



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

PHONE : 080 - 26998377
Fax : 080 -26989217
E-MAIL pragadeeshtg@bhel.in

Bharat Heavy Electricals Limited
(A Government of India Undertaking)
ELECTRONICS DIVISION

P.O. Box No. 2606, Mysuru Road, Bengaluru - 560 026

An ISO 9001, ISO 14001, OHSAS 18001 & ISO/IEC 27001:2005 Company

E-Tender

The Quotations are invited under two part bid system for Supply of Balance of System items and Installation and Commissioning of 20MW (AC) Solar Photovoltaic Grid-connected Power plant at NTPC Gandhar, Gujrat

RFQ NO and date	TGPBOS0055 dated 31.10.2020 (e-tender)
RFQ due date & time	10.11.2020 up to 13.00 hrs (IST)
Date, Time & Venue of Part-I Bid Opening	10.11.2020 after 13.30 hrs (IST) Website - https://bhel.abcprocure.com
Date, Time & Venue of Price Bid opening	Will be intimated later for technically accepted vendors
Address for Commercial Communication & Contact Person in BHEL (MM dept)	Mr. T.G.Pragadeesh (9742576787) Manager Telephone number: 080 26998377, Email: pragadeeshtg@bhel.in Mr. Vivek Kumar Yadav (9449039232), Deputy General Manager Telephone number: 080 26998237 Email: vivekyadav@bhel.in SC&PV Materials Management, BHEL Electronics Division, PB NO 2606, Mysuru road, Bengaluru-560 026. INDIA
Address for Technical Communication & Contact Person in BHEL with CC to MM dept	Mr. Sheetal Prasad (9739913232) Deputy Manager Telephone number:080 26989551, Email: sheetalprasad@bhel.in Mrs. Prachi Rao (9980160918) Additional General Manager Telephone number: 080 26998276, Email: prachi.rao@bhel.in SC&PV ENGINEERING Department, BHEL Electronics Division, PB NO 2606, Mysuru road, Bengaluru-560 026. INDIA



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

PHONE : 080 - 26998377
Fax : 080 -26989217
E-MAIL pragadeeshtg@bhel.in

Bharat Heavy Electricals Limited
(A Government of India Undertaking)
ELECTRONICS DIVISION

P.O. Box No. 2606, Mysuru Road, Bengaluru - 560 026

An ISO 9001, ISO 14001, OHSAS 18001 & ISO/IEC 27001:2005 Company

Any Deviations from or additions to the "General Conditions of Contract" or "Special Conditions of Contract" require BHEL's express written consent. The General Terms of Business or Sale of the Bidder shall not apply to this tender.

Pre-Qualification Criteria (PQC):

- 1) Vendor should have executed contracts of indoor / outdoor electrical installation of 33kV minimum in power plants or sub-stations in India with scope including both supply & erection for cumulative value of minimum Rs. 2 Crores with such individual contract values not less than Rs. 50 Lakhs within last three years from date of tender opening. As evidence to this, the vendor shall submit
 - (a) Copies of Purchase orders from the clients.
 - (b) Certification from clients for completion of supply & erection
- 2) Vendor should have achieved minimum annual average financial turnover of Rs. 2 Crores in three financial years (17-18, 18-19 and 19-20). Bidder shall submit the audited balance sheets for all the 3 years. In case audited copies for financial year 19-20 is not available, unaudited copy for year 19-20 shall be acceptable.
- 3) Any vendors, against whom, action due to non-performance has been initiated by BHEL are not eligible for participation. Such offers will not be considered.

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679079980 Supply of items for module cleaning syst * HSN/SAC : 9954 Test Certificate Supply of items for module cleaning system	1	ST	1	02.02.2021
2	PS0679082034 Supply of MC4 & Y connectors, ties etc * HSN/SAC : 8504 Test Certificate Supply of MC4 and Y connectors, cable ties, HDPE conduits, cable lugs, hardware etc	1	ST	1	02.02.2021
3	PS0679082042 Supply of LT control / instrumentation * HSN/SAC : 8504 Test Certificate Supply of LT control / instrumentation cables with cable installation accessories, hardware, termination kits etc	1	ST	1	02.02.2021
4	PS0679082050 Supply of UPS, Aux Tfr, ACDB, UPS DB etc * HSN/SAC : 8504 Test Certificate Supply of UPS panels, ACDB, UPS DB Batteries, ONAN Aux transformer, Dry Type Aux transformer etc with all related accessories and hardware	1	ST	1	02.02.2021
5	PS0679082085 Supply of items of earthing system * HSN/SAC : 8504 Test Certificate Supply of items of earthing system for solar array field, inverter/CMCS room panels, transformer yard / pooling yard equipment etc including earthing electrodes, Copper flats, earthing cables, GI wires, MS rods (earth mat), earth chamber lids and all related miscellaneous hardware etc	1	ST	1	02.02.2021
					02.02.2021

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES:

1. This RFQ is governed by:
 - a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at <http://edn.bhel.com> (**RFQ-PO Terms & Conditions**)
 - b) Any other specific Terms and Conditions mentioned.
 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same.
- * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

TG Pragadeesh
Semiconductors & Pho

1 OF 6

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
6	PS0679082093 Supply of lightning arrestors * HSN/SAC : 8504 Test Certificate Supply of lightning arrestors along with poles/masts, down conductors, all related accessories and hardware for the complete solar power plant	1	ST	1	
7	PS0679082107 Supply of items for plant lighting * HSN/SAC : 8504 Test Certificate Supply of items for plant lighting system such as electric poles, bend pipes, luminaires/lamps, ballasts, junction boxes, cable conduits, fittings/clamps, other related accessories and hardware etc	1	ST	1	02.02.2021
8	PS0679082115 Supply of miscellaneous items * HSN/SAC : 8504 Test Certificate Supply of miscellaneous items such as SMB mounting hardware, weather monitoring system, cable route markers, cable tags, danger boards, hoarding boards, sign boards, display boards, electrical insulation mat, air conditioners, SCADA office furniture etc	1	ST	1	02.02.2021
9	PS0679082131 Supply of safety related items * HSN/SAC : 8504 Test Certificate Supply of safety related items including fire alarm systems for inverter station /CMCS rooms, fire extinguishers, safety gadgets etc	1	ST	1	02.02.2021

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES: 1. This RFQ is governed by: a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at http://edn.bhel.com (RFQ-PO Terms & Conditions) b) Any other specific Terms and Conditions mentioned. 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same. * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.	For and On behalf of BHEL. TG Pragadeesh Semiconductors & Pho 2 OF 6
---	--

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
10	PS0679082140 Supply of spare items * HSN/SAC : 8504 Test Certificate Supply of spare items	1	ST	1	02.02.2021
11	PS0679088075 Electrical works in Inverter station, * HSN/SAC : 7308 I&C: Electrical works in Inverter station, pooling yard, transformer yard etc	1	AU	1	02.03.2021
12	PS0679088083 I&C: Interconnection of SPV modules,.. * HSN/SAC : 7308 I&C: Interconnection of SPV modules, erection of SMB mounting structures, installation of string monitoring boxes including power cable terminations etc.	1	AU	1	02.03.2021
13	PS0679088091 I&C: Underground cable trenches & laying * HSN/SAC : 7308 I&C: Underground cable trenches & laying of cables for LT AC/DC power cables, HT (33kV) cables, data communication / control / SCADA / OFC cables etc.	1	AU	1	02.03.2021
14	PS0679088105 I&C: Erection of indoor / outdoor electr * HSN/SAC : 7308 I&C: Erection of indoor / outdoor electrical panels (PCU containers, VCB breaker panels, SCADA etc) at the inverter station laying & fixing of cable trays, routing and terminations of DC/AC cables (HT, LT, data / control) at the electrical panels up to LV side of	1	AU	1	02.03.2021

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES: 1. This RFQ is governed by: a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at http://edn.bhel.com (RFQ-PO Terms & Conditions) b) Any other specific Terms and Conditions mentioned. 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same. * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.	For and On behalf of BHEL. TG Pragadeesh Semiconductors & Pho 3 OF 6
---	--

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	inverter/auxiliary transformers, laying of earth grids (external underground / internal within the rooms), earthing connections etc.				
15	PS0679088113 I&C: Erection of indoor outdoor electric * HSN/SAC : 7308 I&C: Erection of indoor outdoor electrical panels (VCB breaker panels, SCADA, ACDB/DCDB panels, UPS panels, Aux transformers etc) in the main CMCS control room, 33KV pooling yard laying & fixing of cable trays, routing and terminations of HT, LT, data/control at the electrical panels, auxiliary transformers cabling, laying of earth grids (external underground / internal within the rooms), earthing connections etc	1	AU	1	02.03.2021
16	PS0679088121 I&C: Erection of 33kV transformer yards * HSN/SAC : 7308 I&C: Erection of 33kV transformer yards attached to the 4 inverter stations with necessary land leveling within the yards, laying of underground earth mat grid, erection of inverter transformers, underground cable trenches, routing and terminations of 33kV/LT/ data/ control cables at inverter transformers etc	1	AU	1	02.03.2021
17	PS0679088130 I&C of module cleaning system * HSN/SAC : 7308	1	AU	1	02.03.2021
18	PS0679088148 I&C: Installation works of WMS, SCADA, * HSN/SAC : 7308 I&C: Installation works of Weather monitoring station and	1	AU	1	02.03.2021

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES: 1. This RFQ is governed by: a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at http://edn.bhel.com (RFQ-PO Terms & Conditions) b) Any other specific Terms and Conditions mentioned. 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same. * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.	For and On behalf of BHEL. TG Pragadeesh Semiconductors & Pho 4 OF 6
---	--

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003 (address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	SCADA system laying and terminations of OFC/ instrumentation/ data cables etc at SCADA panels of inverter station and CMCS room				
19	PS0679088156 I&C: Earthing system for solar array * HSN/SAC : 7308 I&C: Earthing system for solar array field including laying of underground earth mat grids and interconnection to the module mounting structures, I&C of lightning protection system (lightning arrestors) with earthing provisions as per respective clauses	1	AU	1	02.03.2021
20	PS0679088164 I&C of lighting system * HSN/SAC : 7308 I&C of lighting system for illumination of the complete power plant including cable terminations at the yard lighting poles as well as ACDB panels of inverter station / main control room etc as.	1	AU	1	02.03.2021
21	PS0679088172 I&C of miscellaneous and safety items * HSN/SAC : 7308 I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, SCADA office furniture, fire extinguishers, fire alarm system, firefighting system, LED display for SCADA system, grouting of electrical panels in inverter station/CMCS rooms etc	1	AU	1	02.03.2021
22	PS0679088180 I&C: Pre-commissioning inspections / che * HSN/SAC : 7308	1	AU	1	02.03.2021

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES: 1. This RFQ is governed by: a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at http://edn.bhel.com (RFQ-PO Terms & Conditions) b) Any other specific Terms and Conditions mentioned. 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same. * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.	For and On behalf of BHEL. TG Pragadeesh Semiconductors & Pho 5 OF 6
---	--

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0055 RFQ DATE : 28.10.2020	Due Date/Day: 10.11.2020 TUE Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state / central departments / CEA/ CEIG etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant				

Total Number of Items - 22

- 1.
- 2.

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES:

1. This RFQ is governed by:
 - a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at <http://edn.bhel.com> (**RFQ-PO Terms & Conditions**)
 - b) Any other specific Terms and Conditions mentioned.
 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same.
- * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

TG Pragadeesh
Semiconductors & Pho

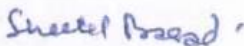
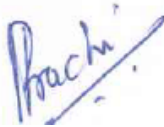
6 OF 6

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 1 OF 56

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited.
It must not be used directly or indirectly in anyway detrimental to the interest to the company.

**Technical specification
for
Supply of Balance of System items and Installation and Commissioning
of
20MW (AC) Solar Photovoltaic Grid-connected Power plant
at
NTPC Gandhar, Gujrat**

Revision details:	Prepared  Sheetal Prasad	Approved  Prachi Rao V	Date: 26.10.2020
-------------------	---	--	-------------------------

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 2 OF 56

1	Introduction
1.1	Overall project outline of 20MW (AC) solar photovoltaic power plant
1.2	Scope of this tender specification
1.3	Enclosures to this tender specification (Tender purpose only)
2	Location/ address of power plant:
3	Vendor scope of supply, Installation and Commissioning
4	BHEL scope of supplies and works
5	Technical specification for supply, installation and commissioning
5.1	Temporary site office for vendor use
5.2	Electrical power / water for construction
5.3	Construction of temporary yards for safe storage of vendor supplied items
5.4	Unloading, safe storage and movement of supply items received at site:
5.5	Series interconnection of SPV modules to form strings
5.6	Routing of 1Cx 4 cable below the SPV modules
5.7	Interconnection of SPV module strings to 1Cx4 cable, Supply MC4 and Y- connectors
5.8	Installation of string monitoring boxes including supply/erection of mounting structures
5.9	Routing of 1Cx4 cable in DWC HDPE pipes underground between the rows of solar array
5.10	Termination of 1Cx4 cables on input side of SMBs
5.11	Ferruling for 1Cx4 cable
5.12	Underground cable trenches and laying of 3.3 KV 1Cx400 sqmm in solar array field
5.13	Laying of 1Cx400 sqmm cables and terminations at PCU
5.14	Termination of 1Cx400 sqmm DC power cables at SMBs
5.15	Laying and Termination of 1Cx400 LT AC power cables between PCU and Inverter Transformer
5.16	Identification marking of cables using cable tags
5.17	Installation of electrical panels / Container at Inverter Station, main control room and 33KV Pooling yard
5.18	Supply and Installation of UPS
5.19	Laying, termination of LT/HT/aux supply cables/ inverter station/ main control rooms and in associated 33KV yards
5.20	Laying and installation of Control / data / instrumentation / OFC cables
5.21	Erection of 33kV yard Equipments
5.22	Supply, erection and commissioning of two auxiliary transformer- Dry type and ONAN
5.23	Auxiliary AC/DC power supply system
5.24	Supply and Installation of Weather monitoring system
5.25	Installation and commissioning of SCADA integration systems
5.26	Supply and installation of lightning protection system (ESE type lightning arrestors) to protect the electrical equipment of SPV power plant and Buildings from lightning.
5.27	EARTHING SYSTEM
5.28	Design, supply and installation of Plant lighting System
5.29	Fire Alarm and Firefighting systems
5.30	Design, Supply and installation of Module Cleaning System
5.31	Identification marking using painting
5.32	Cable markers and cables tags
5.33	Display boards and sign boards

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 3 OF 56

5.34	Electrical insulation mat
5.35	Supply and Installation Miscellaneous Items
5.36	Pre-commissioning inspections/ checks/tests, Quality checks, MRT tests, coordination/liaison with state /central departments/CEIG etc. for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning
5.37	Spares required to be supplied along with main consignment
6.0	SAFETY MANAGEMENT
7.0	General conditions applicable during supply, installation and commissioning
8.0	Documents to be submitted for BHEL/NTPC approval during detailed engineering
Ann-1	1. LT SWITCHGEAR
	2. LT POWER & CONTROL CABLES
	3. INSTRUMENTATION CABLES
	4. CABLE INSTALLATION METHODOLOGY
	5. AUXILIARY POWER SUPPLY SYSTEM

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 4 OF 56

1.0 Introduction

1.1 Overall project outline of 20MW (AC) solar photovoltaic power plant

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a Solar photovoltaic (SPV) power plant for NTPC at Gandhar, Distt Bharuch, Gujarat within Gas Based Power Plant Installation.

Solar PV modules employed at the plant generates DC electricity that in turn is inverted to AC in the range 600-700 V. Output of each solar block (5MW) with independent Inverter station (IR) / transformer yards shall be stepped up to 33kV. Solar plant comprises of 4 no of Inverter stations (Containerized PCUs) with each associated 5 MW PV array and 1 no. of Main Control Room (CMCS/ CR). All the blocks are combined to achieve the 20MW output as per the power plant rating at main pooling switchgear.

Power evacuation is at 220KV level. From main pooling switchgear, cable/ transmission line shall be run upto Power transformer in 220KV Switchyard bay proposed for solar plant in existing NTPC Switchyard. The 220 kV Switchyard shall be with Double Main Bus & Transfer Switching Scheme as indicated in Tender SLD.

Details are given in subsequent clauses

The plant is envisaged to have several other infrastructural support systems such as module cleaning system for SPV modules, plant illumination system, fire alarm system, boundary fencing, approach roads, pathways, drainage system etc.

1.2 Scope of this tender specification

Vendor scope includes supplies and activities but not limited to design, engineering, drafting of drawings, obtaining approval from BHEL/NTPC/STU/PGCIL/GETCO/ GEDA/ CEIG /CEA whichever is applicable for the drawings, manufacture/ testing/ inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage, erection, coordination / liaison with concerned state / central authorities such as GETCO/ CEIG/ CEA/ GEDA etc, and commissioning for the following activities of the project as detailed in this specification.

Solar plant installations as detailed in this specification upto main pooling switchgear is in scope of vendor. 33KV cabling from main pooling switchgear to power transformer and 220KV installations till power evacuation point in 220KV switchyard is in scope of 220KV Switchyard contractor's scope.

Note: The above is only a broad outline of vendor scope for the sake of introduction. The detailed vendor scope is elaborated under various other sections of this specification.

1.3 Enclosures to this tender specification (Tender purpose only)

1	Tentative AC single line diagram of overall Solar PV power plant
2	Tentative SPV plant layout with solar array, control/ inverter rooms
3	Tentative Quality Assurance plans
4	Tentative Manufacturing and Field Quality plans
5	NTPC Approved Vendor List

2.0 Location/ address of power plant:

The 20 MW Solar PV Plant shall be setup at NTPC Gandhar Gas Power Plant in Gujarat.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 5 OF 56

District	Bharuch, Gujarat
Nearest Highway	NH 64 (10 km)
Nearest Railway Station	Bharuch Jn (25 km)
Nearest Commercial Airport	Vadodara (78 km)
Indicative Coordinate	21°49'19.0"N 73°06'53.0"E

3.0 Vendor scope of supply, Installation and Commissioning

The table below indicates the scope of work for the vendor, as briefly outlined. Note that this is not an exhaustive list, supplies and activities will be in line with detailed specification clauses.

#	Scope of work (as briefly outlined)	Qty
1	Supply of MC4 and Y connectors, cable ties, HDPE conduits, cable lugs, hardware etc	1 set
2	Supply of LT control / instrumentation cables with cable installation accessories, hardware, termination kits etc	1 set
3	Supply of UPS panels, ACDB, UPS DB, Batteries, ONAN Aux transformer, Dry Type Aux transformer etc with all related accessories and hardware	1 set
4	Supply of items for module cleaning system	1 set
5	Supply of items of earthing system for solar array field, inverter/CMCS room panels, transformer yard / pooling yard equipment etc including earthing electrodes, Copper flats, earthing cables, GI wires, MS rods (earth mat), earth chamber lids and all related miscellaneous hardware etc	1 set
6	Supply of lightning arrestors along with poles/masts, down conductors, all related accessories and hardware for the complete solar power plant	1 set
7	Supply of items for plant lighting system such as electric poles, bend pipes, luminaires/lamps, ballasts, junction boxes, cable conduits, fittings/clamps, other related accessories and hardware etc	1 set
8	Supply of miscellaneous items such as SMB mounting hardware, weather monitoring system, cable route markers, cable tags, danger boards, hoarding boards, sign boards, display boards, electrical insulation mat, air conditioners, SCADA office furniture etc	1 set
9	Supply of safety related items including fire alarm systems for inverter station /CMCS rooms, fire extinguishers, safety gadgets etc	1 set
10	Supply of spare items	1 set
11	I&C: Electrical works in Inverter station, pooling yard, transformer yard etc	1 AU
12	I&C: Interconnection of SPV modules, erection of SMB mounting structures, installation of string monitoring boxes including power cable terminations etc.	1 AU

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 6 OF 56

13	I&C: Underground cable trenches & laying of cables for LT AC/DC power cables, HT (33kV) cables, data communication / control / SCADA / OFC cables etc.	1 AU
14	I&C: Erection of indoor / outdoor electrical panels (PCU containers, VCB breaker panels, SCADA etc) at the inverter station laying & fixing of cable trays, routing and terminations of DC/AC cables (HT, LT, data / control) at the electrical panels up to LV side of inverter/auxiliary transformers, laying of earth grids (external underground / internal within the rooms), earthing connections etc.	1 AU
15	I&C: Erection of indoor outdoor electrical panels (VCB breaker panels, SCADA, ACDB/DCDB panels, UPS panels, Aux transformers etc) in the main CMCS control room, 33KV pooling yard laying & fixing of cable trays, routing and terminations of HT, LT, data/control at the electrical panels, auxiliary transformers cabling, laying of earth grids (external underground / internal within the rooms), earthing connections etc	1 AU
16	I&C: Erection of 33kV transformer yards attached to the 4 inverter stations with necessary land leveling within the yards, laying of underground earth mat grid, erection of inverter transformers, underground cable trenches, routing and terminations of 33kV/LT/ data/control cables at inverter transformers etc	1 AU
17	I&C of module cleaning system	1 AU
18	I&C: Installation works of Weather monitoring station and SCADA system laying and terminations of OFC/ instrumentation/ data cables etc at SCADA panels of inverter station and CMCS room	1 AU
19	I&C: Earthing system for solar array field including laying of underground earth mat grids and interconnection to the module mounting structures, I&C of lightning protection system (lightning arrestors) with earthing provisions as per respective clauses	1 AU
20	I&C of lighting system for illumination of the complete power plant including cable terminations at the yard lighting poles as well as ACDB panels of inverter station / main control room etc as.	1 AU
21	I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, SCADA office furniture, fire extinguishers, fire alarm system, firefighting system, LED display for SCADA system, grouting of electrical panels in inverter station/CMCS rooms etc	1 AU
22	I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state / central departments / CEA/ CEIG etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant (Trial run and site cleaning)	1 AU

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 7 OF 56

NOTE- It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning for safe and satisfactory operation of the plant shall be included under scope of the bidder.

4.0 BHEL scope of supplies and works

For clarity to the vendor, other items and activities within BHEL scope of solar PV plant end of the project are listed below:

1	Supply of 1C x 4 sqmm Solar Cable	~180 KM
2	Supply of DC cable, 3.3KV 1C x 400 sqmm, Al, XLPE, armoured as per IS: 7098 (from SMB to PCU)	~55 KM
3	Supply of LT cable, 3.3KV 1C x 400 sqmm, Al, XLPE, armoured as per IS: 7098 (from PCUs to Inverter transformers)	~3.5 KM
4	Supply of 33kV cable, 1C x 240, Al, XLPE, armoured as per IS: 7098 (for all 33kV connections within solar plant including Aux transformer HV side)	~9 KM
5	Supply of containerized power conditioning units (PCUs) of 2 x 2.5 or 1 x 5 MW with Dry type Auxiliary transformer, UPS, ACDBs for Inverter stations	4 Sets
6	Supply of String Monitoring Box	104 Sets
7	Supply of inverter transformer 5.3MVA, 33kV/xxx-xxx V, ONAN	4 Nos
8	Supply of 33kV breaker panels	5 Sets (12 Nos)
9	Supply of SCADA system including PLC panels, computers, software systems and related peripherals & accessories	5 set
10	Supply of GI earthing strips for PV array, Inverter station, 33Kv pooling yard, control room	1 Set
11	33KV cabling/ Line work from main pooling switchgear to Power transformer	1 set
12	220KV Switchyard works	1 set
13	Supply and Installation of Module mounting structure including module mounting	~1616 Sets
14	Construction of Inverter and aux transformer foundations including fencing	1 Set
15	Construction of foundation for Inverter station, 33KV pooling yard	1 Set
16	Unloading/ storage/ security for BHEL supplied items.	-
17	Construction of RCC main control room except those vendor scope supply/I&C activities defined under this specification.	1 room
18	Construction of civil works such as approach roads, pathways, drains, overall plant boundary fencing, soak pit, septic tank.	-

5.0 Technical specification for supply, installation and commissioning

#	BHEL specification
5.1	Temporary site office for vendor use Vendor shall make necessary office arrangements such as porta cabin, furniture, electrical points/ fittings etc. on their own for their use/ occupation at site during the period of project execution. Note: Site offices for BHEL and NTPC shall be arranged by BHEL.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 8 OF 56

5.2	Electrical power / water for construction Vendor shall organize, on their own, necessary electrical power supply such as DG sets and water supply etc. required for construction activities.
5.3	Construction of temporary yards for safe storage of vendor supplied items Vendor shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct temporary yards for safe storage of vendor supplied items.
5.4	Unloading, safe storage and movement of supply items received at site: A. Items supplied by vendor (1) Vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc.) for unloading the items (supplied by the vendor) received at site and subsequent movement to storage yards. (2) Similar arrangements shall also be made by vendor for movement of the stored items from storage yards to the exact construction locations within the project site. Vendor shall bring the unused material back to stores on daily basis. (3) Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, LRs, delivery challans, material receipt certificates etc.) and shall take approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL. (4) Registers shall be maintained for the yard to keep track of incoming/outgoing items. (5) Safety of items shall be in vendor scope. Accordingly, suitable watch and ward shall be deployed on round-the-clock basis. B. All other items (supplies from BHEL and other vendors) (1) Receipt, unloading, storage, security guards shall be in scope of BHEL/ other vendors. (2) However, movement of these items from their respective storage locations to the points of construction is in scope of vendor (excluding modules and MMS). Accordingly, vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc.) for this purpose as and when required. Vendor shall bring the unused material back to stores on daily basis. (3) Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, LRs, delivery challans, material receipt certificates etc.) and shall take approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL.
5.5	Series interconnection of SPV modules to form strings Supply of SPV modules is in BHEL scope. Type of module: L24270 (~330Wp). Total quantity = ~90,000 Nos Vendor shall interconnect the SPV modules as follows: (a) Each module is fitted integrally with a junction box having positive and negative polarity cables (4 sq-mm). (b) Positive cable of one module shall be connected to the negative cable of adjacent module. The cables have MC4 type of connectors. One polarity cable has male type connector, while the other has female type connector. (c) This way, 30 modules shall be connected in series. Each set of connections is called as a sub string. (d) Each Module mounting structure (MMS) contains 60 nos of SPV modules. Thus from each MMS, 2 sets of series strings will be formed via leap-frog method. After placing the purchase order on vendor, BHEL will provide layout drawings that will describe the exact way in which the series strings are formed. Vendor shall implement the interconnection as per these drawings.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 9 OF 56

5.6	Routing of 1Cx 4 sqmm cable below the SPV modules (1) 1Cx4 sq-mm cables connecting the SPV module strings to SMBs suitably routed below the SPV modules and along the horizontal C-lip purlin member of MMS structure. These cables shall be dressed properly and fastened to the purlin using UV resistant cable ties of suitable length. (2) Cable ties shall be in vendor scope of supply. (3) Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85 deg C, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit or other reputed equivalent subject to approval of BHEL/NTPC. Width and Length shall be so appropriate as to ensure that the bunched cables are held firmly to the mounting structure. Spacing between two adjacent cable ties shall be so appropriate as to ensure that there is no loose hanging of cables. During detailed engineering, BHEL/NTPC approval shall be obtained for the selected brand and sizes of cable tie. (4) Spacing between two adjacent cable ties shall be so appropriate as to ensure that there is no loose hanging of cables. (5) Solar cables, wherever exposed to direct sunlight (including gaps between tables) and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.
5.7	Interconnection of SPV module strings to 1Cx4sqmm cable and Supply MC4 & Y-connectors (1) Vendor shall connect two series sub-strings of 60 SPV modules (each of 30 SPV modules) to 1Cx4sqmm cable (copper, XLPO insulation cable) using Y-connector and MC4 connectors. (2) Vendor shall supply ~1500 sets (1 set = 2 nos) each of Y-connectors and ~3000 sets (1 set = 1 male + 1 female connector) MC4 connectors. These quantities are excluding spares requirement. (3) Extra quantity shall be procured for any damages / pilferage during the installation by vendor at site. Such additional quantities will not be paid for. Vendor shall ensure that there shall not be any shortage during execution time. (4) Four sets of tool kits shall be supplied. This shall include crimping plier MC4, open end spanner set MC4, stripping plier MC4, socket wrench insert to tighten, socket wrench insert to secure, inserts for 4 sq-mm. (5) MC4 and Y connectors to be supplied and installed shall be In accordance with IEC 62852: 2014. Rated Current, IEC (85 degC) - 30A Rated Voltage- 1500 V Connector design- Snap in Locking Type Protection degree- IP68 (mated) Ambient Temperature- (-) 40 degC to (+) 85 degC Protection/Safety Class- Class II Contact material- Cu Contact Surface material- Silver/ Tin Contact resistance for plug connector- <= 0.5 milli-ohms Stripping length- 10 mm Inflammability Class acc to- UL 94-V0 Insulating material- PPE/ PPO/ Polyamide Pollution degree- 3 Certification- UL/TUV/CSA/EAC or equivalent

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 10 OF 56

	The MC4 and Y connectors proposed shall have type test certificates for the following- I. Protection Degree (IP) II. Operating Temperature III. Inflammability IV. Pollution Degree V. Voltage Withstand (Rated Voltage/Test Voltage) VI. Product Certification (7) vendor shall ensure that MC4 and Y connectors to be mated shall be of same make and model as in SMB and PV modules. In case other make/ models are offered, vendor shall type test for Inter-compatibility as per clause no.6.3.11 of IEC 62852:2014 for offered make(s). Mating of connectors of different makes/model shall not be acceptable if not tested for inter-compatibility by any accredited lab. (6) Approved make: Multicontact, Bizlink, Sunlont, Elmex or other reputed equivalent subject to BHEL/ NTPC approval during detailed engineering. (7) In addition, any other required tools and tackles for crimping of cable etc. shall be arranged by vendor.
5.8	Installation of string monitoring boxes including supply/erection of mounting structures (1) Supply of string monitoring boxes (SMB) with wireless communication, 104 sets, is in BHEL scope. These are 16-in/ 1- out type. SMBs will be supplied along with transmitter and receiver antennas and communication setup for SCADA. (2) SMB shall be mounted with fixing frame on the Module Mounting structures. Provision will be provided in the Module mounting structure to mount the SMB. Frame for mounting of SMBs will be supplied separately by BHEL. However, necessary hardware like nuts, bolts, washers etc shall be in the vendor scope of supply. SMB antenna will be installed with necessary accessories. All hardware like nuts bolts washer etc are in scope of bidder. Antenna fixing on/ near each Inverter room/ MCR is also in scope of vendor. All required structure/foundation/grouting/ hardware supply and work is in scope of vendor. Fixing of accessories and cabling upto SCADA is in scope of vendor. (3) Vendor shall install the SMBs on the module mounting structures. (4) All necessary labour, tools, machinery etc for erection work shall be in vendor scope.
5.9	Routing of 1Cx4sqmm cable in DWC HDPE pipes underground between the rows of solar array (1) Where 1Cx4sqmm cables run vertically along MMS leg or between two rows of structure (or) where the cables cross over the pathway separation between two adjacent solar array blocks, HDPE double walled corrugated (DWC) pipe shall be provided to route the cables underground from one row/ block to the other. HDPE DWC pipe together with necessary HDPE couplers/ joints (T-joints, elbows, bends etc.) shall be within scope of vendor supply. Where cables run vertically along MMS leg, HDPE pipes shall be routed properly and tied/ clamped to leg. For this, necessary UV protective cable ties of suitable length or clamps shall be in vendor's scope of supply. (2) Specification of HDPE DWC pipe: As per relevant IS; ID shall be selected to accommodate the number of 1Cx4 cables to be guided. A maximum of 4 circuits can be run through single HDPE pipe. Fill ratio will be considered max 40%. However, exact ID shall be selected to ensure that only a maximum of 40% of the ID space is occupied by the cables. Vendor to ensure that there is no gap and proper packing at the junction of two pipes, in which DC cable is laid, using proper method and accessories, like bell mouth. Make, part number, sizes/ dimensions shall be submitted for BHEL/NTPC approval during detailed engineering.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 11 OF 56

	(3) Cables with HDPE pipe (and couplers/joints etc.) shall be directly buried underground as per IS: 1255. Continuous trenches shall be excavated on either side of the SMB. In addition, for each SMB, there shall be minimum one pathway crossing, for which trench shall be excavated. - Trench depth = 600 mm minimum - Trench width = As per conduit size and number of conduits - Trench shall, then, be filled with refill soil and compacted. Excavation, laying of pipes, routing of 4 sqmm cables through HDPE pipe, fixing of couplers, sealing end of the HDPE pipes, trench backfilling shall be vendor's scope. Trenches shall be backfilled, compacted and the area shall be neatly levelled. (4) Total length of HDPE DWC pipe and quantity of couplers/joints shall be as required. (5) Bending radii for cables shall be as per IS: 1255. (6) At road crossings, cables shall be routed through Hume pipe of class NP3 of appropriate size that shall be in vendor scope of supply and technical details/ brand etc. shall be submitted for BHEL/ NTPC approval during detailed engineering. (7) All cable entry openings of conduit pipes, after laying/ termination of the cables, shall be sealed using appropriate sealant (single component thermoplastic insulating compound) to ensure water proof tightness. The sealant supply will be vendor's scope of supply. (8) Solar cables, wherever exposed to direct sunlight and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits.
5.10	Termination of 1Cx4sqmm cables on input side of SMBs 1Cx4 sqmm cables of positive and negative polarities originating from SPV module strings shall be terminated at the input side of SMBs using 4 sqmm cable with MC4 connectors. MC4 connector are already fixed in cable entry/exit of SMBs as part of BHEL scope of supply. However, supply and fixing of MC4 connectors required for connecting 4 sqmm cables to strings and SMBs and Y connectors shall be done by Vendor (2) Vendor scope includes removal of sleeve at the cable end, fixing of Y and MC4 connectors of the appropriate type/size and connecting the MC4 connector to the SMB. These cables shall be supported suitably and dressed neatly. (3) 4 sqmm cable will be supplied by BHEL, MC4 connectors shall be supplied by vendor. (4) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope
5.11	Ferruling for 1Cx4sqmm cable 1) For 1Cx4 sqmm DC solar array cable, vendor shall supply and provide UV resistant ferrules printed with source/destination identification of cable. Printing details shall be given by BHEL after placement of order. Printing shall be of appropriate size to ensure readability. 2) Supply of ferrule shall be in vendor scope. 3) Ferrules shall be provided on all termination ends: module end and SMB ends for all 4 sqmm cables.
5.12	Underground cable trenches and laying of 3.3 KV 1Cx400 sqmm in solar array field (1) DC power cable 3.3 KV 1Cx400 sqmm, Al conductor, XLPE, armoured (from SMB to PCU) shall be laid underground by way of direct burying as per IS:1255. Supply of above the cables shall be in BHEL scope. Cable laying shall be carried out as per "Cable installation methodology" defined in this specification. (2) Typical trench details/dimensions are below only for tender purpose. - Total trench depth = 1015 mm minimum - Trench width = As per number of cables laid.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 12 OF 56

	(c) Trench shall have layers one over the other as below (from bottom to top): 1. Bottom layer shall be sand of IS: 383 with 75mm minimum thickness 2. 1Cx400 sqmm cable shall be laid over the sand layer 3. Another layer of sand of 75 mm minimum thickness. 4. Single layer of brick as protective cover covering all cables 5. Trench shall, then, be filled with refill soil and compacted (3) Communication from SMB to SCADA shall be through wireless medium. (4) Bending radii for cables shall be as per IS:1255. At road crossings, cables shall be routed through Hume pipe (Class NP3, 300 dia) of appropriate size that shall be in vendor scope of supply. Any damage/repair work to existing road or drain during trench work will be done by vendor. At Nallah crossings, cables shall be routed through Hume pipe (Class NP3, 300 dia) of appropriate size or Covered cable trays/ structures as shall be approved by NTPC. Hume pipe and cable trays/ structures of appropriate size shall be in vendor scope of supply, fabrication, grouting and erection. Vendor shall take utmost care in laying the cables in order to prevent wastages and damages on outer sheath and inner insulation. Cable shall be drawn with rollers only to ensure no damage to cable during laying. In case cables found to be damaged/ cut after the laying in trenches, vendor shall implement suitable corrective action such as cable jointing, or re-lay a new cable in consultation with BHEL.
5.13	Laying of 1Cx400sqmm in inverters rooms and terminations at PCU (1) 1Cx400 sqmm cables (Al conductor, XLPE insulation, armoured: BHEL scope of supply) running from SMBs (through outdoor cable trenches) shall be routed into the Containers at Inverter stations. (2) Vendor shall carry out drilling of holes in cable gland plates of the PCUs for the 13 positive and 13 negative DC inputs of 1Cx400sqmm cable. Gas cutting method is strictly not allowed. Vendor shall organize hole-saw cutters of appropriate size for this purpose. All necessary drilling machines / tools etc. shall be made available at site. (3) Prior to termination, each cable shall be checked for continuity and megger. In case any cable found defective, vendor shall implement suitable corrective action such as cable jointing, replacement/re-laying of cable etc. as applicable. (4) Vendor shall carry out glanding of the cables following which the glands shall be fitted to the respective holes of gland plates. (5) Vendor shall carry out the 1Cx400 sqmm cable terminations for the 13 positive and 13 negative inputs that include tasks such as unsleeving, crimping, connecting to the tinned copper bus bars, tightening using torque wrench etc for all PCUs (7) Vendor shall arrange torque wrench of appropriate range. Torque setting shall be as per the bolt size and property class. For the setting, approval shall be obtained from BHEL site engineer. (8) All tools/accessories such as crimping tools etc. required to carry out the termination shall be within scope of vendor.
5.14	Termination of 1Cx400sqmm DC power cables at SMBs (1) Cables of 1Cx400 (Al conductor, XLPE insulation, armoured) shall be terminated at the output side of SMBs (positive, negative terminals). Supply of this cable is in BHEL scope. (2) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the tinned copper bus bar within the SMB. Cables shall enter the SMB through the metallic cable glands that are also supplied by BHEL along with SMBs. (3) Bi-metallic lug / Al lug with bi-metallic plate shall be in vendor scope of supply. Make shall be Dowell, or equivalent subject to approval of BHEL/NTPC Lug shall match the cable conductor material /size and also the tin plated copper bus bar of SMB. (4) Quantity of lug and hardware shall also include contingency requirements arising out

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 13 OF 56

	of shortage due to various reasons (damage, theft etc) during installation. (5) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope.
5.15	Laying and Termination of 1Cx400 LT AC power cables at PCU and Inverter Transformer (1) LT Cables 5 runs of 1C x 400 sqmm Al conductor, XLPE, armoured per phase shall be laid between AC side of the PCU and the LT side of the Inverter transformer over the cable trays. Supply of these cable trays along with the cable support structure shall be in vendor's scopes. Cables shall be laid in trefoil arrangement. Trefoil clamps supply and fixing in in vendor's scope. AC side of cables will be terminated overhead as per design of Containerised Inverter solution. (2) Vendor scope includes removal of sleeve at the cable end, crimping with suitable Bimetallic Lug or Aluminium Lug with Bimetallic washer/ strip. Cables shall enter the PCU and Transformer through the metallic cable glands. Supply of Lugs and Glands required for Inverter Transformer side termination shall be in vendor's scope. (3) Cable lug make shall be Dowell, or equivalent subject to approval of BHEL/NTPC. (4) Cable gland metallic type shall be of COMET make or equivalent subject to approval of BHEL/NTPC. (5) Quantity of lug and hardware shall also include contingency requirements arising out of shortage due to various reasons (damage, theft etc.) during installation. (6) All necessary tools such as pliers, strippers, crimping tool etc. shall be within vendor scope.
5.16	Identification marking of cables using cable tags 1) Cable tags shall be provided on all power cables at both ends just before entering the equipment enclosure and every 5 m on cable tray or trench run. 2) Cable tags shall be of rectangular shape. 3) Cable tag shall be of 2mm thick aluminum with number punched (embossed) on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. 4) ID numbering scheme shall be provided to vendor after Purchase order placement. Vendor shall submit the technical details of cable tags for BHEL/NTPC approval during detailed engineering.
5.17	Installation of electrical panels / Container at Inverter Station, main control room and 33KV Pooling yard I. Panel installation at Inverter Station Containerized PCU solution is supplied by BHEL. Vendor shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the panels as below (Quantities mentioned are per inverter room): (a) 2x 2.5 MW or 1 x 5 MW PCU Container consisting of PCU, aux transformer, AC distribution board, UPS, batteries, PCU ducts, PCU cable ducts: 1 sets (This shall be installed on the RCC foundation. Construction of foundation is in BHEL scope) (b) 33kV outdoor VCB panels: 1 No. (This shall be installed on the RCC foundation. Construction of foundation is in BHEL scope) (c) SCADA panel : 1 No (This shall be installed on the RCC foundation. Construction of foundation is in BHEL scope) Panel installation within main control room:

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 14 OF 56

	(a) ACDB main panel with provision of two inputs source: 1 set (b) Distribution boards (wall mounted): DCDB, UPS DB, CR DB (room utilities), LDB (plant lighting), PDB (power DB): 1 No each + any extra boards as required (c) SCADA panel: 2 Nos (d) HMI SCADA control desk with PCs and accessories: 1 set (e) UPS with battery bank – 1 Nos Outdoor Panel installation in 33KV pooling yard near Control room: (a) 33kV outdoor VCB Switchboard: 1 sets. (1 set shall consist of 8 nos 33KV VCB panels. These shall be installed on the RCC foundation. Construction of foundation is in BHEL scope) (b) Outdoor ONAN 100KVA, 33KV/415V Auxiliary Transformer- 1 no (c) Outdoor Dry type 100KVA, 660V*/415V Auxiliary Transformer- 1 no (* Voltage in range of 600V to 700V, same shall be finalized during detailed engineering) (d) SCADA panel: 2 Nos (1) Panels shall be moved to the respective positions and placed over the cable trenches in control room, in the exact sequence and locations as per drawings. Drawing shall be provided after placement of purchase order. (3) Panels / Container shall be suitably grouted using welding/ bolting methods as per relevant standards and recommendation of OEMs. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within vendor scope of supply.
5.18	Supply and Installation of UPS Vendor shall supply, install and commission UPS, UPS battery and UPS DB panels – main CMCS room. Indicative capacity of UPS shall be 5kVA for main CMCS room. The UPS shall have back up of 4 hours. Vendor shall, however, submit exact sizing calculations considering (but not limited to) the loads as below: • Data logger / SCADA • Fire Detection/ Alarm Panel • HMI of SCADA • Emergency Lighting • Other loads UPS sizing calculation will be submitted for approval. Detailed specification of UPS and batteries is as mentioned in Annexure 1
5.19.	Laying, termination of LT/HT/aux supply cables/ inverter station/ main control rooms and in associated 33KV yards (1) For all electrical panels viz. PCUs/ VCB panels/ ACDB panel/ UPS/ battery bank /DB boards/ aux transformer and inverter transformers of the inverter rooms, laying and termination of LT/HT/Aux power cables shall be in vendor scope. (2) For all electrical panels viz. PCUs/ VCB panels/ ACDB panel/ UPS/ Battery bank / DB boards / aux transformers/ inverter transformers, laying and termination of LT/HT/Aux power cables etc shall be in vendor scope. (3) 400 sqmm AC cables in transformer yards in inverter room shall be routed on ladder type cable tray overhead as per containerized inverter solution design requirement. The same will be informed during detailed engineering. Support structure required for cable tray shall be in vendor scope. (4) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 15 OF 56

	applicable), Cable jointing kits, lugs, clamp & connectors, cable support structure for termination of 33KV cable at the evacuation point , bolts, nuts, washers etc. shall be in vendor scope of supply. (5) It is the responsibility of the vendor to assess the actual length requirements duly considering all applicable clearances as per relevant standards, Indian electricity rules, CEA/CEIG requirements etc. For this purpose, tentative (indicative) locations of inverter/Control rooms are enclosed along with tender. (6) For marshalling box of transformer/ UPS/ SCADA/ DB boards, single compression nickel plated brass glands shall be provided by vendor. Make shall be COMET or reputed equivalent subject to approval of BHEL/NTPC. (7) HT termination kits (indoor/ outdoor as applicable) shall be of 3M/ Raychem make as shall be approved by BHEL/NTPC. HT termination shall be carried out by certified jointers. Credentials / certification of experience from 3M/ Raychem for the proposed jointers shall be submitted for BHEL/NTPC approval during detailed engineering. (8) Quantity of 33KV End termination and straight through jointing kits shall be supplied by vendor as follow: a. Indoor 33KV End termination kit for 1Cx300 sqmm (E) cable = As per SLD (tentatively 54 nos) b. Straight through jointing kit for for 1Cx300 sqmm (E) cable = as per site requirement These quantities are excluding spares requirement. (9) The scope of HT cable laying and termination at Control room incomer panels and Inverter room ICOG panel for the cables between Control room and Inverter room shall be in the scope of the vendor. (10) The scope of HT cable laying and termination at from Inverter transformer and HT panels at Inverter rooms shall be in the scope of the vendor. (11) The scope of HT cable laying and termination at Control room Auxiliary transformer to HT panel shall be in the scope of the vendor. (12) The scope of LT cable laying and termination from Nearest Inverter room to Outdoor Dry type 100KVA Auxiliary transformer at CMCS shall be in the scope of the vendor. This cable supply will be in vendor's scope. (13) All trench excavations, cable laying, sand and brick layer, backfilling etc as per IS 1255 shall be in vendor's scope. (14) Vendor shall make appropriate holes in the gland plates of PCUs, HT VCB panels, ACDBs, SCADA panels, Inverter transformers, Marshaling boxes, Auxiliary transformer, Distribution boards etc. for fixing the cable glands. Gas cutting is strictly prohibited. Hole-saw cutters of appropriate sizes with suitable drilling machines shall be made available at site for this purpose. (15) Bimetallic lugs or aluminium lugs with bimetallic strip/washer shall be used for connecting Cu bus bar and Al cables or vice-versa wherever applicable. (16) Terminations with M10 and above shall be tightened using torque wrench. Torque setting shall be as per size, property class of bolt. BHEL approval shall be obtained for the settings prior to tightening. (17) Approximate (indicative) specifications of certain power cables are as follows. Exact specification shall be based on design calculations that shall be submitted for BHEL/NTPC approval during detailed engineering. Quantity shall be appropriately selected. (a) PCU to 5.3MVA transformers: Cable supply in BHEL scope 3-phase 3-wire system, 5Rx1Cx400 sqmm per phase, 1.1kV grade, aluminium conductor, XLPE insulation, armoured, PVC sheathed as per IS: 7098. (Note: cables from inverter transformer shall be laid on ladder type cable tray in trefoil arrangement).
--	---

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 16 OF 56

	(b) HV (33kV) side connections in VCB panels, 5.3MVA transformer, 33KV pooling yard near control room auxiliary transformer: Cable supply in BHEL scope 3-phase 3-wire system, 3Rx1Cx300 sqmm, 33kV, aluminium conductor, XLPE insulation, armoured, PVC sheathed as per IS: 7098. (c) Interconnection between ACDB between IR1 to IR2 and between IR3 to IR4 (c) LV side connections from Nearest Inverter room to Outdoor Dry type 100KVA Auxiliary transformer at CMCS and further to ACDB in Control room shall be in the scope of the vendor. Cable supply in vendor scope. (d) ONAN Auxiliary transformers to ACDB panel in 33KV pooling yard near CMCS room: Cable supply in vendor scope (e) LT AC aux power supply cables from ACDB panels in Inverter/control room to the related utility loads such as battery charger, UPS, MCB DB boxes for room appliances, PCU, transformers aux supply, SCADA, VCB panels aux supply, fire alarm system, panel illumination lamps, space heaters of VCB panels etc. Cable supply in vendor scope (g) LT DC aux power supply cables from DCDB panels in inverter /CMCS rooms to the utility loads such as DCDB panels, VCB panel tripping/closing circuits, SCADA, VCB panel spring charge motors in 33kv pooling yard etc. Cable supply in vendor scope (18) Supply of all cable accessories (for the above requirements) such as cable trays, cable glands, cable lugs, ferrules, nuts/bolts/washers, cable dressing ties etc shall be in vendor scope. (19) Laying of above cables, fixing of cable glands, cable termination at the respective terminal bus bars shall be in the scope of vendor (20) All resources such as labour, machinery, tools and accessories to carry out the above electrical works shall be in vendor scope. (21) All applicable/relevant clauses under Annexure 1 for “General specification of LT cables” and “Cable installation methodology” sections of this specification shall be adopted for all aspects of these cables.
5.20	Laying and installation of Control / data / instrumentation / OFC cables (1) Vendor shall supply all the control/ data/ instrumentation / communication cables except OFC, RS485 and Ethernet LAN cables for SCADA. (2) All the cable installation accessories such as cable trays, cable conduits, cable glands, cable lugs, ferrules, cable ties, bolts, nuts, washers etc. shall be in vendor scope of supply. Cable laying and cable terminations shall be in vendor scope. All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc. shall be in vendor scope. (3) OFC cable termination kits shall be in BHEL scope of supply. Vendor scope includes laying of the OFC cable underground in the conduit from inverter station SCADA panels to main control room SCADA panel. Termination of the OFC cables at both the ends shall be in BHEL scope. Supply of conduits for OFC cable is in scope of BHEL. Supply of conduits for RS485 and LA Cables is in scope of vendor. (4) Vendor shall lay and terminate the RS485 cables to SCADA from all plant equipment e.g. HT panels, ACDBs, transformers, FCBC, UPS etc. These cables shall be laid between the panels of respective inverter station/ main control rooms. (5) Vendor shall lay and terminate the Ethernet cables to SCADA from (a) PCUs, (b) numerical relays of VCB panels. These cables shall be laid between the panels of respective inverter station/ main control rooms. (6) Vendor shall lay and terminate control and instrumentation cables from inverter transformers to SCADA and from HT breakers to SCADA. (7) Electrical Interconnections of HT breaker panels e.g. outgoer, incomers, Bus PT panels for 33KV pooling yard HT breakers.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 17 OF 56

	(8) Suitable size ferrules with details shall be provided on either side on either side of each control/ data/ instrumentation cable. (9) Vendor shall submit cable schedules for approval of BHEL/NTPC. (10)All applicable/relevant clauses under “Cable installation methodology” sections of this specification shall be adopted for all aspects of these cables.									
5.21	Erection of 33kV yard Equipments (1) Near each Inverter station there shall be one transformer yard having one 5.3 MVA inverter transformer, one HT ICOG Panel and one SCADA Panel. (2) Near control room there shall be 1 no of ONAN 100 KVA, 33KV/415V aux transformer, 1no of Dry type 100KVA, 660V*/415V aux transformer, 1 no of SCAD panel and one set of HT panels (8 VCB panels) at 33KV pooling yard. (3) Construction of transformer RCC foundations, fencing and gates for these transformers yard and pooling yard near control room and inverter station is in BHEL scope. Trenches, Levelling, cable support structures fabrication & cable tray support foundation works, all earthing related works-excavation etc shall be in vendor’s scope. TRANSFORMER ERECTION- (1) Vendor shall erect the inverter and auxiliary transformers on RCC foundation as per transformer GA details. Vendor scope of I&C of transformers shall include: a) Movement of transformers and its accessory parts such as radiators, cable boxes, hardware etc from storage yard and placement on foundation pedestal. b) Assembly of transformer parts. c) Cable laying and terminations at LV/HV/Marshalling boxes of transformers. d) All activities applicable to oil filling and filtration including measurement of oil BDV and PPM. Particularly for inverter transformers, filtration of oil shall be carried out to such an extent as to obtain the desired BDV (>60 kV) and PPM (< 15ppm) values. e) Testing of transformers as per “pre-commissioning checks” section of this section. After installation of transformers at the transformer yards of each inverter station/ pooling yard near control room, vendor shall level/ compact the ground with an appropriate magnitude and direction of slope to facilitate draining of rain water away from transformer yard. General Notes- Vendor shall provide applicable earthing connections to transformers, fencing / gates etc. in the yard as per relevant clauses under the “Earthing system” section of this specification. All other items (if any, other than the above) that are required to meet the technical requirements of transformer yard as per applicable standards / electricity rules shall be incorporated by the vendor.									
5.22	Supply, erection and commissioning of two auxiliary transformer- Dry type and ONAN ONAN Transformer Qty required- 1 No Technical parameters and specifications: <table><tr><th>#</th><th>Technical parameter</th><th>Specification</th></tr><tr><td>1</td><td>Transformer type</td><td>Outdoor, oil-immersion type</td></tr><tr><td>2</td><td>IP class</td><td>Transformer, including cable box and marshalling box shall be of IP55</td></tr></table>	#	Technical parameter	Specification	1	Transformer type	Outdoor, oil-immersion type	2	IP class	Transformer, including cable box and marshalling box shall be of IP55
#	Technical parameter	Specification								
1	Transformer type	Outdoor, oil-immersion type								
2	IP class	Transformer, including cable box and marshalling box shall be of IP55								

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 18 OF 56

3	Type of cooling	ONAN
4	Governing Standard	IS: 2026/1180
5	Rating in KVA	100 kVA
6	No. of phases	3
7	Frequency	50 Hz, +/- 3%
8	HV winding	33kV, 3-Ph, with Delta connection
9	LV windings	415V, 3-Ph, with Star connection
10	Winding material	Electrolytic grade copper for both HV and LV windings
11	Winding Insulation	Class A
12	Neutral on LV side	Neutral terminal shall be brought out separately to facilitate earthing connections.
13	Vector Group	Dyn11
14	Short circuit withstand time (thermal)	2 sec.
15	% Impedance	As per IS: 2026
16	Creepage distance	31mm/KV
17	Termination HV/LV/Orientation	Air insulated cable box with disconnecting chamber, for both HV and LV sides. Cable box / Cable box / 180°.
18	Cable entry on HV side	Bottom entry of cables.
19	Cable entry on LV side	Bottom entry of cables.
20	Cables and accessories	HV & LV Cables, termination kits (for HV), cable lugs (Dowell make), (Comet make) and connecting hardware shall be in vendor scope of supply. Vendor shall provide hole on the bottom-side gland-plate of HV & LV side cable box for cable entry as per the final outer diameter of cable provided by BHEL during detailed Engg.
21	Tapping on HV winding	Off circuit tap changer (OCTC) switch with five tap positions: +5%, +2.5%, 0, -2.5%, -5%.
22	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10%. Transformer shall be capable of being loaded in accordance with IS: 6600 / IEC 60076-7.
23	Ambient temperature	Max 50 deg C
24	Temperature rise	For top oil: Max. 50 deg C by thermometer method For winding: Max. 55 deg C by resistance method Both rises shall be over an ambient temperature of 50 deg C irrespective of tap position.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 19 OF 56

25	Flux density	Not to exceed 1.9 Wb/sq.m at any tap position with +/- 10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over-fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds Vendor shall furnish over-fluxing characteristics up to 150%
26	Air Clearance	As per CBIP
27	Load loss principal tap at 75°C, with IS tolerance	This shall be provided by vendor.
28	No Load loss at rated voltage on principal tapping and at rated frequency, with IS tolerance	This shall be provided by vendor.
29	No load current at rated voltage and rated frequency	This shall be provided by vendor. To be indicated as percentage.
30	Efficiency at 75°C, UPF	As per IS 1180 and CBIP
31	Regulation at full load, 75 °C	< 2 % for UPF For 0.8 PF lagging, to be indicated by vendor.
32	Harmonics	Shall be designed to suppress harmonics especially 3 rd & 5 th .
33	Vibration & noise	Noise level shall be according to NEMA TR-1 standard
34	Highest system voltage	LV side: 1.1kV HV side: 36 kV
35	Insulation levels as per IS:2026 Rated Lightning Impulse withstand voltage / Short duration power frequency withstand voltage	LV side: -- kVp / 3 kV rms HV side: 170kVp / 70kV rms
36	Overall dimensions in mm Length x Breadth x Height	This shall be provided by vendor.
37	Oil capacity (in Litres)	This shall be provided by vendor.
38	Weight of transformer in Kg	This shall be provided by vendor.
39	Constructional features	As per relevant clause of this specification

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 20 OF 56

40	Fittings and accessories	As per relevant clause of this specification
41	Painting	RAL 7032

6.0 CODES AND STANDARDS

Transformers	IS:2026, IS:6600, IEC:60076
Bushings	IS:2099, IEC:60137, IS 3347, IS 12676
Insulating oil	IEC 60296
Bushing CTs	IS:2705, IEC 60185
Indian Electricity Act 2003, BEE Guideline 1 star or better & CEA notifications	

6.1 General Construction

Transformer shall be constructed in accordance to IS:2026 and IS:3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect and shall be in scope of supplier.

The other important construction particulars shall be as below.

- The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.
- A double float type Buchholz relay conforming to IS: 3637 shall be provided.
- Suitable Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.
- All bolted connections to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions for complete life of the transformer if not opened for maintenance at site
- The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather (in transparent enclosure). Silica gel shall be isolated from atmosphere by an oil seal.
- Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil.
- Transformer shall have Oil Temperature Indicator and Winding temperature Indicator (WTI applicable for transformer above 50 KVA) with accuracy class of +/-2 deg.
- For Transformers above 100KVA, radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/valve at the bottom and air release plug at the top.
- M. Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above ground level (for transformer above 100 KVA).

6.1.1 Windings

- The bidder shall ensure that windings of all transformers are made in dust proof & conditioned atmosphere.
- The conductors shall be of electrolytic grade copper/Aluminum free from scales &



burrs.

c) All windings of the transformers shall have uniform insulation.

d) Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.

6.1.2 Core

a) The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.

b) Core isolation level shall be 2 kV (rms.) for 1 minute in air.

c) Adequate lifting lugs will be provided to enable the core & windings to be lifted.

6.1.3 Insulating oil

No inhibitors shall be used in the transformer oil. The oil supplied with transformers shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.

S.No.	Property	Permissible values
1.	Kinematic Viscosity, mm ² /s	≤ 12 at 40 ° C ≤ 1800.0 at (-)30 ° C
2.	Flash Point, ° C	≥ 140° C
3.	Pour point, ° C	≤ (-)40 ° C
4.	Appearance	Clear , free from sediment and suspended matter
5.	Density kg/dm ³ at 20 ° C	≤ 0.895
6.	Interfacial Tension N/m at 25° C	≥ 0.04
7.	Neutralisation value, mgKOH/g	≤ 0.01
8.	Corrosive sulphur	Non Corrosive
9.	Water content mg/kg	≤ 30 in bulk supply ≤ 40 in drum supply
10.	Anti-oxidants additives	Not detectable
11.	Oxidation Stability -Neutralization value, mgKOH/g -Sludge, % by mass	≤ 1.2 ≤ 0.8
12.	Breakdown voltage As delivered, kV After treatment, kV	≥ 30 ≥ 70
13.	Dissipation factor, at 90° C And 40 Hz to 60 Hz	≤ 0.005
14.	PCA content	≤1%
15.	Impulse withstand Level, kVp	≥ 145
16.	Gassing tendency at 50 Hz after 120 min, mm ³ /min	≤ 5

Subsequently oil samples shall be drawn. BDV 60 KV (min), PPM 10 (max)

6.1.4 Bushings

a) Bushing below 52 kV shall be oil communicating type with porcelain insulator.

b) No arcing horns to be provided on the bushings.

c) Inverter Transformer LV bushing palms shall be silver/tin plated.

6.1.5 Bushing CTs

Shall be of adequate rating for protection as required, WTI (WTI CT applicable for transformer above 50 KVA) etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted.

All CT terminals shall be provided as fixed type terminals on the M. Box to avoid any hazard due to loose connection leading to CT opening. In no circumstances Plug In type connectors shall be used for CT.

6.1.6 Valves

All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 22 OF 56

valves may be of gun metal or may have cast iron bodies. Sampling & drain valves should have zero leakage rate.

