not to be disposed of in general site waste receptacles.

Spills

The Bidder is responsible for the provision of adequate spill kits/protection and the clean up and disposal costs arising from such spills.

Emissions

The Bidder shall identify and quantify any emission sources associated with the Works. The control measures associated with these emission shall be subject to the approval of Owner's Emissions include but are not limited to noise, dust, fumes, vapours.

Statutory Compliance

1. The Contractor shall at all times during the continuance of the Contract comply fully with all existing Acts, Regulations and bye law as including all statutory amendments and re-enactment of state or Central Government and other local authorities and any other enactment and acts that may be passed in future either by the State or the Central Government or local authority, including Indian Workmen's Compensation Act, Labour Laws and Equal Remuneration Act, 1976,Factories Act, Minimum Wages Act ,IE Act 1956, etc.
2. If as a result of Contractor's failure, negligence, omission, default or nonobservance of any provisions of any laws, BHEL is called upon by any authority to pay or reimburse or required to pay or reimburse any amount, BHEL shall be entitled to deduct the same from any moneys due or that they become due to the Contractor under this Contract or any other Contract or otherwise recover from the Contractor any sums which BHEL is required or called upon to pay or reimburse on behalf of the Contractor. All registration and statutory inspection fees in respect of his work pursuant to the Contract shall be paid by the Contractor.
3. The Contractor shall pay the labourer engaged by him on the work not less than a fair wage, which expression shall mean, whether for time or piece work, rate of wages as may be fixed by the Public Works Department.
4. The Contractor or his sub-contractor shall not employ a young child who has not completed his fifteen year of age. He/they shall also not employ an adolescent who has not completed his eighteenth year unless he is certified fit for the work as an adult as prescribed under Clause (b) of subsection (2) of section 69 of the Factories Act.1948.
5. The contractor shall also comply fully with the provisions of the payment ofWages Act, 1936.
6. If any enhancement in the rates of Wages becomes payable as a result of the implementation of the Chief labour Commissioner's interpretation of the Contract, Labour

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(Regulation and Abolitions) Central Rules 1971 including an increase of the Wages, the same shall be borne by the contractor/contractors.

7. The contractor shall be responsible for the observance by his sub-contractors, of the foregoing provisions/precautions.
8. The Contractor shall make necessary arrangements for the representative of the Employer and/or his representative to witness the payment made by the Contractor to his labourers. The contractor shall also submit periodical returns of labour employed by him and wages paid, to the Employer's representatives.
9. Safety Gears Etc.: The Contractor shall at his own expenses provide all safety gears for all labours engaged during the work and failing to do so, BHEL shall provide the same and recover the cost thereof from any amount due or which may become due to the Contractor or from any amount lying with them or under their control.

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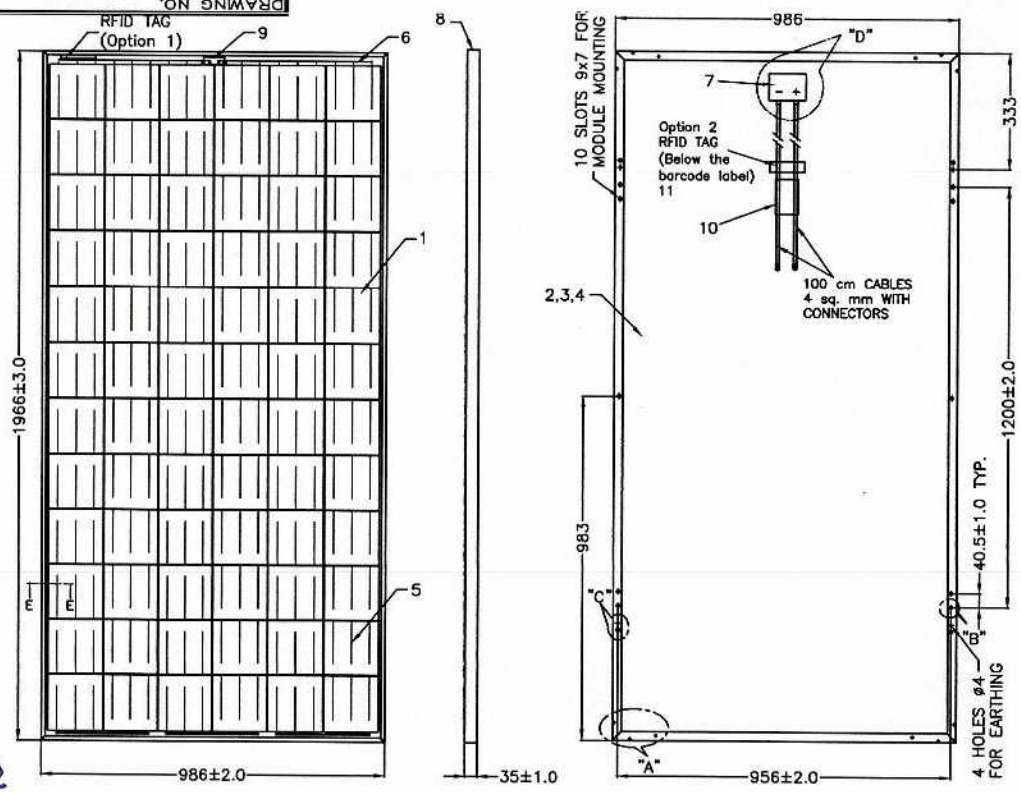
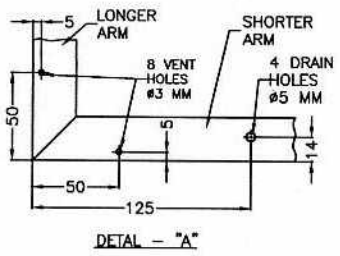
FIRST ANGLE PROJECTION