6.1.7 Gaskets

a) Gasket shall be fitted with weather proof, hot oil resistant, rubberized cork gasket.

b) If gasket is compressible, metallic stops shall be provided to prevent over compression.

c) The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established.

6.1.8 PAINTING

PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT
Inside of tank and accessories (except M Box)	Oil & heat resistant fully glossy white	One coat	Atleast 30 micron
External surface of transformer and accessories including M Box (except radiators)	Chemical resistant epoxy zinc phosphate primer, MIO (Micaceous iron oxide) as intermediate paint followed by polyurethane finish paint (RAL 5012 Blue)	One coat each	Atleast 100 micron
External Radiator surface	Anticorrosive primary paint followed by high quality full glossy outer finish paint (RAL 5012 Blue)	Two coats each	Atleast 100 micron
Internal Radiator surface	Hot oil proof, low viscosity varnish and subsequent flushing with transformer oil	---	---
Internal surface of M Box	Chemical resistant epoxy zinc phosphate primer followed by chemical and heat resistant epoxy enamel white paint	Two coats each	Not less than 100 micron

6.1.9 Neutral Earthing Arrangement

Neutral earthing shall be done as per system requirement.

6.1.10 Cable boxes & disconnecting chamber (Disconnecting chamber applicable 3.3 kV and above)

(a) HV Cable boxes shall be of phase segregated air insulated type & shall be of sufficient size to accommodate Employer's cable & termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)

(b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size & bolt holes to receive cable lugs. The degree of protection of cable boxes shall be IP 55.

(c) A suitable removable gland plate of non-magnetic material drilled as per the

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 23 OF 56

Employer's instruction shall also be provided in the cable box (d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron (e) The contractor shall provide earthing terminals on the cable box, to suit Employer's GI flat. (f) The minimum length provided for terminating 33 kV, 11KV & 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be discussed during detail engineering). The final cable size, number & length of terminating XLPE cable shall be furnished during detailed engineering. (g) Cable boxes shall be designed such that it shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable box on external supports (as applicable). 6.1.11 FITTINGS Following fittings shall be provided with Transformers covered under this sub section. DRY TYPE AUXILIARY TRANSFORMERS: Qty required- 1 no Rating- Outdoor Dry type 100KVA, 660V*/415V Auxiliary Transformer- 1 no (* Voltage in range of 600V to 700V, same shall be finalized during detailed engineering) Dry Type Transformer shall be constructed in accordance to IS:2026, IS:11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline . Transformer rating and all related technical parameters including tap changer (if applicable) shall be as per system requirement/SLD and relevant standards. Transformer shall be suitable for continuous outdoor duty application. Transformer shall be complete & functional in all respect. The other important construction particulars shall be as below. a) The transformers shall be housed in a metal protective housing. The enclosure shall be provided with suitable hardware (as required). b) The conductors shall be of electrolytic grade copper free from scales & burrs. c) Dry Type Transformer windings shall be of class F insulation or better. Cooling shall be AN. d) The Transformers are of High efficient type made of High grade CRGO steel or amorphous material . Scrap CRGO material shall not be used for manufacturing The fittings/accessories including protection/monitoring device (temperature scanner) generally required for satisfactory operation of the transformer, are to be provided. Rating- Outdoor Dry type 100KVA, 660V*/415V Auxiliary Transformer- 1 no (* Voltage in range of 600V to 700V, same shall be finalized during detailed engineering) Type- Epoxy cast resin/resin encapsulated Tap- As per system requirement and SLD.OCTC +/-5% (min.) Type of cooling- AN Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance guarantee shall correspond to air natural (AN) cooling. Maximum Temperature rise of winding over 50 deg. C ambient. (by resistance method) with Air Natural (AN) cooling- 90 deg.C. (class F), 115 deg.C. (class H) SC withstand time (thermal)- 2 sec PD Level (max. Allowable)- 10 pc Loading- Not to exceed 1.9 Wb/sq.m. at any tap position with +/-10% voltage variation

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 24 OF 56

from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due combined voltage and frequency fluctuations:

- 110% for continuous rating.
- 125% for at least one minute.
- 140% for at least five seconds.

7.0 CODES AND STANDARDS

Dry type transformers IS: 11171, IEC 60076-11

Indian Electricity Act 2003 and Indian Electricity Rules, BEE notification & CEA guidelines

8.0 DESIGN AND CONSTRUCTIONAL FEATURES

8.1 The core shall be constructed from high grade non-ageing cold rolled grain oriented silicon steel laminations of M4 grade or better quality. The insulation of core to clamp-plates shall be able to withstand a power frequency voltage of 2 kV (rms) for one (1) minute.

8.2 The transformers shall be housed in a metal protective housing, having a degree of protection of IP-42. Enclosure shall be of a tested quality sheet steel of minimum thickness 2mm & shall also accommodate cable terminations. The housing door shall be interlocked such that it should be possible to open the door only when transformer is off. The enclosure shall be provided with lifting lugs and other hardware for floor mounting. Suitable bi-directional skids with pre-drilled holes shall be provided integral with the enclosure or bi-directional rollers shall be provided with suitable locking arrangement.

8.3 Winding conductor shall be electrolytic grade Copper/ Aluminum. Windings shall be of class F insulation or better. All windings are to be uniformly insulated.

8.4 Transformer HV bushings and LV bushings can be either solid porcelain or epoxy type. Bushing shall be suitable for satisfactory operation in the high ambient temperature inside Bus Duct enclosure (if applicable). LV flange area shall be of non-magnetic material.

8.5 Bushing CTs shall be provided in the LV neutral side of adequate rating for REF protection, WTI, etc.

8.6 For Marshalling Box the sheet steel used shall be at least 1.6 mm thick cold rolled. The box shall be tank mounted type. The degree of protection shall be IP-54 in accordance with IS-13947. Wiring Scheme shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.

8.7 Transformer shall be provided with suitable ventilation system to ensure the temperature rise limits under most severe condition while in service however all tests and performance shall correspond to air natural cooling.

9.0 PAINTING

The inside of enclosure and accessories (except M. Box) shall be painted with two coats of fully glossy white colour with total DFT of 25 to 60 microns. The external paint colour of transformer & accessories shall be blue corresponding to RAL 5012. The external surface of transformer & accessories shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of polyurethane finish paint with total DFT of 80 to 150 microns. The internal surface of M.Box shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of chemical & thermal resistant epoxy enamel white paint with total DFT of 80 to 150 microns.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 25 OF 56

	10.0 Tests and Inspection Bidder shall offer type tested transformer(s) including short circuit test (as per IEC 60076 part-5) for the project. In case the bidder/contractor has conducted type test(s) specified in the specification within last ten years, he may submit the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case short circuit test has not been conducted or the test report not meeting the specification requirement for the offered transformer manufacturer, Bidder /main contractor to meet project schedule shall take suitable steps quite in advance to ensure successful conduction of short circuit test within three months time from date of LOA failing which the offered make of the transformer shall not be considered. In case the Bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract at no additional cost to the Employer and submit the reports for approval.
5.23	Auxiliary AC/DC power supply system 1. Each PCU container shall have 1 no aux transformer for aux supply requirement. Vendor shall provide a small AC distribution board to cater the aux supply requirement like lighting, UPS, transformer aux supply, module washing pump etc. 2. For Control room vendor shall supply the ACDB which shall be fed from two sources. One no of ONAN 100 KVA Aux transformer in CMCS and 1 no of Outdoor Dry type 100KVA Aux transformer in CMCS. Vendor shall connect ONAN Aux transformer to HT panel in Main pooling switchgear through 33KV Cable. Vendor shall connect Dry type Aux transformer to PCU AC busbar in nearest Inverter room. All arrangements and supplies for the same is in in scope of vendor. There shall be a changeover arrangement of suitable source for selection of the transformer. Installation, testing and commissioning is in vendor's scope. Following DB boards for application in main control room shall be in vendor scope of supply, installation and commissioning: UPS DB for 230V AC UPS supply to SCADA, weather monitoring system, fire alarm system, emergency loads - 1Nos i. SLD will be shared after PO placement. ii. Above DBs shall be wall-mounted board, of reputed make such as Legrand, Siemens, Schneider or any other reputed make as approved by BHEL/NTPC. iii. Installation of all the above items including all necessary cable terminations/ installation shall be in vendor scope.
5.24	Supply and Installation of Weather monitoring system As a part of weather monitoring station, Bidder shall provide following measuring instruments with all necessary software & hardware required to integrate with SCADA so as to enable availability of data from meteorological instrument in SCADA. Each instrument shall be supplied with necessary cables, transmitters and accessories (Trackers, Mounting and base stand etc.) provided by OEM of the sensors only. Aux. power required by instruments and data logger shall be from UPS only. Data logger shall have provision to receive redundant power supply. Scope of vendor shall also include supply and erection of all the mounting arrangements including all necessary civil works/ foundations, clamps arrangement etc. as recommended by manufacturer and required at site. Communication cables shall be laid and terminated at both SCADA station at main control room and data logger at

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 26 OF 56

weather monitoring station end. Similarly, power supply cables shall be laid between WMS and DB boards in main control room.

Exact location of the weather monitoring station shall be decided during detailed engineering.

All the instruments to be supplied shall have valid calibration certificate. Single sensor for measuring combination of Wind Speed, Wind Direction, Relative humidity and Rainfall is also acceptable however offered sensor shall meet the specification as mentioned in following sections.

11.0 SOLAR RADIATION SENSORS

Contractor shall provide Solar Radiation Sensors as per specification given in following section. Contractor has the option to provide these sensors on separate base or on a single base (radiation monitoring station) with tracker, shadow ring and transmitter etc provided by the OEM. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with solar radiation sensors. Bidder shall provide Instrument manual in hard and soft form.

11.1 Pyranometer

Bidder shall provide Secondary Standard Pyranometers as per ISO 9060 for measuring incident solar radiation as per below mentioned requirement and quantity.

Global Horizontal Irradiance (GHI) – 1 No.

Global Inclined Irradiance (GII) -1 No.

Diffuse Horizontal Irradiance (DHI)- 1No.

Technical Requirement of Pyranometer

Details	Values
Principle	Thermopile
Spectral Response.	310 to 2800 nm
Sensitivity	Min 7 micro-volt/w/m2
Time response (95%):	Max 15 s
Non linearity:	±0.5%
Temperature Response:	±2%
Tilt error:	< ±0.5%.
Zero offset thermal radiation:	±7 w/m2
Zero offset temperature change	±2 w/m2
Operating temperature range:	0 deg to +80 deg.
Uncertainty (95% confidence Level):	Hourly- Max-3%, Daily- Max-2%
Non stability:	Max ±0.8%
Response Time(95% of final value)	<5 sec

Shadow ring/ball for measuring DHI shall require no regular adjustment for of tracker and shadow ring/ball. Pyranometer shall be shaded throughout the day and shall be exposed to diffuse solar radiation only to provide DHI value without any calculation.

11.2 Pyrliometer (Qty -1no.)

Details	Values
Spectral Response (50 % Point)	200 to 4000 nm
Sensitivity	Min. 7 micro-volt/w/m2



PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR
PV POWER PLANT AT NTPC GANDHAR, GUJRAT

PS-439-1341

Rev No: 01

PAGE : 27 OF 56

Time response (95%)	Max 10 s
Non linearity	Max $\pm 0.5\%$
Temperature Dependence of sensitivity	$\pm 1\%$
Full viewing angle	5deg + 0.2deg
Zero offset thermal radiation	$\pm 7 \text{ w/m}^2$
Zero offset due to temperature change	$\pm 2 \text{ w/m}^2$
Operating temperature range	0 deg to +80 deg.
Daily Uncertainty (95% confidence Level)	1%
Non stability	Max $\pm 0.8\%$
Response Time(95% of final value)	<5 sec
Temperature Sensor	PT 100/Thermistor
Slope Angle	1deg + 0.2deg
Sun tracker accuracy	Max 0.5deg

Bidder shall provide 1 no. handheld portable data logger for offered Pyranometer supplied or endorsed by OEM of the Pyranometer.

12.0 TEMPERATURE SENSORS

12.1 Ambient Air Temperature Sensor (Qty -1 no.)

Details	Values
Principle	RTD (Platinum) Resistance proportional to temperature
Range	0-50 degC
Accuracy	+ 0.2 degC
Operating Temperature	0 to 50 deg C
Radiation Shield	Non-aspirated Radiation Shield

12.2 Indoor Air Temperature Sensor (Qty – 1 no. at each Inverter room)

Details	Values
Principle	RTD (Platinum) Resistance proportional to temperature
Range	0-70 degC
Accuracy	+ 0.2 degC
Operating Temperature and calibration	0 to 70 deg C

12.3 Module Temperature Sensor (Qty – 1 no. per 5 MW)

Details	Values
Principle	RTD (Platinum) Resistance proportional to temperature
Range	0-100 degC
Accuracy	+ 0.2 degC
Operating Temperature	0 to 100 deg C

Module temperature sensor shall be fixed on the back of module surface with adhesive or tape without using any mechanical fastener.

13.0 WIND SPEED SENSOR (Qty- 1no)



Details	Values
Principle	Frequency proportional to wind speed/Ultrasonic Sensor
Velocity range	0-60 m/ sec
Threshold	0.3 m/s
Operating Temperature	0 to 50 deg C
Accuracy	3% (upto 35 m/s), 5% (Above 35 m/s) RMS

14.0 Wind Direction Sensor (Qty- 1no)

Details	Values
Principle	Potentiometric type sensor (Resistance proportional to Wind direction)/Ultrasonic Sensor
Range	0-360 deg
Accuracy	±5°
Operating Temperature	0 to 50 deg C

15.0 RAINFALL (Qty- 1no)

Rain Gauge shall be of Self Recording Type and recording facility shall be provided in Electronics. The Gauge shall be rugged having material of construction resistant to atmospheric corrosion. The Instrument shall have automatic functions for computing rainfall for pre set time periods.

Details	Values
Accuracy	5% or Below
Sensitivity	1.0 mm
Operating Temperature	0 to 50 deg C

16.0 RELATIVE HUMIDITY (Qty- 1no)

Details	Values
Range	0-100 %
Accuracy	±3%
Resolution	1%
Operating Temperature	0 to 50 deg C

In addition to above, measurement of **Cloud Cover (Okta), Sunset and Sunrise time** is also included in the scope of bidder.

17.0 METEOROLOGICAL MAST

One Meteorological Mast of telescopic type and of specified height to be placed on an existing structure (such as Buildings etc) so that height of the Meteorological Sensors from the Ground Level (GL) is 10 meters. The Mast is required for mounting the Meteorological Sensors. Necessary Hangers and Holders along with electrical Grounding Set shall be provided by the vendor for installation of the Sensors.

Material of Construction of the Mast shall be metallic and robust and shall be resistant to atmospheric corrosion. Fencing shall be provided for weather monitoring station.

18.0 CALIBRATION

All the instruments to be supplied shall have valid and traceable calibration certificate.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 29 OF 56

19.0 DATA LOGGER

Weather Monitoring system shall be provided with standalone Data logger suitable for outdoor application with IP65 Protection and industrial grade hardware suitable for operating temperature up to 55 Deg C. Data logger shall be calibrated and proven in field for at least one year in outdoor environment. Data logger shall have following minimum features:

Processor	32 bits
Time synchronization	With Built in GPS Clock or with Solar SCADA GPS Clock
Wireless communication	GSM/GPRS Modem
Data storage	SD card, Min 2GB for storage of raw and processed data locally at resolution of 1 Second for retrieval whenever required. Data to be stored shall be in unencrypted CSV or equivalent format.
Display	LCD display for easy maintenance and debugging for site engineer
Scan resolution	1 Sec
Analog to Digital Converter (ADC)	16 Bit, Sampling :10 Hz (Min)
I/P Channel	As required with 20 % spare of each type of channel

It shall have facility for arithmetic processing (Time Integration, Simple Average and Moving Average etc.) of incoming raw data. Data logger shall be interfaced with Solar SCADA on modbus TCP/IP. Vendor shall submit Factory Acceptance Test (FAT) report and procedure before dispatch of material to site.

Data logger shall be provided with key-locked door access and all the cables (Power and Signal) to the data logger shall be protected with heavy duty HDPE pipes.

Project file (software, settings and sample reports) shall be handed over to site on permanent storage media (CD/DVD) in two copies after data integrity is verified by site and weather monitoring is commissioned. Data logger shall have facility to allow the access authorized with user ID and password only for any configuration changes.

5.25 Installation and commissioning of SCADA integration systems

(1) SCADA system, supply of which shall be in BHEL scope, comprises of data station panels and PC based control desks with software to collect, store, process and report the data parameters of power plant and also to control the operations of the power plant by integrating the various equipment at the segments as follows:

- String monitoring boxes (101 Nos) in solar array field
- Weather monitoring equipment: with datalogger.
- Power conditioning units (8Nos): DC input / AC output parameters of inverters, grid data, fault status and events logged, etc.
- Inverter transformers (4 Nos): Alarm/Trip signals, WTI/OTI temperature values.
- 33kV VCB breaker panels (as per SLD): status of VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters at every 5MW level of the plant.
- ACDB multifunction meters: AC auxiliary utility consumption parameters
- Fire alarm system (all inverter station/ main control rooms): status signals

(2) BHEL scope of SCADA:

- Supply of Data station panels with necessary data loggers / PLCs and other accessories such as power supply etc to integrate the data signals as listed below.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 30 OF 56

	This includes main panel at main control room and intermediate (linking) panels at inverter room. (b) Supply of Desktop PCs (HMI control desks) provided with necessary software packages and remote monitoring features. (c) Supply of OFC, RS485 and LAN cables for SCADA. (d) Supply of conduit for laying of OFC cables (e) Termination of OFC cable at SCADA panels. (3) Vendor scope of supply and installation of SCADA system: (a) Vendor shall install the BHEL supplied SCADA system in the SCADA room in main control room. Vendor shall also install SCADA panels in the inverter rooms. (b) Cable laying/ terminations of all SCADA cables at respective rooms/ panels / equipments including cable trench works shall be in vendor scope. BHEL will provide the necessary cabling schedule during detailed engineering. (c) Supply of all SCADA related control / communication cables except OFC, RS485 and LAN cables shall be in vendor scope. (d) INTERNET CONNECTION: (Broadband Internet at Plant with Static IP: Network access shall be provided at the plant through any broadband/VSAT connectivity of 2Mbps or higher bandwidth. SCADA system shall be capable of sending all plant data in real time to the Remote Server. All required hardware items such as Modem / Router / Wifi facility etc. shall be in vendor scope. Vendor shall arrange for installation charges (one time) and Internet usage charges (recurring) till handover of the plant. (e) SUPPLY and INSTALLATION OF OUTDOOR WIRELESS ACCESS POINT Vendor has to supply 2 (two) nos. of Industrial outdoor IEEE 802.11 b/g/n wireless access point with 2x10/100Base-T(X) having Far Distance Air Connectivity up to 7 KM and protection class IP-67 .It shall be suitable for pole mount with minimum operating temperature of 55 Deg C. (f) Data Communication to SLDC: Vendor shall provide required interface to integrate plant SCADA with GETCO/GEDA/TRANSCO-SLDC, in compliance with grid code, to send any parameters specified by SLDC. Note: The methodology and specification of SLDC interface will be provided separately by SLDC/TRANSCO/GETCO/GEDA and it shall be the responsibility of the vendor to obtain and implement the same as per SLDC/TRANSCO/GETCO/GEDA requirements.
5.26	Supply and installation of lightning protection system (ESE type lightning arrestors) to protect the electrical equipment of SPV power plant and Buildings from lightning. 1.0 GENERAL REQUIRMENTS This specification is intended to outline the requirement of external lightning protection (ELP/Lightning protection) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of external lightning protection system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of Lightning protection system for safe and satisfactory operation of the plant shall be included under scope of the bidder. 21.1 LIGHTNING PROTECTION DESIGN REQUIRMENT The object of a lightning protection system is to protect buildings/structure and equipment

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 31 OF 56

from direct lightning strikes, potential fire as well as the effects of injected lightning currents (non-incentive flash). It consists of termination systems for direct lightning, down conductors and an earth-termination system.

Care must be taken for while designing the lightning protection that surges are prevented in the electrical system to reduce failure of electrical and electronic equipments.

21.2 CODES AND STANDARD

The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Product certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below.

IS/IEC 62305	PROTECTION AGAINST LIGHTNING
IEEE: 80	IEEE guide for safety in AC substation grounding
IEEE: 837	Standard for qualifying permanent connections used in substation grounding
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2633	Method for testing uniformity of coating on zinc coated articles
IS: 513	Cold rolled low carbon steel sheets and strips
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION
IS: 458	Precast Concrete Pipes (With and Without Reinforcement)
UL-467	Grounding and Bonding Equipment
IEC 62561-7	Requirements for earthing enhancing compounds
NFC 17 -102	Early streamer emission lightning protection systems
	CEA regulations for electrical safety-2010
	Indian Electricity Rules/ Indian Electricity Act.

Type test report of ESE LA shall be strictly in line with NFC 17-102.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.

The lightning protection system includes lightning terminal, Down conductor, test link, earth electrode, installation of lightning terminal, down conductor and earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with lightning terminal. Detail specification of earthing system has been mentioned elsewhere in the specification.

22.0 DOWN CONDUCTORS

Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.

Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.

All joints in the down conductors shall be welded type.

Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 32 OF 56

	Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system. Lightning conductors shall not pass through or run inside GI Conduits. Testing link shall be made of galvanized steel of size 25x 6mm. 23.0 LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY 23.1 Codes and Standard IS/IEC 62305 : PROTECTION AGAINST LIGHTNING NF C 17-102 : LIGHTNING PROTECTION WITH EARLY STREAMER AIR TERMINATION ROD 23.2 Complete Solar Array with associated structure shall be protected from Direct Lightning Stroke. Lightning Protection for solar array shall be achieved with any or both of the following two systems as per specification provided in the following section. Single Rod Air Terminal (Faraday Rods) Early Streamer Emission (ESE) Air Terminal Suitable earthing and equipotential bonding shall be ensured for the lightning protection Air Terminal as per applicable standard/Equipment manufacturer guidelines. Current carrying parts and accessories such as clamps, fasteners, down conductor, test links and earth termination etc. shall be preferably procured from OEM of Air Terminals if it is supplied by them as part of lightning protection system. 23.3 LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY WITH SINGLE ROD AIR TERMINAL Solar array of plant shall be protected from direct lightning strike with straight or angled air termination rods of suitable class as per IS/IEC 62305 to be fixed with the module mounting structure (MMS). Air termination rods shall have minimum two clamps to be fixed with MMS and must be capable of carrying full lightning current. Contractor shall ensure proper fixing of the clamps with MMS to allow lightning current to pass through the clamp without damage and to sustain the rods during high velocity wind. Suitable arrangement/ modification required in MMS, if required for fixing of lightning rods will be in scope of bidder. Contractor shall submit the calculation to determine the no. and location of air termination rods to be fixed on structure to provide the lightning protection to each solar module and structure. Earth riser shall be connected to that part/pole of MMS which is nearest to air termination rod. 23.4 LIGHTNING PROTECTION SYSTEM FOR SOLAR ARRAY WITH E.S.E AIR TERMINAL Solar array shall be protected from direct lightning stroke with Early Streamer Emission air terminal in accordance to NF C 17-102. Location and layout of ESE terminal shall be in such a manner that it cast no shadow on the PV Modules during 08:30 AM to 04:30 PM. Number and location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation considering protection level III (minimum) and Autocad drawing of the layout of ESE terminal shall be submitted to NTPC for approval. ESE air terminal shall be type tested as per Annexure- C of NF C 17-102 (Latest Revision) in the manner as mentioned in the standard. ESE Air terminal shall be supplied with test link, counter, down-conductor, Tripod Earthing, support mast and accessories required for completeness for ESE Lightning protection system. BHEL/NTPC shall test ESE terminal (Each terminal/Sample basis) before installation with
--	--

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 33 OF 56

	suitable instrument for functionality of terminal. Vendor shall replace the terminal free of cost if found defective. Support mast for ESE Air terminal shall be heavy duty hot dip galvanized material and shall be suitable to withstand dynamic and static forces acting on it without failure. Foundation for the mast shall be M20 Grade concrete or better with minimum depth of 1200 MM. 24.0 LIGHTNING PROTECTION SYSTEM FOR BUILDING AND ENCLOSURE Contractor shall provide lightning protection for Inverter room/shelter/enclosure, main control room, Switchgear Room/shelter and similar housing per IS/IEC 62305.
5.27	EARTHING SYSTEM 25.1 GENERAL REQUIRMENTS This clause is intended to outline the requirement of earthing (grounding) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of earthing system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of earthing system for safe and satisfactory operation of the plant shall be included under scope of the bidder. 25.1.1 EARTHING DESIGN REQUIRMENT The object of protective earthing system is to provide as nearly as possible a surface under and around a station which shall be at a uniform potential and as nearly zero or absolute earth potential as possible. The purpose of this is to ensure that, in general, all parts of apparatus other than live parts, shall be at earth potential, as well as to ensure that operators and attendants shall be at earth potential at all times. Also by providing such an earth surface of uniform potential under and surrounding the station, there can exist no difference of potential in a short distance big enough to shock or injure an attendant when short-circuits or other abnormal occurrences take place. Care must be taken for equipment with functional earthing that its service is not disrupted due to undesired disturbances in protective earthing system. 25.1.2 CODES AND STANDARD The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Product certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 34 OF 56

IS: 3043	Code of practice for Earthing.
IEEE: 80	IEEE guide for safety in AC substation grounding
IEEE: 837	Standard for qualifying permanent connections used in substation grounding
IS: 2309	Code of Practice for the protection of building and allied structures against lightning.
IS: 802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2633	Method for testing uniformity of coating on zinc coated articles
IS: 513	Cold rolled low carbon steel sheets and strips
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION
IS: 4736	Hot-dip Zinc coating for MS Tubes.
IS: 458	Precast Concrete Pipes (With and Without Reinforcement)
UL-467	Grounding and Bonding Equipment
IEC 62561-7	Requirements for earthing enhancing compounds
	CEA regulations for electrical safety-2010
	Indian Electricity Rules/ Indian Electricity Act.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable. The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus.

25.2 EARTH ELECTRODE

The earth electrode is in direct contact with the ground provides means for conducting earth current with ground. Earth Electrode material should have good electrical conductivity and mechanical strength and should not corrode in wide variety of soil conditions. For an effective earthing system, following type of vertical earth electrodes can be used.

I. MS Rods

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 35 OF 56

	Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm. II. Copper Bonded Rods High tensile-low carbon steel rod having diameter not less than 14/17 mm of Length 3000 mm to be selected based on earth fault current. The Rod shall comply with requirements of BS 4360 Grade 43A or EN10025:2-004 S275JR, molecularly bonded by 99.99% pure high conductivity copper on outer surface with copper coating thickness 250 micron or more in conformity to UL-467. Its surface shall be clean, free from mechanical defect and any visible oxide layer or foreign material. 25.2.1 EARTHING ENHANCEMENT COMPOUND A low resistance earth electrode system is important to provide a low impedance path for the better dissipation of lightning/fault currents, and to protect personnel and equipment by minimizing and equalizing voltage potential differences. Earthing (ground) enhancement materials shall be used to improve the ground electrode resistance. Earth enhancement material shall be a superior conductive material which improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It shall be tested and should conform to the requirements of IEC 62561-7. It shall have the following characteristics:- a) High conductivity, improves earth's absorbing power and humidity retention capability, non-corrosive in nature having low water solubility but highly hygroscopic. b) Carbon based with min 95% of fixed carbon content premixed with corrosion resistant cement to have set properties. Cement shall not mix separately & shall not have Bentonite. c) Resistivity of less than 0.2 ohms -meter. d) It shall not depend on the continuous presence of water to maintain its conductivity and shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time. e) It shall not dissolve, decompose or leach out with time and shall be environmental friendly, suitable for soils of different resistivity and any kind of earth electrode. The Earth enhancement material shall be supplied in sealed, moisture proof bags, marked with Manufacturer's name or trade name, quantity etc. The minimum quantity of earth enhancement compound to be used with each earth-pit shall be 25 Kg. 25.2.2 EARTHING CONDUCTOR Earthing conductor is the conductor for buried below the ground at the depth of 600 mm connecting earth pits to make interconnection of earth pit. To interconnect earth pits, following type of conductor can be used. Application of specific conductor and its size has been mentioned in relevant clause: I. Galvanised Steel Flat (GS) Flat GS/GI Flat (Strip) conductor shall comply to IS 2026 with Galvanization of 85 Micron as per IS. Material shall be clean and free from mechanical defects. II. Copper Clad Steel (CCS) Earthing Conductor The Copper Bonded Steel Grounding Conductor shall be made of steel with the coating of 99.99% pure copper complying to ASTM B 869-96 and ASTM B 452-93 standards. Each strand of CCS shall have continuous, uniform coating and the conductor surface shall be smooth and free from mechanical defects. III. MS Rod Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm. 25.2.3 EARTHING TECHNICAL AND INSTALLATION REQUIREMENT Careful consideration should be given to installing an earthing system that meet or exceed statutory requirements. Contractor shall select certified product and ensure good workmanship for installation for satisfactory performance to fulfill the designed parameters
--	---

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 36 OF 56

	all the times. Following care shall be taken while installation of earthing. I. Metallic frame/ structure of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed as per requirement mentioned elsewhere in the specification. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable. Metallic column for Inverter/Switchgear shelter/E-house shall be earthed with two distinct connections at minimum two column. All the wall cladding section shall be earthed at minimum two location with flexible copper cable of not less than 50 sq. mm. II. Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground. III. Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level. IV. The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects. V. Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound. VI. Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor. VII. Connections between earthing leads/risers and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors. VIII. Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. IX. Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover. X. A minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same. Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively. XI. Earth pit shall be constructed as per IS:3043. Electrodes shall be embedded preferably below permanent moisture level. Minimum spacing between electrodes shall be 600mm. XII. Earth pits shall be treated with earth enhancement compound if resistivity is more
--	--

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 37 OF 56

than 20 ohm meter.

XIII. On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.

XIV. Contractor shall obtain all necessary statutory approvals for the earthing system before charging of the plant and electrical equipments.

25.3. TECHNICAL DETAILS FOR AC EARTHING SYSTEM

This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT and LT Switchgear Panel and other similar electrical equipments, Transformer neutral and shield.

The Contractor shall furnish the detailed design and calculations as per IEEE 80/IS 3043 for Employer's approval for equipment earthing..

25.3.1 Earthing System requirement for AC Earthing:

Conductors above ground level and in built up trenches	Galvanized steel
Conductors buried in earth	Mild steel
Earth electrodes	Mild steel rod of diameter 40mm or Copper bonded steel rod of dia not less than 17 mm
Life Expectancy	25 years
Fault Level	Mentioned Elsewhere
Min. Steel corrosion	As per IS 3043
Soil Restivity	Actual as per site condition

The sizes of earthing conductors for various electrical equipment shall be as below:



S No.	Equipment	Earth Conductor buried in Earth	Earth conductor above ground level and in built up trenches
1	33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear	--	65 x 8mm GS flat
2	415 V MCC/ Distribution boards / Transformers	--	50 x 6mm GS flat
3	LT Motors above 125 KW	--	50 x 6mm GS flat
4	LT Motors 25 KW to 125 KW	--	25 x 6mm GS flat
5	LT Motors 1 KW to 25 KW	--	25 x 3mm GS flat
6	Fractional House power motor	--	8 SWG GS wire
7	Control panel & control desk	--	25 x 3 mm GS flat
8	Push button station/Junction Box	--	8 SWG GI wire
9	Columns, structures, cable trays and bus ducts enclosures	--	50 x 6mm GS flat
10	Crane, rails, rail tracks & Other non-current carrying metal parts	--	25 x 6mm GS flat

25.3.2 Contractor shall ensure there at least two earth pits each dedicated for earthing of each Transformer, HT/LT Switchgear panel, transformer neutral, Battery Charger/UPS/Control Panel etc. shall be provided. Earth electrode shall be located near to the equipment and all earth electrodes shall be interconnected with parallel conductor buried in earth surrounding the equipment.

25.3.3 Earthing system of different locations such as Inverter room/Pooling Switchgear/Sub pooling switchgear/Inverter shelter etc. shall be interconnected in single network with buried conductor of the size 65X8 GS Flat laid at 600 mm depth. Contractor shall submit the calculation based on the system of earth conductor and electrode connected in single network.

Location and manner of interconnection shall be approved during detail engineering. Bidder shall also interconnect Main Pooling Switchgear earthing/Metering Yard earthing with existing NTPC Main Plant Earthing if Solar Plant is being developed at NTPC Station.

25.3.4 For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 39 OF 56

copper cable of size not less than 25 sqmm. Contractor shall comply with the recommendation of OEM (Original Equipment Manufacturer) for electronic earthing and electrode can be connected with other earth electrode as per recommendation of OEM.

25.3.5 Each inverter duty transformer having shield between HV and LV winding shall be provided with 2 nos. Isolated earth electrode connected with each other for functional earthing of transformer shield. Each electrode shall be connected with transformer shield with separate 50X6 Cu flat.

25.4. TECHNICAL DETAIL SOLAR ARRAY (DC) EARTHING

This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provide equipotential bonding for Module Mounting Structure (MMS), SMB Mounting structure, Module Frames etc.

System Requirement for the solar array DC earthing:

Conductors buried in earth	GS Flat or CCS
Conductors above ground level	GS Flat or CCS
Earth Electrode	40 mm MS Rod or Copper bonded steel rod of dia. not less than 14 mm
Life Expectancy	25 Years
System fault level	5 KA for 3 Sec.
Soil resistivity	Actual as per site conditions
Min. Steel corrosion	As per IS 3043

25.4.1 Each Module mounting structure (MMS), SPV Module frames, mounting arrangement for String Monitoring Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system. Earthing system for solar array shall consist interconnected earth pits electrodes connected by 25X6 GS flat (Min.) or Copper Clad Steel (CCS) earthing Conductor of size not less than 120 SQMM laid at the depth of 600 MM below the ground. Minimum size of riser conductor to connect the structures to buried earthing conductor and structure to structure in the solar farm shall be 25X3 GS Flat or CCS of Min. 70 SQ MM size.

25.4.2 Periphery fencing wherever provided shall be earthed at every 100 meter interval with 25X3 GS flat connected with DC or AC side nearest buried earthing conductor.

25.4.3 Earthing conductor for connection to structure and equipment may be kept on the ground below MMS. However, these conductor shall be laid 300 mm below the ground along the pathway and/or crossing the pathway.

25.4.4 Equipment and structure in the solar farm shall be earthed in compliance to the IS: 3043 (Code of Practice for Earthing) and Indian Electricity Rules/Acts.

25.4.5 The Contractor shall furnish the detailed design and calculations for Owner's approval as per IS 3043 to determine the number of earth pit and size of earth conductor. However typically the minimum no. of earth pit electrodes for the DC earthing shall be 1No. earth pit at every 1 MW.

25.4.6 Buried earth conductor shall be laid all around periphery of solar array farm/blocks. GS flat above the ground for structure earthing shall be connected to the nearest buried conductor or electrode. All the earth electrodes shall be interconnected in single network/mesh and no electrode or group of electrodes shall be isolated/islanded. These electrodes shall be uniformly distributed in the solar farm at maximum practical extent and location of earth electrode shall be approved during detail engineering. A continuous earth path is to be maintained throughout the PV array.

25.4.7 Connection of DC earthing system and AC earthing system with location and

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 40 OF 56

	manner of connection shall be approved during detail engineering. Contractor shall submit the design calculation of earthing system of AC and DC side as standalone (no interconnection) system. 25.4.8 Connection of riser to the structures shall be bolted or welded type. Portion of galvanized structure which undergoes welding at site shall be coated with two coats of cold galvanizing and anti-corrosion paint afterwards. 25.4.9 Connections between earthing leads/riser and between main earthing conductors shall be of welded type. For rust protection, welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. 25.4.11 Contractor shall seek owner's approval for connecting solar array earth mesh with any other earth mat/earth grid of the solar PV plant. 25.4.12 Earth strips shall be bend properly and taken along the support structure. 25.4.13 Size of earth conductor, nos. of earth pits given in this clause is applicable for solar array earthing only. Relevant method and practice of laying of earthing conductor, earth pits and riser not mentioned herewith but given elsewhere in this specification is applicable to solar array earthing also. General points: Stainless steel, nuts, plain washers shall be used. Spring washers shall be zinc/epoxy coated. Shield earthing of inverter transformers shall be separate and connected to two earth pits (connected together, isolated from earth grid) using copper flat 50x6mm Neutral of all aux transformers shall be connected to two earth pits (connected together, isolated from earth grid) using copper flat 50X6 mm. Earthing cables, all necessary hardwares like nut, bolts, bimetallic lugs etc. shall be in vendor's scope of supply. Supply of 25x3 and 25x6 GI earth strip shall be in BHEL scope. Flats GI 65x8 shall be supplied by BHEL. The earthing for PCU shall be done through 1Cx 70 flexible copper cable and for SCADA through 1Cx 25 sqmm copper cable. Supply of 1CX70 sqmm cable, 1CX16 sqmm cable, cable lugs and hardware is in scope of vendor. Supply and installation of all other materials related to Earth chambers shall be in vendor scope
5.28	Design, supply and installation of Plant lighting System This clause covers supply and installation of suitable illumination system anear Inverter stations, 33KV pooling yards and along the peripheral roads which is not adjacent to NTPC main plant boundary wall or road. However, Removal and refixing of any existing street light to avoid Shading on PV modules is in the scope of the bidder. 26.1 DESIGN PHILOSOPHY A comprehensive illumination system shall be provided in the entire project. 26.2 LIGHTING SYSTEM DESCRIPTION for CMCS and inverter room Normal AC Lighting System: AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels Control Board (LPs) which in turn will be fed from the lighting distribution

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 41 OF 56

boards (LDBs) of AC Switch board MCC.. Scope of Supply is in vendor's scope.
Emergency AC Lightning System: The emergency lighting system consisting of 20% of the lights shall be fed from UPS DB.

Load of the same has to be considered for UPS sizing. Bidder shall provide outdoor emergency lighting at each inverter station, Main pooling station, security room and main gate.

26.3 Lighting Fixture, Lamps & Accessories

a. All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.

b. AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V & 240 V.

c. All lighting fixtures shall be complete with lamp(s), lamp holder(s), LED chip assembly, terminal blocks, clamps, locking arrangements, fixing brackets etc. Driver circuit/Control gears shall be provided as applicable / specified. The fixtures shall be fully wired upto terminal block. The internal wiring of the fixtures shall be done with suitable low smoke halogen free thermo-plastic or silicon rubber insulated or fire retardant PTFE copper conductor wires of suitable size and type. Further fuse protection of suitable rating in input side shall also be provided specifically for LED luminaires. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.

d. All lighting fixtures shall be provided with an external, brass/GI earthing terminal suitable for connecting 14 SWG, GI earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity throughout the fixture

e. The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection

f. The reflectors shall be manufactured from CRCA sheet steel or aluminium as specified. The aluminium reflectors shall be made of high purity aluminium sheet, polished electrochemically brightened and anodized or proven alternate arrangement of anodizing

g. Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without use of any tool. Starter shall have brass contacts and radio interference suppressing capacitor.

h. LED luminaires body shall such designed that heat sink/heat dissipating housing shall be mounted outside the overall luminaires fixture housing, and shall be suitably clearing the driver circuit. Further for outdoor type LED luminaires, the exposed heat sink shall be suitably designed to avoid dust/foreign particles accumulation on the same.

i. LED luminaires housing/body shall be pressure die cast aluminium or extruded Aluminium or CRCA as specified alongwith finished powder coating. Care shall be taken in the design that there is no water stagnation anywhere.

26.4. LED Luminaires:

26.4.1 CODES AND STANDARDS

All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of technocommercial bid opening. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 42 OF 56

following standards & codes.

16101:2012 General Lighting. LEDs and LED modules Terms and definitions
16102(Part-1 Safety Requirements):2012 Self Ballasted LED Lamps for General Lighting Services.
16102(Part-2 Performance Requirements.):2012 Self Ballasted LED Lamps for General lighting Services.
16103(Part I):2012 LED modules for General lighting Safety Requirements.
15885(Part 2/Sec. 13) :2012 Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c. Supplied Electronic control gear for LED modules
16104:2012 d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.
16105:2012 Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.
16106:2012 Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products
16107:2012 Luminaire Performance
16108:2012 Photobiological safety of Lamps and Lamp Systems
IS 513 Cold rolled low carbon steel sheets and strips
IS 12063 Classification of degree of protection provided by enclosures.
IS 14700(Part 3/Sec. 2): Electro magnetic compatibility (EMC) – Limits for Harmonic emission – THD < 15% (equipment, input current < 16 Amps. per phase.
IS 9000 (Part 6) Environment testing: Test Z – AD: composite temperature/humidity cyclic test.
IS 15885(Part 2/Sec. 13)/ IS 16004 (1 and 2)- Lamp control gear: particular requirements for (Part 2/Sec. 13) DC or AC supplied electronic control gear
IS 16004 – 1 and 2) for LED modules.
IS 4905 Method for random sampling
IEC 60598 Ingress protection, luminaire performance and safety
IEC 61000-3-2 Total Harmonic Distortion
IEC 61000-4-5 Surge Protection
IES-LM 80 along with Lumen Depreciation and Rated life of LED chip TM 21/ IS 16105
IES-LM 79 / IS 16106 Luminaire optics and color parameter and electrical parameter

26.4.2 LED LIGHTING SYSTEM

LED Luminaires shall be used for the lighting of all the outdoor areas.

However for DC lighting & hazardous areas conventional type luminaires shall be used.

The individual lamp wattage for LED shall be upto 3 watt for outdoor type luminaires. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall not be less than 80 Lm/W. Heat sink/heat dissipation arrangement shall be provided in the luminaires. The LED used in the luminaires shall have colour rendering index (CRI) of Min 70 for outdoor luminaires.

Colour designation of LED shall be “cool day light” (min 5700K) type for indoor type LED luminaires. Further for outdoor type luminaires, the colour designation shall be 5000K, except for well glass type LED luminaires, where the colour designation shall be 4000K. The LED luminaires shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.

For highbay & flood light type outdoor luminaires the LED chip with suitable beam angle shall be used to deliver better lumen-output. The maximum junction temperature of bare LED without heat sink shall be limited to 85 deg C, further the lumen maintenance at this temperature shall be min 90%. The THD of tube light based LED Luminaires shall be less than 20%. For other type of luminaries, it shall be minimum 10%. #1

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 43 OF 56

	Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire & safety requirements of luminaire shall be as per IS standards. Suitable heat sink/ heat dissipation arrangement, with proper thermal management shall be designed for the luminaires. Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer. LED Drivers may have following control & protections:- • Suitable precision current control of LED. • Open Circuit Protection • Short Circuit Protection • Over Temperature Protection • Overload Protection • Surge Protection Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have IP55 degree of protection. Wires of different phase shall normally run in separate conduit. Power supply shall be fed from 415 / 240 V normal AC supply through suitable number of conveniently located lighting distribution boards (LDB) and at least one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc. Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for welding purposes at one location. Incandescent lamps may be used only with DC Lighting. Electrification of all building shall be carried out as per IS 732-1989, IS 4648-1968 and other relevant standards. All luminaries and their accessories and components shall be of type readily replaceable by available Indian makes. Following test reports to be submitted for LED chip/LED luminaires: a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer. b) LM 80/IS: 16105 report. c) LM 79/IS: 16106 report 27.0 JUNCTION BOXES, CONDUITS, FITTING & ACCESSORIES Junction boxes for street lighting poles and lighting mast as applicable, shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55. All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox & plate. Conduits, Pipes and Accessories: Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, etc. Pull-out boxes shall have cover with screw. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degree of protection. 28.0 LIGHTING POLES The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of Solar panels. The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole. The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB. The luminaries used shall be minimum
--	---

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 44 OF 56

	32 W with minimum pole height of 2.5 m with 35 m inter-pole spacing for peripheral roads & 50 m for internal roads respectively. For internal roads, the spacing shall be 50 m with same specification. Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable 28.1 EARTHING Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run along with each conduit run. Cable armours shall be connected to earthing system at both the ends. 28.2 AVERAGE ILLUMINATION LEVEL <table><tr><th>Location</th><th>Average Illumination Level (Lux)</th><th>Type of Fixture</th></tr><tr><td>Switchgear Room, HT Breaker, Transformer</td><td>150</td><td>LED Luminaries</td></tr><tr><td>Street lighting-Roads</td><td>Refer Cl. 6.0 LED Luminaries</td><td>LED Luminaries</td></tr></table>	Location	Average Illumination Level (Lux)	Type of Fixture	Switchgear Room, HT Breaker, Transformer	150	LED Luminaries	Street lighting-Roads	Refer Cl. 6.0 LED Luminaries	LED Luminaries																																													
Location	Average Illumination Level (Lux)	Type of Fixture																																																					
Switchgear Room, HT Breaker, Transformer	150	LED Luminaries																																																					
Street lighting-Roads	Refer Cl. 6.0 LED Luminaries	LED Luminaries																																																					
5.29	Fire Alarm and Firefighting systems The SPV plant shall be equipped with suitable fire protection & fire fighting systems for protection of entire plant & control room as per CEIG requirements. 29.1. Bidder shall comply with recommendation of Tariff Advisory Committee to incurring minimal premium for insurance. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection. 29.2 The fire fighting system for the proposed power plant for fire protection shall be supplied and installed by bidder and shall consist of: a) Sand buckets b) Portable fire extinguishers c) Microprocessor based fire alarm panel. 29.2.1 Portable Fire Extinguishers and Sand Buckets Bidder to provide following numbers of type tested portable fire extinguishers as per relevant code in the room/location as per scope of the specification as mentioned below. <table><tr><th>Rooms</th><th>DCP Type (ABC type) (10 Kg. Capacity)</th><th>CO2 Type 9 kg capacity</th><th>Foam Type Hand 9 kg</th><th>Hand Portable pressurized water CO2 9 Litre</th><th>Sand Buckets</th></tr><tr><td>Main Control Room</td><td>2</td><td>2</td><td>1</td><td>1</td><td>1</td></tr><tr><td>Each Inverter Station/Location</td><td>1</td><td>1</td><td></td><td></td><td></td></tr><tr><td>ACDB/SCADA Room</td><td>1</td><td>1</td><td></td><td></td><td></td></tr><tr><td>Each Transformer yard</td><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr><tr><td>132KV Switchyard</td><td>2</td><td>2</td><td></td><td></td><td>1</td></tr><tr><td>Main Pooling Yard</td><td>2</td><td>2</td><td></td><td></td><td>1</td></tr><tr><td>Security Room</td><td></td><td>1</td><td></td><td>2</td><td></td></tr><tr><td>Pantry</td><td></td><td></td><td></td><td>2</td><td></td></tr></table> 29.2.2 Microprocessor based fire alarm panel Bidder to provide intelligent microprocessor based main fire alarm panel of modular construction complete with central processing unit, input and output modules, power supply module, supervision control and isolator modules with 10% spare provisions in	Rooms	DCP Type (ABC type) (10 Kg. Capacity)	CO2 Type 9 kg capacity	Foam Type Hand 9 kg	Hand Portable pressurized water CO2 9 Litre	Sand Buckets	Main Control Room	2	2	1	1	1	Each Inverter Station/Location	1	1				ACDB/SCADA Room	1	1				Each Transformer yard	1	1	1		1	132KV Switchyard	2	2			1	Main Pooling Yard	2	2			1	Security Room		1		2		Pantry				2	
Rooms	DCP Type (ABC type) (10 Kg. Capacity)	CO2 Type 9 kg capacity	Foam Type Hand 9 kg	Hand Portable pressurized water CO2 9 Litre	Sand Buckets																																																		
Main Control Room	2	2	1	1	1																																																		
Each Inverter Station/Location	1	1																																																					
ACDB/SCADA Room	1	1																																																					
Each Transformer yard	1	1	1		1																																																		
132KV Switchyard	2	2			1																																																		
Main Pooling Yard	2	2			1																																																		
Security Room		1		2																																																			
Pantry				2																																																			

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 45 OF 56

	each loop. Fire detection alarm system shall include) but not limited to the following items 1. Fire Alarm control Panel 2. Multi Sensor smoke detector 3. Heat Detectors 4. Hooter cum strobe 5. Manual call Point 6. Hooter 7. Fault isolation modules 8. Control Modules 9. Cables from Sensors to Fire panels. 10. Digital output from the fire detection system shall be integrated with SCADA, necessary cables will be in scope of bidder 11. Network Control Module 12. Interfacing of Fire Alarm System with SCADA for display and storage of status and alarm in SCADA, necessary cables will be in scope of bidder Multi sensor type smoke detectors and heat detectors shall be provided for below false ceiling areas of control room and ACDB and/or inverter rooms. One (01) sensor shall be provided for each 20 sqm of area. All the cable trench inside the control room and inverter room shall be provided with Multi Sensor smoke detector. Bidder shall prepare and submit the layout and scheme indicating fire protection system for approval. Fault Isolation module shall be provided in every room and for every 15 sensors at location proposed by Bidder to be approved by employer during detail engineering. 29.2.3 Fire Alarm Control Panel Indication i. Alarm conditions shall be immediately displayed on the control panel and in SCADA. Alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged the LED shall remain lit. A subsequent alarm received from another zone after acknowledgement shall illuminate the alarm LED and the panel display shall show the new alarm information. ii. During an alarm condition, an alarm tone shall sound within the control panel until the alarm is acknowledged. iii. If the audible alarm signals are silenced for any reason, they shall automatically resound if another zone is activated. iv. All alarm signals shall be automatically “locked in” at the control panel until the operated device is returned to its normal condition and the control panel is manually reset There shall be weather proof Hooter cum strobe outside and strobe inside each Inverter room and control room for indication fire alarm for respective zone/area at suitable location that is visible from all direction. All the hardware, relay and accessories required for completeness of fire alarm system is in Bidder scope. Fire alarm system shall have its own battery and charger and it shall be provided power from UPS DB. Each Inverter room and control room shall be also be provided with manual call point, Alarm acknowledge and reset facility for alarm for respective zone only. Bidder shall submit document to BHEL/NTPC for approval that will include fire alarm system configuration, layout, BoM, Datasheet and necessary test report. Bidder shall consider 30 % design and aging margin for selection of nos. of sensors in each loop and length of each loop. Bidder shall submit the certificate or technical datasheet from OEM indicating maximum nos. of sensors in single loop and maximum length of single loop allowed with offered panel and type of cable to be used. Each Fire Alarm Control panel shall have provision for minimum 10 (Ten) % rounded to next higher integer but not less than 2 (two) nos. spare loops for future use of employer. Bidder shall submit Site Acceptance Test (SAT) for approval by employer. Complete fire alarm system shall be checked at site for verification of faithful performance
--	---

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 46 OF 56

	and completeness of the system. Bidder shall carry out necessary modification and supply hardware/accessories if required free of cost at site.
5.30	Design, Supply and installation of Module Cleaning System 30.1 Bidder shall provide permanent arrangement for module washing in the SPV Plant. This shall include supply and installation for drawl and discharge of water from existing Reservoir, requisite storage arrangement and laying network of HDPE pipe conforming to IS 4984 and other relevant codes. The module washing shall be complete in all respect and the details shall conform to the relevant IS codes. The complete scheme shall be subject to approval of BHEL/NTPC including inputs points, design and drawings for the system. Opening from the HDPE pipe with manual isolating valves should be provided at regular intervals. The opening pipes for fixing the movable/Hose pipes for spraying water on module shall be made of GI pipe. Bidder shall install flow meter for measurement of water consumption. 30.2 Design of solar PV module cleaning system shall be such that complete solar plant shall be cleaned with fresh water twice in a month. Module cleaning system piping network shall be closed looped pipe network configuration consists of Main pipe, sub-main and branches. Minimum 5 tapping /washing point shall be functional at same time. In array layout, if solar blocks is separated from main plot due to water body, Nallah, roads, etc; Module cleaning system piping network may be design for dead end/tree pipe network configuration. Minimum 2 tapping /washing point shall be functional at same time. Cut-off valves shall be provided at suitable junction point so that the repair works may be conducted at a particular area without disturbing the whole area. The water used for cleaning should be of appropriate quality fit for cleaning purpose as per the recommendations of module manufacturer. 30.3 Bidder shall provide the piping and the instrumentation diagram (P&ID) of water washing arrangement including the physical sequence of branches, reducers, valves, pressure gauge, cleaning points with location of pump(s) and water storage tanks to NTPC for approval during detailed engineering. 30.4 The HDPE pipe shall be suitably protected against any impact load. The HDPE pipes shall be covered higher diameter GI pipe at roads crossing for protection against any heavy loads etc. at roads section. The same protection shall also be provided wherever higher loads are expected. The bidder may also propose some other protection system for HDPE pipes. 30.5 These pipes shall be buried in ground by at least 150 mm deep from NGL/FGL. Only in case of rock at surface and difficulty in cutting the surface rocks pipe may be accepted at surface at some location. The same shall be subject to approval from the owner. 30.6 Maximum length of hose pipe shall be 50 meter from tapping point. Tapping point shall be place above PCC slab/block. 30.7 After laying and jointing, Testing of main pipe, service pipe and fitting shall be checked by charging with water. The test pressure shall be minimum 0.5 N/mm² or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or, in the case of long mains or mains of a large diameter, by a power-driven test pump, provided the pump is not left unattended. 30.8 End of the branch pipes/tapping points to be bent horizontal/downward to avoid entry of foreign materials like, earth, sand leaf, gravels, etc. 30.9 Bidder to ensure interconnection between the sub-systems of module washing system through isolating valve, so as module cleaning may be continued in case of outage of any sub-system. 30.10 Bidder shall ensure that the complete module washing system is integrated suitably with water source (reservoir), check dam, motor and water pipe line coming at the periphery of the plant.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 47 OF 56

	30.11 Any additional item, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of cleaning system for satisfactory operation of the plant shall be included under scope of the bidder.																														
5.31	Identification marking using painting Following items shall be identified by way of artistic painting in black letters with yellow background. For danger symbol/text, white letters in red background. Identification number/ text to be painted shall be submitted for BHEL/NTPC approval during detailed engineering for the following. (1) Solar array structures: ~1616 Nos (2) String monitoring boxes: 104 Nos (3) Size/ source/ destination of DC cable 1Cx400 with arrow mark (power flow direction) to be painted on SMBs and PCUs (4) PCUs front side: PCU ID number (1 to 8) with rating 2500kW, AC chamber/ DC chamber, Danger text/symbol. (5) PCUs DC chamber back side: SMB ID numbers, cable size (1Cx400 +,-) with upward arrow mark, danger text/symbol (6) PCUs AC chamber back side: Inv Trnfmr ID, cable size (5Rx1Cx400 / ph) with downward arrow mark, danger text/symbol (7) Same way as above, the corresponding panel ID with rating, cable destination with arrow mark in power flow direction, danger text/symbol shall be painted for all VCB panels, Inverter transformers (HV and LV sides), Aux transformer (HV and LV sides), ACDB panel. (8) For UPS/ FCBC/ SCADA/ all DB boards/ fire alarm panels ID number shall be painted. Cable size/ destination/ arrow marks not required to be painted as cable tags shall be adequate. (9) For earth chambers of inverter rooms, main control room, transformer yards, Main pooling switchgear yard, array, ESE LA, ID number with resistance value and due date shall be painted. All switchboards shall be painted with ID number.																														
5.32	Cable markers and cables tags (1) Cable markers and joint markers for underground cables shall be provided along the route of the cables as per section “ Cable installation methodology ” of this specification. (2) Cable tags shall be provided at either of the cable (at the entry point to the panel / equipment to which it is connected / terminated) shall be provided as per section “ Cable installation methodology ” of this specification. (10) Cable tags details shall be provided by BHEL during detailed engineering.																														
5.33	Display boards and sign boards <table border="1"> <thead> <tr> <th>Sl. No</th><th>Description</th><th>Qty for Inverter Station</th><th>Qty for Control room</th></tr> </thead> <tbody> <tr> <td>1</td><td>Board displaying instruction chart for restoration from Electric Shock</td><td>1 No</td><td>1 No</td></tr> <tr> <td>2</td><td>Board displaying instruction chart for artificial respiration</td><td>1 No</td><td>1 No</td></tr> <tr> <td>3</td><td>Board displaying dos and don'ts.</td><td>1 No</td><td>1 No</td></tr> <tr> <td>4</td><td>Board displaying fire extinguishers details and operations</td><td>1 No</td><td>1 No</td></tr> <tr> <td>5</td><td>“No smoking” board</td><td>2 Nos</td><td>5 Nos</td></tr> <tr> <td>6</td><td>Danger boards: 33000V with danger symbol in Hindi, Telugu, English</td><td>As required</td><td>As required</td></tr> </tbody> </table>			Sl. No	Description	Qty for Inverter Station	Qty for Control room	1	Board displaying instruction chart for restoration from Electric Shock	1 No	1 No	2	Board displaying instruction chart for artificial respiration	1 No	1 No	3	Board displaying dos and don'ts.	1 No	1 No	4	Board displaying fire extinguishers details and operations	1 No	1 No	5	“No smoking” board	2 Nos	5 Nos	6	Danger boards: 33000V with danger symbol in Hindi, Telugu, English	As required	As required
Sl. No	Description	Qty for Inverter Station	Qty for Control room																												
1	Board displaying instruction chart for restoration from Electric Shock	1 No	1 No																												
2	Board displaying instruction chart for artificial respiration	1 No	1 No																												
3	Board displaying dos and don'ts.	1 No	1 No																												
4	Board displaying fire extinguishers details and operations	1 No	1 No																												
5	“No smoking” board	2 Nos	5 Nos																												
6	Danger boards: 33000V with danger symbol in Hindi, Telugu, English	As required	As required																												

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS		PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT		Rev No: 01
			PAGE : 48 OF 56

	7	Identification boards, of suitable sizes, within and outside control room such as Inverter room, Main control room, Executive lounge, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room, Pantry room etc. BHEL will provide list.	1 set	5 set
	(a) 5mm thick sun board with LG make vinyl sticker (computerized cutting and pasting) shall be used for SI Nos 5, 6 and 7. (3) (b) For others, flex banner with design & printing shall be used.			
5.34	Electrical insulation mat (1) Vendor shall supply electrical insulating mats as follows: (a) Reputed make as shall be approved by BHEL/NTPC (b) As per IS: 15652:2006 (c) Class C (d) Thickness 3 mm minimum (e) Size = 2m x 1m minimum, exact size shall be as approved by BHEL/NTPC during detailed engineering. (f) Colour: to be approved by BHEL/NTPC (g) Max use voltage = 33 kV (h) Marking of IS standard on the mat (2) Test certificate shall be provided by vendor Vendor shall lay the mats in front of all the indoor electrical panels viz. PCUs, VCB panels, ACDB panels, SCADA panels, UPS panels, battery banks etc.			
5.35	Supply and Installation Miscellaneous Items (1) Split Air conditioner of 1.5 tonne 5 star rating (2 Nos) of split type for SCADA room of Voltas/ Hitachi/ Samsung/LG make. (2) Furnitures for SCADA room as below • Table with drawer for desktop PC – 3 Nos Table shall be free standing table top type with doors at the back and shall be constructed of 2 mm thick CRCA steel plates. A 19 mm thick wooden top shall be provided on the desk to keep the TFT monitors at top and computers inside. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, mouse pads, monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal and vertical directions. Telephone sets, very few PB stations and lamps shall be mounted on the control desk on mosaic grid structure and same shall be decided during detailed engineering. ASCII Keyboard shall be capable of being pulled out through a tray. • Chair, industry standard, revolving type, with wheels, arm rest, provisions for adjustment of height (hydraulic/ gas lift):5 Nos Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit in-charge &			

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 49 OF 56

	other personnel. These shall be designed for sitting for long duration such that these are comfortable for the back. Arm-rests in one piece shall be of poly-urethane and twin wheel castor of glass filled nylon. • Storage almirah: 3 No • Filing cabinet: 2 No • Printer table: 1 No Printer Table made of Laminated Wood or Heavy Duty MDF shall be provided for printer. (3) Furniture for security room and security cabins • Table with drawers – 2Nos • Chairs revolving type with arm rest – 10 Nos (4) Note : Make of the above mentioned furniture shall be Godrej or equivalent.				
5.36	Pre-commissioning inspections/ checks/tests, Quality checks, MRT tests, coordination/liaison with state /central departments/CEIG etc. for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning <table border="1"> <tr> <td>#</td><td> Scope description Vendor shall be responsible for carrying out following minimum tests/ checks for the respective Inverter stations, transformer yard, CMCS, Main pooling yard and any other tests as per requirements of NTPC / concerned state / central departments / TRANSCO/ GETCO/GEDA/ CEIG/ CEA etc. Site tests shall include all tests to be carried out at site upon receipt of equipment. It shall include but not be limited to testing calibration, configurations and pre commissioning trials start up tests, trial operation and performance and guarantee tests. The vendor shall be responsible for all site/commissioning tests. The vendor shall maintain all tests, calibration records in BHEL/NTPC approved formats, and these shall be countersigned by authorized quality assurance personnel of the vendor, BHEL and NTPC. The vendor shall maintain master checklists to ensure that all tests and calibration for all equipment/devices furnished under these specifications are satisfactorily completed under the supervision of the authorized quality assurance personnel of the vendor. The site / commissioning tests shall be categorized under following categories: (a) Start up tests (b) Calibration and configuration checks (c) Pre-commissioning tests (d) Trial Operation (e) Availability Tests Point-to-point testing of all the I/O signals under the present scope of work shall be done by the vendor at the plant and protection equipment end and the terminal end. Point-to-point testing shall include: - Verification of all status indications by operating the plant - Verification of event / alarm indications by simulating alarm conditions - Verification of all analogue indications by injection testing - Verification of all controls by operating the plant </td></tr> <tr> <td>1</td><td>Pre-commissioning inspections / checks / tests, MRT tests and coordination /</td></tr> </table>	#	Scope description Vendor shall be responsible for carrying out following minimum tests/ checks for the respective Inverter stations, transformer yard, CMCS, Main pooling yard and any other tests as per requirements of NTPC / concerned state / central departments / TRANSCO/ GETCO/GEDA/ CEIG/ CEA etc. Site tests shall include all tests to be carried out at site upon receipt of equipment. It shall include but not be limited to testing calibration, configurations and pre commissioning trials start up tests, trial operation and performance and guarantee tests. The vendor shall be responsible for all site/commissioning tests. The vendor shall maintain all tests, calibration records in BHEL/NTPC approved formats, and these shall be countersigned by authorized quality assurance personnel of the vendor, BHEL and NTPC. The vendor shall maintain master checklists to ensure that all tests and calibration for all equipment/devices furnished under these specifications are satisfactorily completed under the supervision of the authorized quality assurance personnel of the vendor. The site / commissioning tests shall be categorized under following categories: (a) Start up tests (b) Calibration and configuration checks (c) Pre-commissioning tests (d) Trial Operation (e) Availability Tests Point-to-point testing of all the I/O signals under the present scope of work shall be done by the vendor at the plant and protection equipment end and the terminal end. Point-to-point testing shall include: - Verification of all status indications by operating the plant - Verification of event / alarm indications by simulating alarm conditions - Verification of all analogue indications by injection testing - Verification of all controls by operating the plant	1	Pre-commissioning inspections / checks / tests, MRT tests and coordination /
#	Scope description Vendor shall be responsible for carrying out following minimum tests/ checks for the respective Inverter stations, transformer yard, CMCS, Main pooling yard and any other tests as per requirements of NTPC / concerned state / central departments / TRANSCO/ GETCO/GEDA/ CEIG/ CEA etc. Site tests shall include all tests to be carried out at site upon receipt of equipment. It shall include but not be limited to testing calibration, configurations and pre commissioning trials start up tests, trial operation and performance and guarantee tests. The vendor shall be responsible for all site/commissioning tests. The vendor shall maintain all tests, calibration records in BHEL/NTPC approved formats, and these shall be countersigned by authorized quality assurance personnel of the vendor, BHEL and NTPC. The vendor shall maintain master checklists to ensure that all tests and calibration for all equipment/devices furnished under these specifications are satisfactorily completed under the supervision of the authorized quality assurance personnel of the vendor. The site / commissioning tests shall be categorized under following categories: (a) Start up tests (b) Calibration and configuration checks (c) Pre-commissioning tests (d) Trial Operation (e) Availability Tests Point-to-point testing of all the I/O signals under the present scope of work shall be done by the vendor at the plant and protection equipment end and the terminal end. Point-to-point testing shall include: - Verification of all status indications by operating the plant - Verification of event / alarm indications by simulating alarm conditions - Verification of all analogue indications by injection testing - Verification of all controls by operating the plant				
1	Pre-commissioning inspections / checks / tests, MRT tests and coordination /				

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 50 OF 56

		liaison activities with state / central departments / GETCO/ GEDA/ Transco/ DISCOM/ CEIG/ CEA etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant. (Clearances shall include obtaining prior approvals for all applicable drawings/ documents etc from concerned state / central departments / GETCO/ GEDA/ Transco/ DISCOM/ CEIG/ CEA etc.). Vendor shall coordinate with and support existing 220KV switchyard contractor in obtaining necessary approvals/ clearances.	
	A	Basic checks	
	A1	Tightness checks:	
		1) Terminations of AC/DC power cables at SMBs, PCUs, Inverter transformers, Aux transformer, ACDB panel, UPS/ Battery banks, Aux AC/DC DB boards, 33kV VCB panels, Inverter transformer, SCADA panels etc. 2) Terminations of Control/ Instrumentation/ Data/ Communication cables wherever applicable. 3) Terminations of earthing at all electrical equipment/ panels of inverter station/ control room/main pooling yard 4) Terminations of earthing of inverter transformers, aux transformer 5) Terminations of earth chambers of vendor scope. Note: For M10 and above, torque wrench settings shall be followed for reference.	
	A2	Electrical continuity checks	
	A3	Megger (5kV) checks for all HT (33kV) cables	
	A4	Hi-pot testing for all HT (33kV) cables prior to connection to the panels/ transformers.	
	A5	Megger (1kV) checks for all 1.1kV grade cables	
	A6	AC/DC supply checks at TBs of all electrical panels/ DBs/ Transformers.	
	B	Pre-commissioning electrical tests:	
	B1	Power conditioning units (with the support of PCU service engineer at site)	
		1) DC side open circuit voltage and verification with SMB side measurements 2) Vendor to provide technician support to PCU service engineer for all other pre-commissioning tests as per OEM checklist 3) Functioning of duct fans (operation, direction of rotation)	
	B2	Inverter transformers and Aux transformer	
		1) Oil filtration: Equipment of adequate evacuation/ heating/ oil circulation capacity shall be deployed at site for this purpose. Filtration shall be carried out adequately in order to achieve the BDV (min 60kV), ppm (max 10) values within the limits as per relevant standards and as measured by NABL accredited laboratory. The machine shall have built-in BDV measuring set up for in-situ checking of BDV during filtration process. DG if required for oil filtration shall be arranged by vendor. 2) IR tests LV-HV, HV-E, LV-E 3) Vector group	

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 51 OF 56

			4) Voltage ratio 5) Magnetizing current 6) Magnetic balance 7) Winding resistance at all taps 8) Fault simulation checks (at VCB breaker panels): Buchholz, OTI, WTI, PRV, LOLA etc 9) Alarm, trip settings (S1, S2) for WTI, OTI 10) Oil level at conservator (to be topped up, if required)		
	B3		CTs 33kV at VCB panel		
			1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Ratio tests / primary injection		
	B4		PTs 33kV at VCB panel		
			1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Voltage ratio test 3) Polarity test		
	B5		33KV VCB breakers		
			IR tests Contact resistance measurement (CRM) Timing test: close/ open/ close-open Functional checks: breaker open/close, spring-charged motor Remote operation from SCADA panels: open/close, command/ status, lamp indications		
	B6		Numerical relays at 33KV breaker		
			1) Relay calibration using applicable kit/ software 2) IDMT, DT curves with timing/pickup settings in all relays based on gradation across from downstream to upstream taking into account settings at substation 3) Overcurrent/ earth fault pickup/ tripping time tests 4) Undervoltage/ overvoltage protection test		
	B7		CT ratio / PT ratio to be set in meters/relays		
			i. All MFM meters ii. Protection relays		
	B8		ACB breaker settings (with the help of PCU service engineer)		
			1) Over load, Short time fault, ground fault		
	B9		Earth resistance measurements for all chambers of vendor scope		
			1) With electrode connected to grid 2) Without connecting electrode to grid		
	B10		UPS/ Battery banks		
			1) All functional checks: battery charging/ discharging, battery output parameters etc. as per OEM checklists		
	B12		Tests on 30KV LA in VCB panel		
	C		Testing agency		
			Credentials of testing agency shall be submitted to BHEL for approval prior to awarding of work.		
	D		Coordination and Liaison activities to be carried out by vendor:		
			1) Vendor shall lead in the process of obtaining approval from GETCO/GEDA/Transco/ DISCOM/ CEIG/ CEA etc as applicable for plant charging/ grid synchronization/ plant commissioning.		

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 52 OF 56

			2) Liaison responsibility for getting the approvals rests with the vendor. Wherever technical clarifications are required by the approving agencies with regard to SPV portions (including solar array) up to Main pooling switchgear, vendor shall suitably coordinate/liaison with the concerned state/central approving agencies to make the approval process successful. Accordingly, vendor shall participate in direct discussions with the approving agency whenever necessary. Also, all the necessary payments/expenditures to be incurred with ref to such coordination/ liaison in this regard shall be borne by the vendor. 3) Vendor shall coordinate with and support existing 220KV switchyard contractor for successful commissioning of plant. 4) Following are the areas of approval, as applicable (a) GTP/ datasheets/ GA drawings/ Bill of materials, MQP etc of all (BHEL's/vendor's) supply items. (b) Site test reports of transformers, transformer oil, VCB breakers, CTs, PTs, LAs, resistance of earth mat grids etc (c) Interaction with supervising/ inspection agency such as GETCO, GEDA, Transco, CEIG, CEA etc, as applicable, for applying to them/ inviting them for supervision/ inspection at site. (d) Interaction/ coordination with customer in the above process as and when required. (e) All necessary testing kits/ instruments shall be arranged as per the requirements of inspection agency. Basic instruments such as digital multimeter, 5kV digital megger with PI feature, earth resistance meter, VCB open/close timing test kit, clamp meters etc shall be organized at site at the time of inspection. Competent electrical technician shall also be made available at the site. (f) Subsequent to site inspection by the concerned agency, vendor shall obtain the clearance for grid synchronization after implementation of all the observations of CEIG. (g) Vendor shall also coordinate with DISCOM for obtaining approvals such as grid connectivity approval etc.	
		E	Commissioning of Solar Power Plant	
			1) Vendor shall organize all necessary tools/ measuring instruments required to operate the various electrical equipment at the time of commissioning: Digital megger 5KV with PI feature, Earth resistance tester, Phase sequence meter, Clamp meters etc., discharge rods, PPE safety gadgets (helmets, shoes etc.). 2) It is the responsibility of the vendor to successful charge solar plant from solar array to main pooling switchgear and grid synchronization of inverters/ plant commissioning for full DC capacity. 3) Vendor shall participate actively in the commissioning until it is established that there is successful export of power from all the strings, PCUs. 4) Vendor shall coordinate with and support existing 220KV switchyard contractor for successful commissioning of plant.	
		F	Trial run, module cleaning (1 cycle), grass cutting and module cleaning (1 time activity) and Handing over of the Plant	
			Vendor shall participate actively in the commissioning until it is established that there is successful export of power from all the strings, PCUs.	
			After commissioning and completion of all works including clearing of all	

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	Rev No: 01
		PAGE : 53 OF 56

		punch points, trial run of the plant will be commenced for trouble free operation for cumulative 24 hours (effective solar generation hours) during which functionality of all plant components shall be demonstrated and the system shall be in Generating Mode. During trial run vendor shall deploy manpower, operate and maintain the plant and ensure that there are no breakdowns in any equipment. All required tools and instruments during this period will be provided by vendor. In case of extension of trail run schedule/ period, it is vendor's responsibility to ensure that vendor's teams are available at site till successful completion of trial run. Prior to trail run, vendor shall do one cycle of module cleaning and demonstrate the operation and functionality of module cleaning system in full. After successful completion of trial run and acceptance by NTPC, SPV Plant shall be deemed to be successfully erected & commissioned. Vendor shall propose for handover of the plant supplies and installations. Before handover of the project, vendor shall clean entire plant facility for the scrap/ unused material and remove the shrubs/ bushes/ Grass including uprooting of rank vegetation, brush wood, trees and saplings of girth upto 30 cm measured at a height of 1 m above ground level and removal of rubbish. The same shall be disposed at a remote location as shall be informed during execution. The contractor shall hand over the plant and equipment back to the owner in completely safe and healthy condition and without any pending defect.	
5.37	Spares required to be supplied along with main consignment: 1) Fuses of all types: 1 % of total population of respective items 2) MCB of all types: 1% of total population of respective items 3) Indicating lamp set of all types: 1% of total population of respective items 4) Surge protection devices/ MOV: 1% of total population of respective items 5) Lamps for peripheral lighting- 10 Nos 6) MC4 connectors: 150 sets (1 set = 2 nos) 7) Y connectors: 150 nos 8) 33KV, 1C, 300 sqmm (E) Indoor End termination kits- 3 Nos 9) 33KV, 1C, 300 sqmm (E) Straight through jointing kits- 1 Nos 10) Spares of aux transformers: a) HV bushings with metal parts and gaskets: 1 set b) LV bushings with metal parts and gaskets: 1 set c) Neutral bushing with met metal parts an gaskets: 1 set d) Gaskets : 2 sets e) Silica gel breather with charge: 1 set f) Diaphragm of explosion vent: 1 set g) Prismatic oil level gauge: 1 set h) Valves: 1 set Notes: (a) 1 set refers to total quantity of the item used in one transformer. In case quantity arrived based on percentage is a decimal figure, it shall be rounded off to next higher integer.		

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 54 OF 56

6.0 SAFETY MANAGEMENT

6.1 Vendor shall follow the site safety plan at site.

6.2 During the execution of the contract, the bidder and it's sub-vendor(if any) shall follow safety procedures for the safety of the personnel and the equipments during erection, testing, commissioning during the contract period as per NTPC/BHEL safety plan, as per the regulatory requirements and the as per the original equipment manufacturer's recommendations.

6.3 All the expenses, charges towards compliance of the safety norms by the bidder as per the Safety Plan, Safety Policy, and the Safety Coordination Procedures are deemed to be included in the bid price. No additional claims shall be entertained towards meeting the safety requirements

6.4 Safety sign board to be provided near all construction area/ installations.

7.0 General conditions applicable during supply, installation and commissioning

7.1	As already mentioned in previous clauses, vendor shall organize power supply on their own. Accordingly, DG sets of suitable capacity shall be deployed by the vendor for construction works.
7.2	Similarly, water required for construction works shall be organized by vendor (tankers etc).
7.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement and installation of materials / panels / equipment etc shall be organized by the vendor.
7.4	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper/ aluminium cables up to 630 sq-mm), screw driver set, power screw drivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole-saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates/ shuttering materials for RCC works, spade, shovel, hammer etc shall be organized by the vendor.
7.5	All necessary measuring instruments such as digital multimeters, measuring tapes, vernier calipers, electrical testers, digital meggers (1kV, 2.5kV, 5kV), earth resistance meters, clamp meters, transformer oil BDV kit, relay testing kit (secondary injection), primary injection kit, infrared thermal imaging handheld temperature meter etc. All these instruments shall possess valid calibration certificate issued from approved NABL laboratory.
7.6	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.
7.7	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
7.8	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc. at the site.
7.9	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.
7.10	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.
7.11	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.
7.12	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS	PS-439-1341
	SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR	Rev No: 01
	PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PAGE : 55 OF 56

	once amicably so that the progress of work is not affected.
7.13	Any damages on the building, structures etc. attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.
7.14	No child labour shall be employed for execution of the present contract.
7.15	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.
7.16	Special instruction for earthing: In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc. shall be earthed.
7.17	BHEL/NTPC shall witness routine/ acceptance/ type tests performed at manufacturer works for the items supplied by vendor. Vendor shall accordingly provide inspection call to BHEL with submission of quality assurance plan in advance. For the items bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL/NTPC for procurement of the item from dealers.
7.18	Field Quality Plan / Quality control system (if applicable) Vendor shall set up a field quality control laboratory with full set up to facilitate testing of all construction materials in accordance with FQP (Field quality control plan) as approved by BHEL/NTPC. Vendor shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP. Specifically with reference to civil works, vendor shall submit all concrete mix designs and bituminous mix designs for BHEL/NTPC approval before starting of the work. All the third party testing should be conducted in NABL approved laboratories only. Vendor shall submit the FQP for the civil construction works before starting of the works for approval of BHEL/NTPC.
7.19	Any deviations shall be discussed with BHEL/NTPC site engineers and implementation shall be taken up only after approval from BHEL /NTPC.
7.20	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
7.21	Vendor shall, as and when required by BHEL/NTPC, participate in the review meetings conducted by BHEL/NTPC at project site, BHEL-EDN (Bangalore), BHEL-Corporate office (New Delhi), NTPC office, New Delhi etc
7.22	General Guidelines a) Any civil or electrical work which is not mentioned or included in this tender document but necessary for functional requirements of the plant shall be carried out by vendor. b) Vendor shall prepare all designs / drawings based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard. c) Vendor shall provide type test reports and datasheet/ GTP for all equipments covered under vendor scope of supply. d) BHEL reserves right to modify the design at any stage to meet local site conditions / project requirements. e) All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed thereunder and as amended from time to time.
7.23	For all current carrying parts and earthing, S.S hardware shall be provided and all other places, G.I hardware shall be provided. M.S hardware shall not be used in any place.

	PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS AND I&C FOR 20MW(AC) SOLAR PV POWER PLANT AT NTPC GANDHAR, GUJRAT	PS-439-1341
		Rev No: 01
		PAGE : 56 OF 56

8.0 Documents to be submitted for BHEL/NTPC approval during detailed engineering

8.1	BHEL/NTPC approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities during detailed engineering (after receipt of purchase order from BHEL).
8.2	Name of vendor/ make, model number/ part number, specification/ sizes/ dimensions/ drawings/ datasheets shall be submitted for all the vendor supplied items.
8.3	Design calculations/ general arrangement drawings/ single line diagrams/ GTP particulars/ datasheets/ schemes/ layouts/ cable schedules/ bill of materials etc., as applicable.
8.4	Manufacturing Quality Plans for all the vendor supplied items
8.5	Field quality plan for the field work: civil works, electrical works
8.6	Detailed activity-time chart for project implementation
8.7	Detailed manpower deployment schedule

ANNEXURE-1

1. LT SWITCHGEAR

• CODES AND STANDARDS

The design, materials, and method of LT switchgear shall conform to the applicable IEC standard. All equipment shall be installed and all work shall be carried out in accordance with relevant IEC standards. Where an applicable IEC standard is not available, IS/ any applicable international standard shall be referred to as best practice. All standards, specifications and codes of practice shall be the latest editions including all applicable official amendments and revisions.

As a minimum requirement, the following standards shall be complied with:

IS	Details
IEC 60947/IS 13947	Low-voltage switchgear and control gear
IS 2705	Current Transformers
IS 3043	Code of practice for earthing.
IS 3072	Code of practice for installation and maintenance of Switchgear
IS 3156	Voltage Transformers
IS 3202	Code of practice for climate proofing of electrical equipment.
IS 3231	Electrical relays for power system protection.
IS 13703 / IEC 60269	HRC Cartridge fuses
IS 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.
IEC 60255	Electrical Relays

• TECHNICAL PARAMETERS

➤ POWER SUPPLY (AC SYSTEM)	
Voltage	415 V + 10 %, 3 Phase, 4 wire, Neutral Solidly Earthed
Frequency	50 Hz +/- 5%
Minimum system fault level	As per system fault current (for 1 sec)
Short time rating for bus bars, ckt. breakers, current transformers and swgr. Assembly.	As per system fault current (for 1 sec)
Maximum ambient air temperature	50 deg. C
➤ BUS BARS	
Continuous current rating at 50°C ambient:	As Per Requirement
Temperature Rise allowed above ambient	400C for plain joints 550C for Silver plated joints
➤ MCCB	
Rated voltage	415V
Rated Insulation Level	690V
Rated ultimate and service SC breaking capacity(As per system requirement)	As per system fault current (for 1 sec)
Rated making capacity	2.1 times of System fault current

Utilization category	A
➤ DIGITAL MFM	
Accuracy class	0.5
MFM shall be provided at LT incomer feeder. MFM shall have suitable communication port for integration with SCADA system.	
➤ CURRENT TRANSFORMERS	
Type	Cast Resin Bar Primary
Voltage class and frequency	650V, 50HZ
CT Secondary Current	1 A
Class of insulation	E or better
Accuracy class & burden	
a) For Protection	5P20, 5VA
b) For Metering	Class 1.0, 5VA (min)
Instrument Security Factor for metering CT	5
➤ VOLTAGE TRANSFORMERS	
Type	Cast Resin
Voltage Ratio	415 / 110V for line PT 415/V3 / 110/V3V for Bus PT
Method of Construction	Vee Vee
Accuracy Class	0.5
Rated Voltage factor	1.1 continuous, 1.5 for 30 sec.
Class of insulation	E or better
One minute power frequency withstand voltage	2.5 KV
➤ HRC FUSES	
Voltage Class	650 Volts
Rupturing capacity	80kA (RMS) for AC circuits
➤ CONTACTORS	
Type	Air break electro magnetic
Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives
➤ SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS	
Colour finish	
Exterior	RAL9002 (Main body) RAL 5012 (Extreme end covers) The paint thickness shall not be less than 50 microns
Cable entry	Bottom

The quantities/Nos. of the Feeders/MCCB shall be so as to meet the system requirements. 5% spare with minimum 01 No. to be provided on each board/switchgear having more than 5 MCCB. However, no spare Air circuit breaker panels are required.

- **DETAILS OF INDOOR DISTRIBUTION BOARDS**

Applicable for Auxiliary Power Supply system and String Inverter distribution board of rating upto & including 400A.

- Switchboards shall be of metal enclosed, indoor, floor-mounted, free-standing type.
- All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.
- All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.
- The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.
- All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. All cutouts shall be provided with EPDM / Neoprene gaskets.
- All switchboards shall be of uniform height not exceeding 2450 mm.
- Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation / steel insert plates.
- All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. Replacement /Maintenance of individual equipment/ component shall be possible without switching off or isolating the other equipments/components.
- Each switchboard shall be provided with undrilled, removable type gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall be provided with gasket to ensure enclosure protection.
- The minimum clearance in air between phases and between phases and earth for the entire busbars shall be 25mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be at least ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars up to switch / fuses/MCCB shall be fully insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits. All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.
- All switchboards shall be provided with three phase and neutral busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.
- The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.
- All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be

provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.

- All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminium joints shall be provided with suitable bimetallic washers.
- All busbars shall be colour coded as per IS: 375.
- Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.
- The Bidder shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.
- Panel space heaters shall be provided and the supply for this shall be tapped from incomer, before the isolating switch/circuit breaker. Incoming circuit to spaceheater shall have an isolating switch, HRC fuse and neutral link of suitable rating.
- Panel illumination and plug-socket shall also be tapped from the space heater supply.
- A galvanized steel / Copper / Aluminium earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.
- The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth without exceeding the allowable temperature rise.
- All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.
- All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable.
- However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.
- VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.
- All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also be acceptable. The Contractor shall establish earth continuity at site also.
- All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.
- All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, colour coded, PVC insulated wires. Conductor size shall be 1.5 mm² (min.) for control circuit wiring and 2.5 mm² (min) for CT and space heater circuits.
- Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.

- All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.
- All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.
- Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.
- Cable termination arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armoured / unarmoured and PVC sheathed cables. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc., shall be provided by the contractor, to suit the final cable sizes.
- All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.
- All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local pushbutton stations etc. shall be provided with prominent, engraved identification plates.
- All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to Employer's approval.
- Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.
- The gaskets, wherever specified, shall be of good quality EPDM / neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.
- The bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per indian standards / specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.
- ON/OFF status and protection trip status of incomers and bus coupler (if available) be provided for SCADA system.
- Suitable changeover and interlocking arrangement shall be provided for incomers and bus coupler.
- It shall be the responsibility of the contractor to fully coordinate the overload and short circuit breakers/fuses with the upstream and downstream circuit breakers / fuses, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of type ii class of co-ordination as per IS:8544.
- All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-c" as specified in is: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, electrostatic powder coating shall be used. Powder should meet requirements of is 13871 (powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the employer. The paint thickness shall not be less than 50 microns.

- **MCCB**

- MCCB shall be fixed type module, air break type, having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.
- MCCB shall have inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status (on/off etc).
- MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked.
- The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch, shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturer's discrimination table.

- **FUSES**

- All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.
- Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.
- Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.
- The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.

- **CABLE COMPARTMENT/CABLE ALLEY:** - A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley of capacity more than 400 A shall be designed to meet the Form IVb (as per IEC 61439) for safety purpose. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.

- **CONTROL COMPARTMENT:-** A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.
- All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit – breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.
- Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above.
- Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. EPDM / Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels.
- The minimum clearance in air between phases and between phases and earth for the entire busbars. and bus-link connections at circuit-breaker shall be 25mm. All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.
- After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.
- All switchgear (circuit-breaker) panels shall be of single-front type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more.
- All circuit-breaker modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. Suitable arrangement with cradle / rollers, guides along with tool / lever operated racking in / out mechanism shall be provided for smooth and effortless movement of the chassis.
- All switchboards shall be provided with three phase and neutral busbars. Two separate sets of vertical busbars shall be provided in each panel of double front DBs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.
- ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door cannot be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked.
- The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.
- **Temperature raise test of LT switchgear of rating more than 400A:-** The temperature rise of the horizontal and vertical busbars and main bus links including all power draw out contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not

exceed 10deg. C for metallic & 15 deg.C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current.

- The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel.
- Electrically controlled circuit breaker boards shall be provided with DC control supply.

• **CIRCUIT BREAKERS**

- Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.
- Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.
- There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energising the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLY WITHDRAWN" position. Circuit Breaker rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition.
- Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively.
- Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE", "TEST" AND "SPRING CHARGED" positions.
- Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.
- Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and drawout contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.
- Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.
- Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.
- Breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.
- Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.
- Circuit breaker shall be provided with anti-pumping feature and trip free feature, even if mechanical anti-pumping feature is provided.
- Mechanical tripping shall be possible by means of front mounted Red "trip" pushbutton. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.

- Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Bidder's scope of supply.
- Circuit breaker open/close shall be possible from SCADA and open/close status and all other important signal status shall be provided for SCADA monitoring.
- Power operated mechanism shall be provided with a Universal motor suitable for operation on DC Control supply. In case of DC supply motor should satisfactorily operate with voltage variation between 85% to 110% nominal control supply voltage. Motor insulation shall be class "E" or better.
- The motor shall be such that it requires not more than 30 Seconds for fully charging the closing spring at minimum available control voltage.
- Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.
- The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.
- Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.
- All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage between 85% to 110% nominal control supply voltage. The trip coil shall operate satisfactorily at all values of voltage between 70% to 110% nominal control supply voltage.
- Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.
- The ACB Panel door shall not be possible to open in breaker closed condition. Further, the racking mechanism shall be accessible only after opening the breaker panel door.
- Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle at each location. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear.

- **Electrical Parameter of Circuit Breaker**

Type	Air break spring charged stored energy type
Operating duty	O - 3 M I N - O C - 3 M I N -OC
Symmetrical interrupting	As per system fault current (for one sec)
Short circuit rating	2.1 times of System fault current peak)
Short Circuit Breaking current	
a) AC Component	As per system fault current (for one sec)
b) DC Component	As per IS:13947
Short time withstand	As per system fault current

- **DERATING OF COMPONENTS**

The Bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the

permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.

The Bidder shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and amb. temperature of 50 deg C.

2. LT POWER & CONTROL CABLES

LT Power & control cables shall be of minimum 1100 volts grade XLPE / PVC insulated conforming to IS 1554 for utilization voltages less than equal to 415 V.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

• LT POWER CABLES

- The cables shall be suitable for laying on racks, in ducts, trenches, conduits and underground (buried) installation with chances of flooding by water.
- All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- If cables are to be laid underground, laying shall be as per latest relevant IS code. Copper/aluminium conductor used in power cables shall have tensile strength as per relevant standards. Conductors shall be stranded.
- XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg.C and short circuit conductor temperature of 250 deg C.
- PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
- The cable cores shall be laid up with fillers between the cores wherever necessary.
- It shall not stick to insulation and inner sheath. All the cables, other than single core cables, shall have distinct extruded PVC inner sheath of black colour as per IS:5831. Single core cables shall have no Inner sheath as per IS: 7098 Part-I

- For single core armoured cables, armouring shall be of copper/aluminium wires/ formed wires.
- For multicore armoured cables, armouring shall be of galvanised steel as follows:

Calculated nominal dia. of cable under armour	Size and Type of armour
Up to 13 mm	1.4mm dia GS wire
Above 13 & up to 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 & up to 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 & up to 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
Above 55 & up to 70 mm	1.4mm thick GS formed wire /3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

- The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm² per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.
- The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of GS wire / formed wire.
- Outer sheath shall be of PVC as per IS: 5831 & black in colour for power cables. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
 - Oxygen index of min. 29 (as per IS 10810 Part-58).
 - Acid gas emission of max. 20% (as per IEC-754-I).
 - Smoke density rating shall not be more than 60 % (as per ASTM D-2843).
- Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:
 - 1 core - Red, Black, Yellow or Blue
 - 2 core - Red & Black
 - 3 core - Red, Yellow & Blue
 - 4 core - Red, Yellow, Blue and Black
- For reduced neutral conductors (in case of power cable), the core shall be black.

• CONSTRUCTIONAL FEATURES FOR LT POWER CABLES

- KV grade XLPE power cables shall have compacted aluminium/ copper conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I). Cables which are directly buried shall be armoured.
- 1.1KV grade PVC power cables shall have aluminium/copper conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I).

• TESTS

- Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power and control cables enclosed at relevant section.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- All cables to be supplied shall be of type tested design.

- **LT CONTROL CABLES**

- The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground (buried) installation with chances of flooding by water.
- All cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- Conductor of control cables shall be made of stranded, plain annealed copper. Outer sheath shall be of PVC as per IS: 5831 & grey in colour for control cables. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
 - Oxygen index of min. 29 (as per IS 10810 Part-58).
 - Acid gas emission of max. 20% (as per IEC-754-I).
 - Smoke density rating shall not be more than 60 % (as per ASTM D-2843).
- Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:

1 core - Red, Black, Yellow or Blue

2 core - Red & Black

3 core - Red, Yellow & Blue

4 core - Red, Yellow, Blue and Black

- For control cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
- In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.
 - Cable size and voltage grade - To be embossed
 - Word 'FRLS' at every 5 metre - To be embossed
 - Sequential marking of length of the cable in metres at every one metre to be embossed / printed
 - The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
- All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
- Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum, over the declared value in the technical data sheets.
- Repaired cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.

- **CABLE SELECTION & SIZING**

- Control cables shall be sized based on the following considerations:
 - (a) The minimum conductor cross-section shall be 1.5 sq.mm.
 - (b) The minimum number of spare cores in control cables shall be as follows:

No. of cores in cable	Min. No. of spare cores
2C, 3C	NIL
5C	1
7C-12C	2
14C & above	3

- For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.

• **CONSTRUCTIONAL FEATURES FOR LT CONTROL CABLES**

- KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC or XLPE insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).
- Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power and control cables enclosed at relevant section.
- All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- All cables to be supplied shall be of type tested design.

• **CABLE DRUMS**

- Cables shall be supplied in non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection.
- However, For Single core cables upto 6 Sq. mm size, supplier can do alternative packaging of whole Drum/Spool to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.
- Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

3. Instrumentation Cables

- Common Requirement

Property	Requirement
Voltage grade	225 V (peak value)
Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
Continuous operation suitability	At 70 deg. C for all types of cables
Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.
Marking to read 'FRLS	To be provided at every 5 meters on outer sheath
Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the
Variation in diameter	Not more than 1.0 mm throughout the length of cable.
Ovality at any cross-section	Not more than 1.0 mm
Others	a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable.
Color	The outer sheath shall be of blue Blue

- Specific Requirement

	Property	Requirement
	Type of cable	F and G Type cables
➤ Conductors		
	Cross section area	0.5 sq. mm
	Conductormaterial	High conductivity Annealed bare copper
	Colour code	As per VDE-815
	Conductor Grade	Electrolytic
	No & dia of strands	7x0.3 mm (nom)
	No. of Pairs	4,8,12,16,24,48
	Max. conductor resistance per Km (in ohm) at 20 deg. C	73.4 (loop)
	Reference Standard	VDE 0815
➤ Insulation		
	Material	Extruded PVC type YI 3
	Thickness in mm (Min/Nom/Max)	0.25/0.3/0.35

	Volume Resistivity(Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.
	Reference	VDE 0207 Part 4
	Core diameter above insulation	Suitable for cage clamp connector
➤ Pairing and Twisting		
	Single layer of binder tape on each pair provided	Yes
	Bunch(Unit formation) for more than 4P	To be provided
	Conductor /pair identification as per VDE081	To be provided
➤ Shielding		
	Type of shielding	Al-Mylar tape
	Individual pair shielding	To be provided for F-type cable
	Minimum thickness of Individual pair shielding	28 micron
	Overall cable assembly shielding	To be provided
	Minimum thickness of Overall cable assembly shielding	55 micron
	Coverage Overlapping	100% coverage with 20% overlapping
	Drain wire provided for individual shield	Yes (for F-type) Size=0.5mm ² , No.of strands=7, Dia of strands =0.3 mm, Annealed Tin coated copper
	Drain wire provided for overall shield	Yes. Size=0.5 mm ² , No.of strands=7,Dia of strands=0.3mm Annealed Tin coated copper
➤ Fillers		
	Non-hygroscopic, flame retardant	To be provided
➤ Outer Sheath		
	Material	Extruded PVC compound YM1 with FRLS properties
	Minimum Thickness at any point	1.8 mm
	Nominal Thick-ness at any point	>1.8 mm
	Resistant to water, fungus, termite & rodent attack	Required
	Minimum Oxygen index as per ASTMD-2863	29%
	Minimum Temperature index as per ASTMD- 2863	250 deg.C
	Maximum acid gas generation by weight as per IEC-60754-1	20%

	Maximum Smoke Density Rating as per ASTMD-2843	Maximum 60% To be provided (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD- 2843)
	Reference standard	VDE207 Part 5,VDE-0816
➤ Electrical parameters		
	Mutual Capacitance Between Conductors At 0.8khz (max)	120 nF/km for F type 100 nF/km for G-type
	Insulation Resistance(Min.)	100 M Ohm/Km
	Cross Talk Figure (Min.) At 0.8 Khz	60 dB
	Characteristic Impedance (Max) At 1 Khz	320 OHM FOR F-TYPE 340 OHM FOR G-TYPE
	Attenuation Figure At 1 Khz (Max)	1.2 db/km
➤ Complete Cable		
	Complete Cable assembly	Shall pass Swedish Chimney test as per SENSS 4241475 class F3.
	Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification
➤ Tests		
	Routine & Acceptance tests	Refer Type Test requirement of Specification for C & I System
	Type tests	
➤ Cable Drum		
	Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.
	Outermost layer covered with waterproof paper	Yes
	Painting	Entire surface to be painted
	Length	1000 m + 5% for up to & including 12 pairs 500 m + 5% for above 12 pairs

4. CABLE INSTALLATION METHODOLOGY

• CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.

IS:513	Cold rolled low carbon steel sheets and strips.
IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS:1079	Hot Rolled carbon steel sheet & strips
IS:1239	Mild steel tubes, tubulars and other wrought steel fittings
IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating
IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).
IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear
IS:2309	Code of Practice for the protection of building and allied structures against lightning.
IS:2629	Recommended practice for hot dip galvanising of iron & steel
IS:2633	Method for testing uniformity of coating on zinc coated articles.
IS:3043	Code of practice for Earthing
IS:3063	Fasteners single coil rectangular section spring washers.
IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables
IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.
IS:9537	Conduits for electrical installation.
IS:9595	Metal - arc welding of carbon and carbon manganese steels - recommendations.
IS:13573	Joints and terminations for polymeric cables for working voltages from 6.6kv upto and including 33kv performance requirements and type tests.
BS:476	Fire tests on building materials and structures
IEEE:80	IEEE guide for safety in AC substation grounding
IEEE:142	Grounding of Industrial & commercial power systems
DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors
VDE 0278	Tests on cable terminations and straight through joints

BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables.
	Indian Electricity Act.
	Indian Electricity Rules.

Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.

- **General**

- The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.
- Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.
- Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:
 - Meet all safety requirements
 - Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc
 - All cables shall be supported by conduits or cable tray run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turn made of symmetrical bends or fittings. When cables are run on cable trays, they shall be clamped at a minimum intervals of 2000mm.
- Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.
- Sharp bending and kinking of cables shall be avoided. Installation of other cables like high voltage, coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gaslines, special care should be taken for the protection of the cables in designing the cable channels.
- In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop fault at a later date.
- Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to the Employer's approval.
- Multicore control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilising plastic or

nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.

- The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably terminate in Elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.

- **EQUIPMENT DESCRIPTION**

- **Cable trays, Fittings & Accessories**

Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.

Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.

Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.

Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per relevant IS. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm

- **Support System for Cable Trays**

Cable tray support system shall be pre-fabricated similar or equivalent to "Unistrut make".

Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder:

a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.

b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised.

c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be

brushed and red lead primer, oil primer & aluminium paint shall be applied

d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drill ing and other machining operation.

e. Support system shall be able to withstand

- ✓ weight of the cable trays

- ✓ weight of the cables (75 Kg/Metre run of each cable tray)
- ✓ Concentrated load of 75 Kg between every support span.
- ✓ Factor of safety of minimum 1.5 shall be considered.

➤ **PIPES, FITTINGS & ACCESSORIES**

Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria GI Pipes shall be of medium duty as per IS:1239

Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.

Hume pipes shall be NP3 type as per IS 458

➤ **Junction Boxes**

Junction Boxes with IP:55 degree of protection, shall comprise of a case with hinged door constructed from cold rolled sheet steel of thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.

Terminal blocks shall be 1100V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq mm each. All internal wiring shall be of minimum 1.5 sq. mm cu. Conductor PVC wire.

➤ **Terminations & Straight Through Joints**

Termination and jointing kits for 33kV, 11kV, 6.6 kV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be premoulded type, taped type or heat shrinkable type. 33kV, 11kV and 6.6 kV grade joints and terminations shall be type tested as per IS:13573. 3.3kV grade joints and terminations shall be type tested as per VDE0278. Critical components used in

cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solderless crimping type cable lugs & ferrule as per DIN standard.

Straight through joint and termination shall be capable of withstanding the fault level for the system.

1.1 KV grade Straight Through Joint shall be of proven design.

➤ **Cable glands**

Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation.

Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality.

Cable glands shall be suitable for the sizes of cable supplied/erected.

➤ **Cable lugs/ferrules**

Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to relevant standard

➤ **Trefoil clamps**

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.

➤ **Cable Clamps & Straps**

The cable clamps required to clamp multicore cables on vertical run shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables, selflocking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment

➤ **Receptacles**

Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped galvanised or of die-cast aluminium alloy of thickness not less than 2.5 mm.

The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position.

Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity.

➤ **Galvanising**

Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.

The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified

➤ **Welding**

The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595

• **INSTALLATION**

➤ **Cable tray and Support System Installation**

Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.

Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray

installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the

support system along with tray, spacing etc in line with relevant standard.

The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.

The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval.

All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.

In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.

➤ **Conduits/Pipes/Ducts Installation**

The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/ roof/ wall/ cable tunnel/ cable trenches made for conduit installation shall be sealed and made water proof by the Contractor **either with any proven fire sealing system rated for one hour or** Modular multi-diameter cable sealing system consisting of frames, blocks, Compression wedge and its accessories. **The Cable sealing system should have been tested for fire insulation for min. 1 hr as per BS 476 and shall also provide water sealing. System shall be anti- rodent and anti- termite. #1** GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.

Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material

Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise

Conduit /pipe size (dia).	Spacing
Upto 40 mm	1 M
50 mm	2.0 M
65-85 mm	2.5 M
100 mm and above	3.0 M

For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.

➤ **Junction Boxes Installation**

Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.

➤ Cable Installation

Cable installation shall be carried out as per IS:1255 and other applicable standards.

For Cable unloading, pulling etc following guidelines shall be followed in general :

Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends.

Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.

While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer.

Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.

Cables shall be laid on cable trays strictly in line with cable schedule Power and control cables shall be laid on separate tiers in line with approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multi core cables shall be laid in touching formation.

Power and control cables shall be secured fixed to trays/support with self-locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.

Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.

Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.

No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.

In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.

Wherever few cables are branching out from main trunk route troughs shall be used.

Wind loading shall be considered for designing support as well Cable trays wherever required. Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.

The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time

➤ **Separation**

At least 300mm clearance shall be provided between:

- HT power & LT power cables,
- LT power & LT control/instrumentation cables

Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

No. of cores in cable	No. of spare cores
2C,3C	NIL
5C	1
7C-10C	2
14C and above	3

➤ **Directly Buried Cables**

Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255.

RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.

Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 5 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate.

Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.

➤ **Cable Terminations & Connections**

The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.

Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.

The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.

Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.

All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.

All cable terminations shall be appropriately tightened to ensure secure and reliable connections.

5. AUXILLARY POWER SUPPLY SYSTEM

• GENERAL

- Auxiliary power supply arrangement shall be in line with tender SLD. Each Inverter Room/local pooling/sub-pooling/CMCS room shall have its own auxiliary power supply system comprising of AC distribution board (ACDB) which shall be fed from LV side of Inverter transformer through suitably rated auxiliary transformers. All ACDB's shall have two incomer (100% rated) fed from two different sources. At CMCS, auxiliary transformer directly feed from 33kV switchgear are also acceptable. Following consideration shall be taken while arriving kVA capacity of auxiliary transformer,
 - 20% design margin.
- All non-critical auxiliary loads shall be fed directly from ACDB. However, emergency and important load shall be fed from suitable sized Uninterrupted Power Supply (UPS) or Battery Charged. Input AC supply for Uninterrupted Power Supply (UPS) and Battery Charger shall be fed from ACDB. Bidder shall consider the following one of the supply option for feeding different equipment loads:

Equipment Name	Option-1 ACDB	Option-2 UPS
SCADA including remote RTU/IO panel		✓
SCADA HMI		✓
Data logger		✓
Fire Detection /Alarm Panel		✓
Emergency Lighting		✓
HMI of SCADA		✓
Energy Meter/MFM		✓
Sub and Local Pooling Switchgear control & protection		✓
Main Pooling Switchgear (CMCS) control & protection		✓
Switchgear spring charging motor		✓

switchgear space heater	√	
Illumination, Fan supply etc	√	
Module washing system	√	
Other non-critical auxiliary loads	√	

- UPS system shall comprise of 2 x 100% UPS. Each UPS shall consist of 1x100% charger and inverter, 1 x 100% Battery bank for providing 30 minutes backup. Bypass Line static switch, manual bypass switch, 1 x 100% UPSDB, and other necessary Protective devices and accessories. UPSDB shall have two incomer fed from two separate UPS as mention above. At a time one incomer shall be in service. Suitable auto changeover logic shall be provided. In place of UPS, bidder can provide DC supply system (2 x 100% Battery Charger) of 12V or above upto 220V DC if the auxiliary power supply requirement of loads are in DC.
- The rated AC output capacity shall be taken for UPS battery size calculation. However the minimum UPS rating shall be 2KVA and the battery sizing shall be calculated on a minimum load of 1 KW (DC) for 30 minute backup. All UPS having rating 5KVA or more shall have three phase input.
- The Bidder can provide alternate arrangement with suitable redundancies such as power pack with 30 minute backup for switchgears.
- Each Battery charger system shall consist of 1 x 100% charger and 1 x 100% Battery bank for min 30 minutes back up and 1 x 100% DCDB, and other necessary protective devices and accessories. DC supply system voltage shall be 12V or above upto 220V DC.
- It is mandatory to use Battery charger system for control and protection supply of main pooling HT switchgear.
- Bidder shall submit configuration diagram, power supply distribution scheme, single line diagram and data sheets, all calculations such as Rectifier Modules/UPS Charger/Inverter rating calculations, battery sizing calculation etc. for UPS, Battery Charger & Battery system during detailed engineering stage for employer's review and approval.
- Size and rating of UPS, Battery Charger and Battery shall be finalized during details Engineering stage.

• **UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM**

- The minimum capacity of the UPS at load factor of 0.8 lagging inclusive of 10% design margin at 50 deg C. The UPS shall have an overload capacity of 125 % rated capacity for 10 minutes and 150 % rated capacity for 10 seconds. The overall efficiency of UPS shall be at least 80% on full load.
- The UPS system shall be capable of operating without D.C. battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.
- For UPS capacity 5 kVA or more, in addition to indications/display on UPS panel, important alarms along with important analog signal shall also be provided for use in SCADA. For UPS capacity less than 5 kVA bidder shall provide status, common alarm and trip DI (soft or hard) signal to SCADA
- The UPS chargers shall be self-regulating, solid state silicon controlled, full-wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for close voltage stability even when AC supply voltage fluctuates. The charger should be capable to fully charge the required batteries as well

as supply the full rated load through inverter. The charger shall be able to re-charge the fully discharge battery within 8 hours. The charger shall be design for input supply variation of $\pm 10\%$ and frequency variation of $\pm 5\%$. Charger design shall ensure that there is no component failure due to fluctuations of input supply or loss of supply and restoration. The detailed specification for the battery charger for UPS rating of 5kVA and above has been mentioned in the battery charger section below in this specification.

- The UPS inverter shall be of continuous duty, solid state type using proven Pulse Width Modulation (PWM)/Quasi square wave/step wave technique. Ferro-resonant types Inverters are not acceptable. The nominal voltage output shall be 230 Volts single phase ,50 Hz. The inverter equipment shall include all necessary circuitry and devices to conform to requirements like voltage regulation, current limiting, wave shaping, transient recovery, etc. The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum.
- The static switch shall be provided to perform the function of transferring UPS loads automatically without any break from faulty inverter to standby AC source. Manual bypass switch shall be employed for isolating the UPS during maintenance.
- Contractor has the option of supplying either Nickel Cadmium type batteries or Lead Acid Plante type batteries. The detailed specification for the batteries has been mentioned in the battery and charger section below in this specification.
- Equipment enclosures shall match and line up in assemblies of freestanding floor mounted cabinets designed for indoor service.
- Individual enclosure shall be ventilated switchboard type fabricated from not less than 1.6-mm thick sheet steel. Enclosures shall be furnished with concealed hinges. Front and rear doors shall be designed to permit easy access to all components for maintenance or replacement. The enclosures shall be reinforced with formed steel members as required to form a rigid self-supporting structure. Doors shall have three point latches.
- Adequate ventilating louvers and enclosure top panels shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings.
- The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application.
- The temperature rise inside all the cabinets/enclosures shall not exceed 10 deg.C above ambient temperature.
- The Contractor shall also carry out the site tests on UPS as required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.
- One set of tool shall be provided for maintenance and testing purposes.
- Battery shall be either Nickle Cadmium battery or Lead Acid Plante Battery. Specifications are as mentioned below-

- **BATTERY: NICKEL-CADMIUM BATTERY**

BATTERY PARAMETER

- a) Battery Voltage- To be decide during Detail Engineering
- b) No. of Cells- To be decide during Detail Engineering
- c) Battery type- Nickel-Cadmium
- d) Nominal discharge voltage per Cell- 1.2
- e) Float voltage- 1.42V/Cell

Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein, shall be the latest editions including all applicable official amendments and revisions as on date of opening of techno-commercial bid. In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:

IEC 60623/ IS 10918 Specification for vented type Nickel Cadmium Batteries.

IS 106 Quality tolerances for water for storage batteries

IEC 60993 Electrolyte for vented Nickel-Cadmium cells

Indian electricity rules

Indian electricity acts

Equipment complying with other internationally accepted standards such as IEC., BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.

DC Batteries shall be stationary Nickel Cadmium Pocket plate type conforming to IS:10918. The batteries shall be high/medium discharge performance type suitable for the backup time as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.

DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell.

- **Construction Features:-**

- **Containers**

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistance, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.

- **Vent Plugs**

Vent plugs shall be provided in each cells. They shall be antisplash type, having more than one exit hole shall allow the gases to escape freely but shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

➤ **Plates**

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS:10918. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked.

➤ **Sediment Space**

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

➤ **Electrolyte**

The electrolyte shall be prepared from battery grade potassium hydroxide conforming to IEC 60993. The cells can be shipped either in charged condition or in dry condition. Necessary electrolyte for make-up shall be supplied separately.

➤ **Connectors and Fasteners**

Nickel plated copper connectors shall be used for connecting adjacent cells and PVC insulated flexible copper cables shall be used for inter-row / intertier / inter-bank connections. Bolts, nuts and washers shall be Stainless Steel / Nickel coated steel to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds.

g) Battery racks

Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor.

Testing

The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries).The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier. Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.

• **BATTERY : LEAD –ACID PLANTE BATTERY**

➤ **BATTERY PARAMETER**

- a) Battery Voltage- To be decide during Detail Engineering
- b) No. of Cells- To be decide during Detail Engineering
- c) Battery type- Stationary Lead Acid Plante
- d) Nominal discharge voltage per cell- 2.0V
- e) Float Voltage 2.25V/Cell

➤ **CODES AND STANDARDS**

IEC 60896 Stationary Lead-Acid Batteries

IS : 266 Specification for sulphuric acid

IS : 1069 Specification for water for storage batteries

IS : 1146 Specification for rubber & plastic containers for lead acid storage batteries.

IS : 1652 Specification for stationary cells and batteries, lead acid type (with plante positive plates).

IS : 3116 Specification for sealing compound for lead acid batteries.

IS : 8320 General requirements and methods of tests for lead acid storage batteries.

IS : 6071 Specification for synthetic separators for lead acid batteries.

Indian Electricity Rules

Indian Electricity Acts

- Equipment complying with other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.
- DC Batteries shall be stationary lead acid Plante positive plate type conforming to IS:1652. The batteries shall be high/medium discharge performance type suitable for the backup time as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.
- DC Batteries shall be suitable for standby duty. The Batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 2.7 volts per cell maximum and float charged at about 2.25 V/cell.
- **Construction Features:-**

- **Containers**

Containers shall be made of transparent glass, hard rubber, suitable robust, heat resistance, leak proof, non absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of transparent containers. Float type level indicator shall be provided in case of opaque containers. The stem portion of the float should be long enough to prevent falling of the float inside the container even if there is no electrolyte in the container. The marking for the electrolyte level should be for the upper and lower limits. The material of level indicator shall be acid proof and oxidation proof. Container shall be closed/sealed lid type. Lid and sealing compound shall be non-cracking type. The container made of hard rubber and plastics shall be type tested as per IS : 1146. All type tests shall be carried out for sealing compound as per IS:3116. The pole sealing arrangement should be such that no acid particle get entrapped due to acid creep as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.

- **Vent Plugs**

Vent plugs shall be provided in each cells. They shall be antisplash type, having more than one exit hole shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

- **Plates**

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS : 1652 as applicable. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked.

➤ **Sediment Space**

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

➤ **Cell Insulator**

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on the racks with adequate clearance between adjacent cells. Minimum distance between adjacent cells shall be more than the bulge allowed for two cells in accordance with IS:1146.

➤ **Electrolyte**

The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS:266 and distilled water conforming to IS:1069. The cells shall be shipped dry uncharged. The electrolyte shall be supplied separately.

➤ **Connectors and Fasteners**

Lead or Lead coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. The thickness of lead-coating of connectors should not be less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX F of IS:6848 (latest edition). All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded copper conductors and PVC insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the contractor.

➤ **Battery racks**

Wooden racks for all the batteries shall be provided. These racks shall be made of good quality first class seasoned teak wood in line with CPWD specification. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries rack and wooden support for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags, resistant to acid, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor. Wherever racks are transported in dismantled condition, suitable match markings shall be provided to facilitate easy assembly.

➤ **Testing**

The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/IS 1652 (for lead-acid plate batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier. Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.

➤ **AUXILIARY EQUIPMENTS**

Manual discharge resistance bank suitable for each type of battery bank of UPS/Battery Charger has to be provided by contractor.

Following shall be provide (as per applicability) for maintenance purpose

a Hydrometer 2 Nos.

b Set of hydrometer syringes suitable for the vent holes in different cells 2 Nos.

c Thermometer for measuring electrolyte temperature 2 Nos.

d Specific gravity correction chart 2 Nos.

e Wall mounting type holder made of teak wood for hydrometer & thermometer 2 Nos.

f Cell testing voltmeter (3-0-3 V) 2 Nos.

g Alkali mixing jar 2 Nos.

h Rubber aprons 5 Nos.

i Pair of rubber gloves

j Set of spanners 5 Nos.

k No smoking notice for each battery room 2 Nos.

l Goggles (industrial) 2 Nos.

m Instruction card 2 Nos.

n Temperature indicator 1 No. per room

o Cell lifting facility 1 Set per room

- **SITE TESTS**

The contractor shall carry out the following site tests as applicable on UPS, Battery Charger and Battery system. However, any other site test is required to be conducted as a standard practice of the OEM or deemed necessary by the employer and mutually agreed between the contractor and the employer, the same shall also be carried out.

- **Light Load Test**

This test is carried out to verify that the UPS/Battery Charger is correctly connected and all functions operate properly. The load applied is limited to some percent of rated value. The following points should be checked:

- a) Output voltage, frequency and the correct operation of meters;
- b) Operation of all control switches and other means to put units into operation.
- c) Functioning of protective and warning devices.

- **C. Input Failure Test**

The test is performed in UPS/Battery Charger with a fully charged battery and is carried out by tripping input supply feeder or may be simulated by switching off all rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope/Recorder.

- **C Input Return Test**

AC input return test is performed in UPS/Battery Charger by closing AC input supply feeder, or is simulated by energizing rectifiers. Proper operation of rectifier starting and voltage and frequency variations are to be observed. This test is normally performed with a fully or partially charged battery.

- **Auto changeover Test**

This test shall be carried out in UPS ACDB fed from two separate UPS system. Auto changeover of one UPS source to standby UPS to be check by tripping the active UPS manually or by simulation condition. This test shall be check as per approved auto changeover logic.

- **Transfer Test (for UPS)**

This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.

- **Full load test**

Load tests are performed by connecting the actual load to the UPS/Charger output. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, and temperature.

- **Rated Stored Energy Time (Battery test)**

This test is a load test to prove the actual possible time of battery operation. If rated load is not available in the case of large UPS/Battery charger, it is possible to apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer. Discharge time with rated load shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS/Battery Charger and the battery voltage shall be recorded during the test. Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.

- **Rated Restored Energy Time**

Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.

- **Battery Ripple Current**

If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient.