DRAWING NO. 3 988 00 001 10

ALL DIMENSIONS ARE IN mm





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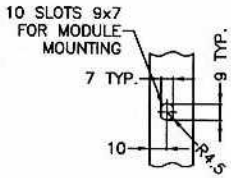

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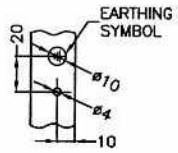
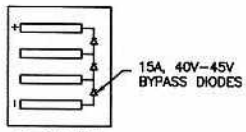


DETAIL – "C"

11	RFID TAG
10	MODULE RATING STICKER
9	PV MODULE SL. NO. STICKER
8	ANODISED ALUMINIUM EDGE FRAME
7	JUNCTION BOX WITH CABLES & CONNECTORS
6	BUS BAR
5	INTERCONNECTS
4	BACK SHEET
3	EVA SHEET
2	HIGH TRANSMISSION TEMPERED GLASS
1	72 Nos. OF 156 mm MULTI CRYSTALLINE SILICON SOLAR CELLS CONNECTED IN SERIES
PART	DESCRIPTION



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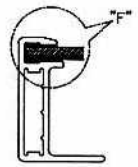

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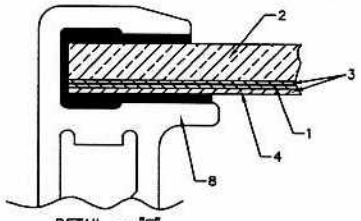


DETAIL – "F"

REV.	DATE	ALTERED / CHECKED / APPROVED	PK / NAR / CNP
02	200117		

TITLE CHANGED TO SOLAR PHOTOVOLTAIC MODULE

REV.	DATE	ALTERED / CHECKED / APPROVED	PK / NAR / CNP
01	160117		

TYPE NO L24270P WAS L24300P

REV.	DATE	ALTERED / CHECKED / APPROVED
00		

FIRST ISSUE

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTROCERAMICS DIVISION, BANGALORE

	NAME	SIGN.	DATE
DRN	PK	Sd/–	191216
CKD	NAR	Sd/–	211216
APPD	CNP	Sd/–	211216

No. OF VAR

DEPT.		SCALE	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
SPV	FOR UNSPECIFIED–TOLERANCES REFER ED 0230499	1 : 10				
CODE 901						

TITLE
SOLAR PHOTOVOLTAIC MODULE (SPV)
156mm Multi Solar Cell (Corner Block Type)

DRAWING NO. 3 988 00 001 10 REV. 02

SHEET NO. 01 NO. OF SHEETS 01

REF. DRG.NO. | SIGN & DATE | INVENTORY NO.

FORM No. A3–02

A3 SIZE

TECHNICAL SPECIFICATION FOR SPV MODULE

1. SPV MODULE TYPE NO. : L24270P

2. CONFIGURATION : SINGLE GLASS LAMINATED TYPE WITH 72 NOS. OF 156-mm MULTI CRYSTALLINE SILICON SOLAR CELLS (12*6) IN SERIES CONFIGURATION.

3. OVERALL SIZE : 1966 (±3) * 986 (±2) * 35 (±1) mm

4. WEIGHT : 22.5 Kg. (Typ.)

5. SPV MODULE FRAME MATERIAL : ANODISED ALUMINIUM

6. JUNCTION BOX : IP 65 GRADE JUNCTION BOX WITH CABLES AND CONNECTORS

7. RFID Tag : As per MNRE Guidelines

8. TYPICAL ELECTRICAL CHARACTERISTICS:

Type No.	Voc (V)	Isc (A)	Vmp (V)	Imp (A)	Pmax (Wp) Min.	Cell Efficiency (%)	Module Efficiency (%)	Fill Factor (FF)
L24270P-300	45	8.70	36.0	8.33	300	17.12	15.47	≥ 0.70
L24270P-305	45	8.80	36.0	8.47	305	17.12	15.47	≥ 0.70
L24270P-310	45	8.80	36.0	8.61	310	17.12	15.47	≥ 0.70

NOTE:

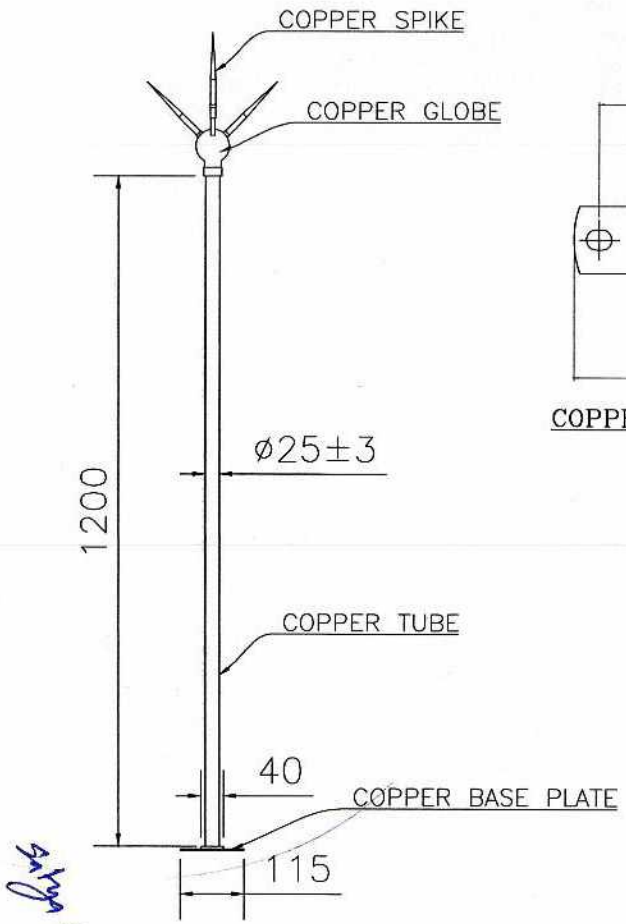
1. Electrical specifications mentioned above are at Standard Test Conditions of 100 mW/sq.cm solar insolation (AM 1.5) and at 25 deg. C temperature.
2. Measurement repeatability of peak power output: ±3%.

Abbreviation:
OPEN CIRCUIT VOLTAGE (Voc), SHORT CIRCUIT CURRENT (Isc)
VOLTAGE AT PEAK POWER POINT (Vmp)
CURRENT AT PEAK POWER POINT (Imp)
PEAK POWER OUTPUT (P max.)

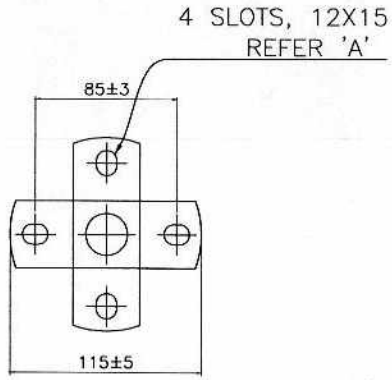
REVISION: (00) - FIRST ISSUE

APPROVED BY: CNP

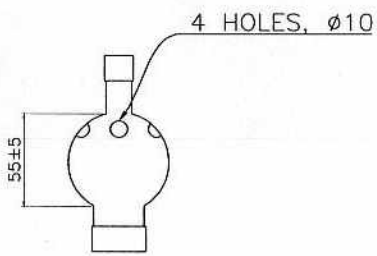
PREPARED	ISSUED	DATE
NAR	SPV ENGG.	18.04.2017



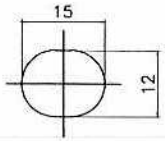
SCALE: 1:1



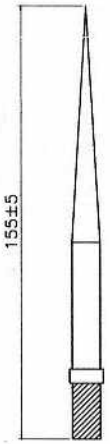
COPPER BASE PLATE
SCALE: 3:1



COPPER GLOBE
SCALE: 3:1



DETAIL 'A'
SCALE: 10:1



COPPER SPIKE
SCALE: 5:1

NOTE:-

(1) LIGHTNING ARRESTOR: 25±3MM DIA 1.2 MTRS. (MIN.) LONG COPPER TUBE WITH COPPER GLOBE ON THE TOP. SCREW ON TYPE CPOPPER SPIKES- 5NOS. MOUNTED ON THE COPPER GLOBE.

(2) FOUNDATION BOLT AM10x125 AS PER IS:5624 WITH M10 HEX. NUT, M10 SPRING WASHER & M10 PLAIN WASHER-4 SETS-FINISH; ZINCPLATED TO 12 MICRONS.

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

BHARAT HEAVY ELECTRICALS LIMITED RUDRAPUR

PROJECT/PRODUCT: SPV POWER PLANT

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	–			
CKD.	–			
APPD.	–			

DEPTT.	UNTOL.DIM.GR.	SCALE	WEIGHT-KG	REF.TO ASSY.DRG.	IT.NO.	NO.OF ITEM
BDC	C/M/F	N.T.S.	–	–	–	

TITLE: LIGHTNING ARRESTOR

DRAWING NO. 3-679-05-00037 REV. 00

SHEET NO.- 01 NO.OF SHEETS- 01 SIZE- A3