CLAUSE NO.	TECHNICAL SPECIFICATIONS														
	SQE _10		4) LT SWITCHGEAR & LT BUSDUCT												
	(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)														
	ATTRIBUTES / CHARACTERISTICS														
	ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NTPC spec	All Routine tests as per NTPC spec. & IS
	Sheet Steel (IS : 513)	Y	Y		Y	Y		Y							
	Aluminum Bus bar Material (IS : 5082)	Y	Y	Y	Y	Y		Y							
	Copper Bus bar Material (IS : 613)	Y	Y	Y	Y	Y		Y							
	Support Insulator	Y	Y	Y	Y			Y							
	Air Circuit Breaker (IS: 13947)	Y	Y				Y	Y			Y	Y			Y
	Energy Meters (IS : 13010, 13779)	Y	Y				Y	Y			Y				Y
	Power & Aux. Contactors (IS : 13947)	Y	Y				Y	Y			Y				
Protection & Aux. Relays	Y	Y				Y	Y			Y				Y	
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT			TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)							PART-F			PAGE 6		

CLAUSE NO.	TECHNICAL SPECIFICATIONS															
	(IS : 3231) (IEC 60255 / IEC 61850)															
	Control & Selector Switches (IS : 13947)	Y	Y				Y	Y			Y					
	CT's & PT's (IS 2705 / 3156)	Y	Y					Y								Y
	MCCB (IS : 13947)	Y	Y					Y			Y					
	Indicating Meters (IS : 1248)	Y	Y				Y	Y			Y					Y
	Indicating Lamps (IS : 13947)	Y	Y				Y	Y			Y					
	Air Break Switches (IS : 13947)	Y	Y				Y	Y			Y					
	Control Terminal Blocks	Y	Y				Y	Y								
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT					TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)					PART-F			PAGE 7			

CLAUSE NO.	TECHNICAL SPECIFICATIONS														
	LT SWITCHGEAR														
	(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)														
	ATTRIBUTES / CHARACTERISTICS														
	ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NTPC Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness &	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NTPC spec	All Routine tests as per NTPC spec. & IS
	Fuse (IS 13703)	Y	Y				Y	Y							
	Control Transformer (IS : 12021)	Y	Y				Y	Y			Y				Y
	Push Buttons (IS : 4794)	Y	Y				Y	Y			Y				
	Transducer (IEC : 60688)	Y	Y				Y	Y			Y				Y
	MCB (IS : 8828)	Y	Y				Y	Y			Y				
	Breaker Handling Trolley	Y	Y				Y			Y	Y				Y
Synthetic Rubber Gasket (IS : 11149)	Y	Y		Y	Y		Y								
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)							PART-F			PAGE 8			

CLAUSE NO.	TECHNICAL SPECIFICATIONS														
	LT SWITCHGEAR (IS : 8623)	Y	Y				Y	Y	Y	Y	Y		Y	Y	Y
	Notes:														
	1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NTPC approval.														
</															

CLAUSE NO.	TECHNICAL SPECIFICATIONS															
	LT BUSDUCT															
	ATTRIBUTES , CHARACTERISTICS															
	ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimension & Surface Finish	Make, Type, Rating & TC	Electrical Properties	Mechanical Properties	Chemical Properties	Item to conform to relevant IS	WPS Approval, Welder Qualification	Weld Quality Check (DP test & x-ray Test)	Paint Shade, Thickness, Adhesion & Finish	Tightness by Torque measurement	Electrical Clearances	Galvanizing Test as per IS 2629/ 2633/ 4759	IR – HV – IR Test	Phase Sequence Check	Degree of Protection routine test as per NTPC spec.
	Aluminum Sheets / Plates / Strips / Flexibles / tubes (IS : 5082 / 737)	Y	Y		Y	Y	Y	Y	Y							
	CRCA Flats / ISMC (IS 2062)	Y	Y		Y	Y	Y									
	Neoprene / Synthetic Rubber Gaskets (IS 11149 / 3400)	Y	Y		Y	Y										
	Rubber Bellows (IS : 3400)	Y	Y		Y	Y										
	Support Insulator (BS : 2782, IEC : 660, IS : 10912)	Y	Y	Y	Y											
	Galvanized Structure & GI Earthing Flat (IS : 2629 / 2633 / 4749)	Y	Y				Y						Y			
	Space Heater &		Y	Y										Y		
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)										PART-F		PAGE 10		

CLAUSE NO.	TECHNICAL SPECIFICATIONS																
	Thermostat																
	LT Busduct (IS : 8623 PART 2)	Y	Y				Y	Y	Y	Y	Y	Y		Y	Y	Y	
Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NTPC approval.																	
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT	TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)										PART-F			PAGE 11			

CLAUSE NO.		TECHNICAL SPECIFICATIONS													
		5) CABLING, EARTHING, LIGHTNING PROTECTION													
MODULE NO. SQE-16		Page 1 of 1													
ATTRIBUTES / CHARACTERISTICS ITEMS/COMPONENTS / SUB SYSTEMS		Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC Specification
	Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
	Switch box/Junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
	Cable glands(BS-6121)	Y													Y
	Cable lug	Y													Y
	Lighting wire (IS-694)	Y											Y		
	Flexible conduits	Y											Y		Y
	Conduits (Galvanise & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
	RCC Hume Pipe (IS-458)												Y		
	Cable termination & straight through joint (IS 13573)	Y											Y		Y
	Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
	DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)								PART-F		PAGE 12		

CLAUSE NO.	TECHNICAL SPECIFICATIONS															
Trefoil clamp	Y														Y	
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y				Y		Y	
GI wire (IS-280)	Y												Y			
Fire Sealing System (BS -476)													Y	Y	Y	
.Note:1.This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2.* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses. 3. Make of all items will be subject to NTPC approval.																
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT					TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)					PART-F			PAGE 13			

CLAUSE NO.		TECHNICAL SPECIFICATIONS														
		6) Control Cables														
Attributes / Characteristics Item / Components / Sub System Assembly		Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden drums	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC specification	FRLS Tests
		Copper (IS-8130)	Y	Y	Y	Y		Y								
		PVC insulation Compound (IS: 5831)	Y		Y		Y				Y	Y				
		FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y						Y	Y				Y
		Extrusion & curing /Manufacturing of Core		Y		Y						Y				
		Core Laying						Y								
		Armour wire/strip	Y	Y	Y											
		Inner sheath	Y	Y												
		Armouring		Y					Y							
		Outer Sheathing		Y						Y						
		Finished Cable (IS-5831, ASTM-D2843, IS10810 (Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)						Y	Y	Y	Y	Y		Y	Y	Y
		Wooden drum(IS-10418) /Steel Drum		Y									Y	Y		
		Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Make of all major Bought out items will be subject to NTPC approval.														
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT			TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)							PART-F			PAGE 14			

CLAUSE NO.	TECHNICAL SPECIFICATIONS 		
	ROUTINE TESTS		Following routine tests shall be carried out on each drum of finished cables for all sizes.
	1)		Conductor Resistance test
	2)		High voltage test
	ACCEPTANCE TESTS		Following Acceptance tests shall be carried out on each size of cables, in the offered lot.
	A) For Conductor (as per sampling plan mentioned in IS: 1554)		
	1)		Annealing test (Copper)
	2)		Resistance test
	B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554)		
	1.		Measurement of Dimensions
	2.		Tensile Tests
	3.		Elongation Test
	4.		Torsion Test For Round wires only
	5.		Wrapping Test
	6.		Resistance Test
	7.		Mass of Zinc coating test For G S wires / Formed wires only
	8.		Uniformity of Zinc coating For G S wires / Formed wires only
	9.		Adhesion test For G S wires / Formed wires only
	10.		Freedom from surface defects
	C) For PVC insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554)		
	1)		Test for thickness
	2)		Tensile strength & Elongation before ageing (for tests after ageing see "D")
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)	PART-F PAGE 15

CLAUSE NO.		TECHNICAL SPECIFICATIONS			
D) Ageing test:					
		Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).		All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C+/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
			Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
E) Following tests will be carried out on completed cables as per IS on each size:					
		1)	Insulation resistance test (Volume resistivity method)		
		2)	High voltage test		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes):					
		1)	Thermal stability test on PVC insulation and outer sheath		
		2)	Oxygen index test on outer sheath		
		3)	Smoke density rating test on outer sheath		
		4)	Acid gas generation test on outer sheath		
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable will be carried out as per following sampling plan:					
			This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured, unarmoured) will be bunched together, as per calculations in line with the IEC. All sizes of armoured & unarmoured cables shall be covered.		
H) Following tests shall be carried on one length of each size (armoured & unarmoured) of offered lot:					
		1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / outer sheath extrusion's batch number marking		
		2)	Measurement of Eccentricity & Ovality		
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)		PART-F	PAGE 16

CLAUSE NO.	TECHNICAL SPECIFICATIONS																	
	7) LT Power Cables																	
	Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as er relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath &	Thermal stability	Anti termite coating on wooden drums	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC specification	FRLS Tests	
		Aluminum (IS-8130)	Y	Y	Y	Y		Y										
		XLPE Compound (IS-7098)	Y		Y			Y	Y				Y					
		PVC insulation Compound (IS: 5831)	Y		Y			Y					Y	Y				
		FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y								Y	Y				Y
		Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y		Y					Y				
		Core Laying								Y								
		Armour wire/strip	Y	Y	Y													
		Inner sheath	Y	Y														
		Armouring		Y							Y							
		Outer Sheathing		Y								Y						
		Power Cable (Finished) (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)								Y	Y	Y	Y	Y		Y	Y	Y
		Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		
		Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Make of all major Bought out items will be subject to NTPC approval.																
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)									PART-F			PAGE 17				

CLAUSE NO.	TECHNICAL SPECIFICATIONS				
	ROUTINE TESTS		Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.		
	3)	Conductor Resistance test			
	4)	High voltage test			
	ACCEPTANCE TESTS		Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.		
	A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)				
		1)	Annealing test (Copper)		
		2)	Tensile Test (Aluminum)		
		3)	Wrapping Test (Aluminum)		
		4)	Resistance test		
	B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)				
		1.	Measurement of Dimensions		
		2.	Tensile Tests		
		3.	Elongation Test		
		4.	Torsion Test For Round wires only		
		5.	Wrapping Test		
		6.	Resistance Test		
		7.	Mass of Zinc coating test For G S wires / Formed wires only		
		8.	Uniformity of Zinc coating For G S wires / Formed wires only		
		9.	Adhesion test For G S wires / Formed wires only		
		10.	Freedom from surface defects		
	C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)				
		1)	Test for thickness		
		2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")		
		3)	Hot set test (For XLPE insulation)		
	D) Ageing test:				
		Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:		Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine.	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C+/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)		PART-F	PAGE 18

CLAUSE NO.	TECHNICAL SPECIFICATIONS				
		The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).			the criteria) will be put on ageing test as per IS.
			Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
	XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot, will be put on ageing test as per IS.			
	E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)				
		1)	Insulation resistance test (Volume resistivity method)		
		2)	High voltage test		
	F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)				
		1)	Thermal stability test on PVC insulation and outer sheath		
		2)	Oxygen index test on outer sheath		
		3)	Smoke density rating test on outer sheath		
		4)	Acid gas generation test on outer sheath		
	G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:				
			This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NTPC approved datasheet.		
	H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:				
		1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch)number marking on sheath		
	2)	Measurement of Eccentricity & Ovality			
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)		PART-F	PAGE 19

CLAUSE NO.	TECHNICAL SPECIFICATIONS																
	10) CONTROL DESK, PLC /SCADA PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM																
	CONTROL DESK, PLC /SCADA PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM																
	TESTS ITEMS																
		Visual ®	GA, BOM , Lay Out of components ®	Dimensions ®	Paint Shade/Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring ®	IR & HV ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ osaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	Functional Check for Control Element , Annunciation ®	Mimic ®	Test as per IEC 1131 ® *	Test as per Std ® & (A)	
1. Control Desk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				
2. Annunciation, Control, PLC/SCADA Panel	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y			Y	Y		
3.Smoke Detectors (UL-268,EN-54 PT-7), Heat Detectors(UL-521/EN 54 PT-5) Annunciation/ Control Panel (UL -864, EN-54, PT-2)															Y		
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure alongwith relevant supporting documents. • *Applicable for PLC • Y - Test Applicable , ® - Routine Test (A) - Acceptance Test																	
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)								PART-F				PAGE 24			

CLAUSE NO.	TECHNICAL SPECIFICATIONS																
	INSTRUMENTATION CABLE																
	TESTS TEMS		Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®
		L. Instrument cable twisted and shielded															
		Conductor(IS-8130)	Y			Y			Y								
		Insulation(VDE-207)				Y	Y	Y	Y						Y		Y
		Pairing/Twisting				Y	Y		Y								
		Shielding				Y			Y			Y					
		Drain wire	Y			Y			Y		Y	Y					
		Inner Sheath				Y	Y	Y	Y					Y	Y		
		Outer Sheath				Y	Y	Y	Y					Y	Y		
		Over all cable	Y	Y	Y	Y	Y		Y	Y			Y			Y	
		Cable Drums(IS-10418)				Y			Y								
		Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784. Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items. Note : ® - Routine Test A - Acceptance Test Y - Test Applicable Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable) * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1) ** Characterisitic Impedence, Attenuation, Mutual Capacitance, Cross Talk (As applicable) + Sample size will be One No. of each size/type per lot. ++ Sample size will be One No. sample for complete lot offered irrespective of size/type.															
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT				TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)				PART-F				PAGE 25					

CLAUSE NO.	TECHNICAL SPECIFICATIONS																					
	POWER SUPPLY FOR C&I SYSTEMS (UPS/BATTERY/BATTERY CHARGER/ACDB/DCDB)																					
	TESTS	Visual/dimension/rating/ Paint Adhesion/ Thickness (R)	General arrangement/BOM/make of components /Mimic ®	Efficiency ,regulation(R)	Input voltage variation (A)	Out put voltage and frequency adj.range(A)	Premilinary light load test(R)	Load transfer retransfer test (R) *	AC input failure and return test (R)	Parralel operation and current divison(R)	Relative harmonic content(R)	Restart with PRI A.C and battery (separately)(R)	System transfer and retransfer (R)*	Asynchronous transfer(R)	Ripple content(R)	Load limiter operation (R)	IR/HV(R)	Tests as per standard &specification (R)&(A)				
	ITEMS																					
	UPS/CONVERTER (IEC-146 PT-4)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				
	VOLTAGE STABILISER	Y	Y	Y	Y	Y					Y		Y				Y					
	LEAD ACID BATTERY(TUBULAR)-IS-1651																	Y				
	LEAD ACID BATTERY (PLANTE)-IS-1652																	Y				
	NICKEL CADMIUM BATTERY(IS-10918/IEC-623)																	Y				
	SMF BATTERY																	Y				
	ACDB/DCDB	Y	Y															Y	Y			
	BATTERY CHARGER	Y	Y	Y	Y	Y				Y					Y	Y	Y	Y				
	R-Routine Test		A- Acceptance Test							Y – Test applicable												
	* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded . Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.																					
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT										TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)										PART-F		PAGE 26

CLAUSE NO.	TECHNICAL SPECIFICATIONS								
	11) DC SYSTEM								
	LEAD ACID BATTERY								
	ATTRIBUTES / CHARACTERISTICS →								
	ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimensions & Finish	Conformance to relevant part drg. & Manufacturer's standards	Chemical composition	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Paint Process checks, Paint Shade, Thickness, Adhesion & Finish	Constructional requirements as per NTPC Spec.	Routine & acceptance tests as per relevant standard
	Container & Lids (IS : 1146)	Y	Y						
	Vent Plugs	Y	Y						
	Sealing Compound (IS : 3116)		Y	Y					
	Positive & Negative Plates		Y	Y					
	Separators (IS : 6071)	Y	Y						
	Electrolyte (Water / Sulphuric Acid) (IS : 1069 / 266)		Y	Y					
	Inter-cell Connectors & Fasteners	Y	Y		Y				
	Battery Stand	Y	Y			Y	Y		
	Cell Insulators	Y	Y						
	Stack Assembly	Y	Y						
	Lead Acid Battery (IS : 1652)	Y						Y	Y
Note: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.									
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)			PART-F		PAGE 27		

CLAUSE NO.	TECHNICAL SPECIFICATIONS								
	Ni- Cd BATTERY								
	ATTRIBUTES / CHARACTERISTICS → ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimensions & Finish	Impact Strength	Conformance to relevant part drg. & Manufacturer's standards	Resistance to Alkali	Chemical composition	Nickel Plating thickness	Paint Shade, Thickness, Adhesion & Finish	Routine & acceptance tests as per relevant standard
	Container & Lids	Y	Y	Y	Y				
	Vent Plugs	Y		Y	Y				
	Perforated Steel Strips	Y		Y	Y		Y		
	Active Material for Positive & Negative Plates			Y		Y			
	Separators	Y		Y	Y				
	Electrolyte			Y		Y			
	Inter-cell Connectors & Fasteners	Y		Y	Y		Y		
	Battery Stand	Y			Y			Y	
	Cell Insulators	Y		Y	Y				
	Stack Assembly	Y		Y					
	Ni-Cd Battery (IS : 10918)	Y							Y
	Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NTPC approval.								
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)			PART-F		PAGE 28		

CLAUSE NO.	TECHNICAL SPECIFICATIONS										
	DC HEALTH MONITORING SYSTEM										
	Attributes / Characteristics →										
	Items / Components / Sub- assembly ↓	Make, Model, Type, Rating & Finish	Verification of Routine test reports as per relevant IS	Sheet Steel Pretreatment & Painting process checks	Conform to relevant Standard & NTPC spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per NTPC approved drgs & specification	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50°C for 48 hrs in 31energized condition	Degree of Protection Test as per NTPC Spec.
	Enclosure	Y		Y	Y	Y					Y
	Synthetic Rubber Gaskets	Y			Y						
	Control & Selector Switches ,Indicating Meters, Indicating Lamps	Y			Y			Y			
	Control Terminal Blocks ,Push Buttons, MCB	Y			Y			Y			
	MCB	Y			Y			Y			
	PVC insulated Copper control / signal cables	Y	Y		Y						
	Transducers / detectors	Y	Y		Y			Y			
	PCB & racks for electronic cards	Y									
	Electronic Cards	Y						Y		Y	
	Microprocessor Based Controller	Y						Y		Y	
	SCADA	Y						Y			
	Software	Y						Y			
	DC Health Monitoring System	Y			Y	Y	Y	Y	Y	Y	Y
	Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NTPC approval.										
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)				PART-F			PAGE 31		

CLAUSE NO.	TECHNICAL SPECIFICATIONS														
	12) STATION LIGHTING													SQE_17	
	Item Components Sub System Assembly Attributes Characteristic	Make, Type , Rating/ TC	Dimension	Pre-Treatment of sheat	Paint Shade Thickness Adhesion & Finish	Galvanization Tests	IP Test	Bought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Constructional Feature as per NTP spec	Routine Test as per relevant std and spec	Acceptance Test as per relevant std and spec	Item to conform to relevant standard	
		Luminaries (IS-10322 Part-5 Sec.1 (non – LED type)	Y					Y		Y			Y	Y	Y
		Electronic Ballast	Y										Y	Y	Y
		Lighting Wire (IS-694)	Y										Y		
		Fans (IS-374)	Y										Y		
		Pole (IS-2713)	Y			Y						Y	Y	Y	
		Lamps (IS-9800, IS-9974)	Y										Y	Y	
		Lighting Mast (with raise & lower lantern type)	Y	Y			Y					Y	Y	Y	
		Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT				TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)				PART-F		PAGE 32	
---	--	--	--	--	--	--	--	--------	--	------------	--

CLAUSE NO.	TECHNICAL SPECIFICATIONS			
	13) LED Luminaire Quality Requirements 1) LED modules to conform to IS: 16103 part 2. Manufacturer to issue a certificate of compliance for the same. 2) Control gear to conform to IS 15885 part 2 section 13. Manufacturer to issue a certificate of compliance for the same. 3) LED luminaire to conform to IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same. 4) LED luminaire marking to be as per IS 16107 part 2 section 1. Manufacturer to issue a certificate of compliance for the same. 5) Acceptance tests as per IS 16107 part 2 section 1 to be carried out on LED luminaire except long duration tests i.e. a) Chromaticity coordinates & correlated color temperature (CCT); b) Color rendering index (CRI). Manufacturer will submit a COC for above tests i.e. CCT & CRI 6) LED driver make, model, type & rating may be as per recommendations of LED module manufacturer. Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Make of all major Bought Out Items will be subject to NTPC approval			
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)	PART-F	PAGE 34

CLAUSE NO.	TECHNICAL SPECIFICATIONS													
	14) TRANSFORMER Converter Duty Type													
	Attributes / Characteristics													
	Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection.	Functional check	WPS & POR	Routine Test as per relevant standard / NTPC Specification
	Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y					Y	
	Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
	Copper Conductor (IS:191)	Y	Y	Y		Y								
	Insulating Material	Y	Y	Y	Y	Y	Y							
	CRGO Lamination & Built Core	Y	Y	Y		Y	Y				Y			
	Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y			Y
	Gasket	Y	Y			Y	Y		Y		Y			Y
	Transformer Oil (IEC296)			Y										Y
	OLTC / Off-Circuit Tap Changer	Y									Y			Y
	Core Coil Assembly & Pre-tanking	Y								Y	Y			
	Marshalling Box	Y									Y	Y		Y
	WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Valves	Y									Y	Y		
	Welding (ASME Sect-IX)	Y						Y					Y	
	Complete Transformer (IS:2026/ IEC-60076)	Y												Y
Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2) All major Bought Out Items will be subject to NTPC approval.														
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)								PART-F		PAGE 35		

CLAUSE NO.	TECHNICAL SPECIFICATIONS										
	LT INDOOR TRANSFORMER (DRY TYPE TRANSFORMER)										
	Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model / TC / General Physical Inspection	Routine Test as per relevant standard / NTPC Specification	
	Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y		
	Copper Conductor	Y	Y	Y		Y					
	Insulating Material	Y			Y	Y					
	CRGO Lamination & Built Core	Y							Y		
	Porcelain Bushing /Insulator (IS:2544 / 5621)	Y	Y	Y					Y	Y	
	Gasket (IS 2712)	Y	Y						Y	Y	
	Off-Circuit Tap Changer	Y							Y	Y	
	Core Coil Assembly	Y						Y			
	Marshalling Box	Y								Y	
	WTI, Thermistor, Terminal Connector	Y							Y		
	Complete Transformer (IS:11171 / IEC 60076)	Y								Y	
	Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalisation for all item. 2) All major Bought out Items will be subject to NTPC approval.										
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT		TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)					PART-F		PAGE 36		

CLAUSE NO.	TECHNICAL SPECIFICATIONS 		
	17) <u>Module Cleaning and Ventilation Quality Requirements</u> A. Module Cleaning System: - Pipes, Valves, Pumps etc shall be tested as per requirements of relevant standard. B. VENTILATION SYSTEM - Split/Window Cassette Air conditioner less than 10 TR will be accepted on the basis of Manufacturer Standard Guarantee and Warrantee certificate. - Fans, Filters etc shall be tested as per requirements of relevant standard.		
DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT	TECHNICAL SPECIFICATION BID DOC. NO: RECS-5734-004-9(R)	PART-F	PAGE 40



SYSTEM EQUIPMENT:

TRANSFORMERS UPTO 100 MVA,
132 kV CLASS

SUB-SYSTEM:

STANDARD FIELD QUALITY PLAN

CONFORMANCE TO: NTPC SPECIFICATION

QP No: 0000-999-QOE-J-001

REV No: 0

DATE: 01.11.2006

PAGE: 1 of 5

VALID UPTO: 31.10.2009

REVIEWED BY

APPROVED BY

H. Shekhar
S. D. Singh
O. P. Narain

U. R. Khosla

REMARKS

Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*
1	2	3	4	5	6	7	8	9	10
1.00	MATERIAL RECEIPT AND STORAGE.								
1.01		Inspection of item on receipt at site	B	Visual	100%	Packing List	Packing List	Logbook	
1.02		Condition of packages	B	Visual	-do-	Packing List	Good Condition	-do-	Material Damage Report in case of damage
1.03		Check for short supply, if any	C	Verify	-do-	Packing list	No item short	-do-	Report to Manufacturing Unit for short supply.
1.04		N ₂ pressure in transformer on receipt at site, if transformer is send with N ₂ - N ₂ pressure gauge	B	Visual	At the time of receipt & every fortnight	Mfr's Erection & Maint. Manual	Positive pressure/ Mfr Manual	-do-	In case pressure is zero, inform manufacturer for further necessary action.
1.05		Check oil level in the transformer, if transformer is send with oil - Oil level gauge	B	Visual	At the time of receipt & every fortnight	-do-	Upto the mark.	-do-	In case oil level is low & winding is exposed, call manufacturer representative.
1.06		Check reading of shock recorder on receipt at site - Impact Recorder	B	Visual	At the time of receipt	-do-	Mfr's Erection & Maint. Manual	-do-	In case data recorded is above normal, inform manufacturer for further necessary action.
1.07		Safe unloading of material at site	C	Visual	Each Package		No damage		Material Damage Report in case of damage
1.08		Check safe storage & position for bushings	C	Visual	During storage	Mfr's Erection & Maint. Manual	Mfr's Erection & Maint. Manual	-do-	
1.09		Check oil level in condensor bushings - Oil level	B	Visual	At the time of receipt & every fortnight	-do-	Upto the mark	-do-	Fill in case the same is low
1.10		Check blanking of radiators (if sent separately)	B	Visual	100%		Intactness of blanking plates	-do-	In case of radiators blanks are missing, finshing of the same to be done & cover with new blanking plate.
1.11		Ensure covered storage for identified items (fans, pumps, WTI, OT), breather, etc)	C	Visual	-do-	Mfr's Erection & Maint. Manual	No physical damage	-do-	Store indoor
1.12		Safe storage of other materials (oil, conservator, radiator, etc)	C	Visual	-do-	-do-	No physical damage	-do-	Store in outdoor covered with tarpulin.

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER. (A & B SHALL BE NTPC CHP STAGE)



SYSTEM EQUIPMENT:
TRANSFORMERS UPTO 100 MVA,
132 kV CLASS

SUB-SYSTEM:

STANDARD FIELD QUALITY PLAN

CONFORMANCE TO: NTPC SPECIFICATION

QP No: 0000-999-QOE-T-001
 REV No: 0
 DATE: 01.11.2006
 PAGE: 2 of 5
 VALID UPTO: 31.10.2009

REVIEWED BY
 H. Sankar
 S. D. Singh
 O. P. Niranjan

APPROVED BY
 H. Sankar
 S. D. Singh
 O. P. Niranjan



Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10
1.13		Ensure horizontal storage & protection of oil drums from water	C	Visual	At the time of receipt & monthly	-do-	No leakage	-do-	Check for seal integrity & tampering
1.14		Marshalling box to be stored vertically in their respective cases.	C	Visual	At the time of storage	-do-	No physical damage		In case supplied loose.
2.00 PRE-ERECTION									
2.01		Check availability of relevant drgs., T&P, protocols etc.	C	Verify	Once before erection	Mfr's Erection & Maint. Manual	Available as per list	Logbook	
2.02		Check availability of proper tools and tackles including jacking pad for carrying out erection	C	Visual	-do-	-do-	-do-		
2.03		Where rollers are applicable, check that rollers are greased properly before assembly of transformer	C	Visual	100%	-do-	Free movement of rollers		
2.04		Check for pipe cleaning before erection	B	Visual	100%	-do-	No dust / Moisture ingress	-do-	Oil flushing to be done, if required
2.05		Check insulation resistance between core to earth -500 V meggar	B	Measure	Once before erection	-do-	IR>1 Mega Ohm		If core earthing is done outside the transformer tank.
2.06		Check general condition of core-coil assy. Including wedging of core through inspection covers	A	Visual	As Req'd.	-do-	No damage/distortion	-do-	Material Damage Report in case of damage / misalignment.
2.07		Check oil parameters (as per specification) before & after filling in transformer.	B	Measure	As Req'd.	NTPC Specification	NTPC Specification	-do-	
2.08		Oil filling under vacuum (for N2 filled jobs)	B	Measure	As Req'd.	Mfr's Erection & Maint. Manual		-do-	
2.09		Oil filtration using filter machine	B	Testing	Before erection	NTPC Specification for oil parameters	NTPC Specification		Use new filters in filter machine and ensure M/c is moisture free
2.10		Check IR value between core & earth after oil filling -500v meggar	B	Measure	-do-	-do-	IR>1 Mega Ohm	-do-	✓ If core earthing is done outside the transformer tank.

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC POA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND

'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)



SYSTEM EQUIPMENT:
TRANSFORMERS UPTO 100 MVA,
132 KV CLASS

SUB-SYSTEM:

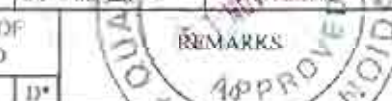
STANDARD FIELD QUALITY PLAN

CONFORMANCE TO: NTPC SPECIFICATION

QP No: 0000-999-QOE-T-001
REV No: 0
DATE: 01.11.2006
PAGE: 3 of 5
VALID UPTO: 31.10.2009

REVIEWED BY: H Shekhar
S D Singh
O P Niranjan

APPROVED BY: P S Khosla



Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10*
2.11		Check all bushings are free from damage and oil level upto the mark - Oil level gauge	C	Visual	-do-	-do-	Upto the mark	-do-	In case of condenser bushing.
2.12		Check all condenser bushings for IR value & capacitance / tan delta test at 10 kV - (2.5 kV megger)	A	Measure	100%	-do-	IR > 5000 M ohms tan delta < 0.007	Logbook	✓
2.13		Verify tan delta tap is set back to normal earthed position and record the same	A	Physical	100%			-do-	
2.14		Ensure new gaskets during final erection of turrets, bushings and piping	B	Physical	Once before erection	-do-			
3.00	ERECTION								
3.01		Foundation readiness as per layout drawing	B	Measure	100%	Drawing	As per drawing	Log book	
3.02		Proper erection & alignment of all accessories	B	Visual	Each Unit	Mfr's Erection & Maint. Manual	As per drawing		
3.03		Operational checks on fans, oil pumps prior to installation	C	Testing	Each Unit	Mfr's Erection & Maint. Manual	To operate smoothly	Log book	
3.04		Manually operate OLTC / OCTC to raise & lower all taps, before electrical operation	C	Manual	-do-	-do-	To operate smoothly	-do-	
3.05		Direction of rotation of fans & pumps	C	Visual	-do-	-do-	Rotation as per mark	-do-	
3.06		Lubrication of fans & pumps	C	Visual	Each Unit	-do-	No abnormal noise	-do-	As applicable
3.07		Check tightness of core earthing after IR measurement between core to earth	A	Physical	-do-	-do-	No looseness	-do-	If core earthing is done outside the transformer tank.
3.08		Check earthing connections between transformer tank & cover, radiator bank, tank & OLTC head, main tank.	B	Physical	-do-	-do-	To be tight	-do-	
3.09		Check continuity & IR value of internal wiring in marshalling box - 500 V megger	B	Test	-do-	-do-	IR > 1 Mega Ohm	-do-	
3.10		Forming of cables at both ends for identification	C	Visual	-do-	-do-	As per drg	-do-	
3.11		Ratio of CT (for WTI)	B	Visual	-do-	Test report	Test report	-do-	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR. *A* SHALL BE WITNESSED BY NTPC FQA. *B* SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND *C* SHALL BE WITNESSED BY MAIN SUPPLIER. (A & B SHALL BE NTPC CHP STAGE)



SYSTEM EQUIPMENT:
TRANSFORMERS UPTO 100 MVA,
132 KV CLASS

STANDARD FIELD QUALITY PLAN

QP No: 0000-999-QOE-T-001
REV No: 0
DATE: 01.11.2006
PAGE: 4 of 5
VALID UPTO: 31.10.2009

REVIEWED BY:
APPROVED BY:
H. Shukla
S. D. Singh
O. P. Nigam
U. R. Khanna

SUB-SYSTEM:

CONFORMANCE TO: NTPC SPECIFICATION

Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	
1	2	3	4	5	6	7	8	9	D*
3.12		Oil filling under vacuum (for N2 filled jobs)	B	Measure	As Reqd.	Mfr's Erection & Maint. Manual		-do-	
3.13		Proper cleaning of transformer after erection & oil filtration	C	Visual	-do-	Mfr's Erection & Maint. Manual	No sweating of oil	-do-	
3.14		Neutral grounding arrangement	B	Visual	100%	Drawing		-do-	
3.15		Connection check for neutral formation & core, if applicable	B	Visual	100%	Mfr's Erection & Maint. Manual		-do-	
3.16		Insulation resistance measurement between following by 500V/1kV megger a) high voltage winding to earth b) low voltage winding to earth c) high voltage to low voltage windings	A	Test	100%	Mfr's Erection & Maint. Manual	Minimum IR value is (kV+1) M Ohms	Log book	√
3.17		Polarity of CT's	B	Measure	100%	-do-		-do-	
3.18		Check readiness of alarm / trip of safety & protection equipment	C	Visual	-do-	-do-		-do-	
3.19		Check continuity between HV winding & neutral, while OLTC in operation	A	Visual	-do-	-do-	Continuity should not break, while OLTC in operation	-do-	
3.20		Check oil level in transformer - Oil level gauge	B	Visual	Each unit	-do-	Upto the mark	-do-	Fill processed oil in case oil is below the mark.
3.21		Test on oil samples taken from main tank top & bottom after 24 hours of oil settling for BDV, moisture content, etc.	A	Testing	Each Unit	Mfr's Erection & Maint. Manual / NTPC Specification	Mfr's Erection & Maint. Manual / NTPC Specification	-do-	√
3.22		Oil leakage test at normal head plus 35 kN/sq m measured at the base of tank for 24 hrs - Pressure Gauge	B	Visual	Tank Assly.	-do-	No leakage	-do-	As per NTPC Specification
3.23		Check bushing connections at line ends	B	Visual	Each Unit	-do-	-do-	-do-	
3.24		Check IR values between bushing terminal & flange of bushings-1/2.5 kV megger	B	Measure	Once	-do-	IR>(kV+1) M ohms	-do-	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A - CRITICAL, B-MAJOR, C-MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)



SYSTEM EQUIPMENT:
TRANSFORMERS UPTO 100 MVA,
132 KV CLASS
SUB-SYSTEM:

STANDARD FIELD QUALITY PLAN

CONFORMANCE TO: NTPC SPECIFICATION

QP No: 0000-999-QOE-T-001
REV No: 0
DATE: 01.11.2006
PAGE: 5 of 5
VALID UPTO: 31.10.2009

REVIEWED BY: *[Signature]*
APPROVED BY: *[Signature]*
H. Shrivastava
S. D. Singh
O. P. Miranjan
REMARKS:
APPROVED
N.T.P.C. NOIDA

Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*
1	2	3	4	5	6	7	8	9	D*
3.25		Functioning of oil pump from manual, local and remote controls.	B	Physical	100%	Schematic Drawing		-do-	
3.26		Sequential operation of cooling system on auto operation.	B	Physical	100%	Schematic Drawing		Log book	
3.27		Touch up painting to be carried out, wherever necessary.	C	Physical	Once before erection	-do-			
3.28		Check for tightness of joints and connections	B	Physical	100%	Mfr's Erection & Maint. Manual	Mfr's Erection & Maint. Manual	-do-	
3.29		Check the readiness of fire alarm system and fire protection system.	B	Test	100%			-do-	
3.30		Record of OLTC - multimeter/stopwatch a) motor current b) operating time c) control voltage	B	Measure	100%	Mfr's Erection & Maint. Manual	Instruction Manual	-do-	
3.31		Check the completeness of erection	A	Visual	100%	Mfr's Erection & Maint. Manual / Apprvd Drg	Mfr's Erection & Maint. Manual / Apprvd Drg	-do-	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)

Format No.: QS-01-QAI-P-10/F4-R1

1/1

Engg. Div./QA&I



SYSTEM EQUIPMENT:

DRY TYPE TRANSFORMER

(RECEIPT, STORAGE & ERECTION)

SUB-SYSTEM:

STANDARD FIELD QUALITY PLAN

CONFORMANCE TO: NTPC SPECIFICATION

QP No: 0000-999-QOE-I-006

REV No: 0

DATE: 15.01.2009

PAGE: 1 of 2

VALID UPTO: 14.01.2012

REVIEWED BY

Banish K Jha

V K Prasad

H Shekhar



Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10
1	MATERIAL, RECEIPT AND STORAGE	Check that transformer is lifted using the lifting angle provided on the transformer for lifting the complete transformer as per lifting instruction plate	C	Physical	100%	OGA Drg.	Instruction Manual	Logbook	
2		Safe unloading of material at site	C	Visual	-do-	Instruction Manual	No damage	-do-	
3		Check that the transformer should be stored indoor to prevent the rain and moisture	B	Physical	-do-	-do-	Instruction Manual	-do-	Material Damage Report in case of damage
4		Condition of packages	B	Visual	-do-	Packing List	Free from damages	-do-	
5		Inspection of item on receipt at site	B	-do-	-do-	Packing List / CHP / MDCC	Packing List / CHP / MDCC	-do-	
6		Check for short supply, if any	C	Verify	-do-	Packing list	No item short	-do-	Report to Manufacturer for short supply.
7	PRE - ERECTION	Check that the transformer plinth is properly levelled and is as per foundation plan	C	Measure	Once before erection	OGA Drg & Foundation plan	OGA Drg & Foundation plan	Logbook	
8		Check that exact location and centre line of roller assembly has been marked on plinth	B	Visual	-do-	-do-	-do-	-do-	
9		Check availability of proper tools and tackles including special handling equipment & suitable locking arrangement for carrying out erection and wheels are kept locked when transformer is not to be rolled	C	Verify	-do-	Instruction Manual	Instruction Manual	-do-	
10		Check that relevent AC/DC supplies have been made available for the Marshalling Box	C	Physical	-do-	Wiring Schematic Diagram	Wiring Schematic Diagram	-do-	
11		Check that instruments are mounted intact and are working properly	B	Physical	-do-	OGA Drg	No defect	-do-	
12		Check that transformer is kept clean and free from dust and loose parts	B	Visual	-do-	Instruction Manual	Instruction Manual	-do-	
13		Check Terminal Marking	B	-do-	-do-	OGA Drg / Appvd Data Sheet	OGA Drg / Appvd Data Sheet	-do-	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS#: A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)

		SYSTEM EQUIPMENT:		STANDARD FIELD QUALITY PLAN			QP No: 0000-999-QOE-1-006		REVIEWED BY	
		DRY TYPE TRANSFORMER (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:					CONFORMANCE TO: NTPC SPECIFICATION			REV No: 0 DATE: 15.01.2009 PAGE: 2 of 2 VALID UPTO: 14.01.2012
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS	
1	2	3	4	5	6	7	8	9	D*	10
14	ERECTION	Foundation readiness as per layout drawing	B	Measure	100%	OGA Drawing	OGA Drawing	Logbook		
15		Proper erection & alignment of all accessories	B	Visual	-do-	Instruction Manual	As per drawing	-do-		
16		Check that all hardware used in transformer are tightened properly	B	Physical	-do-	-do-	NTPC Spec / Approved Data Sheet	-do-		
17		Check that HV& LV cables are terminated inside the cable box	B	-do-	-do-	OGA Drawing	OGA Drawing	-do-		
18		Check that control wiring are terminated on terminal block inside marshalling box as per wiring schedule	B	-do-	-do-	-do-	Wiring Schematic Diagram			
19		Ferruling of cables at both ends for identification	C	Visual	-do-	-do-	OGA Drawing	-do-		
20		Neutral Termination arrangement and all earthing points of transformer enclosure	B	Physical	-do-	-do-	Proper grounding	-do-		
21		Check that all clearances inside the enclosure are maintained	A	-do-	-do-	-do-	OGA Drawing	-do-	✓	
22		Fuctional check of all alarms and trips	B	Verify	-do-	-do-	-do-	-do-		
23		Check that limit switch in enclosure door is functioning properly, if provided	C	-do-	-do-	-do-	-do-	-do-		
24		Touch up painting to be carried out, wherever necessary.	C	Physical	-do-	*	*	*		
25		Measurement of Insulation Resistance	B	Measure	-do-	Instruction Manual / NTPC Spec.	NTPC Spec.	Logbook		
26	Check the completeness of erection	A	Verify	-do-	Instruction Manual / NTPC Spec / Approved Data Sheet	Instruction Manual / NTPC Spec / Approved Data Sheet	-do-	✓		

LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)

Format No.: QS-01-QAI-P-10/F4-R1

1/1

Engg. Div./QA&I

		SYSTEM EQUIPMENT: EARTHING SYSTEM		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS 3043 & INDIAN ELECTRICITY RULES/ ACTS			QP NO.: 0000-999-QO - E - 1-003 REV. NO.: 00 DATE : 26/03/08 PAGE 2 OF 3		REVIEWED BY: L.J.SINGH <i>gmlcr</i> VIKRAM TALWAR <i>W</i> S.D.SINGH <i>ld</i> O.P.NIRANJAN <i>Suraj</i>		APPROVED BY U.R.KHOSLA <i>[Signature]</i>	
		SUB-SYSTEM :					VALID UPTO : 25/03/11					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	उमेश राज खोसला उपा. महाप्रबन्धक एनटीपीसी लिमिटेड, सर्वोपनिवेश A-8A, Sector-24, Noida-201 301 (U.P.)		REMARKS		
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
2.08	RESISTANCE OF JOINTS	ELEC	MEAS	B	100%	NOT MORE THAN THE RESISTANCE OF EQUIVALENT LENGTH OF CONDUCTOR	NOT MORE THAN THE RESISTANCE OF EQUIVALENT LENGTH OF CONDUCTOR	--DO--				
2.09	EARTHING CONDUCTORS BURIED, EMBEDDED	MECH	V	C	100%	NTPC LAY OUT DRGS. & NTPC TECH. SPECTS	NTPC LAY OUT DRGS. & NTPC TECH. SPECTS	--DO--				
2.10	EARTH PITS ARE PROPERLY PREPARED FOR ELCTRODES	MECH	V	B	100%	IS 3043/ NTPC TECH. SPECTS.	IS 3043/ NTPC TECH. SPECTS.	--DO--				
2.11	CLAMPING / SUPPORT OF EARTHING CONDUCTORS ALONG WALL, COLUMN ETC.	-DO--	V	C	100%	NTPC TECH. SPECTS.	ONE METER INCASE OF WELDING / 750MM IN CASE OF CLEAT SUPPORT	--DO--				
3.00												
3.01	CONTINUITY OF EARTH CONDUCTORS & EFFICIENCY OF ALL BONDS & JOINTS CHECKING	ELEC	MEGGER	A	100%	IS3043-1987	IS3043-1987	--DO-				
3.02	EARTH RESISTANCE OF TREATED EARTH PIT ONLY	ELEC	EARTHIN G RESISTA NCE TESTER	A	100%	--DO--	-DO--	--DO-				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

	SYSTEM EQUIPMENT: EARTHING SYSTEM		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS 3043 & INDIAN ELECTRICITY RULES/ ACTS				QP NO.: 0000-999-QO - E - I-003 REV. NO.: 00 DATE : 26/03/08 PAGE 3 OF 3		REVIEWED BY: I.J.SINGH <i>gnter</i> VIKRAM TALWAR <i>his</i> S.D.SINGH <i>his</i> O.P.NIRANJAN <i>his</i>		APPROVED BY U.R.KHOSLA <i>his</i>	
	SUB-SYSTEM :						VALID UPTO : 25/03/11		Dr. General Manager (QA) FORMATION & RECORDS NTPC Limited Sector-24, Noida-201 301 (U.P.)		U.R.KHOSLA <i>his</i>	
	SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	9.	D*	10.	
1.	2.	3.	4.	5.	6.	7.	8.					

LEGENDS USED FOR 'STORAGE LEVEL'	
STORAGE LEVEL "A"	OUTSIDE WITH NO PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT)
STORAGE LEVEL "B"	OUTSIDE WITH PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT, COVERED WITH PVC/TARPAULIN)
STORAGE LEVEL "C"	INDOOR SHELF ITEMS (STORED IN PUCCA SHED, IN STORE)
STORAGE LEVEL "D"	INDOOR CLEAN CONDITIONS (STORED IN PUCCA SHED, IN STORE. THE STORAGE AREA SHALL BE DRY AND FREE FROM DUST AND THERE SHALL NOT BE ACID/ CHEMICALS IN VICINITY)
STORAGE LEVEL "E"	INDOOR TEMPERATURE AND HUMIDITY CONTROLLED – AIR CONDITIONED (STORED IN PUCCA SHED, IN STORE WITH CONTROLLED ATMOSPHERE)

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN			QP NO.: 0000-999-QOE-I-002 REV. NO.: 00 DATE : 26/03/08 PAGE 1 OF 8		REVIEWED BY: L.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					CONFORMING TO CODE:			VALID UPTO : 25/03/11		
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	उमेश खोसला / U.R. KHOSLA उप महाप्रबन्धक (गुणवत्ता आश्वासन) Dy. General Manager (QA)			
1.	2.	3.	4.	5.	6.	7.	8.	9.	D* एनटीपीसी लिमिटेड / NTPC Limited A-8A, Sector-24, Noida-201 301 (C.P.)			
1	RECEIPT & STORAGE											
1.1	RECEIVING INSPECTION (COMPLETENESS OF DOCUMENTS, TEST CERTIFICATES ETC.)	-	C	V	100%	CHP/ MDCC	CHP/MDCC	REGISTER				
1.2	CHECK FOR TYPE AND NOS. OF LIGHTING FIXTURE	-	C	V	100%	CHP/ MDCC	CHP/ MDCC	REGISTER				
1.3	VISUAL EXAMINATION A) CHECK FOR ANY DAMAGE IN TRANSIT B) THEFT/ LOSS	-	C	V	100%	--DO--	FREE DAMAGE FROM	REGISTER				REPORT DAMAGES/ THEFT/ TO NTPC
1.4	STORAGE											
1.41	LIGHTING FIXTURES	CHECK FOR PROPER STORING STORAGE LEVEL "D"	C	V	100%	NO DAMAGE	NO DAMAGE	REGISTER				
1.42	LIGHTING PANEL, SWITCH BOXES, RECEPTACLES AND JUNCTION BOXES	CHECK FOR PROPER STORING STORAGE LEVEL "D"	C	V	100%	NO DAMAGE	NO DAMAGE	REGISTER				
1.43	STREET LIGHTING POLES, FLOOD LIGHTING POLES, LIGHTING MASTS	CHECK FOR PROPER STORING STORAGE LEVEL "A"	C	V	100%	NO DAMAGE	NO DAMAGE	REGISTER				
1.44	GI CONDUIT	CHECK FOR PROPER STORING STORAGE LEVEL "A"	C	V	100%	NO DAMAGE	NO DAMAGE	REGISTER				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:			QF NO.: 0000-999-QOE- I -002 REV. NO.: 00 DATE : 26/03/08 PAGE 2 OF 8		REVIEWED BY: I.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					VALID UPTO : 25/03/11					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	उमेश राज खोसला / U.R. KHOSLA उप निरीक्षक (गुणवत्ता आश्वासन) Dy. General Manager (QA) एनटीपीसी लिमिटेड / NTPC Limited A-8A, Sector - 24, Noida - 201 301 (U.P.)			
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*			
1.45	CEILING FANS & REGULATORS	CHECK FOR PROPER STORING STORAGE LEVEL "C"	C	V	100%	NO DAMAGE	NO DAMAGE	REGISTER				
1.5	TRANSPORTATION TO ERECTION SITE	-	C	V	100%	MECHANISED SYSTEM	MECHANISED SYSTEM	-				
2.0	PRE ERECTION											
2.1	AVAILABILITY OF CATALOGUE /NTPC SPETS./ NTPC APPR. DRGS.	-	C	V	100%	----	---	-				
2.2	AVAILABILITY OF ALL MATERIALS FOR ERECTION AS PER LAY OUT DRGS.	-	C	V	100%	--	--	-				
2.3	CIVIL/ FOUNDATION READINESS OF STREET LIGHTING POLES, FLOOD LIGHTING POLES, LIGHTING MASTS/ PANEL FOUNDATION ETC.	-	C	V	100%	CIVIL STRUCTURAL DRAWING &	CIVIL STRUCTURAL DRAWING &	-				
2.4	STEEL FABRICATIONS AS PER SPECIFIC SITE REQUIREMENTS	--	C	V	100%	APPROVED LAY OUT DRAWING	APPROVED LAY OUT DRAWING	-	ALL STEEL FABRICATIONS SHALL BE PAINTED WITH TWO COATS OF METAL PRIMER FOLLOWEED BY TWO COATS OF ALUMINIUM PAINT			
3.0	ERECTION											
3.1	MOUNTING OF LIGHTING FIXTURES	--	C	V	100%	APPD. LAY OUT DRGS. & MANUF. CATALOGUE & NTPC SPECTS.	APPD. LAY OUT DRGS. & MANUF. CATALOGUE & NTPC SPECTS.	CHECK LIST	10% "B" CHECK ON FIXTURES MOUNTING IN LINE WITH MANUF. CATALOGUE/ MOUNTING INSTRUCTION			

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:			QP NO.: 0000-999-QOE-T-002 REV. NO.: 00 DATE : 26/03/08 PAGE 3 OF 8		REVIEWED BY: I.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN.		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					VALID UPTO : 25/03/11		उमेश राज खोसला / U.R. KHOSLA उप महाप्रबन्धक (गुणवत्ता आश्वासन) Regional Manager (QA) एनटीपीसी लिमिटेड / NTPC Limited A-8A, Sector-24, Noida-201 301 (U.P.)			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	10.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
3.2	FIXING OF LIGHTING FIXTURES INSTALLED ON/ UNDER PLATFORMS IN BOILER AREA / TG PEDESTALS	-	C	V	100%	APPROVED LAY OUT DRAWING & NTPC SPECTS.	VIBRATION DAMPERS/ RUBBER CUSHIONS TO MINIMISE VIBRATIONS	CHECK LIST				
3.3	FLOOD LIGHTS MOUNTING	--	C	V	100%	--DO--	FLOOD LIGHT SHALL BE PROVIDED TO THE FIXTURES BY ABOUT 5 DEGREES	--DO--				
3.4	LIGHTING FIXTURES ON FALSE CEILING	--	C	V	100%	--DO--	LIGHTING FIXTURES SHALL BE SUPPORTED SEPARATELY BY FALSE SEALING GRID OR ROOF OVER FALSE CEILING	--DO--				
3.5	EMERGENCY AC FIXTURES FROM NORMAL AC FIXTURES	--	C	V	100%	--DO--	RED PAINTED CIRCULAR MARK ONE CM DIA SHALL BE PROVIDED ON EMERGENCY FIXTURES	--DO--				
3.6	STEEL INSTALLATIONS ACCESSORIES	--	C	V	100%	--DO--	PAINTING WITH RED LEAD PRIMER FOLLOWED BY TWO COATS OF ALUMINUM PAINT/ ENAMEL PAINT	--DO--				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

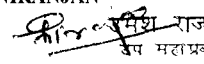
		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:			QP NO.: 0000-999-QOE-T-002 REV. NO.: 00 DATE : 26/03/08 PAGE 4 OF 8		REVIEWED BY: I.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					VALID UPTO : 25/03/11		उमेश राज खोसला/U.R. KHOSLA उप महाप्रबन्धक (गुणवत्ता आश्वासन) REMARKS एनटीपीसी लिमिटेड/NTPC Limited. A-8A, Sector - 24, Noida - 201 301 (U.P.)			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	10.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
3.7	LIGHTING PANEL, SWITCH BOXES, RECEPTACLES AND JUNCTION BOXES a) CHECK MOUNTING IS PROPER AND PROPERLY BOLTED b) CHECK EARTHING OF PANELS c) PROPER SIZE CABLE GLAND ARE USED FOR CABLING	--	B	V	100%	APPROVED LAY OUT DRAWING	APPROVED LAY OUT DRAWING/ NTPC TEC. SPECTS.	--DO--		1. IN OFFICE AREAS AND CONTROL ROOMS, SWITCH BOXES SHALL BE FLUSH MOUNTED IN WALL AND JUNCTION BOXES SHALL BE RECESS MOUNTED. 2. NO GAS CUTTING SHALL BE USED FOR DRILLING / PUNCHING.		
3.8	CONDUITS											
3.8	CONDUITS SUPPORTING	--	C	V	100%	NTPC TECH. SPECTS.	USING METTALIC SADDLES CLAMP SECURED TO NYLON RAWL PLUGS WITH SCREWS TO THE BUILDING STEEL AT AN INTERVAL OF NOT MORE THAN ONE METER, BUT EITHER SIDE OF COUPLER S, OR BENDSOR SIMILAR FITTINGS.	--DO--		SADDLES/ CLAMPS SHALL BE FIXED AT A DISTANCE OF 30CM FROM THE CENTRE OF SUCH FITTINGS.		
3.81	EPOXY COATED G.I. CONDUITS & ACCESSORIES IN BATTERY ROOM, WATER TREATMENT PLANT ETC.	--	B	V	100%	APPROVED LAY OUT DRAWING	APPROVED LAY OUT DRAWING	--DO--				
3.82	CONDUITS CLAMPING	--	C	V	100%							
3.83	EXPOSED/ EMBEDDED CONDUITS FIXING	--	C	V	100%	APPROVED LAY OUT DRAWING	NTPC TECH. SPECTS.	--DO--				
3.84	SEALING OF CONDUITS	--	C	V	100%	CEMENT MORTAR / PUTTY/ GLASS WOOL SEALING AFTER PULLING OF CABLES	CEMENT MORTAR / PUTTY/ GLASS WOOL SEALING AFTER PULLING OF CABLES	--DO--				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN			QP NO.: 0000-999-QOE-T-002 REV. NO.: 00 DATE : 26/03/08 PAGE 5 OF 8		REVIEWED BY: L.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					CONFORMING TO CODE:			VALID UPTO : 25/03/11		 उ.प्र. महाप्रबन्धक (सुपरवाइजर, स्थापना) By: General Manager (QA)
		SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
3.85	PULL OUT BOXES FOR LONG CONDUITS	--	C	V	100%	NTPC TECH. SPECTS	PULL OUT BOXES SHALL BE PROVIDED AT SUITABLE INTERVALS NOT EXCEEDING 6 MTRS	--DO--		1. PULL OUT BOXES NOT REQUIRED WHEREVER JUNCTION BOXES EXISTS 2. HEAT SHALL NOT BE APPLIED FOR BENDING CONDUITS		
3.86	METAL CONDUITS EARTHING	--	C	V	100%	--DO--	SHALL BE CONTINUOUS AND THOROUGHLY GROUNDED	--DO--				
3.87	DESIGNATION OF CONDUITS	--	C	V	100%	APPROVED LAY OUT DRAWING/ NTPC TECH. SPECTS	SHALL BE BY MEANS OF PAINTING FOR EACH RUN OF CONDUITS AT EACH END. WHERE CONDUITS TERMINATE AT PANELS, SWITCH BOXES, JUNCTION BOXES, OR OTHER ENCLOSURE, THE DESIGNATION SHALL ALSO BE PAINTED ON THE INSIDE OF ENCLOSURE ADJACENT TO CONDUITS.	--DO--				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:			QP NO.: 0000-999-QOE-T-002 REV. NO.: 00 DATE : 26/03/08 PAGE 6 OF 8		REVIEWED BY: L.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					VALID UPTO : 25/03/11		उमेश राज उपा महाप्रबन्धक (गुणवत्ता प्रबन्धन) एनटीपीसी लिमिटेड/नई दिल्ली A-8A, Sector - 24, Noida-201 301 (D.P.)			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	REMARKS		
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
3.9	LIGHTING POLE/ MAST	--	C	V	100%	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	--DO--		1.NO CUTTING OR DRILLING IS PERMITTED ON GALVANIZED STRUCTURE 2. LIGHTING POLE SHALL BE PAINTED WITH TWO COATS OF ALUMINIUM PAINT AFTER COMPLETION OF INSTALLATION		
3.9.1	WIRING											
3.9.2	LIGHTING FIXTURES	--	C	V	100%	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	--DO--		1. IT SHALL BE GENERALLY GROUP CONTROLLED DIRECTLY FROM LIGHTING PANEL. 2. FOR OFFICE AREA IT SHALL BE FROM SWITCH BOXES		
3.9.3	AC NORMAL, AC EMERGENCY & DC SYSTEM	--	B	V	100%	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	WIRING SHALL BE IN DIFFERENT CONDUITS FOR INDIVIDUALS SYSTEM	--DO--				
3.9.4	RECEPTACLES & LIGHTING CIRCUIT a) USE PROPER DIE FOR CRIMPING b) CRIMPING TOOL TO BE CALIBRATED	--	B	V	100%	APPROVED LAY OUT DRAWING./ NTPC TECH. SPECTS	SHALL BE FED FROM DIFFERENT CIRCUITS	--DO--				
3.9.5	LIGHTING WIRES CRIMPING a) PULL WIRES TO CHECK CRIMPING QUALITY	--	C	V	100%	--DO--	CRIMPING SHALL BE SOLDERLESS	--DO--				
LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)												

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:			QP NO.: 0000-999-QOE-T-002 REV. NO.: 00 DATE : 26/03/08 PAGE 7 OF 8		REVIEWED BY: I.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :					VALID UPTO : 25/03/11		उमेश राय खोसला Dy. General Manager (QA) एन.एम.एस. लिमिटेड / NTPC, Limited A-8A, Sector-24, Noida-201 301 (U.P.)			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	10.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.		
3.9.6	CEILING FANS & REGULATORS	--	C	V	100%	--DO--	APPROVED LAY PUT DRAWING / NTPC TECH. SPECTS	--DO--				
3.10	EARTHING OF LIGHTING SYSTEM											
3.10 1	LIGHTING PANELS ETC. EARTHING	--	B	V	100%	APPROVED LAY OUT DRAWING / NTPC TECH. SPECTS	TWO SEPARATE & DISTINCT CONNECTIONS WITH EMPLOYER EARTHING	--DO--				
3.10 2	SWITCH BOXES, LIGHTING FIXTURES, JUNCTION BOXES, FANS & SINGLE PHASE RECEPTACLES ETC. EARTHING	--	B	V	100%	--DO--	SHALL BE EARTHED BY SEPARATE EARTH CONTINUITY CONDUCTOR	--DO--				
3.10 3	CABLES EARTHING	--	B	V	100%	--DO--	CABLE ARMOUR S SHALL BE EARTHED AT BOTH ENDS TO EARTHING SYSTEM	--DO--				
3.10 4	EARTHING CONDUCTORS	-	B	V	100%	-DO--	APPROVED DRAWING / NTPC TECH. SPECTS	--DO-				
3.10 5	APPLICATION OF PROTECTIVE PAINTING ON EQUIPMENT BOLTED CONNECTIONS	--	C	V	100%	--DO--	PAINTING WITH ANTI CORROSIVE PAINT / COUMPOUND	--DO--				
4.00	ERECTION CHECK											

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT : STATION LIGHTING		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE:				QP NO.: 0000-999-QOE- I - 002 REV. NO.: 00 DATE : 26/03/08 PAGE 8 OF 8		REVIEWED BY: I.J.SINGH V. TALWAR S.D. SINGH O.P. NIRANJAN		APPROVED BY U.R. KHOSLA	
		SUB-SYSTEM :						VALID UPTO : 25/03/11		उमेश राज खोसला उप महाप्रबन्धक (गुणवत्ता प्रबंधन) उपाध्यक्ष, गुणवत्ता प्रबंधन एनटीपीसी लिमिटेड/एनपीसी लिमिटेड A-8A, Sector-24, Noida-201 301 (U.P.)			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS # OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS				
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.			
4.01	IR CHECK ON FIXTURES / PANELS / SWITCH BOXES/ RECEPTACLES AND CABLES / WIRES	ELECTR.	A	MEGGER	100%	SHOULD NOT SHOW ZERO VALUE	SHOULD NOT SHOW ZERO VALUE	CHECK LIST					
4.02	CHECK CONTINUITY OF EARTHING	--DO--	B	--	100%	CONTINUITY OF EARTH CONDUCTORS	CONTINUITY OF EARTH CONDUCTORS	--DO--					

LEGENDS USED FOR 'STORAGE LEVEL'	
STORAGE LEVEL "A"	OUTSIDE WITH NO PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT)
STORAGE LEVEL "B"	OUTSIDE WITH PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT, COVERED WITH PVC/TARPAULIN)
STORAGE LEVEL "C"	INDOOR SHELF ITEMS (STORED IN PUCCA SHED, IN STORE)
STORAGE LEVEL "D"	INDOOR CLEAN CONDITIONS (STORED IN PUCCA SHED, IN STORE. THE STORAGE AREA SHALL BE DRY AND FREE FROM DUST AND THERE SHALL NOT BE ACID/ CHEMICALS IN VICINITY)
STORAGE LEVEL "E"	INDOOR TEMPERATURE AND HUMIDITY CONTROLLED – AIR. CONDITIONED (STORED IN PUCCA SHED, IN STORE WITH CONTROLLED ATMOSPHERE)

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSARY UP TO 33KV SUB-SYSTEM :		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION			QP NO.: 0000-999-QO E - I- 004 REV. NO.: 00 DATE : 26/03/08 PAGE 1 OF 6 VALID UPTO : 25/03/11		REVIEWED BY: L.J.SINGH <i>Inden</i> VIKRAM TALWAR <i>11/08</i> S.D.SINGH O.P.NIRANJAN <i>11/08</i>		APPROVED BY U.R.KHOSLA <i>11/08</i>	
SL NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	उपकरणों की जाँच (गुणवत्ता आश्वासन) Dy. General Manager (QA)	REMARKS	REMARKS	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
1	RECEIPT & STORAGE											
1.1	RECEIVING INSPECTION A) COMPLETENESS OF DOCUMENTS B) CABLES ARE RECEIVED AS PER MDCC / CHP C) STRAIGHT THROUGH JOINTS & TERMINATION KITS	---	C	V	100%	DELIVERY CHALLAN	MDCC/CHP PACKING LIST OF DRUMS	MAIN CONTRA CTOR PERFOR MA				
1.2	VISUAL EXAMINATION A) DAMAGE TO DRUMS B) THEFT	---	C	V	100%	DRUMS ARE NOT DAMAGED	DRUMS ARE NOT DAMAGED	--DO--			DAMAGE/ THEFT TO BE REPORTED TO NTPC	
1.3	PROPER STORAGE	CHECK FOR PROPER STORAGE LEVEL " B "	C	V	100%	IS 1255 CL.7.0	CABLES DRUMS ARE PLACED ON RAISED PLATFORM, HARD & WELL DRAINED SURFACE	--DO--			IN NO CASE DRUMS SHALL NOT BE STORED IN FLAT I.E. WITH FLANGE HORIZONTAL	
1.4	TRANSPORATION TO ERECTION SITE	--	C	V	100%	MECHNISED SYSTEM	MECHNISED SYSTEM ENSURE SAFETY OF DRUMS & PERSONNELS					
2.0	ERECTION											
2.01	FOR H T CABLE:- SIZE OF CABLE/ ROUTE LENGTH	V	B	V	100%	APROVED CABLES SCHEDULE	APROVED CABLES SCHEDULE	--DO--			CABLE LENTGH IS TO BE PLANNED IN SUCH A WAY SO THAT MIMNMUM STRAIGHT THROUGH JOINTS ARE MADE	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND
'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

		SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSARY UP TO 33KV SUB-SYSTEM :		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION			QP NO.: 0000-999-QO E - I- 004		REVIEWED BY: I.J.SINGH VIKRAM TALWAR S.D.SINGH O.P.NIRANJAN		APPROVED BY U.R.KHOSLA	
							REV. NO.: 00 DATE : 26/03/08 PAGE 2 OF 6					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			
2.02	FOR LT CABLE:- SIZE OF CABLE/ ROUTE LENGTH	V	C	V	100%	--DO--	--DO--	DO				
2.03	MARKING IDENTIFICATION ON CABLE DRUMS	--	C	V	100%	IS1554-I, IS7098-I & 2	SHOULD MATCH WITH PACKING LIST	CHECK LIST				
2.04	REMOVAL OF WOODEN PLANK FROM CABLE DRUMS	--	C	MECH	100%	USE PROPER TOOL	CABLES ARE NOT DAMAGED	--DO--				
2.05	CABLE DRUMS ARE KEPT ELEVATED FROM GROUND WITH THE HELP OF CABLE DRUMS JACKS	CABLE DRUMS JACK	C	MECH	100%	IS1255 CL.8.0	CABLES DRUMS ARE NOT TOUCHED ON GROUND	--DO--				
2.06	CABLES LENGTH UNWOUNDING / PULLING TENSION	MECH	C	MECH	100%	IS1255 CL.5.0	IS1255 CL.5.0	--DO--	CABLES SHOULD NOT DAMAGE			
2.07	1.GROUND ROLLERS SHALL BE USED AT EVERY 2 METER INTERVAL. 2. CABLES SHALL NOT BE PULLED FROM END WITHOUT HAVING INTERMEDIATE PUSHING ARRANGEMENT.	GROUND ROLLERS	C	MECH	100%	IS1255, CL 10.0 & NTPC TECH. SPECTS.	IS1255 /CABLES ARE NOT DRAGGED ON HARD GROUND	--DO--				
2.08	IN EACH CABLE RUN SOME EXTRA LENGTH SHALL BE KEPT TO ENABLE ONE LT/ TWO HT STRAIGHT THROUGH JOINTS TO BE MADE	--	C	V	100%	NTPC TECH. SPECTS.	NTPC TECH. SPECTS.	--DO--				
2.09	SINGLE CORE CABLE/ MULTI CORE CABLE	--	C	V	100%	NTPC APROVED LAY OUT DRGS./ CABLES SCHEDULE/ NTPC TECH. SPECTS. - REFER CABLE INSTALLATION	SINGLE CORE CABLE IN TREFOIL FORMATION SHALL BE LAID WITH A DISTANCE OF FOUR TIMES THE DIAMETER OF CABLE BETWEEN TREFOIL CENTRE LINES AND CLAMPED AT EVERY TWO METRE. ALL MULTI CORE CABLES SHALL BE LAID IN TOUCHING FORMATION	--DO--				

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSARY UP TO 33KV SUB-SYSTEM :		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION			QP NO.: 0000-999-QO E - I- 004 REV. NO.: 00 DATE : 26/03/08 PAGE 3 OF 6 VALID UPTO : 25/03/11		REVIEWED BY: I.J.SINGH <i>gm</i> VIKRAM TALWAR <i>ms</i> S.D.SINGH <i>ms</i> O.P.NIRANJAN <i>ms</i>		APPROVED BY U.R.KHOSLA <i>ms</i>	
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1.	2.	3.	4.	5.	6.	7.	8.	उमेश खोसला/U.R. KHOSLA उप निरीक्षक (गुणवत्ता आश्वासन) 9. Dy. General Manager (QA) एनटीपीसी लिमिटेड/NTPC Limited -DO- A-8A, Sector-24, Noida-201 301 (U.P.)				
2..10	SECURING OF CABLES	--	C	V	100%	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/ NTPC TECH. SPECTS REFER CABLE INSTALLATION	POWER& CONTROL CABLES SAHLL BE SECURED FIXED TO TRAYS/ SUPPORT WITH SELF LOCKING TYPE NYLON CABLE TRAYS TYPE STRAPS WITH DE-INTERLINKING FACILITIES. FOR HORIZONTAL TYAPS ARRANGEMENTS, MULTI POWER CABLES & CONTROL CABLES SHALL BE SECURED AT EVERY FIVE METER INTERVAL. FOR VERTICAL TRAYS ARRANGEMENT IN INDIVIDUAL MULICORE POWER CABLES AND CONTROL CABLESSAHL BE SECURED AT EVERY ONE METER BY NYLON CABLE STRAP.	--DO--				
2.11	CONTROL CABLES SECURING IN VERTICAL TRAYS	--	C	V	100%	--DO--	CONTROL CABLES SHALL BE BINDED TO TRAYS / SUPPORTS BY ALUMINUM STRIPS AT EVERY FIVE METER INTERVAL & AT EVERY BEND	--DO--				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSARY UP TO 33KV SUB-SYSTEM :		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION			QP NO.: 0000-999-QO E - I - 004 REV. NO.: 00 DATE : 26/03/08 PAGE 4 OF 6 VALID UPTO : 25/03/11		REVIEWED BY: I.J.SINGH <i>[Signature]</i> VIKRAM TALWAR <i>[Signature]</i> S.D.SINGH <i>[Signature]</i> O.P.NIRANJAN <i>[Signature]</i>		APPROVED BY U.R.KHOSLA <i>[Signature]</i>	
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	WITNESSED BY	WITNESSED BY	WITNESSED BY	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
2.12	PROTECTION OF CABLES ON ROAD CROSSING	MECH	C	V	100%	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255	--DO--				
2.13	LAYING OF CONTROL CABLES AND POWER CABLES IN DIFFERENT LAYERS OF TRAYS	--DO--	C	V	100%	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255/ NTPC TECHNICAL SPECIFICATION REFER CABLE INSTALLATION	HT CABLES SHALL BE LAID ON TOP MOST TIER & CABLES OF SUBSEQUENT LOWER VOLTAGE GRADES ON LOWER TIERS OF TRAYS	--DO--				
2.14	IR CHECK OF CABLES	MEGGER	C	V	100%	SHOULD NOT SHOW ZERO VALUE	SHOULD NOT SHOW ZERO VALUE	--DO--				
2.15	EARTHING AND BONDING (METAL SHEATHING , METAL SCREENING AND ARMOUR OF CABLE SHOULD BE EARTHED AT BOTH ENDS.)	MECH	B	V	100%	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/ NTPC TECHNICAL SPECIFICATION REFER EARTHING SYSTEM INSTALLATION	METALLIC SHEATH/SCREENS, AND ARMOUR OF MULTI-CORE CABLES SHALL BE EARTHED AT BOTH ENDS. METALLIC SHEATH AND ARMOUR OF SINGLE CORE CABLES SHALL BE EARTHED AT SWITCHGEAR END ONLY OR AS PER APPD. CABLE SCHEDULE.	--DO--				
2.16	CABLE IDENTIFICATION TAG	V	C	V	100%	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255/ NTPC TECHNICAL SPECIFICATION REFER CABLE INSTALLATION	NTPC APPROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255/ NTPC TECHNICAL SPECIFICATION REFER CABLE INSTALLATION	--DO--				

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QAI-P-10/F4-R1

ENGG. DIV./QA&I

		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION				Q.P. NO.: 0000-999-QO E - I-004 REV. NO.: 00 DATE : 26/03/08 PAGE 5 OF 6 VALID UPTO : 25/03/11		REVIEWED BY: L.J.SINGH VIKRAM TALWAR S.D.SINGH O.P.NIRANJAN		APPROVED BY U.R.KHOSLA	
SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSORY UP TO 33KV SUB-SYSTEM :											
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS		
1.	2.	3.	4.	5.	6.	7.	8.				
2.17	STRAIGHT THROUGH JOINTS & TERMINATION										
2.18	LT STRAIGHT THROUGH JOINTS & TERMINATION	V	C	V	100%	NTPC APROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255/ NTPC TECHNICAL SPECIFICATION / TERMINATION MANUFACTURER RECCOMENDATIONS	--DO--	--DO--		1.CABLE JOINTER SHALL BE QUALIFIED TO CARRY OUT SATISFACTOR Y CABLE JOINTING / TERMINATION 2.CONTRACTOR SHALL FURNISH FOR REVIEW DOCUMENTA RY EVIDENCE / EXPERIENCE REPORTS OF THE JOINTERS TO BE DEPLOYED AT SITE.	
2.19	HT STRAIGHT THROUGH JOINTS & TERMINATION	V	B	V	100%	--DO--	--DO	--DO--			
2.20	G.I. CONDUITS EARTHING	MECH	C	V	100%	IS3043-1966/ NTPC SPECTS.	IS3043-1966 / NTPC SPECTS.	--DO--			
2.21	SEALING OF END OF CONDUITS AFTER CABLE LAYING	--DO--	C	V	100%	NTPC TECH.SPECTS.	ENDS OF CONDUITS /PIPES SHALL BE SEALED WITH GLASS WOOL/CEMENT MORTAR/ PUTTY	--DO--			
2.22	CLEANING OF CABLE TRENCH & COVER THE CABLE TRENCH WITH COVERS	--DO--	C	V	100%	NTPC TECH. SPECTS	REPLACE RCC/STEEL TRENCH COVERS AFTER INSTALLATION WORK	--DO--			

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

		SYSTEM EQUIPMENT: POWER & CONTROL CABLES AND ACCESSARY UP TO 33KV SUB-SYSTEM :		STANDARD FIELD QUALITY PLAN CONFORMING TO CODE: IS1255-1983 AND NTPC TECHNICAL SPECIFICATION			QP NO.: 0000-999-QO E - I- 004 REV. NO.: 00 DATE : 26/03/08 PAGE 6 OF 6 VALID UPTO : 25/03/11		REVIEWED BY: I.J.SINGH <i>Giden</i> VIKRAM TALWAR <i>mes</i> S.D.SINGH <i>del</i> O.P.NIRANJAN <i>del</i>		APPROVED BY U.R.KHOSLA <i>del</i>	
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1.	2.	3.	4.	5.	6.	7.	8.	9. Dy. General Manager (QA)				
2.23	LAYING OF SAND BRICKS/ SLABS FOR BURRIED CABLES	--DO--	C	V	100%	NTPC APROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255	NTPC APROVED LAY OUT DRGS./ CABLES SCHEDULE/IS1255	--DO--	उमेश राज खोसला/U.R. KHOSLA डी.जी.एस. (गुणवत्ता आश्वासन) एन.टी.पी.सी. लिमिटेड/NTPC Limited --DO-- A-8A, Sector-24, Noida-201 301 (U.P.) 1. POWER CABLE SHOULD NOT BE LAID ABOVE TELECOMMUNICATION CABLE. 2. CABLE PROTECTIVE COVER MAY BE MARKED BY "POWER CABLE"			
3.1	ERECTION TESTS											
3.2	FOR LT CABLES											
3.3	IR TEST	MEGGER	B	MEAS	100%	IS1255	IS1255	--DO--				
3.4	DC HV TEST	HV TESTER	B	MEAS	100%	IS1255	IS1255	--DO--				
3.5	FOR HT CABLES											
3.6	IR BEFORE AND AFTER LAYING	MEGGER	A	MEAS	100%	IS1255	IS1255	--DO--				
3.7	DC HV TEST ON EACH CORE	MEGGER	A	MEAS	100%	IS1255	IS1255	--DO--				

LEGENDS USED FOR 'STORAGE LEVEL'	
STORAGE LEVEL "A"	OUTSIDE WITH NO PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT)
STORAGE LEVEL "B"	OUTSIDE WITH PROTECTIVE COVER (OPEN SPACE /YARD ON RAISED SURFACE, PROPERLY STACKED AND FREE FROM WATER LOGGING AND LOADING / UNDUE WEIGHT, COVERED WITH PVC/TARPAULIN)
STORAGE LEVEL "C"	INDOOR SHELF ITEMS (STORED IN PUCCA SHED, IN STORE)
STORAGE LEVEL "D"	INDOOR CLEAN CONDITIONS (STORED IN PUCCA SHED, IN STORE. THE STORAGE AREA SHALL BE DRY AND FREE FROM DUST AND THERE SHALL NOT BE ACID/ CHEMICALS IN VICINITY)
STORAGE LEVEL "E"	INDOOR TEMPERATURE AND HUMIDITY CONTROLLED – AIR CONDITIONED (STORED IN PUCCA SHED, IN STORE WITH CONTROLLED ATMOSPHERE)

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

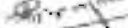
NTPC		EQUIPMENT LT SWITCHGEAR		STANDARD FIELD QUALITY PLAN			QP NO. 0000-999-QOE- T-002 REV NO. 0 DATE : 26 -12-2006 PAGE 1 OF 4 Valid upto : 25 -12-2009		REVIEWED BY AM <i>[Signature]</i> VT <i>[Signature]</i> OPN <i>[Signature]</i> SDS <i>[Signature]</i>			
				CONFORMING TO CODE : IS 8623								
S No	Activity & Operation		Characteristics / Instrument		Class of Check #	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records		Remarks
1	2		3		4	5	6	7	8	9	10	11

Note for quantum of check: For "A" and "B" type checks quantum of check defined under column # 6 is for NTPC only. However contractor will carry out 100% quantum of check against all activities and operations identified in the SFQP

A MATERIAL RECEIPT & UNLOADING										
	Visual Inspection	Check identification marking on cases & quantity	C	Visual	100%	Challan / Packing slip	Challan / Packing slip			
		Check physical / external damages to packing for breakage	C	Visual	100%					
		If packing found damaged then check physical / external damages to panels for breakage, distortion or dents, cracks, scratches / removal of paint and rusting etc.	C	Visual	100%					
		Ensure availability & use of proper material handling equipment (fork lift or suitable crane)	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual			
		Check for slinging points or handling instructions marked on the packing for proper handling	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual			
	Report theft / damages during transit	Report missing cases / equipment during transit and damages to panels / equipment for insurance claims	B	Visual	100%	Challan / Packing slip	Challan / Packing slip			
B STORAGE OF EQUIPMENT										
	Storage Area	Storage area should be preferably covered or elevated floor (not prone to flooding), non-corrosive & ventilated, safe, secure, clean and preferably vermin proof	B	Visual	100%					
	Storage handling	Panels to be covered with polythene sheet	C	Visual	100%					
		Panels should preferably be stored on wooden bays for further transportation or handling	C	Visual	100%					
C PRE-ERECTION CHECKS										
	Availability of Documents	Ensure the availability of NTPC approved layout drg., GA drg., BOM etc.	C	Visual	100%					

LEGEND : * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED - C - CONTRACTOR, S - NTPC, CLASS # A - CRITICAL, B - MAJOR, C - MINOR. *A SHALL BE WITNESSED BY NTPC IQA, *B SHALL BE WITNESSED BY NTPC PRECTION / CONSTRUCTION DEPT., *C SHALL BE WITNESSED BY CONTRACTOR (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO. : QS-01-QA-I-P-10/F4-00

NTPC	EQUIPMENT:-		STANDARD FIELD QUALITY PLAN			QP NO. 0000-999-QOE-T-002		REVIEWED BY		
	LT SWITCHGEAR		CONFORMING TO CODE : IS 8623			REV NO. 0 DATE : 26 -12-2006 PAGE 2 OF 4 Valid upto : 25 -12-2009		AM  VT  OPN  SDS 		
S No	Activity & Operation	Characteristics / Instrument	Class of Check #	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format Of Records		
1	2	3	4	5	6	7	8	9	10	11

	Civil works & structures	Check readiness of switchgear location i.e., cut-outs, embeddings have been provided at required locations	C	Visual	100%	NTPC appd. Drgs	NTPC appd. Drgs				
		Check the civil construction and ensure that there is no hindrance for erection of Switchgear panels	C	Visual	100%	NTPC appd. Drgs	NTPC appd. Drgs				
		Check civil work dimensions i.e. of floors, various openings, beams, columns, wall etc. as per NTPC approved drg	C	Measure	100%	NTPC appd. Drgs	NTPC appd. Drgs				
	Check transportation route	Panel transportation route suitability / clearance	C	Visual	100%						
	Tools and tackles	Ensure availability of Tools, Tackles, erection hardware	C	Visual	100%	Manufacturer's Manual	Manufacturer's Manual				
	Transport panels to location	Ensure availability & use of proper material handling equipment (fork lift or suitable crane)	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual				
		Check for slinging points or handling instructions marked on the packing for proper handling	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual				

D	ERECTION CHECKS										
	Unpacking of panels	Check completeness of supply / availability of items	C	Visual	100%						
	Visual inspection	Verify Name plate, Label, caution plate	C	Visual	100%						
		Check physical / external damages to panels / component equipments for breakage, distortion or dents, cracks, scratches and removal of paint/rusting etc	C	Visual	100%						
	Handling of panels	Preferably use fork lifts for placing the panels onto foundations or if panels are rolled on to foundation then retain base plank to avoid damage to base frame	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual				
	Location of panels	Check for mounting of each panel as per NTPC approved layout drg.	B	Visual	100%	NTPC Appd Drg	NTPC Appd Drg				
	Alignment check	Check alignment of panels and accuracy of placement use shims if required	C	Visual	100%	Manufacturer's Manual	Manufacturer's Manual				

LEGEND: * RECORDS, IDENTIFIED WITH "TRK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: C=CONTRACTOR, N=NTPC, CLASS # A=CRITICAL, B=MAJOR, C=MINOR, 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT, 'C' SHALL BE WITNESSED BY CONTRACTOR (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QA/P-1094-R0

NTPC	EQUIPMENT :		STANDARD FIELD QUALITY PLAN			QP NO. 0000-999-QOE- T-002		REVIEWED BY		APPROVED BY	
	LT SWITCHGEAR					CONFORMING TO CODE : IS 8623		REV NO. 0 DATE : 26 -12-2006 PAGE 3 OF 4 Valid upto : 25 -12-2009		AM VT OPN SDS	
S No	Activity & Operation	Characteristics / Instrument	Class of Check #	Type of Check	Quantity of Check	Reference Document	Acceptance Norms	Format Of Records	Remarks		
1	2	3	4	5	6	7	8	9	10	10	

		Check alignment of all operating handles for all switches and CBs	B	Visual	At random					
		Check alignment of all power & control draw out contacts	B	Visual	At random					
	Installation checks	Check that insulators and conductors are thoroughly cleaned with dry air or scrubbed & cleaned suitably as required	B	Visual	At random					
		Ensure that insulators are handled carefully	C	Visual	100%					
		Remove oxide film preferably with sand paper or fine wire brush from the joint surfaces and then clean with Carbon Tetrachloride (CCl ₄) or equivalent liquid	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual			
		Check alignment of bushbars	C	Visual	100%	NTPC Appd Drg	NTPC Appd Drg			
		Verify use of proper washers Belleville / star / spring type	C	Visual	100%					
		Check tightness of bolts of joints of main bus bars, auxiliary buses	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check connectors & tightness of connection of busduct entry. If these connections are to be done later, then ensure that the enclosure ends are kept closed / covered preventing entry of dust, water etc.	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check that inter panels earthing busbar is properly connected and board is connected to station earth	B	Visual	At random					
		Check CT secondary shorting links & remove them where required for connection to relays & meters	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check for inter panel gaskets	C	Visual	100%					
		Check alignment of MCC doors and free movement as well as interchangeability of similar modules	B	Visual	At random					
		Check operating mechanism physically for any looseness of links etc.	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual			

LEGEND : * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED : C = CONTRACTOR; N = NTPC. CLASS : A = CRITICAL, B = MAJOR, C = MINOR. "A" SHALL BE WITNESSED BY NTPC QA, "B" SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPT., "C" SHALL BE WITNESSED BY CONTRACTOR (A & B CHECK SHALL BE NTPC EHP STAGE)

FORMAT NO. : QS-01-QA-P-1074-R0

NTPC	EQUIPMENT		STANDARD FIELD QUALITY PLAN			QP NO. 0000-999-QOE-T-002		REVIEWED BY		APPROVED BY	
	LT SWITCHGEAR					CONFORMING TO CODE : IS 8623		REV NO. 0 DATE : 26 -12-2006 PAGE 4 OF 4 Valid upto : 25 -12-2009		AM VT OPN SDS	
S No	Activity & Operation	Characteristics / Instrument	Class of Check #	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format of Records	Remarks		
1	2	3	4	5	6	7	8	9	10		

		Check Degree of protection by paper insertion method at the gasketed joints for IP 5X sections	B	Visual	At random					
		Check caution / danger plate provided	C	Visual	100%					
	Continuity check	Check continuity of main & auxiliary circuits	A	Elec	100%	NTPC approved drgs.	NTPC approved drgs.			
	IR check	Perform IR of main & auxiliary circuits with 500 V Meggar	A	Elec	100%	IS 8623	IS 8623			
	Earthing	Check earthing with grid	A	Visual	100%	NTPC approved drgs.	NTPC approved drgs.			
	Cabling checks	Check for completeness of control cable terminations	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check for completeness of power cable terminations	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check for completeness of communication cable terminations, if applicable	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Do not earth shielding on communication cable in MCC	B	Visual	At random	NTPC approved drgs.	NTPC approved drgs.			
		Check control and power cables are properly secured or clamped	B	Visual	At random					
		Check tightness of control and power cable terminations	B	Visual	At random	Manufacturer's Manual	Manufacturer's Manual			
		Plug all unused holes and openings including those for cable entries	C	Visual	100%					
E	FINAL VISUAL INSPECTION	Check no loose tools or hardware or any other unwanted material etc are left inside the Panels	B	Visual	100%					
		Check for any damage to paint finish and ensure touch up.	B	Visual	100%					
		Check all switches and CBs are in OFF position	C	Visual	100%					
		Check completeness of installation of Switchgear panels	B	Visual	100%					

LEGEND * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: C - CONTRACTOR, N - NTPC, CLASS #, A - CRITICAL, B - MAJOR, C - MINOR, 'A' SHALL BE WITNESSED BY NTPC/QA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPT., 'C' SHALL BE WITNESSED BY CONTRACTOR (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO : QS-01-QAI-P-10F4-R0

ITEM : Instrumentation Cables. SUB SYSTEM : Shielded Instrument/ TC extension/ Compensating PVC FRLS Cable		STANDARD QUALITY PLAN					To be filled by NTPC QP No.: 0000-999-QOI-S-035 Revision:00 Date:05/09/2012 Page:1 OF 5		Reviewed By: Archana Nati Rajeev Garg S.samanta		Approved By: A.K.GARG	
SI No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C,N	Reference Document	Acceptance Norms	Format of record	Agency M C N	Remarks		
1	2	3	4	5	6	7	8	9	10	11		
I. RAW MATERIAL												
A CONDUCTOR												
A1	COPPER ROD For Conductor/ Drain wire	a) Dimension	Maj.	Measu.	1 sample/lot	IS 613/IS 12444	IS:613/IS:12444	IMR/ TC	V	-	-	Make - As per Annexure enclosed
		b) Conductivity/ Resistivity	Cri.	Elec.	1 sample/lot	IS:613/IS 12444	IS:613/IS:12444	IMR/ TC	V	V	-	
A2	Conductor for compensating cable	a) Size	Min	Dimen	1 Sample / lot	APPROVED DATASHEET	APPROVED DATA SHEET	IMR/ TC	P	-	-	Make - As per Annexure enclosed
		b) Resistance check	Maj	Elec	1 Sample / lot	APPROVED DATASHEET	APPROVED DATA SHEET	IMR/ TC	P	-	-	
		c) Thermo emf	Cri	Elec	1 Sample / lot	ANSI MC 98.1	ANSI MC 98.1	IMR/ TC	P	-	-	
		d) Specific resistance, Temp. coefficient	Maj	Elec/Me ch	1 Sample / lot	Mfr. catalog	Mfr. catalog	IMR/ TC	V	V	V	
		e) Chemical composition.	Maj	Chem.	1 Sample / lot	Mfr. catalog	Mfr. catalog	IMR/ TC	V	V	V	
B PVC COMPOUND												
B1	PVC Compound (Insulation & Sheath) Type of compound as per NTPC Spec.	a) Thermal stability (for Insulation)	Maj.	Therm	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	P	V	-	
		b) TS & % Elongation Before and After aging and variation.	Maj.	Mech.	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	P	V	-	
		c) Loss of Mass (Sheath)	Maj	Therm.	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	P	V	-	
B2	FR Properties for Filler Compound	a) Oxygen index	Cri.	Chem	1 sample/lot	29 %(min)ASTMD2863	29%(min)ASTMD2863	IMR/ TC	P	V	-	
		b) Temperature index deg. C	Cri.	Chem	1 sample/lot	250 deg. C(min) ASTMD2863	250 deg. C(min) ASTMD2863	IMR/ TC	P	V	-	
B3	FRLS Properties for Sheath	a) Oxygen index	Cri.	Chem	1 sample/lot	ASTMD2863/ APPROVED DATASHEET	ASTMD2863/ APPROVED DATASHEET	IMR/ TC	P	V	-	
		b) Temperature index	Cri	Chem	1 sample/lot	ASTMD2863/ APPROVED DATASHEET	ASTMD2863/ APPROVED DATASHEET	IMR/ TC	P	V	-	
		c) Smoke density rating	Cri.	Chem	1 sample/lot	ASTMD2843/ APPROVED DATASHEET	ASTMD2843/ APPROVED DATASHEET	IMR/ TC	P	V	-	
		d) HCL Emission	Cri.	Chem	1 sample/lot	IEC754-1/ APPROVED DATASHEET	IEC754-1/ APPROVED DATASHEET	IMR/ TC	P	V	-	
C	Tapes / Binders (Aluminium Mylar, Melinex & Binders)	a) Thickness	Maj.	Mesu.	1 Sample/ Lot	APPROVED DATASHEET	APPROVED DATASHEET	IMR/ TC	P	V	-	
		b) Size	Maj.	Mesu.	1 Sample/ Lot	APPROVED DATASHEET	APPROVED DATASHEET	IMR/ TC	P	V	-	
D	Armour (If applicable)	a) Dimension	Maj.	Mesu.	1 Sample/ Lot	APPROVED DATASHEET	APPROVED DATASHEET	IMR/ TC	P	V	-	
		b) TS & %Elongation	Maj.	Mech	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	P	V	-	
		c) Zn Coating	Maj.	Chem	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	P	V	-	
		d) Resistivity	Maj.	Elect	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	P	V	-	

LEGEND * RECORDS, IDENTIFIED WITH " TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION .M:MANUFACTURER/ SUB SUPPLIER C:MAIN SUPPLIER,N:NTPC, P:PERFORM ,W: WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"

Format No. :QS-01-QAI-P-09/F1-R1

ITEM : Instrumentation Cables. SUB SYSTEM : Shielded Instrument/ TC extension/ Compensating PVC FRLS Cable		STANDARD QUALITY PLAN					To be filled by NTPC QP No.: 0000-999-QOI-S-035 Revision:00 Date:05/09/2012 Page:2 OF 5		Reviewed By: Arthana Nair Rajeev Garg S. Sathanta		Approved By: A.K. GARG		
Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Format of record	Agency			Remarks
1	2	3	4	5	M	C,N	7	8	9	10	11		
E	Wooden Drums	a) Constructional checks	Maj	Visu.	100%	-	IS 10418	IS 10418	IMR/ TC	P	-	-	
		b) Dimensions	Maj	Mesu.	1 Sample/ Lot	-	IS 10418	IS 10418	IMR/ TC	P	-	-	
II INPROCESS INSPECTION													
A	Wire Drawing & Annealing	a) Size	Maj.	Dimn.	1 Sample at Start and 1 Sample at End	-	Approved Datasheet	Approved Datasheet	IMR/ TC	P	-	-	
		b) Surface finish	Maj	Visu.	100%	-	Surface shall be smooth	Surface shall be smooth	IMR/ TC	P	-	-	
		c) % of Elongation	Maj	Mech.	1 Sample/ Lot	-	IS 8130	IS:8130	IMR/ TC	P	-	-	
B	Twining (Only for Dra. n wire)	a) Size	Maj	Dimn.	1 Sample/ Lot	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	
		b) Percentage of Elongation	Maj.	Mech.	1 Sample/ Lot	1 Sample/ Lot	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	V	V	
C	Bunching	a) Dimension and No. of strand.	Maj	Measu	1 Sample/ Lot	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	
		b) Resistance	Cri	Elec	1 Sample/ Lot	1 Sample/ Lot	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	V	V	
D	Insulation	a) Surface finish	Maj.	Visu.	100%	-	Surface shall be smooth & free from scratches	Surface shall be smooth & free from scratches	IMR/ TC	P	-	-	
		b) Core Diameter	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	
		c) Radial Thickness(Min & Max.)	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	No Repairs are allowed on the Insulated core
		d) Spark Test	Maj.	Elec.	100%	100%	IS 10810(With 3KV ac)	No Spark failure is allowed	IMR/ TC	P	V	V	
		e) Volume Resistivity/ Insulation Resistance	Maj.	Elec.	1 Sample/ Lot	1 Sample/ Lot	VDE -0207/ Approved Datasheet	VDE -0207/ Approved Datasheet	IMR/ TC	P	V	V	
		f) Colour, Marking/ Identification	Maj.	Visual	100%	100%	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	V	-	
		g) TS & %Elongation	Maj.	Mech	1 Sample/ Lot	-	VDE -0207/ Approved Datasheet	VDE -0207/ Approved Datasheet	IMR/ TC	P	-	-	
E	Twisting	a) Lay length and Direction	Maj	Measu. &	1 Sample at Start and 1 Sample at End	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	
		b) Size/ Dimension	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	
		c) Pair Colour	Maj	Visual	100%	-	NTPC Tech. Specification /Approved Datasheet	NTPC Tech. Specification /Approved Datasheet	IMR/ TC	P	-	-	

LEGEND : * RECORDS, IDENTIFIED WITH " TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION M:MANUFACTURER/ SUB SUPPLIER C:MAIN SUPPLIER,N:NTPC. P:PERFORM ,W: WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"

Format No. :QS-01-QAI-P-09/F1-R1

		ITEM : Instrumentation Cables. SUB SYSTEM : Shielded Instrument/ TC extension/ Compensating PVC FRLS Cable		STANDARD QUALITY PLAN				To be filled by NTPC QP No.: 0000-999-QOI-S-035 Revision:00 Date:05/09/2012 Page:3 OF 5		Reviewed By: Archana Nath Rajeev Gang S. samanta		Approved By: A.K GARG Approved	
Valid up to : 04/09/2015													
Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference	Acceptance	Format of record	Agency			Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
F	Laying of Pairs/ Taping/ Shielding (Wherever Applicable)	a) Construction	Maj.	Visu.	100%	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	IMR/ TC	P	-	-	
		b) Dimension	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
		c) Coverage/ Overlap	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	IMR/ TC	P	-	-	
		d) Continuity	Maj.	Dimn	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
G	Sheathing (Inner - If applicable)	a) Surface Finish	Maj.	Visual	100%	-	Smooth, free from visual defects #	Smooth, free from visual defects#	IMR/ TC	P	-	-	# Porosity, Burnt particles, Pimples (Repairs are not allowed)
		b) Colour	Maj.	Visual	100%	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
		c) Diameter / Thickness	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	IMR/ TC	P	-	-	
H	Armouring (If applicable)	a) Surface finish	Maj.	Visual	100%	-	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC	P	-	-	
		b) Direction of Lay & Coverage	Maj.	Visual	100%	-	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC	P	-	-	Min coverage shall be 90 %. Gap should not be more than 1 wire/ Strip dimension.
		c) Size of Wire/ Strip	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	IMR/ TC	P	-	-	
		d) Diameter over Armouring	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
I	Sheathing (Outer)	a) Surface Finish	Maj.	Visual	100%	-	Smooth, free from visual defects#	Smooth, free from visual defects#	IMR/ TC	P	-	-	# Porosity, Burnt particles, Pimples (No Repairs are allowed)
		b) Colour/ Marking/ Embossing	Maj.	Visual	100%	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
		c) Overall Diameter, Thickness	Maj.	Measu.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
		d) TS & %Elongation	Maj.	Mech.	1 Sample/ Lot	-	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	IMR/ TC	P	-	-	
III. FINAL INSPECTION													
A.	TYPE TEST	Type test as per agreement with NTPC Engg. Review of type test clearance from NTPC Engg. before final inspection - CHP											
B.	ROUTINE TEST	a) Cond.resistance (Cable & Drain wire)	Cri.	Elec.	100%	100%	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	V	V	
		b) HV Test	Cri.	Elec.	100%	100%	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	V	V	
LEGEND : * RECORDS, IDENTIFIED WITH " TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M:MANUFACTURER/ SUB SUPPLIER, C MAIN SUPPLIER, N NTPC, P.PERFORM, W:WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"													
Format No. :QS-01-QAI-P-09/F1-R1													

		ITEM : Instrumentation Cables. SUB SYSTEM : Shielded Instrument/ TC extension/ Compensating PVC FRLS Cable		STANDARD QUALITY PLAN				To be filled by NTPC QP No.: 0000-999-QOI-S-035 Revision:00 Date:05/09/2012 Page:4 QF 5		Reviewed By: Archana Nair Rajesh Sam S.samanta		Approved By A K DARGA	
Valid up to : 04/09/2015													
Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference	Acceptance	Format of record	Agency			Remarks
					M	C,N	Document	Norms		M	C	N	
1	2	3	4	5	6		7	8	9	10	11		11
		c) IR Test (on drum length)	Cri	Elec.	100%	100%	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	V	V	
		d) Drain wire continuity	Cri.	Elec.	100%	100%	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	V	V	
C.	ACCEPTANCE TEST	a) Cond.resistance (Cable & Drain wire)	Cri	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		b) HV Test	Cri	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		c) IR Test	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		d) Constructional Details & Dimensions											
		i) Constructional Details	Maj.	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		ii) Shield Al-mylar thickness	Maj.	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		iii) Insulation thickness	Maj	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		iv) Inner/ Outer sheath thickness (as applicable)	Maj	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	before and after ageing for insulation
		v) Diameter over outer sheath	Maj	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		e) Outer sheath - Colour, Marking/ Embossing & End sealing.	Maj.	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		f) Length checking.	Maj	Measu.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		g) Core - Band marking/ Numbering, Colour.	Maj	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	NTPC Tech.Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		h) Overall Coverage/overlap of shield & Continuity of drain wire.	Maj.	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	Continuity shall be checked as per Manufacturer practice.

LEGEND : RECORDS, IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION M:MANUFACTURER/ SUB SUPPLIER C:MAIN SUPPLIER, N:NTPC, P:PERFORM, W: WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"

Format No. :QS-01-QAI-P-09/F1-R1



ITEM : Instrumentation Cables.
SUB SYSTEM : Shielded
Instrument/ TC extension/
Compensating PVC FRLS Cable

STANDARD QUALITY PLAN

To be filled by NTPC

QP No.: 0000-999-QOI-S-035

Revision:00

Date:05/09/2012

Page:5 OF 5

Reviewed By

Archana Nat

Rajeev Garg

S.samanta

Approved By

A K GARG

Valid up to : 04/09/2015

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Format of record	Agency			Remarks
1	2	3	4	5	6		7	8	9	10	11		12
		i) Thermal EMF test (For compensating cable only)	Maj.	Elec.	Sample as per IS 8784	Sample as per IS 8784	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		j) Thermal Stability (Insulation & Sheath)	Maj.	Chem.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Spec /ADS/IS-5831	Spec /ADS/IS-5831	FIR	P	W	W	
		k) Visual & Surface Finish	Maj.	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Smooth, free from visual defects #	Smooth, free from visual defects #	FIR	P	W	W	# Like Porosity, Burnt particles, Pimples
		l) Electrical Parameters (Mutual capacitance, Cross talk, Attenuation, Characteristic Impedance as applicable)	Maj.	Elec.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		m) Persulphate Test (For Drain wire)	Maj.	Chem.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		n) Swidish chimney test (overall cable)	Maj.	Chem	1 No./ Complete lot offered \$	1 No./ Complete lot offered \$	NTPC Tech Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	\$ Irrespective of size & type.
		o) FRLS Test for outer sheath for OI(Oxygen Index), TI(Temperature Index), SDR(Smoke Density Rating) & HCL Emission.	Maj.	Chem	1 No./ Complete lot offered \$	1 No./ Complete lot offered \$	NTPC Tech Specification /Approved Datasheet	NTPC Tech Specification /Approved Datasheet	FIR	P	W	W	
		p) TS & %Elongation test of Insualtion & Sheath (Before & After aging)	Maj.	Mech	1 No./ Complete lot offered \$	1 No / Complete lot offered \$	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		q) Volume Resistivity (At room and Elevated Temperature)	Maj.	Elec.	1 No / Complete lot offered \$	1 No / Complete lot offered \$	NTPC Tech Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
		r) Armouring Dimension & Zn coating. (If applicable)	Maj.	Measu.	1 No / Complete lot offered \$	1 No / Complete lot offered \$	NTPC Tech.Specification /Approved Datasheet	NTPC Tech.Specification /Approved Datasheet	FIR	P	W	W	
D.	Packaging and Dispatch	Stenciling, completeness & Venfication with packing list	Maj.	Visual.	100%	-	Mfg Practice	Mfg Practice		P	-	-	

NOTE 1 : Where witnessing and verification of records is done only by main contractor (Coloum "C"), NTPC inspection Engineer may do a surveillance Verification/ Witnessing as per his discretion.

NOTE 2 : IMR : Inword Material Register, TC : Test Certificates, Mfg. : Manufacturer, FIR : Final Inspection Report.

NOTE 3: NTPC Inspection Enginner to check,approval date,revision no of reference documents at the time of Inspection.

LEGEND * RECORDS IDENTIFIED WITH " TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION .M-MANUFACTURER/ SUB SUPPLIER C-MAIN SUPPLIER,N:NTPC, P:PERFORM ,W- WITNESS and V: VERIFICATION AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"

Format No. : QS-01-QAI-P-09/F1-R1

ACCEPTABLE MAKES

COPPER ROD

M/S HCL
M/S STERLITE
M/S BIRLA COPPER
M/S INDO GULF
M/S LG INTERNATIONAL

IMPORTED VENDORS (LONDON METAL EXCHANGE REGISTERED VENDORS ONLY)

THERMOCOUPLE WIRES

ISABELLA HAUTE-GERMANY
SANDVIK - (KANTHAL INDIA, HOSUR)
JLC ELECTROMATE-JAIPUR (FOR KX AND SNX)

PVC COMPOUND FOR INSULATION AND FRLS SHEATH

M/S SHRIRAM
M/S KUND KUND POLYMER
M/S KALPANA INDUSTRIES
M/S AIRCON PNEUMATICS PVT. LTD., BHIWADI
M/S BIHANI MANUFACTURING COMPANY, NEW DELHI
M/S LG CHEMICALS
M/S CORDS CABLES, BHIWADI
M/S UNIVERSAL POLYCHEM, DELHI
M/S DELTON CABLE-FARIDABAD
M/S SCJ PLASTICS, NEW DELHI
M/S PARAGON
M/S BHARAT PLASTICS (POLYCAB GROUP)

MASTER BATCH

M/S SHRIRAM
M/S SARAS POLYPRODUCTS, BHIWADI
M/S SCJ PLASTICS, NEW DELHI
M/S BHARAT PLASTICS (POLYCAB GROUP)

See annex



		ITEM: (MATERIAL, CLASS, GRADE, RATING, SIZE ETC.) GALVANISED FLEXIBLE CABLE TRAYS SUPPORT SYSTEM		STANDARD QUALITY PLAN		QP NO. 0000-999-QOE-S-38 REV.:00 DATE : 01.09.04 PAGE 1 OF 2 VALID UPTO:31.08.07		REVIEWED BY S.D.SINGH O.P.NIRANJAN I.J.SINGH		APPROVED BY ANIL GUPTA			
				CONFORMING TO CODE: Design as per NTPC Specification									
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	M	C/N	7	8	9	D*	**	10	11
	Flexible cable trays Support Structure	1. In Black Condition a) Weld Quality	Major	Visual	100%	Random	Manufacturer's Plant Std	Manufacturer's Plant Std	Inspection Report		P	V	V
		b) Burs	Major	Visual	Random	-	No Burs	No Burs	-do-		P		-
2.	Finished Galvanized	2. After Galvanising											
		2.1 General physical inspection including Galvanizing Quality/Defects, Dieromating, White Rusting etc.	Major	Visual	100%	5 Sample/Lot	IS-2629-1985 IS-4759-1996	IS-2629-1985 IS-4759-1996	-do-		P	W	W
		2.2 Dimensional Check & Thickness Check	Major	Measurement	-do-	-do-	NTPC/Main Supplier Approved Drg.	NTPC/Main Supplier Approved Drg.	-do-		P	W	W
		2.3 Galvanizing Tests											
		a) Coating thickness measurement survey by Elcometer	Critical	Measurement	IS-4759-1996	-do-	IS-4759-1996 IS-3203-1982	IS-4759-1996 IS-3203-1982	-do-		P	W	W
		b) Mass of zinc coating	Critical	Measurement	-do-	1 coupon sample of each thickness	IS-6745-1972 IS-4759-1996	IS-6745-1972 IS-4759-1996	-do-		P	W	W
		c) Uniformity of zinc coating/dip test	Critical	Measurement	-do-	-do-	IS-2633-1986 IS-4759-1996	IS-2633-1986 IS-4759-1996	-do-		P	W	W
		d) Adhesion Test	Critical	Visual	-do-	-do-	IS-2629-1985	IS-2629-1985	-do-		P	W	W
LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY THE CONTRACTOR IN QA DOCUMENTATION **M: MANUFACTURER/SUB-SUPPLIER, C: Main Supplier: NTPC, N: NTPC. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE "CHP" BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "W"													

		ITEM: (MATERIAL, CLASS, GRADE, RATING, SIZE ETC.)		STANDARD QUALITY PLAN		QP NO. 0000-999-QOE-S-38 REV.:00 DATE : 01.09.04 PAGE 2 OF 2 VALID UPTO: 31.08.07		REVIEWED BY S.D.SINGH O.P.NIRANJAN I.J.SINGH		APPROVED BY ANIL GUPTA			
				CONFORMING TO CODE: Design as per NTPC Specification									
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			
1.	2.	3.	4.	5.	M	C/N	7	8	9	D*	**	10	
		Proof Load Test as per note 6 Followed by Die Penetration Test (For 600 mm and above cable tray support system)	A	Meas/Visual	One Sample from each offered lot	One Sample from each offered lot	NTPC Technical Specification/ No visible cracks should develop on the weld part	NTPC Technical Specification/ No visible cracks should develop on the weld part	Inspection Report		P	W	W
Note : - The supplier to ensure procurement of steel from main producers like SAIL/TISCO, Rastriya Ispat/Ispat Ind. Jindal/Essex/Lloyds/IIS Co. and Zinc from Hindustan Zinc Ltd. - Welding shall be done by qualified welders as per supplier system. - Material shall be galvanized at NTPC approved sources only. - Pre-treatment of cable trays support system shall be carried out in seven tank process as per IS-2629. All the process parameters e.g. Concentration, temperature, density etc. to be maintained and recorded by the galvaniser. - The process of pre-treatment shall be verified by NTPC on surveillance basis during inspection of Galvanised Flexible Cable Trays support system. - Test on Main support Channel shall be done if only C1 channel are in scope of supply and cantilever arms shall be fitted on one side. This test shall be same as test 4 of type test as per tech. Spec. - Test on Main Support Channel shall be done with C2 Channel and cantilever arms fitted on both sides, if C2 channels are in scope of supply. This test shall be same as test 2 A of type tests. Then test at (i) above shall not be repeated. - Nut slip characteristic test (It shall support minimum load of 350 Kg. Before Nut Slips with bolt torque of 65 NM). This test shall be same as test 5 B of type tests. - The procedure for carrying out above test shall be as per details given in Type Tests Specification.													
LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY THE CONTRACTOR IN QA DOCUMENTATION **M: MANUFACTURER/SUB-SUPPLIER, C: Main Supplier, N: NTPC. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE "CHP" BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "W"													

		ITEM: (MATERIAL, CLASS, GRADE, RATING, SIZE ETC.) GALVANIZED CABLE TRAYS (Perforated & Ladder type) & ACCESSORIES		STANDARD QUALITY PLAN			QP NO. 0000-999-1-S-021 REV.: 1 DATE: 06.02.04 PAGE: 1 OF 1 VALID UPTO : 05.02.07			REVIEWED BY A.K. Sharma Rana Vohra O.P. Niranjan		APPROVED BY ANIL GUPTA		
CONFORMING TO CODE :														
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	M	C/N	6	7	8	9	D*	**	10	11
1	FINISHED CABLE TRAYS & ACCESSORIES	1 In Black Condition	Major	Visual	100%	Random	Manufacturer's Plant Std	Manufacturer's Plant Std	Inspection report	P				A) The cable trays shall be galvanised at NTPC approved sources only.
		a) Weld Quality												
		2 After Galvanising	Major	Visual	Random		-	-	-	P				B) The supplier to ensure procurement of steel from main producers like SAIL/TISCO, Rastriya Ispat/Ispat Ind. Jindal/Essex/Lloyds/IIS Co. and Zinc from Hindustan Zinc Ltd.
		b) Burs												
		2.1 General Physical inspection including Galvanising Quality/ Defects, Dicromating, White rusting etc.	Major	Visual	IS-4759-1996	5 sample/lot	IS-2629-1985 IS-4759-1996	IS-2629-1985 IS-4759-1996	-do-	P	W	W		C) Welding shall be done by qualified welders as per supplier system
		2.2 Dimensional check & Sheet Thickness	Major	Measurment	-do-	-do-	NTPC/Main Supplier Approved Drawing	NTPC/Main Supplier Approved Drawing	-do-	P	W	W		D) Pre-treatment of fabricated cable trays shall be carried out in seven tank process as per IS 2629. All the process parameters e.g. Concentration, temperature, density etc. to be maintained and recorded by the Galvaniser
		2.3 Galvanising tests	Critical	Measure ment	-do-	-do-	IS-4759-1996 IS-3203-1982	IS-4759-1996 Table-I	-do-	P	W	W		E) The process of pretreatment shall be verified by NTPC on surveillance basis during inspection of cable trays
		a) Coating thickness measurement survey by Elcometer												
		2.4 Mass of zinc coating	Critical	Measurment	-do-	1 coupon sample of each thickness	IS-6745-1972 IS-2633-1986	IS-4759-1996 Table - I	-do-	P	W	W		F* One piece each of 2.5 meter length size of cable tray of 300 mm & above shall be taken as sample from each offered lot for inspection. It shall be supported at both ends & loaded with uniformly distributed load of 76kg/meter along the length of cable tray. The maximum deflection at mid span of each sample shall not exceed 7mm.
		b) Mass of zinc coating												
2.5 Uniformity of zinc coating/dip test	Critical	Measurment	-do-	-do-	IS-2629-1985 IS-2633-1986 IS-4759-1996	IS-4759-1996 cl. 9.3	-do-	P	W	W				
c) Uniformity of zinc coating/dip test														
2.6 Adhesion test	Critical	Visual	-do-	-do-	IS-2629-1985	IS-2629-1985	-do-	P	W	W				
d) Adhesion test														
2.7 Deflection Test	Critical	Measurment	1 sample from each size type/lot	1 sample from each size type/lot	*F*	*F*	-do-	P	W	W				

LEGEND: RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY THE CONTRACTOR IN QA DOCUMENTATION

** M: MANUFACTURER/SUB-SUPPLIER, C: CONTRACTOR/NOMINATED INSPECTION AGENCY, N: NTPC. INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION AS APPROPRIATE

"CHP" BY NTPC SHALL BE IDENTIFIED IN COLUMN "N" AS "W".



Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 1 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg		
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N	Reference Document	Acceptance Norms	Record Format	Agency D* M C N	Remarks
1	2	3	4	5	6	7	8	9	10	11
Instructions: 1) Cable manufacturer to maintain records to show co- relation of raw materials to finished cables i.e raw material batch/ lot no. should be traceable to the cable drum. 2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not.										
A	Raw material/ Brought out Items									
1.01	Copper	1. Make	MA	Verify	100%	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR	V -- --
		2. Resistivity	MA	Elect	As per cable Mnf Std	--	IS 613	IS 613	--do--	P -- --
1.02	PVC compound for insulation	1. Make	MA	Verify	--do--	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--	V V --
		2. Type/ Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	--do--	V V V
		3. All acceptance test as per manufacturer norms including Thermal Stability test	MA	Verify	As per manufacturer norms	As per manufacturer norms	--do--	--do--	--do--	V V V Refer note 1
1.03	PVC Compound for inner sheath	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--	V V V
		2. Type/ Grade	MA	Verify	--do--	--do--	NTPC ADS	NTPC ADS	--do--	V V V
1.04	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--	V V V
		2. Dimension	MA	Meas	1 sample from each size / lot	--	NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	--do--	P -- --
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--	IS 3975	IS 3975	Supplier TC	V V --
1.05	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR	V V --
		2. Type / Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	--do--	V V V
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	--do--	--do--	--do--	V V V Refer note 1
		4. Thermal Stability	MA	Chem	One sample / Batch	--	NTPC ADS	NTPC ADS	QCR	P -- --
		5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS	--do--	P -- --

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-GI-QA1-P-10/03-01

O/c



		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)			QP NO. 0000-999- QOE- S-040 REV-00 DATE 25-11-11 Page 2 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG					
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	D*	Agency			Remarks
1	2	3	4	5	M	C/N	7	8	9		M	C	N	11
1.06	Wooden Drum	6. Acid Gas Emission	MA	Chem	One sample / Batch	--	NTPC ADS / IEC60754	NTPC ADS	QCR		P	--	--	
		1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS10418	--do--		P	--	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std.	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC		V	V	V	COC from Cables manuf.
1.07	Steel Drum	1. Dimension	MI	Meas	--do--	--	--do--	--do--	QCR		P	--	--	
		2. Surface finish	MI	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
II Process & Stage Inspection														
2.01	Wire Drawing	1. Surface finish	MA	Visual	One sample/Setting of each size	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR		P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Annealing Test	CR	Mech	--do--	Same as 6M	IS8130/NTPC ADS	IS8130/NTPC ADS	--do--		P	V	V	Refer Sl. No. 3.03(iii).
2.02	Bunching / stranding	1. No. of wires	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		2. Dia of wire	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		4. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		5. Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--	IS 8130	IS8130	--do--		P	--	--	
		6. Surface finish	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		7. DC Resistance	CR	Meas	--do--	--	IS8130/NTPC ADS	IS8130/ NTPC ADS	--do--		P	--	--	
2.03	Insulation extrusion	1. Surface finish	MA	Visual	--do--	--	NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	--do--		P	--	--	PVC compound shall be preferably loaded in to extruder by suction method.
		2. Colour of cores	MA	Visual	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-01-QA1-P-10/03-03

Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)				QP NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 3 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg NTPC, Noida				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		3. Core identification	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	QCR		P	--	--	Core printing shall be legible & indelible
		4. Thickness	CR	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		5. Spark Test	CR	Elect	100%	100%	CABLE MANUF STD.	No FAILURE	--do--		P	V	V	1. Spark test failure record is to be verified. 2. Core repairing not permitted
2.04	Laying up	1. Core sequence	MA	Visual	One sample/Setting of each size	--	IS 1554 (Part I)	IS 1554 (Part I)	--do--		P	--	--	
		2. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		3. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
2.05	Inner Sheath	1. Colour	MA	Visual	--do--	-	--do--	--do--	--do--		P	--	--	
		2. Surface Finish	MA	Visual	100%	-	NTPC SPECIFICATION	FISH EYE, BLOW HOLE NOT PERMITTED	--do--		P	--	-	
		3. Thickness	MA	Meas	One sample/Setting of each size	-	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4. Dia over inner sheath	MU	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
2.06	Armouring (As Applicable)	1. Dimension	MA	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
		2. No. of wires / strip	MA	Meas.	--do--	-	--do--	--do--	--do--		P	--	--	

1. LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M: MANUFACTURER/SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM W: WITNESS, V: VERIFICATION AS APPROPRIATE, CBP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO: QS-01-QAI-P-10/11-R1

NTPC		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 4 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6	7	8	9	10				11	
		3. Direction of lay	MA	Visual	One sample/Setting of each size	--	IS 1554 (Part 1)	IS 1554 (Part 1)	QCR		P	--	--	
		4 Coverage & Quality of armouring	MA	Meas.	100%	--	Min. area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S. Wire /formed wire. The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)	--do--		P	--	--		
		5 Dia over armouring	MA	Meas.	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
2.07	Outer Sheath	1. Surface finish	MA	Visual	100%	--	Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification)	--do--		P	--	--	PVC FRLS compound shall be preferably loaded in to extruder by suction method.	
		2.Colour of sheath	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	--do-		P	--	--	
		3. Dia over outer sheath	MA	Meas	--do--	--	--do-	--do--	--do--		P	--	--	
		4 Thickness of outer sheath	CR	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
		5. Embossing quality	MA	Visual	100%	-	Drum no., IS1554 Part -I , Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (As per NTPC specification)	--do--		P	--	--	Drum no. on cable may be embossed/ printed.	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

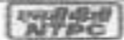
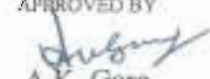
FORMAT NO:QS-01-QA1-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
						M	C/N				D*	M	C	N	
1		2	3	4	5	6		7	8	9	10				11
			6. Sequential marking	MA	Visual	Full length		Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible. (As per NTPC specification)		QCR		P	-	-	
C Finished Cables															
3.01		Type test reports clearance from NTPC Engineering	All type tests as per NTPC specification	CR	Doc	100%	100%	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part I)	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part I)	--do--	✓	P	V	V	
3.02		Routine Tests	1. High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I)	NTPC ADS / IS 1554 (Part I)	Test certificate	✓	P	W	W	Refer note 2
			2. Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I)	NTPC ADS / IS 1554 (Part I)	--do--	✓	P	W	W	
3.03		Acceptance Tests													
3.03(i)		Construction of finished Cable	1. OD of Cable	MA	Meas	Each type & size of cables as per sampling plan of IS 1554 (Part I)		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
			2. Laying of core	CR	Visual	--do--		IS 1554 (Part I)	NTPC ADS / IS 1554 (Part I)	--do--	✓	P	W	W	
			3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	Core printing shall be legible & indelible
			4. Colour of outer sheath	MA	Visual	--do--		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
			5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
			6. Inner sheath colour	MA	Visual	- do -		- do -	- do -	--do--	✓	P	W	W	
3.03 (ii)		Armour wires/ Formed wires (if applicable)	1. Dimensions	CR	Meas	Each type & size of cables as per sampling plan of IS 1554 (Part I)		NTPC ADS / IS 1554 (Part I) / IS 3975	NTPC ADS / IS 1554 (Part I) / IS 3975	--do--	✓	P	W	W	
			2. No. of wires/ formed wire	CR	Mech	-- do --		--do--	--do--	--do--	✓	P	W	W	
			3. Tensile test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M: MANUFACTURER/SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM W: WITNESS, V: VERIFICATION AS APPROPRIATE, CH: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO: QS-41-QAL-P-10/F3-R1

		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 6 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY  A.K. Garg			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1	2	3	4	5	M	C/ N	7	8	9	D*	M	C	N	11
		4. Elongation test	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part I)		NTPC ADS /IS1554(Part)/IS3975	NTPC ADS /IS1554(Part)/IS3975	Test certificate	✓	P	W	W	
		5. Torsion test (for round wires only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		7. Resistance test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		8. Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P	W	W	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--		--do--	--do--	--do--	✓	P	W	W	
		10. Adhesion test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		11. Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
3.03 (iii)	Conductor	1. Annealing Test	CR	Mech	--do--		NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P	V	V	Refer Sl. No. 2.01
3.03 (iv)	PVC Insulation & PVC Sheath	2. Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	
		1. Thickness of insulation & sheath	CR	Meas	--do--		NTPC ADS/ IS 1554(Part I)	NTPC ADS/ IS 1554(Part I)	--do--	✓	P	W	W	
		2. Tensile strength & elongation at break of insulation & outer sheath (before ageing)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	Refer Note 3 also
		3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3		NTPC ADS/ IS 1554(Part I)	NTPC ADS/ IS 1554(Part I)	--do--	✓	P	W	W	Refer Note 3
		4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part I)		--do--	--do--	--do--	✓	P	W	W	
		5. High voltage test at room temperature	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	
		6. Thermal stability on PVC Insulation and outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		--do--	--do--	--do--	✓	P	W	W	
		7. Oxygen index Test on outer sheath	CR	Chem	--do--		NTPC ADS / IS10810 Part 5#	NTPC A.D.S	--do--	✓	P	W	W	
		8. Smoke density rating test on outer sheath	CR	Chem	--do--		NTPC ADS & ASTM D2843	NTPC ADS	--do--	✓	P	W	W	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M: MANUFACTURER/SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM W: WITNESS, V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

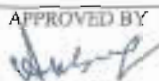
FORMAT NO: QS-01-QA1-P-10/F3-R1

NTPC		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)			QP. NO 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 7 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1		9. Acid gas generation test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS & IEC 60754-1	NTPC ADS	Test certificate	✓	P	W	W	
		10. Flammability test on completed cable	CR	Chem	Refer Note 4	Refer Note 4	NTPC ADS & IEC 60332 Part-3 Category-B)	NTPC ADS	--do--	✓	P	W	W	
		11. Surface finish & length measurement.	CR	Visual & Meas	One length of each size	One length of each size	(1) Drum no. (2) IS 1554 -Part-I (3) Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed Embossing shall be automatic, in line & marking shall be legible & indelible. (4) Sequential marking of length of cable in meter at every one meter is to be embossed / printed Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible	--do--	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc not permitted. Repairing on outer sheath not permitted.	
		12. Sequence of cores armour coverage, gap between two consecutive armour / formed wire	CR	Visual & Meas	One length of each size	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire	--do--	✓	P	W	W		
4	Packing	1. Sealing	MA	Visual	100%	100%	(1)IS1554(Part-I) (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails	QCR	✓	P	-	-		
4.01	Identification	NTPC Sealing	MA	Visual	100%	100%	Sealing shall be visible	Sealing shall be visible	--do--	✓	P	V	V	

LEGEND:- *RECORDS, IDENTIFIED WITH "11CK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

M: MANUFACTURER/SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM W: WITNESS, V: VERIFICATION AS APPROPRIATE, CBP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

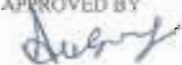
FORMAT NO: Q-01-QA/P-16/T3-R1

		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 8 of 9 VALID UP TO: 24-11-14		REVIEWED BY Inderjit Singh Vikram Talwar Rajeev Garg		APPROVED BY  A.K. Garg	
Sl. No.	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	Agency	Remarks	
Notes:											
1) If the compound manufacturer is carrying out Ageing test , test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer is to carry out ageing test & test report is to be reviewed (quantum of ageing test sample shall be one sample /batch)											
2) (a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre/ Regional Offices :- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. 2(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices, :- Routine Test are to be witnessed by Main Contractor & NTPC. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection.											
3) Refer table on page 8 of 8 for Sampling & Acceptance criteria.											
4) The test shall be carried out on every size & type of control cable offered for inspection as an acceptance test. This test will be carried out using composite sampling i.e. irrespective of sizes of cables of a particular type, may be tested together as per calculations in line with the IEC (all sizes will be covered)											
LEGEND: NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance											

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-01-QA1-P-10/F3-31

		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-040 REV-00 DATE . 25-11-11 Page 9 of 9 VALID UP TO: 24-11-14		REVIEWED BY INDERJIT SINGH VIKRAM TALWA RAJEEV GARG		APPROVED BY  A.K. Garg	
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	Agency	Remarks	

SAMPLING & ACCEPTANCE CRITERIA

Criteria	Manufacturer experience prerequisite	Condition	Testing procedure	Remarks
Samples as per relevant IS from every size of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes which meet the criteria	1 Sample per type out of sizes which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours. Afterwards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. This test shall be witnessed by NTPC.	In case the samples do not meet the requirement in accelerated ageing test then 1 sample of that size will be put on ageing test as per IS.
		In case of size which do not meet the criteria	Particular size will be put on ageing test as per IS. This test shall be witnessed by NTPC.	
	In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices	In case of size which meet the criteria	1 Sample per type out of all sizes which have met the criteria, will be put on aging test and witnessed by NTPC as per relevant IS	
		In case of size which do not meet the criteria	Particular size will be put on ageing test as per IS. This test shall be witnessed by NTPC	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-Q1-QA1-P-18/F3-R1

ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): DRY TYPE (LIGHTING) TRANSFORMER UPTO 100KVA, 415/415 V		STANDARD QUALITY PLAN CONFORMING TO CODE: IS 11171-1985					QP NO.: 0000-999-Q02 S - 035 REV. NO: 00 DATE: 15.10.2004 PAGE...1 OF...1 VALID UPTO: 14.10.2007		REVIEWED BY: A.CHATTERJEE S.D.SINGH O.P.NIRANJAN					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C/N				M	C	N		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.	
1.00	FINAL TEST : ROUTINE TEST	Rating, Name plate	Major	Visual	100%	100%	IS-11171-1985	NTPC APPR DRG DATA SHEET/ IS-11171	TC		P	W	V	DRG. FOR LDB INDICATING RATING GA DRG FOR LDB
		Overall Dimension	Major	Visual	100%	100%	IS-11171	NTPC APPR DRG	TC		P	W	V	
		Measurement of winding resistance	Major	Visual	100%	100%	IS-11171	IS-11171/ Mfr std	TC		P	W	V	
		Measurement of voltage ratio and check of voltage vector relationship	Major	Visual	100%	100%	IS-11171	NTPC APPR DRG	TC		P	W	V	
		Measurement of impedance of voltage (principal tapping), short circuit impedance and load loss	Major	Elect	100%	100%	IS-11171	IS-11171/ Mfr std	TC	✓	P	W	V	
		Measurement of no-load loss and current	Major	Elect	100%	100%	IS-11171	IS-11171/ Mfr std	TC	✓	P	W	V	
		Separate-source voltage withstand test	Major	Elect	100%	100%	IS-11171	IS-11171	TC	✓	P	W	V	
		Induced voltage withstand test	Major	Elect	100%	100%	IS-11171	IS 11171	TC	✓	P	W	V	
2.00	Type test	Review of type test clearance given by NTPC Project Engg												
3.00	PREDESPATCH	COMPLETENESS	Minor	Visual	100%		Mfr. std	Mfr. std			P			

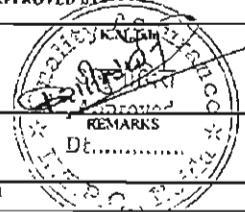
LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: MANUFACTURER SUB-SUPPLIER C: MAIN SUPPLIER. N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE.
 CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

ITEM : LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN CONFORMING TO CODE : As applicable						Q.P.NO:0000-999-QOE-S-062	REVIEWED BY	APPROVED BY
NTPC								Rev No.: 00	SWAPNESWAR MISHRA	K.M.Jain
								Date: 02/11/15	VIKRAM TALWAR	
								VALID UPTO: 01/11/18	SUNIL MALANI	
SI No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6 M	6 CN	7	8	9	10
Note: 1): Lighting fixtures supplier to ensure that constructional features of the lighting fixture (conventional & LED type) are as per NTPC specification requirements 2): Lighting fixture supplier to maintain all quality control records identified in this QP whether it is identified for NTPC verification or witness or not.										
Conventional type Lighting Fixture										
A	Bought out items / in-process checks									
I	Lamps	Make, rating & type	Major	Visual	1 sample per type	1 sample per type	NTPC specification requirements for rating & type, Make to be BIS approved with CML number	NTPC specification requirements for rating & type, Make to be BIS approved with CML number		V - -
I.1	Electronic Ballast (if applicable)	a Certificate of compliance	Major	Visual	-	-	NTPC specification requirements	Certificate of compliance by ballast manufacturer / lighting fixture supplier that ballast meets all NTPC specification requirements	Certificate of compliance	V - -
		b THD and pf check	Major	Electrical	Mnfr std.	-	NTPC specification requirements	THD <=10%, pf >= 0.9 for FH type and pf >= 0.95 for other type of florescent lighting fixtures	Inspection report	P/V * - -
I.2	Castings	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	Castings shall be free from any defects such as blow holes, surface blisters, cracks and cavities etc.	Inspection report	P/V * - -
I.3	Sheet metal forming and fabrication	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	sheet metal fabrication / forming etc should be as per manufacturer drgs	Inspection report	P/V * - -
I.4	Pre-treatment and powder coating	Pre-treatment process checks, Powder coating finish, thickness, uniformity of coating and adhesion	major	Visual, chemical & mech	Mnfr std.	-	Mnfr standard, NTPC specification requirements	Nominal coating thickness 50 microns or more	Inspection report	P/V * - -

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/ SUB-SUPPLIER; C: MAIN SUPPLIER, N: NOT PERFORM W: WITNESS AND V: VERIFICATION. CHP: CUSTOMER HOLD POINT BY NTPC SHALL BE IDENTIFIED UNDER AGENCY COLUMN "N" AS "W".

Format No.: QS-01-QAI-P-10/F3-R0

Engg. Div./QA&I

ITEM : LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN				QF.NO:0000-999-QOE-S-062		REVIEWED BY		APPROVED BY			
		CONFORMING TO CODE : As applicable				Rev No.: 00		SWAPNESWAR MISHRA					
						Date: 02/11/15		VIKRAM TALWAR					
						VALID UPTO: 01/11/18		SUNIL MALAN					
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
					GM	CM							
2	3	4	5	6	7	8	9	10	11	12	13	14	
3	Acceptance Tests on conventional Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard	Major	Visual	-	-	lighting fixture supplier to submit the details of lot offered for NTPC inspection (Type of lighting fixtures, their batch number, sub-vendor name, quantity)	COC	List	P	V	V	The list may be used by NTPC for sample selection
		b Lamp make	Major	Visual	100%	100%	Make to be BIS approved with CML number	Make to be BIS approved with CML number	Certificate of compliance	V	V	V	
		c Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W	
		d Electronic Ballast (if applicable for offered lighting fixtures) THD and pf check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	THD <=10% , pf >= 0.9 for FH type and pf >= 0.95 for other type of florescent lighting fixtures	Inspection report	P	W	W	At lighting fixture supplier test lab
		e Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	1 sample per type	NTPC approved data Sheet	IS 10322 Part 1	Inspection report	P	W	W	
		f Resistance to dust (applicable if IP5X and above)	Major	optical	Mnfr std.	Mnfr std	NTPC approved Data sheet and accepted type test reports	Certificate of compliance	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		f Photometry check	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports	Certificate of compliance for the batch : that offered lighting fixture LOR is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		g Dimensions	Major	Visual	1 sample per type	1 sample per type	NTPC specification and approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W	
		h HV & IR test	Major	Visual	#	#	IS 10322 part 1	IS 10322 part 1	Inspection report	P	W	W	# As per Table 1 (inspection Level S2) and Table 2C AQL 2.5 of IS 2500

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" { V } SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/ SUB-SUPPLIER: C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION. CHP: CUSTOMER HOLDPOINT BY NTPC SHALL BE IDENTIFIED UNDER AGENCY COLUMN "N" AS "W".

Format No.: QS-01-QAI-P-10/F3-R0

Engg. Div./QA&I

ITEM: LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN					Q.P.NO:0000-999-QOE-S-062		REVIEWED BY		APPROVED BY		
		CONFORMING TO CODE : As applicable					Rev No.: 00		SWAPNESWAR MISHRA		VIKRAM TALWAR		
DATE: 02/11/15		VALID UPTO: 01/11/18		SUNIL MALANI		REMARKS							
S	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD				
					6 M	6 CN				D*	**	10	N
1	LED type Lighting fixture												
	Bought out items / in-process checks												
	LED Chip	LED chip efficacy	Major	Visual	Mnfr Std.	Mnfr Std.	NTPC Spec/ Appd. Data sheet/ LM 80 report	NTPC Spec/ Appd Data sheet	LM 80 report	V	V	V	At the time of final inspection
		LED chip CRI and CCT	Major	Visual	Mnfr Std.	Mnfr Std.	NTPC Spec/ Appd. Data sheet/ LM 80 report	NTPC Spec/ Appd Data sheet	LM 80 report	V	V	V	At the time of final inspection
		Reported TM21 (L80) lifetime of LED chip	Major	Visual	Mnfr Std.	Mnfr Std.	NTPC Spec/ Appd. Data sheet/ LM 80 report	NTPC Spec/ Appd Data sheet	LM 80 report	V	V	V	At the time of final inspection
1	LED Driver	a Compatibility with LED module/chip, controls & protection features as per NTPC spec	Major	Visual	-	-	NTPC spec requirements	Certificate of compliance by LED driver manufacturer / lighting fixture supplier that driver meets all NTPC specification requirements	Certificate of compliance	V	V	V	
		b THD and pf check	Major	Electrical	Mnfr std.	-	NTPC specification	THD < 10% and pf >= 0.9	Inspection report	P/V *	-	-	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
	Castings	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	Castings shall be free from any defects such as blow holes, surface blisters, cracks and cavities etc.	Inspection report	P/V *	-	-	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
	Sheet metal forming and fabrication	Freedom from defects	Major	Visual	Mnfr std.	-	NTPC specification requirements	sheet metal fabrication / forming etc should be as per manufacturer standards and good engg practices	Inspection report	P/V *	-	-	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
	Pre-treatment and powder coating	Pre-treatment process checks, Powder coating finish, thickness, uniformity of coating and adhesion	major	Visual, chemical & mech	Mnfr std.	-	Mnfr standard , NTPC specification requirements	Nominal coating thickness 50 microns or more	Inspection report	P/V *	-	-	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER; C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION. CHP: CUSTOMER HOLD POINT BY NTPC SHALL BE IDENTIFIED UNDER AGENCY COLUMN "N" AS 'W'.

Format No.: QS-01-QAI-P-10/F3-R0

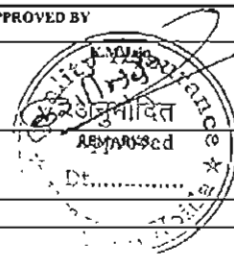
Engg. Div./QA&I

		ITEM : LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN CONFORMING TO CODE : As applicable			Q.P.NO:0000-999-QOE-S-062	REVIEWED BY	APPROVED BY				
					Rev No.: 00	SWAPNESWAR MISHRA		Date: 02/11/15	VIKRAM TALWAR				
							VALID UPTO: 01/11/18	SUNIL MALAN					
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD				
1	2	3	4	5	6 M	6 C/N	7	8	9	10	11	12	
B	Acceptance Tests on LED Lighting fixture	a Details of lot offered and Certificate of compliance that lighting fixture supplier has inspected the offered lot as per their own standard	Major	Visual	-	-	lighting fixture supplier to submit the details of lot offered for NTPC inspection (Type of lighting fixtures, their batch number, sub-vendor name, quantity)	-	List	P	V	V	The list may be used by NTPC for sample selection
		b LED chip make	Major	Visual	-	-	NTPC accepted type test reports (LM80/LM79) report	Certificate of compliance	Certificate of compliance	V	V	V	
		c Constructional features including: Internal wiring, terminal block, earthing terminal, safety chain (if applicable)	Major	Visual	1 sample per type	1 sample per type	NTPC specification and NTPC approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W	
		c Resistance to moisture test in case of lighting fixtures having IP X4 and above rating	Major	Mechanical	1 sample per type	1 sample per type	NTPC approved data Sheet	IS 10322 Part 1	Inspection report	P	W	W	
		f Resistance to dust (applicable if IP5X and above)	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports	Certificate of compliance	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier
		f Photometry check	Major	optical	Mnfr std.	Mnfr std	NTPC accepted type test reports, LM 79, IS 16106, IS 16107	Certificate of compliance for the batch; that offered lighting fixture LOR and lighting fixture efficacy is not be less than 90% (refer IS 16107) with reference to type test reports	Certificate of compliance	P/V *	V	V	P/V * - means test will be performed either by lighting fixture supplier or their sub-vendor and Verified by lighting fixture supplier

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" {✓} SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/ SUB-SUPPLIER: C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION. CHP: CUSTOMER HOLD POINT BY NTPC SHALL BE IDENTIFIED UNDER AGENCY COLUMN "N" AS 'W'.

Format No.: QS-01-QAI-P-10/F3-R0

Engg. Div./QA&I

		ITEM : LIGHTING FIXTURES (Conventional and LED type)		STANDARD QUALITY PLAN			Q.P.NO:0000-999-QOE-S-062		REVIEWED BY		APPROVED BY		
				CONFORMING TO CODE : As applicable			Rev No.: 00		SWAPNESWAR MISHRA				
DATE: 02/11/15		VALID UPTO: 01/11/18		VIKRAM TALWAR		SUNIL MALANI							
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD				
				6 M 6 CN									
1	2	3	4	5	6 M	6 CN	7	8	9	10	11	12	
	g	Dimensions	Major	Visual	1 sample per type	1 sample per type	NTPC specification and approved data sheet/drg.	NTPC specification and approved data sheet/drg.	Inspection report	P	W	W	
	i	LED driver: THD and pf check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	THD < 10% and pf >= 0.9	Inspection report	P	W	W	
	j	LED driver: Precision current control check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W	
	k	LED driver: Open circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W	
	l	LED driver: Short circuit protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W	
	m	LED driver: Over temperature protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W	
	n	LED driver: Overload protection simulation check	Major	Electrical	1 sample per type	1 sample per type	NTPC specification	NTPC specification and NTPC approved data sheet	Inspection report	P	W	W	
	o	LED driver: Surge protection compliance check	Major	Electrical	-	-	NTPC specification	Certificate of compliance that surge protection is provided	Certificate of compliance	V	V	V	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/ SUB-SUPPLIER: C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION. CHP: CUSTOMER HOLD POINT BY NTPC SHALL BE IDENTIFIED UNDER AGENCY COLUMN "N" AS 'W'.

Format No.: QS-01-QAI-P-10/F3-R0

Engg. Div./QA&I



		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				QP. NO 0000-999- QOE- S-041 REV-00 DATE 03-02-12 Page 1 of 11 VALID UP TO: 02-02-15	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG						
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
Instructions: 1) Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e raw material batch/ lot no. should be traceable to the cable drum. 2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not														
A Raw material/ Brought out Items														
1.01	Aluminium	1. Make	MA	Verify	100%	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR		V	--	--	
		2. Resistivity	MA	Elect	As per Cable Mfr Std	--	IS5082	IS5082	--do--		P	--	--	
1.02	PVC / XLPE/compound for insulation	1. Make	MA	Verify	--do--	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--		V	V	--	
		2. Type/ Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	--do--		V	V	V	
		3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	--do--		V	V	V	Refer note 1
1.03	PVC Compound for Inner sheath	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Type/ Grade	MA	Verify	--do--	--do--	NTPC ADS	NTPC ADS	--do--		V	V	V	
1.04	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	--do--	--do--	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Dimension	MA	Meas	1 sample from each size / lot	--	NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	--do--		P	--	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--	IS 3975	IS 3975	Supplier TC		V	V	--	
1.05	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%	MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR		V	V	--	
		2. Type / Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	QCR		V	V	V	
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	QCR		V	V	V	Refer note 1

NTPC		Item: 1.1 KV Power (XLPE & PVC) Insulated cables FRLS	STANDARD QUALITY PLAN (CONFORMING TO CODE, IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				QP NO 0000-999- QOE- S-041 REV-00 DATE 03-02-12 Page 2 of 11 VALID UP TO 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		4. Thermal Stability	MA	Chem	One sample / Batch	--	NTPC ADS	NTPC ADS	QCR		P	--	--	
		5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS/ IS 10810 Part 58	--do--		P	--	--	
		6. Acid Gas Emission	MA	Chem	One sample / Batch	--	NTPC ADS / IEC60754	NTPC ADS / IEC60754	QCR		P	--	--	
1.06	Wooden Drum	1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS10418	--do--		P	--	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC		V	V	V	COC from (man) manuf
1.07	Steel Drum	1. Dimension	MI	Meas	--do--	--	--do--	--do--	QCR		P	--	--	
		2. Surface finish	MI	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
B	Process & Stage Inspection													
2.01	Wire Drawing	1 Surface finish	MA	Visual	One sample/Settin g of each size	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR		P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Tensile test	CR	Mech	--do--	--do--	--do--	--do--	--do--		P	V	V	Refer Sl. No 3.03(iii)
		4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	--do--		P	V	V	--do--
2.02	Bunching / stranding	1. No. of wires	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		2. Dia of wire	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		4. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		5. Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--	IS 8130	IS8130	--do--		P	--	--	
		6. Surface finish	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		7. DC Resistance	CR	Meas	--do--	--	IS8130/NTPC ADS	IS8130/ NTPC ADS	--do--		P	--	--	
2.03	Insulation extrusion	1. Surface finish	MA	Visual	One sample/Settin g of each size	--	NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED	QCR		P	--	--	XLPE/ PVC compound shall be preferably loaded in to extruder by suction method

Item: 1.1 KV Power (XLPE & PVC) FRLS Insulated cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)					QP NO 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 3 of 11 VALID UP TO: 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Charya Dt.			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	U/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10			11	
1		2.Colour of cores	MA	Visual	One sample/Setting of each size	-	NTPC ADS	NTPC ADS	QCR		P	-	-	
		3.Thickness	CR	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	-	-	
		4.Spark Test	CR	Elect	100%	100%	CABLE MANUF. STD.	No FAILURE	--do--		P	V	V	1.Spark test failure record is to be verified. 2.Core repairing not permitted
		5. Hot Set	CR	Mech	One sample/Setting of each size	--	IS 7098- Part I	IS 7098- Part I	--do--		P	-	-	Sample is to be taken from both top & bottom end
2.04	Laying up	1. Core sequence	MA	Visual	--do--	--	IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	--do--		P	-	-	
		2. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	-	-	
		3. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	-	-	
2.05	Inner Sheath	1.Colour	MA	Visual	--do--	-	--do--	--do--	--do--		P	-	-	
		2. Surface Finish	MA	Visual	100%	-	NTPC SPECIFICATION	FISH EYE, BLOW HOLE NOT PERMITTED	--do--		P	-	-	
		3.Thickness	MA	Meas	One sample/Setting of each size	-	NTPC ADS	NTPC ADS	--do--		P	-	-	
		4.Dia over inner sheath	MI	Meas	--do--	-	--do--	--do--	--do--		P	-	-	
2.06	Armouring (As Applicable)	1.Dimension	MA	Meas	--do--	-	--do--	--do--	--do--		P	-	-	
		2.No. of wires / strip	MA	Meas.	--do--	-	--do--	--do--	--do--		P	-	-	
		3. Direction of lay	MA	Visual	--do--	--	IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	QCR		P	-	-	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS, V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-01-QAI-P-10/F3-01

		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				QP NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 4 of 11 VALID UP TO: 02-02-15	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG						
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	APPROVED BY				Remarks
					M	C/ N				D*	M	C	N	
1	2	3	4	5	6	--	7	8	9	10	11	12	13	
		4 Coverage & Quality of armouring	MA	Meas.	100%	--	Min. area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S Wire /formed wire The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)	QCR		P	--	--		
		5 Dia over armouring	MA	Meas.	One sample/Setting of each size	--	NTPC ADS	--do--		P	--	--		
2.07	Outer Sheath	1. Surface finish	MA	Visual	100%	--	Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification)	--do--		P	--	--	PVC FRLS compound shall be preferably loaded in to extruder by section method	
		2.Colour of sheath	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Thickness of outer sheath	CR	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		5. Embossing quality	MA	Visual	100%	--	Drum no. IS1554-1 / IS7098-1, Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (As per NTPC specification)	--do--		P	--	--	Drum no. on cable may be embossed/printed	
		6. Sequential marking	MA	Visual	Full length	--	Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible. (As per NTPC specification)	--do--		P	--	--		
C	Finished Cables													
3.01	Type test reports clearance from NTPC Engineering	All type tests as per NTPC specification	CR	Doc.	100%	100%	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part I	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part I	--do--	✓	P	V	V	

NTPC		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP. NO 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 5 of 11 VALID UP TO: 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY RAJEEV GARG			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
3.02	Routine Tests	1. High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	W	Refer note 2
		2. Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	W	Refer note 2
3.03	Acceptance Tests													
3.03 (i)	Construction of finished Cable	1. OD of Cable	MA	Meas.	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		2. Laying of core	CR	Visual	--do--		NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	--do--	✓	P	W	W	
		3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
		4. Colour of outer sheath	MA	Visual	--do--		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
		6. Inner sheath colour	MA	Visual	- do -		- do -	- do -	--do--	✓	P	W	W	
3.03 (ii)	Armour wires/ Formed wires (if applicable)	1. Dimensions	CR	Meas	--do--		NTPC ADS / IS 1554(Part I) / IS 3975	NTPC ADS / IS 1554(Part I) / IS 3975	--do--	✓	P	W	W	
		2. No. of wires/ formed wire	CR	Mech	-- do --		--do--	--do--	--do--	✓	P	W	W	
		3. Tensile test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		4. Elongation test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		5. Torsion test (for round wires only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	
		7. Resistance test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	W	W	

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N	Reference Document	Acceptance Norms	Record Format	Agenda D* M C N				Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3.03 (IV)	PVC/XLPE/Insulation & PVC Sheath	1. Thickness of insulation & PVC Sheath	CR	Meas	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)	NTPC ADS/ IS 1554(Part1) & IS 7098 Part 1	NTPC ADS/ IS 1554(Part1) & IS 7098 Part 1	Test Certificate	✓	P	W	W		
		2. Tensile strength & elongation at break of insulation & outer sheath (before ageing)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)	NTPC ADS/ IS 1554(Part1) & IS 7098 Part 1	NTPC ADS/ IS 1554(Part1) & IS 7098 Part 1	Test Certificate	✓	P	W	W		Refer Note 3 Also
		3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3	--do--	--do--	--do--	✓	P	W	W		Refer Note 3 (ath)
		4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part 1	--do--	--do--	--do--	✓	P	W	W		
		5. High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part 1	--do--	--do--	--do--	✓	P	W	W		
		6. Hot Set test (for XLPE insulation only)	CR	Phy	--do--	--do--	--do--	--do--	✓	P	W	W		
		7. Thermal stability on PVC insulation and outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	--do--	--do--	--do--	✓	P	W	W		

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-01-QAL-P-10/13-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
						M	C/N				D*	M	C	N	
1			8. Oxygen index Test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS / IS10810 Part 58	NTPC A.D.S	--do--	✓	P	W	W	
			9. Smoke density rating test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS & AS IMD2843	NTPC ADS	--do--	✓	P	W	W	
			10. Acid gas generation test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS & IEC 60754-1	NTPC ADS	Test Certificate	✓	P	W	W	
			11. Flammability test on completed cable	CR	Chem	Refer Note 4	Refer Note 4	NTPC ADS & IEC 60332 Part-3 (Category-B)	NTPC ADS	--do--	✓	P	W	W	
			12. Surface finish & length measurement.	CR	Visual & Meas	One length of each size	One length of each size	(1) Drum no. (2) IS1554-1 / IS7098-1, Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (3) Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible	--do--	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted	
			13. Sequence of cores armour coverage, gap between two consecutive armour / formed wire	CR	Visual & Meas	One length of each size	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space & there shall be no cross over / over riding of armour wire / formed wire. Zn rich paint shall be applied on armour joint surface of G S Wire / formed wire	--do--	✓	P	W	W		
4	Packing	I. Sealing	MA	Visual	100%	100%	(1) IS1554(Part-I) & IS 7098-Part I (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC / rubber caps secured by "U" nails.	QCR	✓	P	--	--			
4.01	Identification	NTPC Sealing	MA	Visual	100%	100%	Sealing shall be visible	QCR	✓	P	V	V			

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

M: MANUFACTURER/SUPPLIER, C: MAIN SUPPLIER, N: NTPC, P: PERFORM W: WITNESS, V: VERIFICATION AS APPROPRIATE, CH: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO: QS-01-QAI-P-16/F3-R1



		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 9 of 11 VALID UP TO: 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg					
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N		Reference Document	Acceptance Norms	Record Format	Agency D* M C N				Remarks
1	2	3	4	5	6		7	8	9	10				11
Notes:														
1) If the compound manufacturer is carrying out Ageing test , test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer is to carry out ageing test & test report is to be reviewed (quantum of ageing test sample shall be one sample /batch)														
2) (a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre/ Regional Offices :- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. 2(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices, :- Routine Test are to be witnessed by Main Contractor & NTPC. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection.														
3) Refer table on page 10 & 11 of 11 for Sampling & Acceptance criteria.														
4) For PVC insulated LT power cable :- For cables with OD less than equal to 30 mm, any size of cable may be clubbed together. For cables where OD is more than 30 mm, clubbing to be done for cables having similar ODs. For XLPE Insulated LT Power cable: Clubbing to be done for cables having similar ODs.														
LEGEND: NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance														

		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 10 of 11 VALID UP TO: 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	D*	Remarks
					M	C/N					
1	2	3	4	5	6		7	8	9	10	11

Sampling & Acceptance Criteria

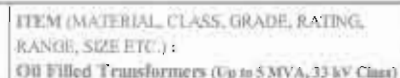
Criteria	Manufacturer experience prerequisite	Condition	Testing procedure	Remarks
Samples as per relevant IS from every size/ type of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes/ type which meet the criteria	1 Sample of PVC insulation & outer sheath per type of cables offered which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours. 1 Sample of XLPE insulation per type of cables offered which have met the criteria, will be put on ageing test as per IS 7098. After wards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. This test shall be witnessed by NTPC.	In case the samples do not meet the requirement in accelerated ageing test then 1 sample of that size/ type will be put on ageing test as per IS.
		In case of size /type which do not meet the criteria	Particular size/ type will be put on ageing test as per IS. This test shall be witnessed by NTPC.	----

 Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables			STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP NO 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 11 of 11 VALID UP TO: 02-02-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		 APPROVED BY Approved D.K. Garg				
Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices	In case of size /type which meet the criteria	1 Sample per type out of all sizes which have met the criteria, will be put on aging test and witnessed by NTPC as per relevant IS				----				
					In case of size/ type which do not meet the criteria	Particular size / type will be put on ageing test as per IS. This test shall be witnessed by NTPC				----				

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CBP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

FORMAT NO:QS-01-QAL-P-10/F3-R1



STANDARD QUALITY PLAN

DP No: 0000-999-DOE-S-036, Rev No: 0

REVIEWED BY

APPROVED BY:

Date: 20.02.2013

Page: 1 of 3

VALID UPTO: 19.02.2016

Marshall K. Jan

11 Stocking

15. 15. 15.

20/10/2000

2

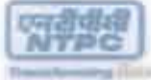
1. **Country:**

Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OR RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1	2	3	4	5	6		7	8	9	D*	**	10	11
1.00 L01	RAW MATERIAL Steel Plate & Pipe	a) Thickness	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:2062 /IS:1239	Mfr Plant Std./ IS:2062 /IS:1239	QC Record	P	V	V	A) Supplier's TC for all BOIs shall be recommended by Mfr for NTPC verification.
		b) Surface defects	-do-	Visual	-do-	-	-do-	-do-	-do-	P	-	-	B) Make of all BOIs & Raw Material shall be subject to NTPC acceptance and Vendor In the same will be submitted as annexure to project/package specific endorsement sheet.
		c) Chemical Composition	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-	
		d) Mechanical Properties	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		e) Hydraulic Test of Pipes	-do-	-do-	-do-	-	-do-	-do-	-do-	V	V	V	
1.02	CRGO Steel	a) Make,Thickness,Finish & Gr	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:3024/IS:649	Mfr Plant Std./ IS:3024/IS:649	QC Record	P	V	V	
		b) Cutting & edge burr	-do-	Test	-do-	-	-do-	-do-	-do-	P	-	-	
		c) Waviness & edge camber	-do-	-do-	-do-	-	-do-	-do-	Supplier's TC	V	-	-	
		d) Specific core loss	-do-	-do-	-do-	As per IS/ Plant Std	-do-	-do-	-do-	V	V	V	
		e) Surface resistivity/Insulation resistance of surface coating	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		f) Stacking factor	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		g) Permeability at 800A/m	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		h) Bend Test / Ductility	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
1.03	Paper Insulated Copper Conductor	a) Dimensions & tolerances (Bare & Insulated)	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:13730/IEC 60554	Plant Std./ IS:13730/IEC 60554	QC Record	P	V	V	
		b) Resistivity/Conductivity	-do-	Test	-do-	-do-	-do-	-do-	Supplier's TC	V	V	V	
		c) Paper Covering	-do-	Measure	-do-	-	-do-	-do-	-do-	P	-	-	
		d) Voltage Test betn Strands for bundled conductor	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-	For CTC only
		e) Cu Purity	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		f) Elongation	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		g) Tensile Strength	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
1.04	Insulating Paper	a) Make,Dimensions & Type	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:1060/IS:9335 IEC 60554	Mfr Plant Std./ IS:1060/IS:9335 IEC 60554	QC Record	P	V	V	
		b) Density & substance	-do-	-do-	-do-	-	-do-	-do-	Supplier's TC	V	-	-	
		c) Tensile Strength	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-	
		d) Elongation	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		e) Water Absorption	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		f) Moisture Content	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		g) pH Value & conductivity aqueous extract	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		h) Ash Content	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-	
		i) Electrical Strength in Air	-do-	-do-	-do-	As per IS/Plant Std	-do-	-do-	-do-	V	V	V	
		j) Air Permeability	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		k) Tear Index	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	
		l) Heat Stability	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MAIN SUPPLIER C: MAIN SUPPLIER N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.

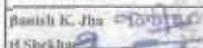
CHP: STPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QP No: 0000-999-QOE-S-036, Rev No: 0 Date: 20.02.2013 Page: 2 of 8 VALID UPTO: 19.02.2016		REVIEWED BY Banish K. Jha H. Shekhar B.D. Prasad				
CONFORMING TO CODE : NTPC TECHNICAL SPECIFICATION / IEC:60076				QUANTUM OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY			
S/N	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	M	C/N						M	C	N	
1.05	Press-Board	a) Make, Type, Dimensions	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS-1576	Plant Std./ IS-1576	QC Record	P	V	V			
		b) Compressibility	-do-	Test	-do-	-	-do-	-do-	Supplier's TC	V	-	-			
		c) Density	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		d) Tensile strength	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		e) pH Value/Conductivity of Water extract	-do-	-do-	-do-	As per IS/ Plant Std	-do-	-do-	-do-	P	V	V			
		f) Electrical Strength in air and oil	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	V			
		g) Shrinkage in air & oil	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		h) Flexibility/ Elongation	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		i) Ash content	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		j) Moisture content	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		k) Oil absorption	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		l) Cohesion between plies	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
1.06	Densified Wood	a) Dimensions & Type	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:3513/IS3400- P-II	Mfr Plant Std./ IS-3513	QC Record	P	-	-			
		b) Surface finish	-do-	Visual	-do-	-do-	-do-	-do-	-do-	P	-	-			
		c) Electrical Strength in air and oil	-do-	Test	-do-	-do-	-do-	-do-	Supplier's TC	V	V	V			
		d) Oil absorption	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		e) Shrinkage in air & oil	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		f) Moisture content	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-			
		g) Compression strength	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		h) Crossbreaking strength	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		i) Tensile strength	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		j) Density	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		k) Specific gravity	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
1.07	Gasket Synthetic Rubber or Acrylo Nitrile Butadiene Rubber for Gasket.	a) Dimensions, Grade & Type	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	Mfr Plant Std./ IS:4253-P-1/II	Plant Std./ IS:4253-P-1/II	QC Record	P	-	-			
		b) Hardness	-do-	-do-	-do-	-do-	-do-	-do-	Supplier's TC	V	V	V			
		c) Tensile strength	-do-	Test	-do-	-	-do-	-do-	-do-	V	-	-			
		d) Compressibility	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	V			
		e) Recovery	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		f) Compression set	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		g) Flexibility	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		d) Ageing in air & oil	-do-	-do-	-do-	-	-do-	-do-	-do-	V	V	-			
		e) Accelerated ageing	-do-	-do-	-do-	-	-do-	-do-	-do-	V	V	-			
		f) Chloride/Sulphate content of water extract	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			
		g) Density	-do-	-do-	-do-	-	-do-	-do-	-do-	V	-	-			

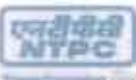
LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: Mfr / SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.

CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QF No: 0000-999-QOE-S-036, Rev No: 0		REVIEWED BY		APPROVED BY	
				CONFORMING TO CODE: NTPC TECHNICAL SPECIFICATION / IEC:60076					Date: 20.02.2013 Page: 3 of 8 VALID UPTO: 19.02.2016		 Banish K. Jha  J D Prasad		 J D Prasad  J D Prasad	
S/N	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	M	C/N	6	7	8	9	10	11	12	13
1.08	Insulating Oil	a) Make, Appearance of oil	Major	Visual	As per IEC/IS	As per IEC/IS	NTPC Specification/ IEC-296/IS-335	NTPC Specification	Supplier's TC	✓	V	V	V	
		b) Density, Resistivity	-do-	Test	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		c) Kinematic Viscosity	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		d) Interfacial Tension	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		e) Flash & pour point	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		f) Neutralisation value	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		g) Corrosive Sulfur Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		h) Water content	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		i) Anti Oxidants Additives	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		j) Oxidation Stability, Neutralisation Value in mgKOH/g and Sludge %	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		k) Breakdown Voltage (As delivered and after treatment)	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		l) Dissipation factor	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		m) PCA Content	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		n) Impulse withstand Level	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		o) Gassing tendency	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	
		q) Ageing characteristics at 115°C for 96 hours	-do-	-do-	-do-	-do-	IS-335-1993	IS-335-1993	-do-	✓	V	V	V	
		r) S.K. Value	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	V	V	V	For reference only
2.00	FITTING AND ACCESSORIES													
2.01	Porcelain Busings	a) Make, Rating, Dimensions	Major	Measure	As per IS/ Plant Std	As per IS/ Plant Std	IS:2099/IS:3347/ IS:12676/NTPC Spec.	IS:2099/IS:3347/ IS:12676/NTPC Spec.	QC Record	P	-	-		
		b) Visual Defects	-do-	Visual	-do-	-	-do-	-do-	-do-	P	-	-		
		c) Routine testing	-do-	Testing	-do-	-do-	-do-	-do-	Supplier's TC	✓	V	V	V	
2.02	Bucholz Relay	a) Type, Size & Make	Major	Visual	As per IS/ Plant Std	As per IS/ Plant Std	Plant Std./ IS:3637	Plant Std./ IS:3637	QC Record	P	V	V		
		b) Continuity for alarm & trip (Performance)	-do-	Test	-do-	-do-	-do-	-do-	Supplier's TC	V	V	-		
		c) Porosity Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	-		
		d) High Voltage & IR Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	-		
		e) Element Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	-		
		f) Gas Volume Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	V		
		g) Loss of Oil & Surge Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	V	V	-		
2.03	Pressure Relief Device (if applicable)	a) Type, Size & Make	Major	Visual	10%	As per IS/ Plant Std	Mfr Plant Std./ IS:3637	Plant Std./ IS:3637	QC Record	P	V	-		
		b) Operation (Pressure & flag indication)	-do-	Test	-	-	-do-	-do-	Supplier's TC	V	-	-		
		c) Switch Contact Operation	-do-	-do-	-	-	-do-	-do-	-do-	V	-	-		
		d) HV Test	-do-	-do-	-do-	-	-do-	-do-	-do-	V	V	-		

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: Mfr / SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.
 CRP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QP No: 0000-999-QOE-S-036, Rev No: 0 Date: 20.02.2013 Page: 4 of 8 VALID UPTO: 19.02.2016		REVIEWED BY Banish K. Jha H. Sheldar B.D. Prasad		APPROVED BY  Approved T. Gupte	
CONFORMING TO CODE : NTPC TECHNICAL SPECIFICATION / IEC:60076														
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C/N				M	C	N		
1	2	3	4	5	6	7	8	9	10*	11	12	13	14	
2.04	Magnetic Oil Level Gauge	a) Type, Size & Make b) Dial Marking c) Switch Continuity d) Leak Test e) HV Test f) Operational test	Major	Visual	10%	-	NTPC Spec/ Plant Std/Mfr Drg	NTPC Spec/ Plant Std/Mfr Drg	QC Record Supplier's TC	P	-	-		
2.05	Off-Circuit Tap Changer (if applicable)	a) Dimensions, Alignment of padlocking arrangement b) Physical condition c) Operation of Switch d) Insulation Resistance Test e) Leak Test of Handle Stuffing Box	Major	Measure	10%	As per IS / Plant Std	Mfr Drg. / Mfr Plant Std	Mfr Drg. / Mfr Plant Std	QC Record Supplier's TC	P	V	-		
2.06	On Load Tap (if applicable)	a) Visual Check, make, type b) Dimensional check c) Mechanical operation on Diverter & selector switch d) HV test on auxiliary circuit	Major	Visual Measure verify Test	100% - - - - 100%	- - 100% - - -	IS: 2026/IS:8468 -do- -do- -do- -do-	IS: 2026/IS:8468 -do- -do- -do- -do-	QC Record Supplier's TC	P P P V	V - V V	- - - V		
2.07	Valves (Gate/Globe/Butterfly)	a) Dimensional check b) Type, Size & Make c) Hydraulic/Leakage Test (for Body & Seat) d) Operational Test (Smooth Close & Open)	Major	Measure	10%	-	Mfr Drg./Plant Std/ IS:778-P-1	Mfr Drg./Plant Std/ IS:778-P-1	QC Record Supplier's TC	P	-	-	Drain and Sample Valve should have zero leakage rate	
2.08	Marshalling Kiosk & Remote Tap Control (RTCC)	a) Dimensional/Visual checks, makes of MB & mountings b) 2 kV insulation test on auxiliary wiring c) IP-55 Degree of protection by thin paper insertion d) Check for paint, shade & thickness	Major	Visual Test Test Measure/ Test	100% -do- -do- -do- -do-	100% -do- -do- -do- -do-	NTPC Appd Drgs -do- IS:13947-1993 NTPC Specn./ IS:101-P-IV-Sec-2	NTPC Appd Drgs Should withstand for one minute IS:13947-1993 NTPC Specn./ IS:101-P-IV-Sec-2	QC Record Test Report -do-	W W P W	W W W W	V V V V	At Marshalling Kiosk's manufacturer's works.	
2.09	OTI & WTI	a) Type, Size & Make b) HV Test c) Temperature Calibration d) Switch setting & switch differential e) Calibration & operation of Switch	Major	Visual	As per IS/ Plant Std	As per IS/ Plant Std	NTPC Specs/ Apvd drgs/ Mfr Std/ IS:11222/IS:2848 -do- -do- Mfr Std / IS 2848 -do-	NTPC Specs/ Apvd drgs/ Mfr Std/ IS:11222/IS:2848 -do- -do- Mfr Std / IS 2848 -do-	QC Record Supplier's TC	P	V	V		

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: Mfr./SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, CIP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QIP No: 0000-999-QOE-S-036, Rev No: 0		REVIEWED BY		APPROVED BY	
				CONFORMING TO CODE: NTPC TECHNICAL SPECIFICATION / IEC:60076					Date: 20.02.2013 Page: 5 of 8 VALID UPTO: 19.02.2016		Banish K. Jha H. Shukla B. D. Prasad		  	
Sl. No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C/N				M	C	N		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
2.10	Bushing CT	a) Make & rating b) Dimensions/Visual check c) Routine Test	Major Major -do-	Visual Measure Test	100% As per IS 100%	10% - 100%	Mfr Drg./IS:2705 -do- -do-	Mfr Drg./IS:2705 -do- -do-	QC Record Supplier's TC -do-	V V V	V - V	V - V		
2.11	Radiator	a) Type, Model, Rating, make b) Dimensions & No. of elements c) Paint, Shade, Finish & thickness d) Pressure test e) Adhesion Test on paint	Major -do- -do- -do- -do-	Visual Measure Visual / Measure Test -do-	100% -do- -do- -do- -do-	100% -do- -do- -do- As per IS	NTPC Specs/ Apvd drgs/ Mfr Std -do- -do- -do- -do- IS:101	NTPC Specs/ Apvd drgs/ Mfr Std -do- -do- -do- -do- IS:101	QC Record -do- -do- Supplier's TC -do-	P W W W W	V V V V V	V - V V V		
2.12	Terminal Connector	a) Dimensional check b) Surface Finish c) Acceptance Test	Major -do- -do-	Measure Visual Test	10% As per IS -do-	- - -	Mfrs Drg./IS:5561 -do- -do-	Mfrs Drg./IS:5561 -do- -do-	QC Record -do- Supplier's TC	P V V	- - -	- - -		
2.13	Silicagel Breather	a) Type, Size, Model b) Pressure/Breathing Leakage Test c) Colour of Silica gel	Major -do- -do-	Visual Test Visual	10% -do- -do-	- - -	Mfr Plant Std. -do- -do-	Mfr Plant Std. -do- -do-	QC Record Supplier's TC -do-	P V V	- - -	- - -		
3.00	IN-PROCESS													
3.01	Fabrication of Tank, Cover, Conservator and welding requirement	a) Welding Procedure Specification b) Process Qualification Records c) Welders Qualification d) Welding Electrodes e) Fitup for Butt weld joints of tank and cover f) Visual check on weldment g) Dimensional check after welding h) DP Test on welded joints of load bearing member i) Check for flatness of gasket surface j) Rim flatness k) Surface cleaning by sand/shot blasting l) Primer coating, Paint shade, thickness inside and outside m) Paint adhesion test	Major -do- -do- -do- -do- -do- -do- -do- -do- -do- -do- Major -do-	Verify Test -do- -do- Visual Visual Measure Test Visual Measure Visual Measure Test	100% -do- -do- As per IS -do- 100% -do- 100% -do- 10% 100% 100% 100% -do- 5%	100% -do- -do- - - - 100% - - - - 10% 100% 10% -	ASME-Sec-IX -do- -do- As per WPS/IS:814 Mfr Drg./Plant Std -do- -do- Mfr Drg./Plant Std/ IS:3658 Mfr Drg./Plant Std -do- -do- IS:101/ NTPC Specification IS:101	Approved WPS/ ASME-Sec-IX -do- As per WPS/IS:814 Mfr Drg./Plant Std -do- -do- Mfr Drg./Plant Std/ IS:3658 Mfr Drg./Plant Std -do- -do- IS:101/ NTPC Specification IS:101	QW-482 QW-483 QW-484 Supplier's TC QC Record -do- -do- -do- -do- -do- -do- -do- -do- -do-	V W W V V V V W W W W W W W	V V/W V/W - - - - V V V V V V V	V V/W V/W - - - - - V V V V V V V	†-WPS approval, Welders & PQR qualification shall be done as per following :- A) Upto-2 MVA - by Transformer Mfr B) 2-5 MVA - by Main Contractor	
3.02	Core Stamping	a) Burr & Bow b) Dimensional check	Major -do-	Visual Measure	Plant Std -do-	- -	Mfr Drg./Plant Std -do-	Mfr Drg./Plant Std -do-	QC Record -do-	P P	- -	- -		
3.03	Core Building	a) Dimensional check b) Assembly of limb insulation and limb plates c) Rectangularity of core assembly	Major -do- -do-	Measure Visual -do-	100% -do- -do-	- - -	Mfr Drg./Plant Std -do- -do-	Mfr Drg./Plant Std -do- -do-	QC Record -do- -do-	P P P	- - -	- - -		

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MFR / SUB-SUPPLIER C: MAIN SUPPLIER N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.

CRP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers 41p to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QF No: 0000-999-QOE-S-036, Rev No: 0		REVIEWED BY		APPROVED BY	
				CONFORMING TO CODE : NTPC TECHNICAL SPECIFICATION / IEC:60076					Date: 20.02.2013		Banshi K. Jha		Approved	
									Page: 6 of 8		H Shekhon		Approved	
									VALID UPTO: 19.02.2016		B D Prasad		Approved	
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	ID*	AGENCY			REMARKS
					M	C/N					M	C	N	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		d) Freedom from overlaps & air gap at joints.	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		e) Core verticality	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		f) Limb & stack thickness	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		g) Limb clamping & binding	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		h) Core Diameter	-do-	-do-	-do-	100%	-do-	-do-	-do-		P	V	V	
		i) Earthing of Core	-do-	-do-	-do-	-do-	-do-	-do-	-do-		P	V	V	
3.04	Test on core	a) Dimensional check	Major	Measure	100%	-	Mfr Drg/Plant Std	Mfr Drg/Plant Std	QC Record		P	-	-	
		b) Pre-core Loss measurement	-do-	-do-	Plant Std.	-	-do-	-do-	-do-		P	-	-	
3.05	Winding	a) Brazing procedure, PQR & Brazer qualification	Major	Review	100%	100%	Mfr Drg/Plant Std	Mfr Drg/Plant Std	QC Record		P	V	V	
		b) Conductor size	-do-	Measure	-do-	-	-do-	-do-	-do-		P	-	-	
		c) Radial Depth of winding	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		d) Anchoring & Binding	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	At start & finish
		e) No of turns	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		f) Transposition & cross overs	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		g) Dimensional checks	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	OD, ID & axial length
		h) Insulation arrangement & alignment	Major	Measure	100%	-	-do-	-do-	-do-		P	-	-	
		i) Winding length	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		j) Brazed joints	-do-	Visual	-do-	-	-do-	-do-	-do-		P	-	-	
		k) Lead & Coil identification and marking	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		l) Free from damages	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		m) Continuity test for leads	-do-	Test	-do-	100%	-do-	-do-	-do-		P	V	V	
		n) IR Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-		P	V	V	
3.06	Core coil assembly	a) Cleanliness of core	Major	Visual	100%	-	Mfr Drg/Plant Std	Mfr Drg/Plant Std	QC Record		P	-	-	
		b) Alignment of spacers / blocks	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		c) Cleaning of Core before Core Coil Assembly	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		d) Arrangement of Top & Bottom Insulation and Pressure rings.	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		e) Resting of Common Blocks on Active Part	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		f) Isolation Test of Core, if applicable	-do-	-do-	-do-	100%	-do-	NTPC Spec.	-do-		P	V	V	
		g) Earthing of core	-do-	-do-	-do-	100%	-do-	Mfr Drg/Plant Std	-do-		P	V	V	
3.07	Connection and tap switch assembly	a) Ratio Test on all taps	Major	Test	100%	-	Mfr Drg/Plant Std	Mfr Drg/Plant Std	QC Record		P	-	-	
		b) Lead disposition	-do-	Visual	-do-	-	-do-	-do-	-do-		P	-	-	
		c) Brazing of joints	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		d) Crimping of joints	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		e) Insulation over joints	-do-	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		f) Vector group	-do-	Test	-do-	-	-do-	-do-	-do-		P	-	-	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MFR/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE.

CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

NTPC		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QP No: 0000-999-QOE-S-036, Rev No: 0		REVIEWED BY		REMARKS	
				CONFORMING TO CODE : NTPC TECHNICAL SPECIFICATION / IEC:60076					Date: 20.02.2013 Page: 7 of 8 VALID UPTO: 19.02.2016		Banish K. Jha H Shukla B D Prasad			
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				
					M	C/N				M	C	N		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
3.08	Ovening and	a) Cleanliness of tank b) Drying c) Check tightness of clamped blocks and measurements of winding height d) Electrical Clearances e) Tightening of Coil & Spacers, Locking of tie rods & fasteners f) Check Paint shade, thickness & Adhesion g) Oil filling and air release	Major -do- -do- -do- -do- -do- -do-	Visual Physical Measure -do- -do- Visual/ Phys. Physical	100% -do- -do- -do- -do- -do- -do-	- - - 100% - - -	Mfr Drg/ Plant Std -do- -do- -do- -do- -do- -do- -do-	Mfr Drg/ Plant Std -do- -do- -do- -do- -do- -do- -do-	QC Record -do- -do- -do- -do- -do- -do- -do-	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	P P P P P P P P	- - - V - - - -	- - - V - - - -	
4.00	Type & Special Test	a) Review of Type test & Special test report b) Review of all previous stage of inspection as per QP												NTPC RIO to verify type test clearance from NTPC Engg for complete transformer including bushings, MB, transformer tank (eg: Pressure & Vacuum tests), terminal connector, OLTC, etc, as per specs. / LOA.
			Major	Verify	100%	100%	NTPC Specs/ Apvd Drg/DS	CHP Reports/ Protocols	TC / TR	✓	V	V	V	
5.00	Routine Test	a) Dimensional check b) Measurement of winding resistance of HV at normal, extreme taps & LV winding c) Measurement of voltage ratio at all taps, polarity & vector group d) Magnetic balance test e) Measurement of No-Load Losses & magnetising current at 90%, 100% & 110% voltage at 50 Hz. f) Measurement of No Load Current with 415 Volt/ 50 Hz AC Supply g) Measurement of impedance & short circuit impedance at normal & extreme taps h) Measurement of load loss i) Measurement of insulation resistance of winding	Critical -do- -do- -do- -do- -do- -do- -do- -do- -do-	Measure -do- -do- -do- -do- -do- -do- -do- -do- -do-	100% -do- -do- -do- -do- -do- -do- -do- -do- -do-	1 Sample / Lot/Rating 100% -do- -do- -do- -do- -do- -do- -do- -do-	NTPC Spec/ Apvd Drgs/ DS/IS:2026 / IEC-60076 -do- -do- -do- -do- -do- -do- -do- -do- -do-	NTPC Spec/ Apvd Drgs/ DS/IS:2026 / IEC-60076 -do- -do- -do- -do- -do- -do- -do- -do- -do-	QC Record -do- -do- -do- -do- -do- -do- -do- -do- -do-	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	P P P P P P P P P P	W W W W W W W W W W	W W W W W W W W W W	Each transformer shall be assembled with all fittings and accessories quant for the particular transformer before offering for inspection and testing by NTPC.

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: Mfr / SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE,
 CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

		ITEM (MATERIAL, CLASS, GRADE, RATING, RANGE, SIZE ETC.): Oil Filled Transformers (Up to 5 MVA, 33 kV Class)		STANDARD QUALITY PLAN					QP No: 0000-999-QOE-S-036, Rev No: 0 Date: 20.02.2013 Page: 8 of 8 VALID UPTO: 19.02.2016		REVIEWED BY Banish K. Das H. Shukla B.D. Prasad		APPROVED BY  Approved  Approved	
CONFORMING TO CODE : NTPC TECHNICAL SPECIFICATION / IEC:60076		REMARKS												
Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				
1	2	3	4	5	M	C/N	6	7	8	9	10	11	12	
		j) Dielectric Test		-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		1) Separate source AC withstand voltage test of HV & LV	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		2) Induced over voltage test on HV & LV terminals	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		k) Repeat no load current/ loss measurement & IR measurement after completion of dielectric tests	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		l) Measurement of Capacitance & tan delta for winding to earth	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		m) BDV of oil before and after dielectric test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		n) Jacking test on oil filled transformer followed by DP Test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		o) Oil Leakage test	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		p) IP-55 Degree of protection by thin paper insertion on MB	Major	Test	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		q) Functional/Continuity checking of wiring, IR, & HV on MB	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		r) Functional / Continuity checking of WTI, OTI, PRV, Buchholtz Relay	-do-	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W
		s) Paint, Shade, Thickness, Adhesion	Critical	-do-	Random basis	Random basis	-do-	-do-	-do-	-do-	✓	P	W	W
6.00	PRE-DESPATCH	a) Packing of loose items and main unit	Major	Physical	100%	-	Mfr Std/Packing List /Chalan	Mfr Std/Packing List /Chalan	QC Record	✓	P	-	-	Accessories to be segregated unitwise
		b) Blanking of openings & valves after adjustment/drainage of oil	-do-	-do-	-do-	-	-do-	-do-	-do-	✓	P	-	-	

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 ** M: Mfr/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE.
 CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

1

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT :				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.: DATE: PAGE: OF....		PACKAGE :			
				SUB-SYSTEM: -				CONTRACT NO. :			
								MAIN-SUPPLIER:			
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
1	UNLOADING	UN LOADING FROM TRUCK	C	VISUAL	100%	MANUFACTURER INSTRUCTION MANNUAL	USE PROPER MATERIAL HANDLING EQUIPMENT TO AVOID DAMAGES TO THE ENCLOSURE. USE PRECAUTIONS MENTIONED IN THE MANUFACTURER MANUAL	STORE REGISTER			
		CHECK FOR QUANTITY & IDENTIFICATION	C	VISUAL	100%	DELIVERY CHALLAN, PACKING LIST	NO DAMAGE/MISSING ITEMS				

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE						REVIEWED BY	APPROVED BY	APPROVAL SEAL

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.: DATE: PAGE: OF....					
				SUB-SYSTEM: -							
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
2	STORAGE	MOVEMENT TO STORAGE	A	VISUAL	100%	MANUFACTURER INSTRUCTION MANNUAL	SAFE STORAGE ON ELEVATED SURFACE, DRY SURFACE FREE FROM FLOODED WATER	STORE REGISTER			
		STORE HANDLING	A	VISUAL	100%	MANUFACTURER INSTRUCTION MANNUAL	SAFE STORAGE ON ELEVATED SURFACE, DRY SURFACE FREE FROM FLOODED WATER				
	BATTERY AND BATTERY CHARGER										
3	PRE-ERECTION INSTALLATION	VERIFICATION OF QUANTITY & IDENTIFICATION	C	VISUAL	100%	PURCHASE ORDER/ DELIVERY CHALLAN/PACKING LIST					

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE						REVIEWED BY	APPROVED BY	APPROVAL SEAL

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.:					
				SUB-SYSTEM: -		DATE: PAGE: OF....					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		PACKAGE INSPECTION	C	VISUAL	100%	PCHECK FOR MANUFACTURER INSTURCTION MANUAL	PACKAGE SHOULD BE IN GOOD CONDITION I.E. WITHOUT BREAKGE OR VISUAL DEFECTS				
		REPORTING OF DAMAGE/MISSING ITEM	C	VISUAL	100%	PACKING LIST/DELIVERY CHALLAN	NO DAMAGES OR MISSING OF ITEMS				
		CHECK THE EACH CELLS & TERMINALS FOR ANY DAMAGE	C	VISUAL	100%	NO DAMAGE TO CELLS	NO DAMAGE TO CELLS				
		CHECK CABLES GLAND AND CABLE/BUS BAR SUPPORTS ARE CONNECTION TO STATION EARTH	C	VISUAL	100%	NO LOOSE SUPPORT/BUS BAR	NO LOOSE SUPPORT/BUS BAR				
		CHECK THE IDENTIFICATION MARK ON EACH CELLS/BATTERY	C	VISUAL	100%	CELL/BATTERY IDENTIFICATION	CELL/BATTERY IDENTIFICATION				

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY		APPROVED BY	APPROVAL SEAL	

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.:					
				SUB-SYSTEM: -		DATE: PAGE: OF....					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		CHECK & ENSURE THE PROPER VENTILATION IN THE BATTERY ROOM	C	PHYSICAL	100%	MANUFACTURER INSTALLATION MANNUAL	BATTERY SHALL BE INSTALLED IN A ROOM WITH PROPER VENTILATION				
		GENERAL INSPECTION FOR LOOSE TERMINAL CONNECTION, DAMAGED WIRING CONNECTIONS	B	VISUAL & PHYSICAL	100%	MANUFACTURER INSTALLATION MANNUAL	NO DAMAGE WIRING				
		CABLE/BUS BAR ENTRY POINTS IN THE BATTERY ROOM(CABLE/BUS BAR SIZE AND SUPPORTS)	C	VISUAL	100%	MANUFACTURER INSTALLATION MANUAL/APPROVED DRAWING	MANUFACTURER INSTALLATION MANUAL/APPROVE D DRAWING				
		CABLE BENDING RADIUS FOR BATTERY CONNECTION	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	MANUFACTUER INSTALLATION MANUAL/APPROVE D DRAWING				

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY		APPROVED BY	APPROVAL SEAL	

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.:					
				SUB-SYSTEM: -		DATE: PAGE: OF....					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		INTERCELL TERMINATION, FIXING OF SHROUDS ON INTER CELL CONNECTIONS	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	USE OF THE PROPER TOOL FOR TIGHTENING, NO LOOSE CONNECTION				
		CHECK FOR THE VERTICALLY AND HORIZONTAL MOUNTING OF BATTERIES	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	USE SPRIT LEVEL FOR ACCEPTANCE				
		LEAKAGE, CRACK OR DAMAGE	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	NO LEAKAGE, CRACK OR DAMAGE				
		PROPER HANDLING OF BATTERIES	C	MEASUREM ENT	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	NO DAMAGE				
		CHECK BATTERY STAND AS PER DRAWING DIMENSIONS, BOLT TIGHTNESS, PAINT	C	MEASUREM ENT	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	APPROVED DRAWINGS				

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY		APPROVED BY	APPROVAL SEAL	

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.:					
				SUB-SYSTEM: -		DATE: PAGE: OF....					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		ASSEMBLY OF BATTERY CELLS OVER STAND ON AN INSULATORS	B	PHYSICAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	MANUFACTURER INSTALLATIONMA NUAL/APPROVED DRAWINGS				
		PAINTING OF BATTERY STAND	B	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	BATTERY STAND SHALL BE PAINTED				
		ALIGNMENT AND LEVELLING OF EACH CELL	B	VISUAL & PHYSICAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	BATTERY CELLS SHALL BE ALIGNED, TO BE CHECK WITH SPRIT LEVEL				
		APPLICATION OF GREASE & CHECK TIGHTENING TORQUE OF BUS BAR	B	PHYSICAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	APPLICATION OF GREASE, NO LOOSE CONNECTIONS				

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:			REV.....		
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE					
SIGNATURE				REVIEWED BY			APPROVED BY		APPROVAL SEAL	

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.:					
				SUB-SYSTEM: -		DATE: PAGE: OF....					
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		CHECK FOR INCOMING CABLES/BUS BAR CONNECTION TIGHTENING TORQUE TO THE BATTERY	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	ALL CONNECTION SHALL BE TIGHTNED WITH PROP-ER TORQUE WRENCH				
		INITIAL FILLING OF ELECTROLYTE (IF APPLICABLE)	C	VISUAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	FILLING OF ELECTROLYTE UP TO REQUIRED MARKING				
		RESTORATION OF ELECTROLYTE LEVEL AFTER SOACKING PEIROD	B	PHYSICAL	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	AS PER MANUFACTURERE STANDARDS				
		VERTICALITY OF PANEL	B	MEASUREM ENT	100%	MANUFACTUER INSTALLATION MANUAL/APPROVED DRAWING	ERECTION MANUAL /APPROVED DRAWING	SITE REGISTER			
		EARTH CONNECTION ,IR CHECKING POWER AND CONTROL CKTS	B	PHYSICAL	100%	AS PER MANUFACTURERE STANDARDS	ERECTION MANUAL /APPROVED DRAWING	SITE REGISTER			

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)			DOC. NO.:		REV.....	
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE						REVIEWED BY	APPROVED BY	APPROVAL SEAL

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		INDICATIVE FIELD QUALITY PLAN			PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : BATTERY AND BATTERY CHARGER		QP NO.: REV. NO.: DATE: PAGE: OF....					
				SUB-SYSTEM: -							
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS# OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.	
		CHARGING & DISCHARGING CYCLE	A	PHYSICAL	100%	TO BE CHECK PHYSICALLY AND CHARGING AND DISCHARGING	TO BE CHECK PHYSICALLY AND CHARGING AND DISCHARGING				

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)		DOC. NO.: REV.....		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN				QP No: 0000-999-QOE-I-013 REV No: 0 DATE: PAGE: 1 of 3 VALID UPTO:		REVIEWED BY Dileep Kumar Dixit		APPROVED BY	
		Solar Inverter (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:											
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS				
1	2	3	4	5	6	7	8	9	10				
1	MATERIAL, RECEIPT AND UNLOADING	Safe unloading of material at site	C	Visual	100%	Manufacturer Installation Manual	No damage	Logbook					
		Verification of quantity, short supply if any	C	-do-	-do-	Packing List / CHP / MDCC/Challan	Packing List / CHP / MDCC/Challan	-do-	Report to Manufacturer for short supply.				
		Package Condition	C	Visual	-do-	Packing List	Free from damages	-do-	Material Damage Report in case of damage				
	STORAGE	Movement to warehouse	C	Visual	-do-	Manufacturer Installation Manual	No damage	-do-					
		Storage Space	A	Physical	-do-	-do-	Instruction Manual	-do-					
		Store Handling	C	Physical	-do-	-do-	Store in such a way which avoid direct mechanical hit with sharp objects	-do-					
3	PRE - ERECTION	Documents Availaibity	C	Visual	-do-	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	-do-					
		Tools, fixing hardware availability	C	Visual	-do-	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-					
		Completeness of Inverter foundation	C	Measure	-do-	NTPC approved civil drawing	NTPC approved civil drawing	-do-					
		Material Movement to site	C	Visual	-do-	Manufacturer Installation Manual	No damage	-do-					
		Unpacking of Material and its handling	C	Verify	-do-	Manufacturer Installation Manual	No damage	-do-					
LEGEND: * RECORDS INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)													

		SYSTEM EQUIPMENT:	INDICATIVE FIELD QUALITY PLAN				QP No: 0000-999-QOE-I-013 REV No: 0 DATE: PAGE: 2 of 3 VALID UPTO:		REVIEWED BY	APPROVED BY
		Solar Inverter (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:	CONFORMANCE TO: NTPC SPECIFICATION						Dileep Kumar Dixit	
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS	
1	2	3	4	5	6	7	8	9	D*	10
4	ERECTION	Lift the Inverter by using proper material handling equipment and position the Inverter in place.	C	Visual	100%	Manufacturer Installation Manual/NTPC approved Drawing	Manufacturere Installation Manual/NTPC approved Drawing	Logbook		
		Secure the enclosure mounting lugs to preinstalled anchoring with suitable bolts.	C	Electrical	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-		
		Ensure all anchor bolts are properly tightened	C	Visual	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-		
		Check verticality of Panels	C	Sprit Level	100%	NTPC approved drawing	NTPC approved drawing	-do-		
		Ensure that remaining units are lined up by placing packers of various thickness under each unit.	C	Visual	100%	NTPC approved drawing	NTPC approved drawing	-do-		
		Verification of Input Power Cable polarity	C	Electrical	100%	NTPC approved drawing	NTPC approved drawing	-do-		
		Input Power Cable Termination tightness check	B	Electrical	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-		5% at random by NTPC
		Output Power Cable Termination tightness check	B	Electrical	200%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-		5% at random by NTPC
		Verification of phase sequence of Output Power	C	Electrical	100%	NTPC approved drawing	NTPC approved drawing	-do-		
		Panel Earthing (including doors) , its tightness & continuity to Earth Pit	B	Visual and Electrical	100%	NTPC approved drawing/Installation Manual	NTPC approved drawing/Installation Manual	-do-		5% at random by NTPC
		Check cable size for purpose of D.C. input, A.C. output, communications, control and auxiliary power and check tightness of termination	B	Visual	100%	Manufacturer instruction manual/NTPC Approved drawings	Manufacturer instruction manual/NTPC Approved drawings	-do-		5% at random by NTPC
		All the busbar should be tightened.	B	Visual	100%	Manufacturers instruction manual	Manufacturers instruction manual.	-do-		5% at random by NTPC
		Verify the size of cable, rating of Auxiliary power source	B	Visual	100%	NTPC approved drawings	NTPC approved drawings	-do-		5% at random by NTPC
		Verifications that open entries/holes are plugged in.	C	Visual	100%	Manufacturer instruction manual	Manufacturer instruction manual	-do-		

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN				QP No: 0000-999-QOE-I-013 REV No: 0 DATE: PAGE: 3 of 3 VALID UPTO:		REVIEWED BY Dileep Kumar Dixit		APPROVED BY	
		Solar Inverter (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:											
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS			
1	2	3	4	5	6	7	8	9	D*	10			
		Check the insulation value (Megger) & continuity for all the incoming and outgoing cables.	B	Electical/Megger/Multi meter	100%	Manufacturer instruction manual	Manufacturer instruction manual	-do-		5% at random by NTPC			
LEGEND: * RECORDS INDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)													

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 01 of 3 DATE: PAGE: VALID UPTO:		REVIEWED BY		APPROVED BY	
		MV Switchgear (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	REMARKS		
1	2	3	4	5	6	7	8	9	D*	10		
1	MATERIAL, RECEIPT AND UNLOADING	Safe unloading of material at site	C	Visual	100%	Manufacturer Installation Manual	No damage	Logbook				
		Verification of quantity, short supply if any	C	-do-	-do-	Packing List / CHP / MDCC/Challan	Packing List / CHP / MDCC/Challan	-do-		Report to Manufacturer for short supply.		
		Package Condition	C	Visual	-do-	Packing List	Free from damages	-do-		Material Damage Report in case of damage		
2	STORAGE	Movement to warehouse	C	Visual	-do-	Manufacturer Installation Manual	No damage	-do-				
		Storage Space	A	Physical	-do-	-do-	Instruction Manual	-do-				
		Store Handling	C	Physical	-do-	-do-	Store in such a way which avoid direct mechanical hit with sharp objects	-do-				
3	PRE - ERECTION	Documents Availability	C	Visual	-do-	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	-do-				
		Tools, fixing hardware availability	C	Visual	-do-	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-				
		Completeness of foundation, Cable trenches, floor opening for cables	C	Measure	Once before erection	NTPC approved civil drawing	NTPC approved civil drawing	-do-				
		Material Movement to site	C	Visual	-do-	Manufacturer Installation Manual	No damage	-do-				
		Unpacking of Material and its handling	C	Verify	-do-	Manufacturer Installation Manual	No damage	-do-				
LEGEND: * RECORDS IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 02 of 3 DATE: PAGE: VALID UPTO:		REVIEWED BY		APPROVED BY	
		MV Switchgear (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS		
1	2	3	4	5	6	7	8	9	D*	10		
4	ERECTION	Lift the Panel by using proper material handling equipment and position the Panel in place.	C	Visual	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	Logbook				
		Secure the enclosure mounting lugs to preinstalled anchoring with suitable bolts.	C	Electrical	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-				
		Ensure that base frames are securely tag welded	C	Visual	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-				
		Check verticality of Panels	C	Sprit Level	100%	NTPC approved	NTPC approved	-do-				
		Ensure that remaining units are lined up by placing packers of various thickness under each unit.	C	Visual	100%	NTPC approved	NTPC approved	-do-				
		Ensure that correct sequence of panel positioning is maintained as per layout drawing for both normal & phase reversal panels.	B	Visual	100%	NTPC approved drawing	NTPC approved drawing	-do-				
		Check and ensure that un-plated contact surfaces, if any are thoroughly cleaned and electrical jointing compound applied on the surface after scratching with fine emery paper. Plated surfaces are to be cleaned with solvents.	C	Visual	100%	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-				
		Check correctness of bus duct entry w.r.t. phase sequence for both normal & phase reversal panels.	B	Visual	100%	NTPC approved drawing	NTPC approved drawing	-do-				
		Ensure that the bolting surface are free from dust, grease and other contamination.	C	Visual	100%	Manufacturer Installation Manual	Manufacturer Installation Manual					
		Coupling Bolt/ Busbar connections tightness	B	Visual	100%	Manufacturers instruction manual	Manufacturers instruction manual.	-do-			5% at random by NTPC	
		Panel Earthing (including doors), its tightness & continuity to Earth Pit, no earthing of communication cable shield to panel	B	Visual and Electrical	100%	NTPC approved drawing/Installation Manual	NTPC approved drawing/Installation Manual	-do-				
		Ensure Vacuum Interrupters have not suffered any damage	C	Visual	100%	Manufacturers instruction manual	Manufacturers instruction manual	-do-				
		Check for no moisture, dust deposition on interrupter & insulator surface	C	Visual	100%	Manufacturers instruction manual	Manufacturers instruction manual	-do-				
Check for completeness of interpanel wiring	C	Visual	100%	NTPC approved drawing	NTPC approved drawing	-do-						
LEGEND: * RECORDS IDENTIFIED WITH "TICK" (Ö) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.												
LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND												
'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												
Format No.: QS-01-QAI-P-10/F4-R1					2/3					Engg. Div./QA&I		

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 03 of 3 DATE: PAGE: VALID UPTO:		REVIEWED BY		APPROVED BY	
		MV Switchgear (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	REMARKS		
1	2	3	4	5	6	7	8	9	D*	10		
		Check cable size for all input, output connections, communications, control connections and auxiliary power connections and check tightening torque of cable termination.	B	Visual	100%	Manufacturer instruction manual/NTPC Approved drawings	Manufacturer instruction manual/NTPC Approved drawings	-do-		5% at random by NTPC		
		Verifications that open entries/holes are plugged in.	C	Visual	100%	Manufacturer instruction manual	Manufacturer instruction manual	-do-				
		Ensure CT polarity & CT secondaries shorting where remote instruments are to be used.	B	Electrical	100%	NTPC approved drawing	NTPC approved drawing	-do-		5% at random by NTPC		
		Check Voltage ratio of PT, in case mounting is done at site	C	Elec	100%	NTPC approved drawing	NTPC approved drawing	-do-				
		Check pad locking of doors	C	Visual	100%	NTPC approved drawings	NTPC approved drawings	-do-				
		Check interchangeability of breaker trolleys	C	Visual	100%	NTPC Specification	NTPC Specification	-do-				
		Check for manual spring charging, closing & tripping of the breaker	C	Visual	200%	NTPC Specification	NTPC Specification	-do-				
		Check for electrical spring charging, closing & tripping of the breaker	C	Visual	300%	NTPC Specification	NTPC Specification	-do-				
		Check degree of protection by paper inertion	B	Visual	400%	NTPC Specification	NTPC Specification	-do-				
		IR Test before & after the HV Test with 500V meggar for control circuit and 5.0KV Meggar for Power Ckt.	B	Electical/Megger/ Multi meter	100%	IEC 62271-200	IEC 62271-200	-do-				
		HV test on Power & control ckt at 90% of test voltage as per IEC-62271-200	A	Electical/Megger/ Multi meter	100%	IEC 62271-200	IEC 62271-200	-do-				
LEGEND: * RECORDS IDENTIFIED WITH "TICK" (Ö) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.												
LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												
Format No.: QS-01-QAI-P-10/F4-R1					3/3					Engg. Div./QA&I		

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 0 DATE: PAGE: 1 of 3 VALID UPTO:		REVIEWED BY		APPROVED BY	
		String Monitoring Box (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1	2	3	4	5	6	7	8	9	D* 10			
1	MATERIAL, RECEIPT AND UNLOADING	Safe unloading of material at site	C	Visual	100%	Manufacturer Installation Manual	No damage	Logbook				
		Verification of quantity, short supply if any	C	-do-	-do-	Packing List / CHP / MDCC/Challan	Packing List / CHP / MDCC/Challan	-do-	Report to Manufacturer for short supply.			
		Package Condition	C	Visual	-do-	Packing List	Free from damages	-do-	Material Damage Report in case of damage			
	STORAGE	Movement to warehouse	C	Visual	-do-	Mfr Instruction Manual	No damage	-do-				
		Storage Space	A	Physical	-do-	-do-	Manufacturer Installation Manual	-do-				
		Store Handling	C	Physical	-do-	-do-	Store in such a way which avoid direct mechanical hit with sharp objects	-do-				
3	PRE - ERECTION	Documents Availaibity	C	Visual	-do-	Ensure availability of Manufacturer instruction manual, NTPC approved Layout drawing/data sheet etc.	Ensure availability of Manufacturer instruction manual, NTPC approved Layout drawing/data sheet etc.	-do-				
		Tools, fixing hardware availability	C	Visual	-do-	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-				
		Completeness of Module Mounting Structure & Availability of SMB Clamps	C	Measure	Once before erection	NTPC approved civil drawing	NTPC approved civil drawing	-do-				
		Material Movement to site	C	Visual	-do-	Instruction Manual	No damage	-do-				
		Unpacking of SMBs and its handling	C	Verify	-do-	Instruction Manual	No damage	-do-				
LEGEND: * RECORDS INDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 0 DATE: PAGE: 2 of 3 VALID UPTO:		REVIEWED BY		APPROVED BY	
		String Monitoring Box (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1	2	3	4	5	6	7	8	9	D* 10			
4	ERECTION	Fixing of SMB to MMS	C	Visual	100%	NTPC approved GAdrawing/ Manufacturer Installation Manual	NTPC approved drawing/ Manufacturer Installation Manual	Logbook				
		Verification of continuity between +ve & -ve busbar	C	Electrical	100%	NTPC approved drawing	No continuity between + and - bus bars	-do-				
		Verification of any loose connection/physical parts inside SMB/Out side SMB	C	Visual	100%	-	No loose connection	-do-				
		Verification of continuity between +ve inputs and bus bars through fuses	C	Electrical	100%	NTPC approved drawing	No disconnection	-do-				
		Verification of continuity between -ve inputs and bus bars through fuses	C	Electrical	100%	NTPC approved drawing	No disconnection	-do-				
		Earthing & its tightness	B	Visual and Electrical	100%	NTPC approved drawing/Manufacturere Installation Manual	NTPC approved drawing/Manufacturere Installation Manual	-do-		5% at random by NTPC		
		Degree of protection check	B	Visual	100%	NTPC approved drgs / NTPC Spec	No insertion possible from doors			*by paper pulling method *5% at random by NTPC		
		IR check with Megger	B	Electrical	100%	IR>10Mega Ohm		-do-	√	5% at random by NTPC		
		Check the insulation value (Megger) & continuity for all the incoming and outgoing cables.	B	Electical/ Megger/M ulti meter	100%	Manufacturer instruction manual	Manufacturer instruction manual	-do-	√	5% at random by NTPC		
		DC cable termination and tightness check by pull check method	B	Physical	100%	NTPC approved drawing/Manufacturere Installation Manual	1) Ensure right polarity 2) Proper tightness 3) Terminals should not get loose/come out during pull check.	-do-		5% at random by NTPC		
Identification of String Number with ferrulling	C	Visual	100%	NTPC approved drawing	NTPC approved drawing	-do-						
LEGEND: * RECORDS INDENTIFIED WITH “TICK” (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 0 DATE: PAGE: 3 of 3 VALID UPTO:		REVIEWED BY		APPROVED BY	
		String Monitoring Box (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1	2	3	4	5	6	7	8	9	10			
		Verification of number of +ve and -ve input strings, VOC between each +ve and -ve inputs (also ensure right polarity)	C	Electrical	100%	NTPC approved drawing	NTPC approved drawing	-do-				
		Verification of VOC between +ve and -ve bus bar (also ensure right polarity)	B	Electrical	100%	NTPC aproved drawing	NTPC approved drawing	-do-	√	5% at random by NTPC		
		Check for DC disconnecter function and output terminal voltage with polarity (before output cable termination)	C	Funtional & Electrical	100%	NTPC approved drawing/Manufacturere Installation Manual	NTPC approved drawing/Manufacturere Installation Manual	-do-				
		Verification of output Power cable polarity marking & Ferulling	C	Electrical	100%	NTPC approved Drawing	NTPC approved Drawing	-do-				
		Verification of output Power cable connection tightness	B	Electrical	100%	Manufacturer installation manual	Manufacturer installation manual	-do-		5% at random by NTPC		
		Verify the enclosure box fully tightened to avoid any water entry	C	Electrical	100%	Manufacturer installation manual	Manufacturer installation manual	-do-				
LEGEND: * RECORDS INDENTIFIED WITH “TICK” (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)												

Format No.: QS-01-QAI-P-10/F4-R1

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN				QP No: REV No: 0 DATE: PAGE: 1 of 2 VALID UPTO:		REVIEWED BY		APPROVED BY	
		Solar Module (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:											
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS			
1	2	3	4	5	6	7	8	9	D*	10			
1	MATERIAL, RECEIPT AND UNLOADING	Safe unloading of material at site	C	Visual	100%	Instruction Manual	No damage	Logbook					
		Verification of quantity, short supply if any	C	-do-	-do-	Packing List / CHP / MDCC/Challan	Packing List / CHP / MDCC/Challan	-do-		Report to Manufacturer for short supply.			
		Condition of solar module pallets	C	Visual	-do-	Packing List	Free from damages	-do-		Material Damage Report in case of damage			
	STORAGE OF MODULES	Movement to warehouse	C	Visual	-do-	Instruction Manual	No damage	-do-					
		Storage Space	A	Physical	-do-	-do-	Instruction Manual	-do-					
		Store Handling	C	Physical	-do-	-do-	Maximum stack heights 3 pallets	-do-					
3	PRE - ERECTION	Documents Availaibity	C	Visual	-do-	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	Ensure availability of Manufacturers instruction manual, NTPC approved Layout drawing/data sheet etc.	-do-					
		Tools, fixing hardware availability	C	Visual	-do-	Manufacturer Installation Manual	Manufacturer Installation Manual	-do-					
		Completeness of MMS foundation and MMS structure	C	Measure	-do-	NTPC approved civil drawing	NTPC approved civil drawing	-do-					
		Predrilled mounting holes on MMS	C	Visual	-do-	NTPC approved civil drawing	NTPC approved civil drawing	-do-					
		Material Movement to site	C	Visual	-do-	Instruction Manual	No damage	-do-					
		Unpacking of pallets and Solar module handling	C	Verify	-do-	Instruction Manual	No damage	-do-					
LEGEND: * RECORDS INDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)													

		SYSTEM EQUIPMENT:		INDICATIVE FIELD QUALITY PLAN			QP No: REV No: 0 DATE: PAGE: 2 of 2 VALID UPTO:		REVIEWED BY		APPROVED BY	
		Solar Module (RECEIPT, STORAGE & ERECTION) SUB-SYSTEM:										
Sl No	ACTIVITY AND OPERATION	CHARACTERISTICS	#CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS			
1	2	3	4	5	6	7	8	9	D*	10		
4	ERECTION	Fixing of modules to MMS	C	Visual	100%	NTPC approved drawing/ Manufacturer Installation Manual	NTPC approved drawing/ Manufacturer Installation Manual	Logbook				
		Module Series wiring	B	Visual	-do-	NTPC approved drawing/ Manufacturer Installation Manual	1. Right polairty 2. No loose connection 3. No short Circuit 4. No of modues in series (string) as per approved SLD 5. DC wires to be properly supported & secured with ties.	-do-		5% at random by NTPC		
		Earthing & its tightness	B	Visual and Electrical	100%	NTPC approved drawing/Manufacturere Installation Manual	NTPC approved drawing/Manufacturere Installation Manual	-do-		5% at random by NTPC		
		String VOC measurement	B	Electrical	-do-	NTPC approved drawing/ approved datasheet	String VOC should match with the approved SLD	-do-	√	5% at random by NTPC		

LEGEND: * RECORDS INDENTIFIED WITH “TICK” (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
 LEGEND TO BE USED: CLASS# : A = CRITICAL, B=MAJOR, C=MINOR; ‘A’ SHALL BE WITNESSED BY NTPC FQA, ‘B’ SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND
 ‘C’ SHALL BR WITNESSED BY MAIN SUPPLIER (A & B SHALL BE NTPC CHP STAGE)

		Item: (Material, Class, Grade, Rating, Size Etc.) Uninterrupted Power Supply (UPS) For Single and Three Phase UPS from 10 KVA up to 150 KVA			Indicative Quality Plan			To Be Filled In By NTPC						
					Conforming To Code:			Quality Plan Number :		Prepared By		Approved By		
								Revision. :		Reviewed By				
								Date : Page : 1 of 4						
			Valid Up To :			ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY			REMARKS	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT				M	C		
A) Bought Out Items (Electrical & Mechanical)														
1	Power transformers & Choke	Electrical Parameters & Dimensions	Major	Measurement, & Visual	100%	100%	MFGR's Drawing / Catalogues	MFGR's catalogues & No damages	TC		P	V		
2	CT's	Electrical Parameters & Dimensions	Major	measurement, visual	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
3	Switches & Isolators	Functional Check (On/Off, Continuity), dimension	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
4	Contactors, MCB's, MCCB's & Circuit Breakers	Functional Check (On/Off, Continuity), dimension	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
5	Fabricated items	Dimension (Critical) Surface finish	Major	Measurement, & Visual	10% & 100%	10% & 100%	UPS MFGR's Drawings / Catalogues	UPS MFGR's Drawings / Catalogues / No damages	TC		P	V		
6	Capacitors	Functional Tests	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
7	Meters	a) Calibration b) Accuracy	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
8	Power Modules Thyristors & IGBT	Dimension, Rating & Physical damage checking	Major	Measurement & visual	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues & No damages	TC		P	V		
9	Resistors	a) Resistance Value b) Dimensions	Major	Measurement & visual	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues / No damages	TC		P	V		
10	Connectors	a) Dimension b) Continuity	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues / No damages	TC		P	V		
11	Coolin Fans Fan Motors	a) Functional Tests b) HV & IR Test	Major	Measurement	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues / No damages	TC		P	V		
12	HRC, GC, Semiconductor & Ceramic Fuses	Continuity & Physical checking	Major	Measurement, & Visual	As per Mfr Sampling Plan	As per Mfr Sampling Plan	MFGR's catalogues	MFGR's catalogues / No damages	TC		P	V		
13	Electronic Modules	Performace as per relevent Test Procedure	Major	Functional, Visual	100 %	100 %	MFGR's drawing / test procedure	MFGR's drawing / No damages	TC		P	V		

LEGEND: "** RECORDS IDENTIFIED WITH "TICK" MARK SHALL BE ESSENTIALLY INCLUDED BY CONTACTOR IN QA DOCUMENTATION. ** M:MANUFACTURER / SUB CONTRACTOR. "C" CONTRACTOR, "N": NTPC TO INDICATE "P" PERFORM. "W" WITNESS & "V" VERIFICATION AS APPROPRIATE "CHP" NTPC SHALL BE IDENTIFIED IN COLUMN "N".

		Item: (Material, Class, Grade, Rating, Size Etc.) Uninterrupted Power Supply (UPS) For Single and Three Phase UPS from 10 KVA up to 150 KVA			Indicative Quality Plan			To Be Filled In By NTPC						
					Conforming To Code:			Quality Plan Number :		Prepared By		Approved By		
								Revision :		Reviewed By				
								Date : Page : 2 of 4						
Valid Up To :			ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY			REMARKS				
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT					M	C	N
B) Assembly														
1	Loose components Fixing / Assembly	Component Item Code Assembly Correctness	Major	Visual & Verification	100%	-	MFGR's Drawings / work instruction	MFGR's Drawings / work instruction	Test Report		P	-	-	
2	Sub Assembly Wiring	Wiring Accuracy, Crimp Quality & Operation	Major	Visual	100%	-	MFGR's Drawings / work instruction	MFGR's Drawings / work instruction	Test Report		P	-	-	
3	Inprocess Inspection	Component Mounting Clearance, wiring Accuracy	Major	Visual	100%	-	MFGR's Drawings / work instruction	MFGR's Drawings / work instruction	Test Report		P	-	-	
4	Physical check up	Component Mounting Clearance, Workmanship	Major	Visual	100%	-	MFGR's Drawings / work instruction	MFGR's Drawings / work instruction	Test Report		P	-	-	
5	HV & IR Test	Insulation & Leakage current between Earth & Live terminals	Major	Electrical Measurement	100%	-	Work instruction/ MFGR's Test procedure.	NTPC Approved Drawings & Datasheet / NTPC Specification requirement.	Test Report		P	V	V	
7	Internal overall Inspection & Testing	All Inspection & Tests have been carried out & Results meet specified requirement	Major	Electrical Measurement	100%	-	Sub Assembly test procedure / NTPC approved DATA SHEET	Sub Assembly test procedure / NTPC approved DATA SHEET	Test Report		P	V	V	NOTE - 1
8	NOTE - 1 - Main contactor need verify and submit the Internal test report while raising the inspection call.											P	V	
LEGEND : *RECORDS, IDENTIFIED WITH "TICK" shall be Essentially included by Supplier in QA Documentation M : MANUFACTURER / SUB SUPPLIER C: MAIN SUPPLIER, N : NTPC, P : PERFORM, W: WITNESS and V : VERIFICATIONS, TC : Internal Test certificate AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"								Note : NTPC Inspection Engineer to check, approval date / revision no of reference documents at the time of inspection						

		Item: (Material, Class, Grade, Rating, Size Etc.) Uninterrupted Power Supply (UPS) For Single and Three Phase UPS from 10 KVA up to 150 KVA			Indicative Quality Plan		To Be Filled In By NTPC							
					Conforming To Code:		Quality Plan Number : Revision : Date : Page : 3 of 4 Valid Up To :		Prepared By		Approved By			
									Reviewed By					
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C, N				M	C	N		
C) Final Testing														
1	UPS System	Physical Appearance, Paint Shade , GA / BOM	Major	Visual	100%	100%	NTPC Approved Drawings & Datasheet / MFGR's Standard Test procedure / NTPC Specifacaiton requirement.	NTPC Approved Drawings & Datasheet / MFGR's Standard Test procedure / NTPC Specifacaiton requirement.	ITR	✓	P	W	W	Makes of BOM as per ANNEXURE - I
2	UPS System	Dimensions, Paint thickness	Major	Measurement	100%	100%			ITR	✓	P	W	W	
3	UPS System (Parametric)	Capacity, Efficiency, Ripple content, Regulation, Harmonics content (on linear load)	Major	Measurement	100%	100%			ITR	✓	P	W	W	# - Temperature Rise test - For same size of panel, same make & rating of Power Transformer & Control transformer - Teperature rise test will not repeated again if the same is witnessed by NTPC in earlier packages for same or higher rating of UPS.
4	UPS System (Functinal)	Load Limiter Operation, Input Voltage Variation, Output Voltage Adjustment Range, Load tranfer / retransfer (sync), Parallel Operation & current sharing, AC Input failure, return test, Restart test with primary AC, overshoot & undershoot, Functionality of protective and warning devices.	Major	Measurement	100%	100%			ITR	✓	P	W	W	
5	UPS System #	Temperature rise test / Heat Run Test (without Redundant Fans)	Major	Measurement	One of Similar type	One of Similar type			ITR	✓	P	W	W	
6	UPS System	Checking of Aux Devices (like Breaker / fuses / fan / Annunciation / Meters etc)	Major	Operation	100%	100%			ITR	✓	P	W	W	
7	Mimic	Functions	Major	Visual	100%	100%			ITR	✓	P	W	V	
8	Servo / Static Control Voltage Stabiliser	BOM	Major	Visual	100%	100%			ITR	✓	P	W	W	
9	Servo / Static Control Voltage Stabiliser	Functional (Line Regulation & Load Regulation)	Major	Measurement and Visual	100%	100%			ITR	✓	P	W	W	
10	ACDB (if Applicable)	BOM	Major	Visual	100%	100%			ITR	✓	P	W	W	
11	ACDB (if Applicable)	Functional	Major	Visual	100%	100%	ITR	✓	P	W	W			
12	Packaging	Proper Loading, Unloading, Storage & Staking Instruction Marked on Packing and installation manual to be submitted.	Major	Visual Verification & Marking	100%	-	MFGR's Drawings & Handling , Storage, Installation Instruction	As specified in MFGR's related Documents.			P	V	-	
LEGEND : *RECORDS, IDENTIFIED WITH "TICK" shall be Essentially included by Supplier in QA Documentation M : MANUFACTRER / SUB SUPPLIER C: MAIN SUPPLIER, N : NTPC, P : PERFORM, W: WITNESS and V : VERIFICATIONS, TC : Internal Test certificate AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W", ITR - Inspection Test Report								Note : NTPC Inspection Engineer to check, approval date / revision no of reference documents at the time of inspection						

	Item: (Material, Class, Grade, Rating, Size Etc.) Uninterrupted Power Supply (UPS) For Single and Three Phase UPS from 10 KVA up to 150 KVA				Indicative Quality Plan		To Be Filled In By NTPC					
					Conforming To Code:		Quality Plan Number :		Prepared By		Approved By	
							Revision : Date : Page : 4 of 4		Reviewed By			
							Valid Up To :					
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS		
					M C, N				M C N			

ANNEXURE - I - Makes of BOM

Sr. No	Items as applicable	Standard makes by UPS Supplier
1	On Load isolators	
2	MCCBs	
3	SFUs	
4	MCBs	
5	CTs	
6	Control Txr	
7	Power Txr	
8	PCBs	
9	AC CAPACITORS	
10	DC CAPACITORS	
11	COOLING FAN	
12	SCRS	
13	IGBT	
14	FUSES	
15	DCCT	
16	METERS	
17	SELECTOR SWITCHES	
18	RELAY	
19	SHUNT	
20	TIMERS	
21	CONTACTORS	
22	VARIAC	
23	CONTROL WIRES	
24	POWER WIRES	
25	TERMINAL BLOCKS	
26	UPS and ACDB PANEL FABRICATION (EPOXY POWDER COATED)	
27	INDICATING LAMPS	
28	CLUSTER LED	
29	ISO TRANSFORMER	
30	VOLTAGE TRANSDUCER	
31	CURRENT TRANSDUCER	
32	FREQUENCY TRANSDUCER	

LEGEND : *RECORDS, IDENTIFIED WITH "TICK" shall be Essentially included by Supplier in QA Documentation M : MANUFACTRER / SUB SUPPLIER C: MAIN SUPPLIER, N : NTPC, P : PERFORM, W: WITNESS and V : VERIFICATIONS, TC : Internal Test certificate AS APPROPRIATE, "CHP" NTPC SHALL INDICATED IN COLOUM "N" AS "W"							Note : NTPC Inspection Engineer to check, approval date / revision no of reference documents at the time of inspection				
---	--	--	--	--	--	--	--	--	--	--	--

		Item: Fire alarm System		Indicative Quality Plan					To Be Filled In By NTPC					
									Conforming To Code: UL/FM/LPCB/VDS					Quality Plan Number :
									Revision. :		Reviewed by			
									Date :					
					Page : 01 Of 01									
					Valid Up To :									
Sl. No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of Check		Reference Document	Acceptance Norms	Format of Record	Agency				Remarks
					M	C / N				M	C	N		
1	2	3	4	5	6		7	8	9	D*	**	10		11
1	Fre alarm Panel/Repeater Alarm Panel (Microprocessor based)	Make ,Model	Major	Visual & TC/COC Review	100%	10%	UL/FM/VDS/LPCB /NTPC ADS	UL/FM/VDS/LPCB /NTPC ADS	TC/COC	√	P	W#	V	Following documents are require to be submitted for issuance of MDCC. 1.UL/FM/LPCB/VDS listing certificate 2. Proof of Origin 3.Certificate of Test from Manufacturer. 4.COC from Main Contractor
2	Addressable Detectors Multi Sensor, Photo & Heat Detector Type)(As applicable)	Make ,Model	Major	Visual & TC/COC Review	100%	10%	UL/FM/VDS/LPCB /NTPC ADS	UL/FM/VDS/LPCB /NTPC ADS	TC/COC	-	P	W#	V	
3	Interface unit,Manual Call Point,Hooter Cum Strobes/ Hooter(As applicable)	Make ,Model	Major	Visual & TC/COC Review	100%	10%	UL/FM/VDS/LPCB /NTPC ADS	UL/FM/VDS/LPCB /NTPC ADS	TC/COC	-	P	W#	V	
# -For Indigenous Supply Witness(W) by Main Contractor & For imported Supply Verification(V) by Main Contractor Notes:Mandatory Spares to be treated as NTPC Inspection CAT-III.														
LEGEND: * Records, identified with " Tick" (√) shall be essentially included by supplier in QA documentation. ** M: Manufacturer / Sub Supplier, C: Main Supplier, N: NTPC, P: Perform, W: Witness and V: Verification as appropriate."CHP" NTPC shall identify in column "N" As "W".														

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT :				
				ITEM : LT SWITCHGEAR		QP NO.: REV.NO.: DATE: PAGE: OF....				PACKAGE :				
				SUB-SYSTEM: LT						CONTRACT NO. :				
		MAIN-SUPPLIER:												
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C / N				M	C	N		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.		11.	
A	RAW MATERIAL													
1	Angles, channels & Sheet Steel for fabrication (CRCA / HR)	1) Thickness	Major	Meas	1 Sample of each type & size per lot	-	IS-513, IS-1079, IS 2062	NTPC Specification	QC Records/ supplier TC		P	-	-	
		2) Surface finish & check for waviness / flatness	Major	Visual	-do-	-	IS-513, IS-1079, IS 2062	Mfr Std/Drg	QC record/ Supplier TC		P	-	-	
		3) Bending Test	Major	Mech	Sample	-	IS-513, IS-1079, IS 2062	IS-513, IS-1079, IS 2062	Supplier TC		V	-	-	
2.	Busbars – Aluminium & Copper	1) Dimensions	Major	Meas.	1 Sample of each type & size per lot	-	IS-5082 (for Al) IS1897 & IS 613 (for Cu), NTPC Approved Drgs. / data shee	IS-5082 (for Al) IS1897 & IS 613 (for Cu), NTPC Approved Drgs. / data shee	QC record/ Supplier TC	-	P	-	-	
		2) Surface finish	Major	Visual	-do-	-	IS-5082 (for Al) IS1897 IS 613 (for Cu),	IS-5082 (for Al) IS1897 IS 613 (for Cu)	QC Record	-	P	-	-	
		c) Conductivity	Major	Electrical	As per IS	-	IS-5082 (for Al) IS1897 IS 613 (for Cu)	IS-5082 (for Al) IS1897 IS 613 (for Cu)	QC Records/ supplier TC		P	-	-	

		LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM “N” AS ‘ W’	DOC.NO.:		REV..... CAT.....		
MANUFACTURER/ SUB-SUPPLIER			MAIN-SUPPLIER				
SIGNATURE							
				 FOR NTPC USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN				PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:							
				ITEM : LT SWITCHGEAR		QP NO.:									
				SUB-SYSTEM: LT		REV.NO.:									
						DATE:		PAGE: OF....							
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS		
					M	C / N				M	C	N			
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	**	10.	11.		
B Bought out items : (For Makes refer Note # 1)															
1	Air Circuit Breaker	1) Type & Rating	Major	Visual	100%	-	IS-13947 Part 2/ NTPC approved drg. / Data sheet	IS-13947 Part 2/ NTPC approved drg. / Data sheet	QC record	-	P	-	-		
		2) All routine tests including calibration of releases	Critical	Tests	-do-	-	IS-13947 Part 2/ NTPC approved drg. & Data sheet	IS-13947 Part 2/ NTPC approved drg. & Data sheet	Mfr.'s Complianc e TC		V	V	V		
2	CT's	1) Overall dimensions & mounting arrangement	Major	Meas.	10% of each type & rating per lot	-	Mfr drg. / NTPC Spec	Mfr drg. / NTPC Spec	QC Record / Supplier TC		P	-	-		
		2) Type & Rating	Major	Visual	-do-	10% of each type & rating per lot	NTPC App. Drg. & data sheet	NTPC App. Drg. & data sheet	QC Record		P	-	-		
		3) All routine tests as per IS 2705	Critical	Electrical	100%	100%	IS 2705	IS 2705	Supplier's TC		V	V	V		
3	PT's	1. Overall dimensions & mounting arrangement	Major	Meas.	10% of each type	-	Mfg Drg.	Mfr. Drg.	QC Record/Su pplier's TC		P	-	-		
		2) Type & Rating	Major	Visual	-do-	10% of each type & rating per lot	NTPC Appd. Drg/ Data sheet	NTPC app. Drg/Data sheet	QC Record/Su pplier's TC		P	V			
				LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"				 FOR NTPC USE		DOC.NO.: REV..... CAT.....					
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		SIGNATURE				FOR NTPC USE		REVIEWED BY		APPROVED BY		APPROVAL SEAL	

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	INDICATIVE MANUFACTURING QUALITY PLAN				PROJECT :			
		ITEM : LT SWITCHGEAR		QP NO.:		PACKAGE :			
		SUB-SYSTEM: LT		REV.NO.:		CONTRACT NO. :			
				DATE:		MAIN-SUPPLIER:			
				PAGE: OF....					

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C / N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.		11.
		3) All routine tests as per IS 3156 (92)	Critical	Electrical	100%	100%	IS 3156	IS 3156	Supplier's TC		V	V	V
4	AC / DC Power & aux. Contactors	1) Type & Rating	Major	Visual	5 sample of each type, make & rating per lot	-	IS-13947 Part 4 sec 1, NTPC appd. drg & Data sheet	IS-13947 Part 4 sec 1, NTPC appd. drg & Data sheet	QC Record/ Swbd TC		P	-	-
5	Air Air Break switches / Fuse Switch units	1) Type & Rating	Major	Visual	5 sample of each type, make & rating per lot	-	IS-13947 Part 3 , NTPC appd. drg & Data sheet	IS-13947 Part 3 , NTPC appd. drg & Data sheet	QC Record/ Swbd TC		P	-	-
6	Timers	1) Type & Rating	Major	Visual	10% of each type, & rating per lot	-	NTPC App. Drg. & data sheet	NTPC App. Drg. & data sheet	QC Record		P	-	-
		2) Compact configuration	Major	Electricazl	-do	-	-do-	-do-	Reg/Sheet		P	-	-
7	HRC Fuses	1) Type & Rating	Major	Visual	10% of each rating per lot	-	Makes as per LOA / Endorsement sheet IS-13703 / NTPC App. Drgs	NTPC Appd. Drgs.	Swbd TC		P	-	-
8	Indicating Instruments	1) Type & Ratings (Calibration report to be verified)	Major	Visual	10% of each rating per lot	10% of each rating per lot	NTPC Appd Drg/ Data sheet	NTPC Appd drg/ data sheet	Supplier's TC		P	V	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER					
SIGNATURE						
			REVIEWED BY	APPROVED BY	APPROVAL SEAL	

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT :					
			ITEM : LT SWITCHGEAR			QP NO.:			PACKAGE :					
			SUB-SYSTEM: LT			REV.NO.:			CONTRACT NO. :					
						DATE:			MAIN-SUPPLIER:					
						PAGE: OF....								
		b) Finish & workmanship	Minor	Visual	Sample	-	Compliance to standard Engg. Norms & free from surface defects		-		P	-	-	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
					M	C / N				M	C	N		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			
		2) Routine tests including calibration & accuracy test reports	Major	Electrical	100%	100%	IS 1248 , NTPC Appr .drg / data sheet	IS 1248 , NTPC Appr .drg / data sheet	Supplier's test report		V	V	V	
9	KWH Meters	1) Type & Ratings	Major	Visual	10% of each type & rating per lot	10% of each type & rating per lot	NTPC Appr .drg / data sheet	NTPC Appr .drg / data sheet	QC Records		P	V	-	
		2) Routine tests including calibration & accuracy test report	Major	Electrical	100%	100%	IS 722 & IS 13779 , 13010 & NTPC Appr .drg / data sheet	IS 722 & IS 13779 , 13010 & NTPC Appr .drg / data sheet	Supplier's test report		V	V	V	
10	Transducers	1) Type & Ratings	Major	Visual	10% of each type & rating per lot	10% of each type & rating per lot	NTPC Appr .drg / data sheet	NTPC Appr .drg / data sheet	QC Records		P	V	-	
		2) Routine tests including calibration & accuracy test reports	Major	Electrical	100%	100%	IS 12784 & NTPC Appr .drg / data sheet	IS 12784 & NTPC Appr .drg / data sheet	Supplier's test report		V	V	V	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W "	 FOR NTPC USE	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN				PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:					
				ITEM : LT SWITCHGEAR		QP NO.:							
				SUB-SYSTEM: LT		REV.NO.:							
						DATE:		PAGE: OF....					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMA T OF RECOR D	AGENCY			REMARKS
					M	C / N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.		11.
11	Push Button	1) Type, Color & Ratings	Major	Visual	5 samples of each type & rating per lot	-	IS 13947 Part 5 sec1 NTPC App. Drg. & data shee	IS 13947 Part 5 sec1 NTPC App. Drg. & data shee	QC Record		P	-	-
12	IEC 61850 compliant Numerical Relays	1)Type & Rating	Major	Visual	100%	10% of each type, & rating per lot	NTPC appd drg & data sheet	NTPC appd drg & data sheet	QC Records		V	-	-
		2) Routine test certificate	Major	Electrical	100%	100%	IEC 60255 / IEC 61850 Relay Mfr's Specifications	IEC 60255 / IEC 61850 Relay Mfr's Specifications	Supplier's TC	-	V	V	V
		3) Numerical Relay Testing	Major	Electrical	10% of each type, & rating per lot	10% of each type, & rating per lot	As per Approved test procedure No. 9548-206-QVEQ-005	As per Approved test procedure No. 9548-206-QVEQ-005	Procedure No. 9548-206-QVEQ-005	-	P	W	W
13	Control & Selector Switches	1) Type & Rating	Major	Visual	5 samples of each type & rating per lot	-	IS 13947 Part 5 sec1 NTPC App. Drg. & data sheet	IS 13947 Part 5 sec1 NTPC App. Drg. & data sheet	QC Records	-	P	-	-
		2Contact configuration check	Major	Visual	Do	Do	Do	Do	Do	-	P	-	-

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W'		DOC. NO.:		REV..... CAT.....			
MANUFACTURER/ SUB-SUPPLIER				MAIN-SUPPLIER		 FOR NTPC USE			
SIGNATURE								REVIEWED BY	
						APPROVAL SEAL			

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:			
				ITEM : LT SWITCHGEAR		QP NO.:							
				SUB-SYSTEM: LT		REV.NO.:							
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMA T OF RECOR D	AGENCY			REMARKS
					M	C / N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	**	10.	11.
14	Overload relay with SPPR facility & Heavy duty starting overload relay	1) Type & Rating	Major	Visual	10% of each type & rating per lot	-	IS-3231 NTPC appd. drg & data sheet	IS-3231 NTPC appd. drg & data sheet	QC Records / Swbd TC		P	-	-
		2)Routine tests	Major	Electrical	-do-	-	Do		-		P	-	-
15	Coupling relays	1) Type & Rating	Major	Visual	10% of each type per lot		IS-3231, NTPC appd. drg & data sheet	IS-3231, NTPC appd. drg & data sheet	QC Records		P	-	-
16	MCB	1) Type & Rating	Major	Visual	-do-	-	IS-8828 & NTPC appd. drg	IS-8828 & NTPC appd. drg	QC Records		P	-	-
17	Control Transformer	1) Type & Rating	Major	Visual	100%	`	NTPC Appd drg/data sheet	NTPC appd drg/data sheet	QC Records		P	-	-
18	Insulating barriers & shrouds – (Fire retardant type)	1) Dimensions including thickness check and HV test.	Major	Electrical	5 sample of each type per lot	-	Mfr drg	2.5 KV for 1 min	QC Record		P	-	-
		2) Flame Resistance	Major	Flame Test	Sampling as per Mfr. Std.	-	IS 6746	IS 6746	-do-		P	V	V
				LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM “N” AS ‘ W”						DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER											
SIGNATURE										FOR NTPC USE		REVIEWED BY	

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT :																		
			ITEM : LT SWITCHGEAR			QP NO.:			PACKAGE :																		
			SUB-SYSTEM: LT			REV.NO.:			CONTRACT NO. :																		
						DATE:			MAIN-SUPPLIER:																		
			c) Eccentricity of insulation & ovality of core			Major		Physical		Sample		-		IEC 60840		IEC 60840		Reg/Sheet		P		-		-			
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS														
					M	C / N				M	C	N															
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.			11.													
19	Busbar Support Insulator	1) Dimension	Major	Meas.	Each setting	-	5 sample of each type per lot	5 sample of each type per lot	QC Records		P	V	V	Insulators to preferably have Batch Identification													
		2) Finish	Major	Visual	-do	-do-	No visual defects	No visual defects	QC Records		P	V	V														
		3) Comparative Tracking Index check	Major	Electrical	1 Sample per lot	-	IS 2824	IS 2824	QC Records		P	V	V														
		4) HV Test	Major	Electrical	-do-	-	BS-2782/IS-8623	2.5 KV for 1 Min	-do-		P	V	V														
		5) IR Test	Major	Electrical	Do	-	-do-	BS-2782/IS-8623	-do-		P	V	V														
		6) Flexural strength test	Critical	Mech.	Do	-	BS-2782	BS 2782	Supplier's TC		V	V	V														
20	Synthetic rubber Gasket / Neoprene rubber gasket	1) Material Type	Major	Visual	Supplier's std	Supplier's std	NTPC spec & IS 11149 / L&T's drgs	NTPC spec & IS 11149 / L&T's drgs	Supplier's Conformance Report		V	-	--	Type, Dimensions & profile of the gaskets should be same as type tested panel gaskets													

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.				 FOR NTPC USE		DOC. NO.:		REV..... CAT.....			
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER		** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS 'W'									
SIGNATURE								REVIEWED BY		APPROVED BY		APPROVAL SEAL	

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT :				
			ITEM : LT SWITCHGEAR			QP NO.:			PACKAGE :				
			SUB-SYSTEM: LT			REV.NO.:			CONTRACT NO. :				
						DATE:			MAIN-SUPPLIER:				
						PAGE: OF....							
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C / N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	**	10.	
		2) Dimensions, profile & Visual Inspection	Major	Meas.	-do-	-	L&T's drg	L&T's drg	QC Record		P	-	-
		3) Shore Hardness	Critical	Test	1 Sample per lot	-	NTPC Spec & IS 11149, L&T Drg	NTPC Spec & IS 11149, L&T Drg	Supplier's TC / QC Record		P	V	V
		4) Elongation at break & ageing	Major	Test	Mfr's std	Mfr's std	-do-	-do-	Supplier's TC		V	V	V
		5) Compression Test	Critical	Test	-do-	-	-do-	-do-	-do-		V	V	V
		6) Ozone Resistance Test	Major	Test	-do-	-	-do-	-do-	-do-		V	V	V
21	PVC wires (HR FR Grade)	Verify size, colour and HR-FR Grade	Major	Visual	1 sample of each type & rating per lot	-	IS-694		QC Records/ Mfr's Test Report		P	-	-
22	Space Heater, Thermostat, 3 pin socket, hooter	1) Dimension/ Mounting arrangement	Major	Meas	-do-	-	Purchase spec : Rated Voltage/Current/ wattage	Purchase spec : Rated Voltage/Current/ Wattage	-do-		P	-	-

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS 'W'	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		 FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:						
			ITEM : LT SWITCHGEAR			QP NO.:									
			SUB-SYSTEM: LT			REV.NO.:									
						DATE:			PAGE: OF....						
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS		
					M	C / N				M	C	N			
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.		11.		
23		2) Function Test	Major	Test	-do-	-	Mfr Std	Mfr. Std	QC Record		P	-	-		
	ACB Handling trolley	Overall dimensions & functional checks	Major	Test	1 sample of each type & rating of first lot	1 sample of each type & rating of first lot	Mfr std/drg	Mfr std/drg	QC Record		P	V	V		
	24	Terminal Block	Type & Rating	Major	Visual	5 sample of each type & rating per lot	-	NTPC Spec.	NTPC specification	QC Records		P	-	-	
	25	Paint/Powder	Make, Type & Shelf life	Major	Visual	100%	-	Mfr std	Mfr. Std	-do-		P	-	-	
	IN-PROCESS														
1.	Fabrication	1) Cutting, Punching, Shearing & Bending	Major	Meas.	Mfr. Practice	-	NTPC Approved GA Drg		QC Records		P	-	-		
		2) panel front door cut-outs punching	Major	Meas.	-do-	-	NTPC Approved GA Drg	NTPC Approved GA Drg	-do-		P	-	-		
	2	Pretreatment & Painting (powder coating)	1) Pre treatment of sheet steel (all tanks)	Major	Process	-do-	Mfr Practice	Mfr Std practice , NTPC spec., IS- 600	Mfr Std practice , NTPC spec., IS- 600	-do-		P	-	-	
			2) Paint shade	Major	Visual	1 sample per lot	-	NTPC spec. approved drgs.	NTPC Spec. approved Drg. RAL std shade	QC Records		P	V	V	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W'	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		 FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT :				
		ITEM : LT SWITCHGEAR			QP NO.:			PACKAGE :				
		SUB-SYSTEM: LT			REV.NO.:			CONTRACT NO. :				
						DATE:			MAIN-SUPPLIER:			
						PAGE: OF....						

								card					
		f) Outer sheath thickness	Major	Physical			Approved data sheet	Approved data sheet	-do-		P	W	W
		g) Hot set test for insulation	Major	Physical			IEC 60540	IEC 60540	-do-		P	W	W
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.		
3		3) Paint Thickness & Adhesion	Major	Meas. & test	Mfr practices	-	-do-		-do-		P	-	-
		4) Salt spray test	Major	Meas. & test	1 sample per year		Mfr practice	Mfr Practice	-do-		P	V	V
	Panel Assembly	1) Panel shell assembly, Top & back cover assembly, Panel door assembly, hinge fitting & door knob fitting etc.	Major	Process	100%	-	Mfr Internal Drgs made to meet NTPC Appd.Drgs.	Mfr Internal Drgs made to meet NTPC Appd. Drgs.	-do-		P	-	-
		2) Size of busbar & busbar finish	Major	Process	100%	-	-do-	-do-	-do-		P	-	-
		3) Colour coding of busbar	Major	Process	100%	-	-do-	-do-	-do-		P	-	-
		4) Insulator type & mounting	Major	Process	100%	-	-do-	-do-	-do-		P	-	-
		5) Busbar support distance & tightness of bolts for Main bus bars and bus bar joints	Major	Process	100%	-	Size KGM M8 0.85 M10 1.88 M12 3.2	Size KGM M8 0.85 M10 1.88 M12 3.2	-do-		P	-	-

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS 'W'	 FOR NTPC USE	DOC.NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : LT SWITCHGEAR			QP NO.:							
				SUB-SYSTEM: LT			REV.NO.:							
						DATE:			PAGE: OF....					
		6) Main , Control & Auxiliary Busbar Clearances	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
4		6) Main , Control & Auxiliary Busbar Clearances	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		7) Tin / silver plating / bimetallic strip /washer between Cu & Al joints	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		8) CT / PT mounting arrangement & tightness	Major	Process	100%	-	-do-	-do-	-do-		P	-	-	
		9) Termination for power & control circuits	Major	Process	100%	-	-do-	-do-	-do-		P	-	-	
		10) Lug size & crimping quality	Major	Process	100%	-	Mfr Internal Drgs made to meet NTPC Appd. Drgs.	Mfr Internal Drgs made to meet NTPC Appd. Drgs.	QC Records		P	-	-	
		11) Earthing busbar size & continuity ; earthing of panel & door	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		12) Breaker safety shutter operation	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		13) Spring loaded power & control contacts alignment	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
	Module assembly	1) Component identification	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"					 FOR NTPC USE		DOC. NO.: _____ REV..... CAT..... _____					
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER							REVIEWED BY		APPROVED BY		APPROVAL SEAL	
SIGNATURE														

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN							PROJECT :				
			ITEM : LT SWITCHGEAR			QP NO.: REV.NO.: DATE: PAGE: OF....				PACKAGE :				
			SUB-SYSTEM: LT							CONTRACT NO. :				
		2) Component layout, mounting & dimensions	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
6		3) Incoming & outgoing power & control contacts assembly & alignment	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		4) Power circuit wire / strip termination & clearances	Major	Process	100%	-	Mfr Internal Drgs/spec made to meet NTPC Appd. Drgs.	Mfr Internal Drgs /spec made to meet NTPC Appd. Drgs.	QC Records		p	-	-	
		5) Busbar joints	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
		6) Functional Checks	Major	Process	100%	-	-do-	-do-	QC Records		P	-	-	
	Control Wiring	1) Wire Size & lug size. Colour of wire	Minor	Visual	100%	-	NTPC apprd. Wiring diagram	NTPC apprd. Wiring diagram	QC Records		P	-	-	
		2) Proper wire Clamping & Ferruling	Minor	Visual	100%	-	Shop practice	Shop practice	QC Records		P	-	-	
		3) Continuity as per wiring drg	Critica l	Test	Sample	-	NTPC Appr. Drg.	NTPC Appr. Drg.	QC Records		P	-	-	
		4) Tightness of termination & crimping check	Major	Test	100%	-	Mfr. Std	Mfr. Std	QC Records		P	-	-	
	D 2	Final Inspection												
		1. Overall visual check for aesthetics, verticality of panels and alignment	Major	Visual	100%	10%	Approved GA Drgs	Approved GA Drg.	TC		P	W	W	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER					
SIGNATURE			FOR NTPC USE		REVIEWED BY	APPROVED BY

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
			ITEM : LT SWITCHGEAR			QP NO.:							
			SUB-SYSTEM: LT			REV.NO.:							
						DATE:			PAGE: OF....				
		between two transport sections											
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
		2. Verification of overall Dimensions Including sheet steel thickness	Major	Meas.	100%	1 Sample of each type of panel/lot	Approved GA	Approved GA Drg.	TC		P	W	W
		3)Busduct interface, phase sequence, flange dimensions & clearances	Major	Visual	100%	100%	NTPC appd Drg / NTPC Specification	NTPC appd Drg / NTPC Specification	TC		P	W	W
		4. Busbar (Main –horizontal) – clearances, color coding, phase sequence identification for each transport unit	Critical	Meas. & Visual	100% Transport Units	10%	NTPC Appr. Drgs / NTPC Specification	NTPC Appr. Drgs / NTPC Specification	TC		P	W	W
		5. Busbar support arrangement : centre – centre distance between supports	Major	Meas	100%	10%	NTPC accepted Type test reports	NTPC Appd Drgs/ NTPC spec.	TC		P	W	W
		6. Overlapping of busbar joints	Major	Meas.	100%	10%	NTPC appd. Drgs	NTPC appd. Drgs	TC		P	W	W
		7. Verification of tightness of busbar joints by torque wrench	Critical	Mech.	100%	10%	Size KGM M8 0.85 M10 1.88 M12 3.2	Size KGM M8 0.85 M10 1.88 M12 3.2	TC		P	W	W
		8. CT /PT fixing & mounting arrangement	Major	Visual	100%	10%	NTPC Speci	NTPC Spec.	TC		P	W	W
		LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM “N” AS ‘ W”					 FOR NTPC USE		DOC.NO.: REV..... CAT.....				
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER											
SIGNATURE									REVIEWED BY		APPROVED BY		APPROVAL SEAL

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:					
			ITEM : LT SWITCHGEAR			QP NO.:								
			SUB-SYSTEM: LT			REV.NO.:								
						DATE:			PAGE: OF....					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
		9. Check shrouding of accessible live parts , Cable supports and tool falling shroud in cable alley and application of PVC sleeves on busbars	Major	Visual	100%	Random	NTPC Spec	NTPC Spec.	TC		P	W	W	
		10. Verification of Components for make, type, rating & layout	Major	Visual	100%	10% of each type of module per lot	Makes as per LOA / Endorsement Sheet Type, rating & Layout as per NTPC approved GA / scheme drg	Makes as per LOA / Endorsement Sheet Type, rating & Layout as per NTPC approved GA / scheme drg	TC		P	W	V	
		11. Check control wiring / terminal arrangement & ferruling	Major	Visual	100%	10% Same as above	NTPC apppd drg	NTPC Appd drg	TC		P	W	W	
		12. Safety Shutters operation check	Critical	Electrical	100%	10% Same as above	NTPC Specification	NTPC specification	TC		P	W	W	
		13. Check door interlock & defeat interlock & adlocking feature	Major	Electrical	100%	10% Same as above	NTPC Specification	NTPC specification	TC		P	W	W	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS 'W'	 FOR NTPC USE	DOC.NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:				
				ITEM : LT SWITCHGEAR			QP NO.:							
				SUB-SYSTEM: LT			REV.NO.:							
						DATE:			PAGE: OF....					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
		14. Mech operation test for ACB as per IS	Critica l	Electrical	100%	10 Same as above	IS 13947	IS 13947	TC		P	W	W	
		15. Breaker operation at service , test & isolate position	Critica l	Electrical	100%	100%	IS 13947; NTPC appd drg	NTPC Spe;cification	TC		P	W	W	
		16. Power & control drawout contacts alignment check	Major	Electrical	100%	10% of each type of module per lot	NTPC Specification	NTPC Specification	TC		P	W	W	
		17. Check for Breaker antipumping & trip free feature	Major	Electrical	100%	100%	NTPC Specification	NTPC Specification	TC		P	W	W	
		18. Earthing of ACB Cradle	Major	Visual	100%	10%	NTPC Spec.	NTPC Spec.	TC		P	W	W	
		19. Interlocks & operation check: - elect. / mech - open, close: under test , service & isolation position	Critica l	Electrical	100%	10% of each type of module per lot	Approved drgs & NTPC Specification	Approved drgs & NTPC Specification	TC		P	W	W	
		21. Earth bus dimensions, earthing of drawout modules, door etc.	Major	Electrical.	100%	10% of each type of module per lot	NTPC Appd GA Drg	NTPC Appd GA Drg	TC		P	W	W	

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"		 FOR NTPC USE		DOC.NO.:		REV..... CAT.....			
MANUFACTURER/ SUB-SUPPLIER		MAIN-SUPPLIER									
SIGNATURE						REVIEWED BY		APPROVED BY		APPROVAL SEAL	

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:					
			ITEM : LT SWITCHGEAR			QP NO.:								
			SUB-SYSTEM: LT			REV.NO.:								
						DATE:			PAGE: OF....					
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
		22. Check Paint shade, thickness, Adhesion & finish	Major	Visual/Test	100% for shade & finish; 2 - 3 samples / lot for thickness & adhesion check	2 - 3 samples / board	NTPC approved drg. For shade Paint Thickness to be checked as per NTPC spec.	NTPC approved drg. For shade Paint Thickness to be checked as per NTPC spec.	TC		P	W	W	Paint adhesion check by cross hatch method using adhesive type
		23. draw in- draw out- draw-in of modules at random and check damages of fixed contacts and lyra contacts if any		Visual	Random	Random	No damages				P	W	W	
		24. Degree of protection check, check profile & fixing of gaskets	Major	Visual	2 - 5 samples at gasketed joints per board	2 - 5 samples at gasketed joints per board	NTPC approved drgs / NTPC Specification	No insertion possible from openings & gasketed joints	TC		P	W	W	Paper insertion method for IP 5X compartments & 1 mm wire insertion method for IP 4X compartments. Type, Dimensions & profile of the gaskets should be same as type tested panel gaskets

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS ' W'	 FOR NTPC USE	DOC. NO.:		REV..... CAT.....	
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER						
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

MFGR.'s LOGO		MANUFACTURER'S NAME AND ADDRESS		INDICATIVE MANUFACTURING QUALITY PLAN						PROJECT : PACKAGE : CONTRACT NO. : MAIN-SUPPLIER:						
				ITEM : LT SWITCHGEAR			QP NO.:							REV.NO.:		
				SUB-SYSTEM: LT			DATE:							PAGE: OF....		
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS		
2		25. IR Test before & after the HV Test	Major	Electrical.	100%	100%	IS-8623	IS-8623	TC		P	W	W			
		26. HV test on Power & control circuit.	Critical	Electrical	100%	100%	IS-8623	IS-8623	TC		P	W	W			
		27. Fitting of sheet steel covers at both ends of transport units	Major	Visual	100%	100%	NTPC Spec.	NTPC Spec.	TC		P	V	V	Surveillance check by Main contractor / NTPC		
	Packing	-Completeness -Sturdiness -Loose Items	Major	Visual	100%	-	Mfr. Std. Practice	Mfr. Std. Practice	QC Records		P	-	-			

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"	DOC.NO.:		REV..... CAT.....		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		 FOR NTPC USE				
SIGNATURE					REVIEWED BY	APPROVED BY	APPROVAL SEAL



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 2

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Hensel	Sriperumbudur	A	Conditions apply
				AEG	Bangalore	A	Conditions apply
				Statcon	Pilkhuwa	A	Conditions apply
				Weidmuller	Spain	A	Conditions apply
4.	Weather station panel (comprising of Pyranometer, anemometer & thermometer etc.)	III		Any make-model with VDE/ CE/UL/ CSA marking or BIS approved with CML no. (Refer Note-6)			
5.	DC Cable Connector	III		Any make-model which is Type Tested as per EN 50521 or having marking of VDE/ CE/UL/ CSA/ "BIS with CML no." (Refer Note-1)			
6.	Floor mounted Draw out type indoor LT Switchgear Panel (MCC etc.) Refer Note-5	I	Q-004	L&T	Mumbai / Coimbatore/Ahmednagar	A	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no.
				GE	Bangalore	A	
				C&S Electric	Noida / Hardwar	A	
				Schneider	Nasik	A	ACB from Schneider, France
				Unilec	Gurgaon	A	
				Siemens	Kalwa	A	Conditions apply

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 3

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Tricolite	Manesar	A	Conditions apply
7.	LV Air Circuit Breaker	*		C&S Electric	Noida	A	*(part of Swgr MQP)
				L&T	Mumbai	A	
				GE	Bangalore	A	
				Siemens	Germany	A	
				Schneider	France	A	
8.	Floor mounted Fixed type indoor LT Switchgear Panel (ACDB / DCDB / MLDB etc.) Refer Note-5	I	Q-005	Switching Circuits	Kolkata	A	BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no.
				Tricolite	Sahibabad / Manesar	A	
				Hindustan Control & equipment Ltd	kolkata	A	With fabrication & painting at unit II & MP Electrical Narendrapur
				Maktel	Vadodara	A	Prior Type Testing
				Jakson	Greater Noida	A	
				Vidyut Control	Gaziabad	A	
				Adlec Power	Rohad (Jhajjar)	A	
				Pyrotech	Udaipur	A	



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 4

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Conquerent Control System	Manesar	A	Condition apply ,upto 1250A
				Control & Schematics	Hyderabad	A	
				Positronics	Vadodara	A	
				Anand Power Ltd.	Noida	A	
				Nitya Electrocontrols	Noida	A	
				Additionally all vendors identified for Floor mounted Draw out type indoor LT Switchgear Panel			
9.	Wall mounted fixed type indoor / outdoor LT Switchgear non compartmentalized Panel (Lighting panels / AC / DC Fuse boards etc.) Refer Note-5	I	Q-006	Control Devices	Kolkata	A	BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no.
				Conquerent Control Systems	Manesar	A	
				Jasper	Noida	A	
				Havells	Faridabad	A	
				Novateur Electrical & distribution systems	Murthal	A	
				Avaid Technovator	Manesar	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 5

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Additionally all vendors identified for Floor mounted Draw out type indoor LT Switchgear Panel			
				Additionally all vendors identified for Floor mounted fixed type indoor LT Switchgear Panel			
10.	Lighting & Welding Transformer	II	Q-007	Southern Electric	Chennai	A	
				Indcoil	Thane	A	
				Pragati	Thane	A	
				Prayog	Pune	A	
				Precise	Mumbai	A	
				Logicstat	Delhi	A	
				Gujarat Plug in	Vadodara	A	
				AE	Thane	A	
				Power Pack Enterprises	Mumbai	A	
				Amex Impex,	Ahmedabad	A	
11.	LT CT/PT/CBCT/ Control Transformer	III		Kappa	Bangalore	A	
				Southern Electric	Chennai	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 6

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Precise	Mumbai	A	
				G&M	Baroda	A	CBCT Only
				Silkaans	Mumbai	A	
				Ind Coil	Mumbai	A	
				Pragati	Thane	A	
				Prayog	Pune	A	
				AE	Mumbai	A	
				Logicstat	Delhi	A	For control transformer only
				C&S Electric	Noida	A	For CT only
				Newtek	Aurangabad	A	For CT/PT/Control transformer
12.	1.1Kv LT Power Cable (From SMB to PCU)	Refer Note-2	Q-008	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar , Kolkata	A	
				Torrent Cable Ltd	Nadiad	A	
				Incab	Pune	A	
				Hindustan Vidyut Products Ltd	Faridabad	A	
				KEI Industries	Bhiwadi	A	
				Delton Cable Ltd	Faridabad	A	A) Unarmoured cable all sizes. B) Armoured cable up to 3.5 x 240 sq. Mm with GI strip armour and 1CX70 sq mm with Al strip armour



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 7

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
				Paramount Cable	Khushkhera	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				Gemscabs Industries	Bhiwadi	A	
				Cords Cables	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Sri ram Cables	Bhiwadi	A	
				Ravin Cables	Pune	A	
				Thermocables	Hyderabad	A	
				Sbee Cables	Bangalore	A	
				Suyog Cables	Vadodara	A	
				Gupta Power Cables	Khurda	A	
				Finolex	Pune	A	
				Scot Innovation wires and cables	Baddi	A	
				Anhui Hualing	China	A	
				LS Cable	Korea	A	
				Radiant Cables	Hyderabad	A	
				Tirupati Plastomatics	Jaipur	A	
				Apar Industries	Umbergao n	A	
				Special Cables	Rudrapur	A	
13.	1.1 KV Control Cable	Refer Note-2	Q-009	Universal Cable Ltd.	Satna	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 8

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

				NICCO	Shamnagar , Kolkata	A	
				Torrent Cable Ltd	Nadiad	A	
				Incab	Pune	A	
				Polycab WiresPvt. Ltd	Daman	A	
				Hindustan Vidyut Products Ltd	Faridabad	A	
				KEI Industries	Bhiwadi	A	
				Delton Cable Ltd	Faridabad	A	
				Paramount Cable	Khushkher a	A	
				Gemscabs Industries	Bhiwadi	A	
				Cords Cables	Bhiwadi	A	
				SPM Cables	Hyderabad	A	
				Elkay Telelink	Faridabad	A	
				Havells India Ltd.	Alwar	A	
				R.R. Kabel	Silvasa	A	
				Ravin Cables	Pune	A	
				Gupta Power cable	Khurda	A	
				Thermocables	Hyderabad	A	
				Finolex	Pune	A	
				Sbee Cables	Bangalore	A	
				Suyog Cables	Vadodara	A	
				Scot Innovation wires and Cables	Baddi	A	
				Anhui Hauling	China	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 9

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

				LS Cable	Korea	A	
				Radiant Cables	Hyderabad	A	
				Tirupati Plastomatics	Jaipur	A	
				Apar Industries	Umbergao n	A	
				Special Cables	Rudrapur	A	
14.	HT Cable Upto 11KV	Refer Note 2	Q-010	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar , Kolkata	A	
				Torrent Cable Ltd	Nadaid	A	
				Incab	Pune	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				KEI Industries	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Sri ram Cables	Bhiwadi	A	
				Krishna Electrical Industries Ltd	Gwalior	A	
				Apar Industries	Valsad	A	
				Finolex	Pune	A	
				KEC International	Vadodara	A	
				Tirupati Plastomatics	Jaipur	A	
				Gupta Power	Kashipur	A	
				Paramount	Khushkhera	A	



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 10

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Gemscab	Bhiwadi	A	
				Sterlite	Haridwar	A	
				Gupta Power	Kashipur	A	
15.	HT Cable upto 33KV	Refer Note 2	Q-011	Universal Cable Ltd.	Satna	A	
				Torrent Cable Ltd	Nadiad	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				KEI Industries	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Apar Industries	Valsad	A	
				Finolex	Pune	A	
				KEC International	Vadodara	A	
				Gupta Power	Kashipur	A	
				Paramount	Khushkhera	A	
				Gemscab	Bhiwadi	A	
				Sterlite	Haridwar	A	
				Gupta Power	Kashipur	A	
16.	DC Cable (Interconnecting SPV Modules, SPV Module to SMB) As per NTPC specification	I	Q-012	Siechem	Pondicherry	A	Upto 35 sq.mm.

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 11

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Apar	Khatalwada	A	Conditions apply
17.	Battery (Ni-Cd)	II	Q-013	M/S HBL-Power System	Hyderabad	A	Up to 990 Ah with conditions
				M/S Amcosoft	Bangalore	A	8Ah to 990Ah- KPH type 10Ah to 1365 Ah- KPM type 11Ah to 1550Ah – KPL type
18.	Battery Plante /Tubular	II	Q-014	M/s Exide	Kolkata	A	
				Hoppeke	Brilon, Ger many	A	
19.	Battery charger	II	Q-015	M/s Amara Raja	Tirupati	A	
				M/s HBL- Power System	Hyderabad	A	
				M/s Chhabhi electrical	Jalgaon	A	
				M/s. Chloride Power	Kolkatta	A	
				M/s Statcon	Hapur	A	Up to 220, V 850 A
				M/s Dubas	Bangalore	A	Up to 220 V, 250 A
				M/s Saft Nife Power Systems	Singapore	A	
				M/s Masstek	Jalgaon	A	
20.	Earthing & Lightning Protection Material like GI Strip/GI Wire etc	III		Main contractor Approved Sources box subject to galvanization at NTPC approved sources as per Note-4			

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 12

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
21.	HT Cable Termination Kits & Straight Through Jointing Kit (Heat shrinkable type)	III		M/s 3M Electro & Communication	Pune	A	Upto 33KV
				Raychem	Halol	A	Upto 33KV
				Hari Consolidated	Delhi	A	Upto 11KV(conditions apply)
22.	Lighting fixtures with accessories including lamp (Filament type)	II	Q-016	M/s Crompton	Mumbai	A	
				M/s Bajaj Electricals	Mumbai	A	
				M/s Philips	Noida	A	
				M/s Wipro	Mumbai	A	
				M/s Surya Roshni	Noida	A	Conditions apply
23.	Lighting fixtures with accessories including lamp (LED type)	II	Q-017	M/ s Wipro	Pune	A	Conditions apply
				M/s Surya Roshni	Noida	A	Conditions apply
				M/s Bajaj	Mumbai	A	Conditions apply
				M/s Goldwyn	Noida	A	Conditions apply
24.	MCB Boxes/Junction boxes / Link Boxes/ Test Link Box/	III		Main Contractor approved sources with galvanization from NTPC approved sources			BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no, Refer Note-6



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 13

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

	Adopter box, Switch Boxes, Pull Boxes (Hot Dip Galvanized)						
25.	Industrial /welding receptacles & boxes	III		Schneider	Nasik	A	
				M/s BCH	Faridabad	A	
				M/s Ajmera	Mumbai	A	
				M/s. Sakthi & Crown	Chennai	A	
				Any other make having CE / UL / CSA mark or BIS approval with valid CML number.			
26.	PVC conduit/hume pipe/lighting wire/GI pipes/HDPE pipe/Structural Steel/ GI steel rigid conduit/ epoxy conduit	III		BIS licensee with valid CML number / ISI marked with valid CML number			
27.	MV Switchgear Panel (Refer Note-5)	I	Q-018	BHEL	Bhopal	A	Upto 33KV
				Megawin	Salem	A	Upto 33KV
				L&T	Ahmednagar	A	Upto 33KV
				Siemens	Mumbai	A	Upto 33KV

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 14

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
				Jyoti	Vadodara	A	Upto 33KV
				ABB	Nasik	A	Upto 33KV
				Schneider	Kolkata	A	Upto 11KV -Salt lake works -VG series Interrupter made at Salt Lake Works
28.	MV Vacuum Type Circuit Breaker	(part of Swgr MQP)		Siemens	Mumbai	A	Upto 33kv
				BHEL	Bhopal	A	Upto 33kv
				L&T	Ahmednagar	A	Upto 33kv
				ABB	Nasik	A	Upto 33kv
				Megawin	Salem	A	Upto 33kv
				Jyoti	Vadodara	A	Upto 33kv
				Schneider	Kolkata	A	Upto 11kv
29.	IEC 61850 compliant Numerical Protection Relays	(Part of Swgr MQP)		SEL	Pullman, USA	A	
				ALSTOM T&D	Stafford, UK	A	P14X, P34X, P44X, P64X, P74X models only.
				ALSTOM T&D	Chennai	A	P14X, P24X, P34X, P44X, P64X, P74X models only.
				ABB	Finland	A	



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 15

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

				ABB	Baroda	A	For 6XX Series
				GE Multilin	Zamudio, Vizcaya, Spain/ Markham, Ontario, Canada	A	F-650 only
				Schneider	Stone, UK	A	PX30, PX40, VAMP 5X and VAMP 2XX models only.
				Siemens	Germany	A	7SX Series only
				Siemens	Goa	A	7SR2X series only
30.	Single Rod Air Terminal Type Solar Array Lightning Arrestor	III		Main Contractor approved sources: subject to manufacturer / supplier having valid Type Test Report as per IS 2309 or equivalent Standard			
31.	ESE Type Solar Array Lightning Arrestor	III		Main Contractor approved sources: subject to manufacturer / supplier having valid Type Test Report as per latest version of NF C 17-102 & country of origin documents			
32.	Lighting Poles	III		BIS Licensee as per IS 2713			

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 16

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

33.	Cable Lug	III		M/s Dowell	Mumbai	A	
				M/s Billets Elektro Werke Ltd. (3 D)	Umbergao n	A	
				M/s Chetna	Nasik	A	
				Additional Vendors with Make-Model having mark of VDE/ UL /CSA / BIS with CML no. Refer Note-1			
34.	Cable Gland	III		Any Make-Model having mark of VDE/ UL /CSA / BIS with CML no. Refer Note-1			
35.	GI Cable Tray, fitting, accessories including bends	Refer Note-3	Q-019	Inar Profiles Ltd	Enkapalli (Vishakhapatna m)	A	
				Vatco	Mumbai	A	Galvanization at Sigma Mumbai
				Indiana cable trays	Mumbai	A	Galvanization at Karamtara galvanizer- Mumbai
				Industrial Perforation	Kolkata	A	Galvanized and offered for inspection at M/s Industrial Perforation Pvt Ltd, Ganganagar , Kolkata, WB
				Ratan Projects	Howrah	A	Galvanization at DMP Projects- Howrah
				India Electric Syndicate	Kolkata	A	Galvanization at BMW Industries/B.P Projects- Howrah
				Steelite engg.	Mumbai	A	
				Premier Power Products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Indiana Gratings	Pune	A	
				M.J. Engineering	Okhla/ Bhiwadi	A	
				T.R.G	Chennai	A	Galvanization at TM Radhakrishna Chetty & Co-Chennai
				Amtech	Pune	A	Galvanization at B.G. Shirke - Pune



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 17

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
				Kannade Anand Udyog	Mumbai	A	Fabrication at their units: Plot No. 42, Morivali, MIDC Thane & Plot No.: D-35 Anand Nagar MIDC, Addl. Ambernath , Dist.Thane Galvanization and offer the galvanized cable trays for inspection at D-34 Anand Nagar MIDC, Addl. Ambernath, Dist.Thane.
				Rukmani	Raipur	A	Ladder type cable trays only
				Passive Infra	Hasangarh (Rohtak)	A	
				Unitech Fabricators & Engineers	Howrah/ Hoogly (Kolkata)	A	
				Patny System	Hyderabad	A	
				Rabi Engg	Kolkata	A	Galvanizing from NTPC approved sources
				MKSD Industries	Taloja	A	Galvanising at Encorp Power trans PVT Ltd, Palghar
				Reliable Sponge	Kalunga	A	
				Rukmani	Hoogly	A	Galvanization at Rukmani Fab & Gal- Howrah
36.	Cable Tray Flexible Tray Support System	Refer Note-3	Q-020	Vatco	Mumbai	A	Galvanising at Sigma Mumbai
				Inar profiles	Enkapalli	A	
				Industrial perforations	Kolkata	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 18

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Premier power products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Steelite engg.	Mumbai	A	
				Indiana gratings	Pune	A	Galvanising at Poona Galvaniser- Pune
				Amtech	Pune	A	Galvanising at B.G. Shirke- Pune
				Ratan Projects	Howrah	A	Galvanization at NTPC approved sources
				MKSD Industries	Taloja	A	Galvanising at Encorp Power trans PVT Ltd, Palghar
37.	Piping – ERW (IS 1239)	III		Main Contractor approved sources; with valid BIS license			
38.	INSTRUMENTATION CABLE	REFER NOTE- 2	Q-031	DELTON CABLES LTD	FARIDABAD	A	PVC, FRLS TYPE
				PARAMOUNT COMMUNICATION LTD	KHUSHKHERA	A	PVC, FRLS TYPE
				CORDS CABLE INDUSTRIES LTD	BHIWADI/ KAHARANI	A	PVC, FRLS TYPE
				KEI INDUSTRIES LTD	BHIWADI	A	PVC, FRLS TYPE
				POLYCAB WIRES PVT. LTD	DAMAN	A	PVC, FRLS TYPE
				THERMOCABLES	HYDERABAD	A	PVC, FRLS TYPE
				ELKAY TELELINKS	FARIDABAD	A	PVC, FRLS TYPE
				GUPTA POWER	KHURDHA	A	PVC, FRLS TYPE
				CMI	Faridabad	A	PVC, FRLS TYPE
				Universal Cables	Satna	A	PVC, FRLS TYPE



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 19

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
39.	FIRE ALARM PANEL (- MICROPROCESSOR BASED) & MANNUAL CALL POINTS	II	Q-032	NOTIFIER	USA	A	
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	
				SCHRACK	AUSTRIA	A	
				EDWARDS	USA	A	
				Shield Fire Safety	UK	A	
40.	ADDRESSABLE DETECTORS (MULTI SENSOR), INTERFACE UNITS ,HOOTER CUM STROBE & HOOTER	II	Q-033	NOTIFIER	USA/GURGAON	A	
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	
				SCHRACK	AUSTRIA	A	
				EDWARDS	USA	A	
				Shield Fire Safety	UK	A	



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 20

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
41.	FIBRE OPTIC CABLES	III		BIRLA ERICSSON OPTICAL	REWA	A	
				AKSH FIBER	BHIWADI	A	
				FINOLEX	PUNE/GOA	A	
				R&M	SWITZERLAND	A	
				HFCL	GOA	A	
				Molex	UK	A	
				Corning	USA	A	
42.	PLC BASED SCADA SYSTEM	I	Q-034	SIEMENS	NASIK	A	
				SCHNEIDER ELECTRIC	BANGALORE	A	
				ROCKWELL AUTOMATION	SAHIBABAD	A	
				ABB	BANGALORE	A	
				GE INTELLIGENT PLATFORM	BANGALORE	A	
43.	ENCLOSURE FOR PANELS	*		PYROTECH	UDAIPUR	A	*Part of PLC Based SCADA System
				PENTAIR (HOFFMAN)	BANGALORE	A	*Part of PLC Based SCADA System
				RITTAL	BANGALORE	A	*Part of PLC Based SCADA System
				MPP	Bangalore	A	*Part of PLC Based SCADA System

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 21

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
44.	UPS SYSTEM with ACDB	I	Q-036	FUJI ELECTRIC	JAPAN	A	
				Vertiv Energy (Emerson)	AMBERNATH	A	APPROVED UP TO 160 KVA, 1Φ
				HITACHI HIREL	GANDHINAGAR	A	APPROVED UP TO 160 KVA, 1Φ
				Vertiv Energy (DB Power)	PUNE	A	APPROVED UP TO 125 KVA, 1Φ
				KELTRON	TRIVENDRUM	A	APPROVED UP TO 150 KVA, 1Φ
				GUTOR	SWITZERLAND	A	
				AEG(Saft)	Germany	A	
45.	CCTV COMPONENTS IP Based (Refer Note-7)	II	Q-037	BOSCH	BANGALORE	A	1.All active main CCTV components like Camera, Server / Storage, Joystick, Video management software will be of Bosch make and to be procured from M/s. Bosch Ltd., Bangalore [Work address: Hosur Road, Adugodi, Bangalore – 560 030]. 2.Other items like workstation, keyboard, monitors, network switches, media converters, interconnecting cables will be supplied as per LOA agreed source.
				Axis	Sweden	A	1-CCTV components will be of Axis communication AB,Sweden make & Video Management Software will be of Milestone Brand. 2.To make the system complete, other indigenous items like server/OWS/PC, Network Switch, Cables etc are to be procured from NTPC approved sources which will be tied up during the finalization MQP 3. Toshniwal Industries Pvt Its (works address: industrial Estate, Makhupura, Ajmer-305002, Rajasthan, India) will

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 22

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

							do the complete integration of CCTV System and installation at site which is noted by NTPC.
				Honeywell	Gurgoan	A	CCTV active component including explosion proof camera along with VMS will be honeywell china make
46.	Fire Extinguisher	III		BIS approved sources with valid BIS License.			
47.	Circuit Breaker upto 220 Kv (SF6 & outdoor type)	I	Q-023	Siemens	Aurangabad	A	
				ABB	Vadodara	A	
				CGL	Nasik	A	
				BHEL	Hyderabad	A	
				GE	Kanchipuram	A	
48.	Isolator upto 220 kv (outdoor type)	I	Q-024	GR Power	Hyderabad	A	
				Hivelm	Chennai	A	
				S&S	Pondicherry	A	
				Switchgear & Structural	Hyderabad	A	
				Siemens Ltd	Hyderabad	A	
49.	PT (Outdoor Type, upto 33Kv)	I	Q-025	Mehru	Bhiwadi	A	
				ABB	Vadodara	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 23

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				GE	Hosur	A	
				CGL	Nasik	A	
50.	CT (Outdoor Type, upto 220 Kv Oil Filled type)	I	Q-026	Mehru	Bhiwadi	A	
				GE	Hosur	A	
				ABB	Vadodara	A	
				CGL	Nasik	A	
				BHEL	Jhansi/Bhopal	A	
				Vishal Transformer	Meerut	A	UP TO 33 KV CT ONLY
				Heptacare	Meerut	A	UP TO 33 KV CT ONLY
51.	CVT (Outdoor Type, upto 220 Kv	I	Q-027	GE	Hosur	A	
				ABB	Vadodara	A	
				CGL	Nasik	A	
				BHEL	Jhansi/Bhopal	A	
52.	LA (Outdoor Type, upto 220 Kv)	I	Q-028	Oblum	Hyderabad	A	
				Lamco	Hyderabad	A	
				Elektrolite	Jaipur	A	UP TO 33 KV ONLY.
				CGL	Nasik	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 24

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
53.	AB Tariff energy meter	II	Q-029	SEMS	Udaipur/Solan	A	Inspection with representative from Local Electricity Board.
				Elster	Mumbai	A	
				L&T	Mysore	A	With CMS software.
54.	Conductor	III		Smita	Ghaziabad	A	
				Gupta Power Infra	Bhubaneswar	A	
				Saravathy	Bangalore	A	
				Galaxy	Sangli	A	
				Hindustan Vidyut products	Faridabad	A	
				Apar Industries	Vadodara / Silvassa	A	
				Hira Cables	Hirakud	A	
				JSK	Silvasa	A	
				Cabcon	Kolkatta	A	
55.	Disc Insulator/Long Rod Insulator	III		Aditya Birla	Rishra	A	
				IEC	Bhopal	A	
				WSI	Chennai	A	
				BHEL	Bangalore	A	
				Imperial Ceramics	Bikaner	A	Upto 90KN
				Modern Insulator	Abu Road	A	
				Goldstone	Hyderabad	A	For Long Rod Insulator only

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 25

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

56.	Bus Post Insulator	III		Aditya Birla	Halol	A	
				IEC	Bhopal	A	
				WSI	Chennai	A	
				MODERN Insulator	Abu Road	A	
				SARAVANA Global Energy	Cuddalore	A	
57.	Clamps & connectors	III		KLEMMEN ENGG	CHENNAI	A	
				MILIND	MUMBAI	A	
				EMI	MUMBAI	A	
				NOOTAN ENGG	MUMBAI	A	
				TAG CORPORATION	CHENNAI	A	
				ITPL	MUMBAI	A	
				RASHTRAUDYOG	KOLKATA	A	
				PEE VEE ENGG	BANGALORE	A	
				MEGHA Engg	CHENNAI	A	
				EXALT	Mumbai	A	
58.	Insulator hardware, conductor accessories & earthwire accessories	III		RASHTRA UDYOG	KOLKATA	A	
				IAC	KOLKATA	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 26

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
				ITPL	MUMBAI	A	
				EMI	MUMBAI	A	
				EMTT	Kolkatta	A	
59.	Aluminium tube	III		HINDALCO	RENUKUT	A	
				INDALCO	ALUPURAM	A	
				CENTURY EXTRUSIONS	KOLKATA	A	
				JINDAL ALUMINUM TUBE	BANGALORE	A	
				ALOM EXTRUSIONS	KOLKATA	A	
				BALCO	KORBA	A	
				SUDAL	NASIK	A	
				Banco	Vadodara	A	
60.	Switchyard Control & Relay Panel / SAS	I	Q-030	GE (Alstom)	Chennai	A	
				Siemens	Kalwa/Goa	A	
				ABB	Peenya	A	
				Schneider	Noida	A	
				BHEL	Bhopal	A	Approved for C&R Panel only
61.	Numerical Relays for Switchyard	(part of C&R MQP)		GE	UK/Chennai	A A	
				Siemens	Germany	A	

**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 27

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				ABB	Sweden/ Bangalore	A	
62.	Transformer (Oil filled type) Refer Note-8	I	Q-021	Schneider	UK	A	
				BHEL	Bhopal	A	up to 400 kV Class
				GE (T&D)	Naini	A	up to 400 kV Class
				Toshiba	Hyderabad	A	up to 400 kV Class
				TELK	Agnamaly, Kerala	A	up to 400 kV Class
				ABB	Vadodara	A	up to 400 kV Class
				CG Power & Industrial Solutions Ltd.	Kanjur Marg	A	up to 400 kV Class
				EMCO	Thane	A	up to 400 kV Class
				BHEL	Jhansi	A	up to 220 kV Class
				Schneider	Vadodara	A	up to 50 MVA, 132 kV Class
				T&R	Ahmedabad	A	up to 16 MVA, 132 kV Class
				Kanohar	Merrut	A	up to 16 MVA, 33 kV Class
				EMCO	Jalgaon	A	up to 16 MVA, 33 kV Class
				Kirloskar	Mysore	A	up to 16 MVA, 33 kV Class
				Andrew Yule	Chennai	A	up to 10 MVA, 33 kV Class
				Tesla (unit-2)	Bhopal	A	up to 5.0 MVA, 33 kV Class
				Indotech Transformers	Chennai	A	up to 16 MVA, 11 kV Class
				PETE Hammond	Hyderabad	A	up to 10 MVA, 33 kV Class

		PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT CONT. NO. :			INDICATIVE VENDOR LIST		DOC NO. : BID DOC. NO: RECS-5734-004(R)-9 REVISION NO. 00 DATE : 09.08.2017 PAGE : 28
Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
				CG Power & Industrial Solutions Ltd.	Malanpur	A	up to 7.5 MVA, 33 kV Class
				ECE	Sonepat	A	up to 4.0 MVA, 11 kV Class
				Voltamp	Savli	A	up to 3.5 MVA, 33 kV Class
				Kirloskar	Pune	A	up to 2.0 MVA, 33 kV Class
				RAYCHEM RPG	Pune	A	Up to 5 MVA, 33 kV Class
				Esennar	Medak	A	Up to 16 MVA, 66 kV Class
				Technical Associate Ltd	Sitarganj	A	up to 16 MVA, 33 kV Class, Conditions Apply
				Prime Meiden Ltd	Nellur	A	up to 63 MVA, 132 kV Class
				KRYFS Power Components Ltd	Silvassa	A	Up to 2.5 MVA, 33 kV Class
				Sudhir Transformers	Bangalore	A	Upto 12.5 MVA, 33KV Class
63.	Dry Type Transformer (refer note-8)	I	Q-022	ABB	Savli	A	up to 8 MVA, 24 kV Class
				Raychem	Pune	A	Up to 3.5 MVA, 33 kV Class
				Toshiba	Hyderabad	A	Up to 2.0 MVA, 33 kV Class
				BHEL	Jhansi	A	Up to 6.3 MVA, 33 kV Class
				Kirloskar	Pune	A	Up to 4.0 MVA, 33 kV Class
				Voltamp	Savli	A	Up to 3.25 MVA, 33 kV Class
				PETE Hammond	Hyderabad	A	Up to 95 KVA, 33 kV Class

Under Sub Supplier approval status as per NTPC column:

A: mean that manufacturer proposed main contractor for this items is acceptable to NTPC.

CA: mean that manufacturer proposed by main contractor is acceptable to NTPC with certain conditions

		PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT CONT. NO. :			INDICATIVE VENDOR LIST		DOC NO. : BID DOC. NO: RECS-5734-004(R)-9 REVISION NO. 00 DATE : 09.08.2017 PAGE : 29
Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

DR-mean that manufacturer proposed by main contractor for the items will be assessed by NTPC. Main contractor is obliged to procure the item from “DR” category manufacturer only after written approval from NTPC

Under QP / INSPN CATEGORY column:

CAT-I : For these items the Quality Plans approved by NTPC & final acceptance will be on physical inspection & witness by NTPC

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on basis of verification of documents as per approved QP

CAT-III : For these items Main supplier approves the Quality Plans. The final acceptance by NTPC shall be on basis of certificate of conformance by the main supplier.

General Notes:

- 1) Vendor list & category of the mandatory spares shall be as mentioned above.
- 2) For item not appearing in the above list, Main Contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
- 3) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor’s approval conditions will be informed on specific request of Main Contractor.

Note-1- “TYPE TEST REPORT AS PER EN 50521” OR “VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY” OR “BIS APPROVAL LETTER” SHALL BE SUBMITTED FOR NTPC’S VERIFICATION /INFORMATION.

Note-2-

Category of inspection for Instrumentation cable/LT Cable(Power & controls) :

TOTAL CONTRACT QUANTITY PER SIZE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 1KM PER SIZE/TYPE	CAT-III AND SUBMISSION OF TC AND CERTIFICATE OF CONFORMANCE BY MAIN CONTRACTOR
TOTAL QUANTITY UPTO 2.5 KM PER SIZE/TYPE	CAT-II



**PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC
PROJECT IN GUJARAT**

**PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR
PHOTO VOLTAIC PROJECT IN GUJARAT**

CONT. NO. :

INDICATIVE VENDOR LIST

DOC NO. : BID DOC. NO: RECS-5734-004(R)-9

REVISION NO. 00

DATE : 09.08.2017

PAGE : 30

Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

TOTAL QUANTITY MORE THAN 2.5 KM PER SIZE/TYPE	CAT-I
---	-------

Category of inspection for HT cables

TOTAL CONTRACT QUANTITY PER SIZE/TYPE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 500 M	CAT-III
GREATER THAN 500 M	CAT-I

Note-3-

FOR CABLE TRAYS THE CATEGORY OF INSPECTION SHALL BE AS FOLLOWS

TOTAL CONTRACT QUANTITY PER SIZE /TYPE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 1KM	CAT-III AND SUBMISSION OF TC AND CERTIFICATE OF CONFORMANCE BY MAIN CONTRACTOR
GREATER THAN 1 KM AND LESS THAN EQUAL TO 5 KM	CAT-II
GREATER THAN 5 KM	CAT-I

FOR CABLE TRAYS SUPPORT SYSTEM:

THE CATEGORY OF INSPECTION SHALL BE AS FOLLOWS

TOTAL CONTRACT QUANTITY PER TYPE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 1KM OF SUPPORT CHANNEL	CAT-III AND SUBMISSION OF TC AND CERTIFICATE OF CONFORMANCE BY MAIN CONTRACTOR

		PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT CONT. NO. :			INDICATIVE VENDOR LIST		DOC NO. : BID DOC. NO: RECS-5734-004(R)-9 REVISION NO. 00 DATE : 09.08.2017 PAGE : 31
Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

GREATER THAN TO 1KM AND LESS THAN 5 KMS OF SUPPORT CHANNEL	CAT-II
GREATER THAN TO 5KM OF SUPPORT CHANNEL	CAT-I

TOTAL CONTRACT QUANTITY PER SIZE / TYPE	CATEGORY OF INSPECTION
LESS THAN EQUAL TO 500 NOS. OF CANTILEVER ARMS	CAT-III AND SUBMISSION OF TC AND CERTIFICATE OF CONFORMANCE BY MAIN CONTRACTOR
GREATER THAN TO 500 NOS. AND LESS THAN 2500 NOS CANTILEVER ARMS	CAT-II
GREATER THAN TO 2500 NOS. CANTILEVER ARMS	CAT-I

Note-4-

1. M/s M J Engg, Delhi 2. M/s Jamna Metal, Delhi 3. M/s A.V. Engg, Kolkata 4. M/s Inar Profiles, Vishakapatnam 5. M/s Anand Udyog, Mumbai 6. M/s Techno Engg, Chandigarh 7. M/S Steelite Engg, Mumbai	8. M/s National Galvanizer, Kolkata 9. M/s Unistar Galvanizer, Kolkata 10. M/s B.P. Project. Kolkata 11. M/s Bajaj Pune 12. M/s Electrocure Industries, Mumbai 13. M/s B.G. Shirke, Pune 14. M/s Gurpreet Galvanizer, Hyderabad	15. M/s Sigma, Mumbai 16. M/s Radhakrishnan Shetty, Chennai 17. Karamtara Mumbai 18. Poona Galvanizers Pune 19. Neha Galvanizer- Kolkata 20. Unitech Fabricators & Galvanizers- Hoogly 21. Patny Systems- Mehdak	22. Indian Gratings, Pune 23. Encorp Power trans PVT Ltd, Palghar 24. Reliable Sponge, Kalunga 25- Rukmani Fab & Gal- Howrah
---	---	--	---

		PROJECT : 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT PACKAGE : DEVELOPMENT OF 21 MW GANDHAR SOLAR PHOTO VOLTAIC PROJECT IN GUJARAT CONT. NO. :			INDICATIVE VENDOR LIST		DOC NO. : BID DOC. NO: RECS-5734-004(R)-9 REVISION NO. 00 DATE : 09.08.2017 PAGE : 32
Sl. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS

Note-5:

a. Raw material & Bought Out components for main equipment will be finalized with vendor identified by Main Contractor.

Note-6: “VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY” OR “BIS APPROVAL LETTER” SHALL BE SUBMITTED FOR NTPC’s VERIFICATION /INFORMATION.

Note-7: CCTV Components consists of Camera with motorized zoom lens, Enclosure, Pan Tilt arrangement, Matrix Switcher, Key Board with LCD, Digital Video Recorder, Monitor, Receiver Driver Unit, Code Distribution unit, Amplifier etc. shall be supplied from the principal manufacturer of CCTV and shall be identical make. Other than this item can be supplied from Indigenous local source approved by NTPC or Principal Manufacturer's approved source.

Note-8:

8.1 Raw material & bought out components for main equipment will be finalized with vendor identified by Main Contractor.

8.2 For Auxiliary Transformers (Oil Filled & Dry Type- below 1.0 MVA, 11 KV Class):

a. Main Contractor’s approved sub-vendors will also be acceptable subject to sub-vendor shall have minimum two years of supply experience for similar rating & type of transformers.

b. NTPC will review the Routine Test Inspection Report, witnessed by Main Contractor as per IS 2026/IS 1180 for Oil Filled Transformer and as per IS 11171 for Dry type Transformer

NTPC APPROVED VENDOR LIST-2

SI No	Equipment	Make	Make	Make	Make
1	Auxiliary Transformer	Kalpa Electricals	Icon Engineers	Toshibha	
2	LT Cable	Havells	Polycab	KEC	Special
3	LT Switchgear	Pyrotech Electronics			
4	UPS	Fuji Electric			
5	Lightining protection	Alleid Power Solutions			



ಭಾರತ್ ಹವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್ भारत हेवी इलेक्ट्रिकल्स लिमिटेड



Bharat Heavy Electricals Limited

(A Government of India Undertaking)

ELECTRONICS DIVISION

P. B. No. 2606, Mysore Road, Bengaluru - 560 026

SCPV: BOS: ITB-Rev 05

INSTRUCTIONS TO BIDDERS

Bidder is requested to read the instructions carefully and submit their quotation taking into consideration of all the points:

A. GENERAL INSTRUCTIONS:

1. Any Purchase Order resulting from this enquiry shall be governed by the Instructions to Bidders (document reference: SCPV:BOS:ITB-Rev 05), General Conditions of Contract (document reference: SCPV: BOS: GCC-Rev 04) and Special Conditions of Contract, if any, of the enquiry.
2. Any deviations from or additions to the "General Conditions of Contract" or "Special Conditions of Contract" require BHEL's express written consent. ***The general terms of business or sale of the Bidder shall not apply to this tender.***
3. Bidders (Also includes Term Suppliers / Contractors, wherever used in this document) are instructed to Quote their most competitive price and best delivery etc. in the Offer. Prices should be indicated in both figures & words (Please also refer Section-12, under Section-B).
4. Regret letter (either through post or by mail or by EPS) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender. Supplier shall be liable for removal as a registered vendor of BHEL when the supplier fails to quote against four consecutive tender enquiries for the same item or all enquiries in last two years for the same item, whichever is earlier.
5. Procurement directly from the manufacturers is preferred. However, if the OEM/ Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer/ supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer/ supplier or the manufacturer/ supplier could bid directly but not both. Agent/Representative authorized by the OEM/Principal in turn cannot further sub authorize any other firm for submitting the offer or for placement of order.

In case bids are received from the manufacturer/ supplier and his agent, bid received from the agent shall be ignored.

6. Consultant / firm (and any of its affiliates) shall not be eligible to participate in the tender/s for the related goods for the same project if they were engaged for consultancy services for the same project.
7. If an Indian representative/associate/liaison office quotes on behalf of a foreign based

bidder, such representative shall furnish the following documents:

- (a) Authorization letter to quote and negotiate on behalf of such foreign-based bidder. (Annexure- AF)
- (b) Undertaking from such foreign based bidder that such contract will be honored and executed according to agreed scope of supply and commercial terms and conditions.
- (c) Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages/damages/replacement/repair of imported scope till the Equipment/ System is commissioned and handed over to customer will be the sole responsibility of the Indian representative/associates/agent/liaison office.
- (d) Refer **Annexure I** on “Guidelines for Indian Agents”.
- (e) In case, The Principal manufacturer decides not to quote directly to BHEL and authorized his representative to quote, the format attached as per annexure duly signed and sealed by authorized signatory and the same shall be attached along with offer.

8. (A) In case it is specified in the SCC as the terms of delivery DDP (delivery duty paid) , FOR destination to site, door delivery at site which means material cost, insurance, customs duty, safe guard duty (SGD) or any other taxes, duties, levies etc air freight sea freight customs handling charges inland transport from port to destination to vendor account.

(B) In case of imported scope of supply, (Not Covered in clause 8 A) customs clearance & customs duty payment will be to BHEL account after the consignment is received at Indian Airport /Seaport. Bidders must provide all original documents required for completing the customs clearance along with the shipment. Warehousing charges due to incomplete or missing documentation will be to supplier's account. All offers for imported scope of supply by air, must be made from any of the gateway ports (within the country) indicated (Refer Annexure II).

9. The offers of the bidders who are on the banned list and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of the banned firms is available on BHEL website: http://www.bhel.com/vender_registration/vender.php
10. Business dealings with bidders will be suspended if they are found to have indulged in any malpractices/misconduct which are contrary to business ethics like bribery, corruption, fraud, pilferage, cartel formation, submission of fake/false/forged documents, certificates, information to BHEL or if they tamper with tendering procedure affecting the ordering process or fail to execute a contract, or rejection of 3 consecutive supplies or if their firms / works are under strike/lockout for a long period. Bidder may refer “Guidelines for Suspension of Business Dealings with Suppliers/ Contractors” available on www.bhel.com for more details.
11. The bidder along with its associate/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention

Policy displayed on BHEL website <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to your notice.

12. Offers to be submitted in English Language only.
13. For this procurement, the local content to categorize a supplier as a Class-I local supplier/ Class-II local supplier/ Non-local supplier and purchase preference to Class-I local supplier, is as defined in Public procurement (Preference to Make in India), Order 2017 dated **16.09.2020** issued by DPIIT. In case of subsequent Orders issued by the Nodal Ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT, but before opening of price bid/s against this NIT.

Any Indian Bidder intending to avail the benefits shall submit the requisite documents as per the aforesaid orders. The self declaration for Make in India or CA certificate for Make in India as per Annexure S/CA to be attached with the offer.

14. The Bidder shall mandatorily submit Declaration as mentioned below, under Rule 144(xi) of General Financial Rules, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India. The declaration to be submitted on Company Letter head duly signed and sealed by authorised signatory, for ascertaining the eligibility of offer in the tender.

“I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered.”

(Where applicable, evidence of valid registration by the Competent Authority shall be attached).

The Competent Authority for the purpose of registration under this Order shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT).

Refer Annexure-X for ‘Restrictions under Rule 144(Xi) of General Financial Rules, 2017 amendment dt: 23.07.2020’.

B. GUIDELINES FOR PREPARATION OF OFFER:

1. Quotation shall be submitted in Single Part Bid, Two Part Bid or Three Part Bid, as called for in the tender:
 - **SINGLE PART BID:** Technical and Commercial Bid with prices along with price summary & filled in BHEL Standard Commercial terms and conditions in a single sealed envelope.
 - **TWO PART BID:** Unpriced offer i.e. “Techno-commercial Bid” with filled in BHEL Standard Commercial terms and conditions in a sealed envelope **along with the copy of the “Price Bid” without the prices** should be enclosed in one cover and the cover must be super scribed **“Techno-commercial offer)** and Priced offer i.e.

“Price Bid” containing price summary in a separate sealed envelope and must be superscribed **“Price Bid”**. Both these envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

- **THREE PART BID:** Pre-qualification Bid (Part-I), Techno Commercial Bid with filled in BHEL Standard Commercial terms and conditions (Part-II), and Price Bid (Part-III). All three envelopes shall be enclosed in a single sealed envelope superscribed with enquiry number, due date of tender and any other details as called for in the tender document.

If any of the offers (Part I, Part II or Part III) are not submitted before the due date and time of submission (or) if any part of the offer is incomplete, the entire offer of the bidder will be rejected.

2. Supplier shall ensure to superscribe each envelope with RFQ number, RFQ Date, RFQ Due date and time, Item Description and Project clearly & boldly. Also mention on the envelope whether it is “Techno Commercial Bid” or “Price Bid” or “Pre-Qualification Bid”. Please ensure complete address, department name and purchase executive name is mentioned on the envelope (before dropping in the tender box or handing over) so that the tender is available in time for bid opening.
3. BHEL standard Commercial Terms and Conditions (duly filled, signed & stamped) must accompany Technical-Commercial offer without fail and should be submitted in original only.

The above indicated submission of Offers in “sealed envelope/hard copy” as mentioned in points B.1-B.3 is applicable for tenders that are not floated through E-Procurement System (EPS).

4. Validity: Unless otherwise specified in SCC (special commercial conditions of contract), the offer will be valid for a period of 90 days from the date of part-I bid opening and in case of Negotiation/Counter-offer/Reverse Auction, price validity will apply afresh for a period of 60 days from the date of according final price by bidder (or) upto original validity period, whichever is later.
5. Any of the terms and conditions not acceptable to supplier, shall be explicitly mentioned in the Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if all terms and conditions of this enquiry are accepted by the supplier without deviation.
6. Deviation to this specification/item description, if any, shall be brought out clearly indicating “DEVIATION TO BHEL SPECIFICATION” without fail, as a part of Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if the entire specification of this enquiry is accepted without deviation.
7. Suppliers shall submit one set of original catalogue, datasheets, bill of materials,

dimensional drawings, mounting details and/or any other relevant documents called in purchase specification as part of Technical Bid. Approximate Packing dimension to be indicated in offer_(L)_ft x_(B)___ft x_(H)_ft, in case of ODC Load. Consignment beyond the dimension_(L)40_ft x_(B)8_ft x_(H)8_ft to be indicated in Offer.

8. "Price Bid" shall be complete in all respects containing price break-up of all components along with all applicable taxes and duties, Packing and forwarding charges, freight charges (if applicable) etc. Once submitted, **NO** modification / addition / deletion will be allowed in the "Price Bid." Bidders are advised to thoroughly check the unit price, total price to avoid any discrepancy.
9. In addition, bidder shall also quote for erection & commissioning charges/erection supervision & commissioning charges (E&C service charges), documentation charges, testing Charges (type & routine), training charges etc. as applicable along with corresponding tax. The price summary must indicate all the elements clearly.
10. Wherever applicable, bidders should indicate "Lumpsum" Erection and Commissioning (or) Erection Supervision and Commissioning charges, as applicable (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for carrying out E&C activity and further handing over to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist (if any).
11. Wherever bidders require PAC (Project Authority Certificate)/applicable certificates for import of raw materials, components required for MNRE, DECC, EPCG Power Projects, Export Projects or other similar projects wherein supplies are eligible for customs duty benefits, lists and quantities of such items and their values (CIF) has to be mentioned in the offer. Prices must be quoted taking into account of such benefits.
12. Prices should be indicated in both figures & words. Bid should be free from correction/overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid will be rejected. Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure III** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid" and BHEL decision will be final.
13. Documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder. However, scanned copy to be attached in E-Procurement System (EPS).

C. GUIDELINES FOR OFFER SUBMISSION:

The under-mentioned clauses 1, 2 & 3 will not be applicable for EPS tenders.

1. Offers / Quotations must be dropped in tender box before 13.00 Hrs. on or before due date mentioned in RFQ. The offers are to be dropped in the proper slot of the Tender Box kept in our reception area with caption "CE, SC&PV, DEFENCE". Tenders

are opened on 3 days in a week (Monday/Wednesday/Friday). Tender must be deposited in the slot corresponding to the day (Monday - Box no.4/Wednesday - Box no. 6 /Friday - Box no.8) while depositing the offer.

2. E-Mail/ Internet/EDI offers received in time shall be considered only when such offers are complete in all respects. In case of offers received through E-mail, please send the offer to the email ID specified in the SCC document of the tender.
3. Offers of Vendors who already have a valid Technical/Commercial MOU with BHEL-EDN for the items of the RFQ shall mention the relevant MOU reference no. and give only such other details not covered in the MOU.
4. In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand or through posts/couriers, the offers are to be handed over either of the two purchase officers whose names are mentioned in the SCC document of tender RFQ.
5. Tenders will be opened on due date, time and venue as indicated in the RFQ in the presence of bidders at the venue indicated in the RFQ. For EPS tenders, e-mail notifications will be automatically generated and forwarded to registered e-mail ID/s of bidders during opening of tenders.
6. Bidder will be solely responsible:
 - (a) For submission of offers before due date and time. Offers submitted after due date and time will be treated as "Late offers" and will be rejected.
 - (b) For submission of offers in the correct compartment of the tender box based on the day of due date (Monday/Wednesday/Friday). Please check before dropping your offer in the correct tender box.
 - (c) For depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong tender box (or) if the tender document is handed over to the wrong person, BHEL will not be responsible for any such delays.
 - (d) For offers received through email etc., suppliers are fully responsible for lack of secrecy on information and ensuring timely receipt of such offers in the tender box before due date & time (This clause will not be applicable for EPS tenders).

The above indicated submission of Offers as mentioned in points 6(a) to 6(d) is applicable for tenders that are not floated through EPS.

- (e) In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, system/software requirements etc. will be the sole responsibility of the bidder. Wherever assistance is needed for submission of e-tenders, help-line numbers as available in the web-site of service provider of BHEL may be contacted.

Purchase Executive/ BHEL shall not be responsible for any of the activities relating to submission of offer.

D. PROCESSING OF OFFERS RECEIVED:

1. Any discount/ revised offer submitted by the supplier on its own shall be accepted provided it is received on or before the due date and time of offer submission (i.e.

Part-I bid). The discount shall be applied on pro-rata basis to all items unless specified otherwise by the bidder.

2. Changes in offers or Revised offers given after Part-I bid opening shall not be considered as a part of the original offer unless such changes/revisions are requested by BHEL. In case of withdrawal of any Technical/Commercial deviation(s) by the bidder before opening of price bids/conducting the Reverse Auction, revision of price/impact bid will not be accepted.
3. In case there is no change in the technical scope and/ or specifications and/ or commercial terms & conditions, the supplier will not be allowed to change any of their bids after Technical bids are opened (after the due date and time of tender opening).
4. In case of changes in scope and/ or technical specifications and/ or commercial terms & conditions by BHEL and it accounts for price implications from bidders, all techno-commercially acceptable bidders shall be asked by BHEL (after freezing the scope, technical specifications and commercial terms & conditions) to submit the impact of such changes on their price bid. Impact price will be applicable only for changes in technical specification / commercial conditions by BHEL. The impact price must be submitted on or before the cut-off date specified by BHEL and the original price bid and the price impact bid will be opened together at the time of price bid opening. Impact price means only for those which have been impacted by addition/deletion/changes in the technical specification or commercial conditions. The impact may be +/- incremental value of the currency in which originally quoted.
5. Un-opened bids (including price bids) will be returned to the respective bidders after release of Purchase order and order acknowledgement. Regarding Offers for EPS tenders that get rejected on PQC/ techno-commercial grounds, the bids for the subsequent parts will not be opened i.e., both technical bid and price bid (Parts-II & III) will not be opened in case of rejection on PQC ground and price bid (Part-II/Part-III, as applicable) will not be opened in case of rejection on techno-commercial ground.
6. After receipt of Purchase Order, supplier should submit required documents viz., specified drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report, O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.
7. Any deviation to the terms and conditions not mentioned in the quotation by supplier in response to this enquiry will not be considered, if put forth subsequently or after issue of Purchase Order, unless clarification is sought for by BHEL and agreed upon in the Purchase Order.
8. Evaluation shall be on the basis of delivered cost (i.e. "Total Cost to BHEL"), as per RFQ terms.
"Total Cost to BHEL" shall include total basic cost, packing & forwarding charges, taxes and/or duties (as applicable), freight charges, taxes on Services, customs clearance charges for imported items, any other cost indicated by bidder for

execution of the contract and loading factors (for non-compliance to BHEL Standard Commercial Terms & Conditions). Benefits arising out of Nil Import Duty on DEEC, EPCG, MNRE projects, DFIA Projects, Physical Exports or such 100% exemptions (statutory benefits), project imports, customer reimbursements of statutory duties (like Basic Customs Duty and cess on customs duty), Input tax credits as applicable will also be taken into account for arriving at the Total cost to BHEL (wherever applicable and as indicated in SCC document of tender).

For EPS tenders, it shall be noted that the prices (including discounts) vis-a-vis currency quoted in EPS portal only will be considered as Final for the purpose of evaluation of the lowest bidder. Bidder shall ensure to indicate the applicable taxes against each line item in online portal, failing to which the same will be considered as inclusive/NIL.

In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders. In case more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by a toss/draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s). Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.

9. For evaluation of offers in foreign currency, the exchange rate (TT selling rate of SBI) shall be taken as under:

Single part bids	:	Date of tender opening
Two/three part bids	:	Date of Part-I bid opening
Reverse Auction	:	Date of Part-I bid opening

In case of Performance Bank Guarantee (PBG) also, exchange rate will be considered as mentioned above for converting foreign currency to Indian currency and vice versa.

If the relevant day happens to be a bank holiday, then the exchange rate as on the previous working day of the bank (SBI) shall be taken.

10. Ranking (L-1, L-2 etc.) shall be done only for the techno-commercially acceptable offers and on basis of Evaluation of Total Cost to BHEL.

E. INFORMATION ON PAYMENT TERMS:

1. All payments will be through Electronic Fund transfer (EFT). Vendor has to furnish necessary details as per BHEL standard format (**Refer Annexure IV**) for receiving all payments through NEFT. (Applicable for Indian vendors only).
2. In case of High Sea Sales transaction, customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors. All warehousing charges due to delay in submission of complete and or correct HSS documents to BHEL will be to supplier's account only. Such recovery will be made out of any of the available bills (**Refer Annexure V**).
3. Statutory deductions, if any, will be made and the deduction certificate shall be

issued.

A. In case vendor does not provide PAN details, the TDS deduction shall be at the maximum percentage stipulated as per the provisions of Income Tax Act.

In addition to the above, Foreign vendors shall also submit relevant details of their bankers like Swift Code, Banker's Name & Address etc.

B. TDS deduction as per section 51 of CGST Act, 2017 shall be applicable as per Gazette Notification No. 50/2018-Central Tax, Dated: 13th September 2018 and subsequent notification/s, as and when released by Govt. authorities.

4. Incomplete documentation will not be accepted. Delayed submission of invoice / documents may result in corresponding delay in payment. In this connection, request to also refer clause: G about invoicing & payment formalities under GST regime. Applicable documents shall be submitted to the purchaser at the time of execution of supplies/services for availing GST input credits.

F. STANDARD PAYMENT TERMS OF BHEL-EDN:

<u>PURCHASE ORDERS FOR:</u>	<u>SUPPLY WITH SERVICE(S)</u>	<u>SUPPLY ONLY</u>
<u>INDIGENOUS PROCUREMENT</u>	a. 80% of basic supply value+100% taxes and freight charges will be paid with 45 days credit from the receipt of material at site or 15 days credit from the date of submission of complete set of documentation whichever is later. b. 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice with proof of completion of I&C along with I&C charges (if Any) c. Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+ 3 months claim period from BHEL Consortium Bank d.I&C/Supervision: 100% on completion of I&C/Supervision and certification line item wise on prorata basis with 15 days credit from the date of submission of complete set of documentation e.O&M: 100% O&M Charges are payable as per RFQ terms against report certified by BHEL with 15 days credit from the date of submission of complete set of documentation	f. 100% of PO value with taxes and freight will be paid in 45 days from the date of dispatch or 15 days from the date of submission of complete set of documentation, whichever is later+ submission of PBG valid for warranty period +3 months claim period from BHEL consortium bank if applicable.

	<u>Note:</u> In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	
<u>IMPORT PROCUREMENT</u>	g. 80% of basic supply value(excluding I&C charges) will be paid will be paid with 45 days credit against sight draft from the date of AWB/BOL on submission of complete set of documents as n PO. h. 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice with proof of completion of I&C along with I&C charges (if Any) i. Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+ 3 months clam period from BHEL Consortium Bank <u>Note:</u> In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	j. 100% of PO value will be paid against sight draft with 45 days credit from the date of dispatch or 15 days credit from the date of submission of complete set of documents whichever is later + submission of PBG valid for Warranty period + 3months claim period from BHEL consortium bank if applicable.
<u>HIGH-SEA SALES PROCUREMENT</u>	k. 100% of basic value will be paid in 45 days from the date of signing of High Sea Sale agreement or 15 days from the date of submission of complete set of documentation, whichever is later <u>Note:</u> In case PBG is not furnished, only 90% payment will be released against 100% claim without the consent of Vendor. This 10% basic amount withheld towards PBG will be paid either against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after expiry of Warranty period.	l. 100% of basic value will be paid in 45 days from the date of signing of High Sea Sale agreement or 15 days from the date of submission of complete set of documentation, whichever is later.

1. Erection and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E&C charges should not be less than 10% of the main supply value. In case the quoted total E&C value is less than 10% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E&C charges.

Payment term: 100% E&C charges along with tax as applicable, will be paid in 15 days credit from the date of submission of supplementary invoice/documents against proof of completion of E&C.

2. Erection Supervision and Commissioning:

Evaluation methodology: Unless and otherwise specified in SCC, E&C charges should not be less than 5% of the main supply value. In case the quoted total E&C value is less than 5% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards E&C charges.

Payment term: 100% E&C charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of E&C.

3. Comprehensive Annual Maintenance Contract:

Evaluation methodology: Unless and otherwise specified in SCC, CAMC will be applicable for a period of 04 years from the date of expiry of warranty period (or) from the date of completion of commissioning of equipment, whichever is later and the total CAMC value should not be less than 20% of the main supply value. In case the quoted total CAMC value is less than 20% of the main supply value, BHEL shall evaluate Bidders Price deducting differential amount from main supply price proportionally from all items and apportioning towards CAMC charges.

Payment terms: 100% CAMC charges along with tax as applicable, will be paid in 15 days from the date of submission of supplementary invoice/documents against proof of completion of CAMC on quarterly basis.

4. Terms of Payment for Training: 100% payment will be made in 45 days from the date of completion of Training or 15 days from the date of submission of complete set of invoice along with documentary evidence, whichever is later.**LOADING FACTORS FOR DEVIATION IN PAYMENT TERMS (APPLICABLE FOR IMPORT PROCUREMENT ONLY):**

- (i) For offers received with Sight draft payment term in place of Usance draft, loading applicable will be 1.0% of basic value.
- (ii) For offers received with Letter of Credit payment term with Usance of 45 days, loading applicable will be 2.5% of basic value.

Additional loading of 2% will be applicable for payment term as Letter of Credit at Sight.

5. Any payment term with credit period of less than 45 days for indigenous supply/HSS and any other variation of payment terms are liable for rejection.
6. Standard payment terms indicated in Clauses: **F (a), (b), (c), (d), (e), (f), (g), (h), (i) & (j) ,(k),(l) will not attract any loading.**

Note 1: Basic value of Purchase Order mentioned above will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C and AMC charges (wherever applicable). Wherever the Purchase Order is split into import portion and indigenous portion of supply, minimum % to be quoted for Services, wherever mentioned, will be of both purchase order values put together.

Note 2: In case of multiple packages/units in a power plant, payment of E&C charges will be processed on pro-rata basis.

Note 3: No deviation will be permitted from the duration of Guarantee/Warranty and/or Comprehensive Annual Maintenance Contract period specified in SCC.

G. Terms & Conditions to be complied under GST regime:

1. All invoices to contain BHEL-EDN (buyer) GSTIN number: 29AAACB4146P1ZB. However, for CGST +SGST/UGST billing outside the state of Karnataka, invoice has to be generated with BHEL's Nodal Agency GSTIN number. Address of Nodal Agency along with GSTIN number will be provided by BHEL at the time of issuing dispatch clearance.
2. The Bidder shall mention Bidder's GSTIN number in all quotations and Invoices submitted.
3. The Bidder shall also mention HSN (Harmonized System of Nomenclature) / SAC (Services Accounting Code) mandatorily in all quotations and invoices submitted.
4. Invoice submitted should be in the format as specified under GST Laws viz., all details as mentioned in Invoice Rules like GST registration number(GSTIN), invoice number with date of issue, quantity, rate, value, taxes with nomenclature – CGST, SGST, UGST, IGST mentioned separately, HSN Code / SAC Code etc. Invoice should be submitted in original for buyer plus duplicate for credit availment.
5. Payment of GST to Vendor will be made only if it is matching with data uploaded by the Vendor in GST portal.
6. For invoices paid on Reverse charge basis – “Tax payable on reverse charge basis” to be mentioned on the invoice.
7. In case GST credit is delayed/denied to BHEL due to non/delayed receipt of goods and/or tax invoice or expiry of timeline prescribed in GST law for availing such ITC, or any other reasons not attributable to BHEL, GST amount will be recoverable from vendor along with interest levied/ leviable on BHEL.
8. In case vendor delays declaring such invoice in his return and GST credit availed by BHEL is denied or reversed subsequently as per GST law, GST amount paid by BHEL

towards such ITC reversal as per GST law will be recoverable from vendor/contractor along with interest levied/leviable on BHEL.

9. Vendor should intimate BHEL immediately on the same date of invoicing without any delay.
10. In case of discrepancy in the data uploaded by supplier in the GSTN portal or in case of any shortages or rejection in the supply, then BHEL will not be able to avail the tax credit and will notify the supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the supplies, within the calendar month notified by BHEL.
11. Bidders to note that Rules & Regulations pertaining to E-way bill system are to be strictly adhered to, as and when notified by Govt. authorities.

H. Performance bank guarantee (PBG):

Performance bank guarantee (PBG) will be applicable as called in the tender documents. Unless otherwise specified in the SCC, the PBG against performance of the contract shall be valid for a period of 24 months from the date of dispatch of goods + claim period of 03 months, for a value equal to 10 % of the basic value of the purchase order which will include all components of the purchase order and will exclude only taxes, duties, freight, training charges, E&C and AMC charges (wherever applicable).

1. The BG issued in Indian Rupees by Banks in India is to be executed on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Bank issuing the guarantee.
2. No deviation for the duration and value of PBG will be permitted.
3. PBG shall be from any of the BHEL consortium of bankers (**refer Annexure VI**).
4. PBGs from nationalized banks are also acceptable.
5. PBG should be sent directly by the bank to the dealing executive mentioned in the purchase order located at the address mentioned in the purchase order.
6. PBG should be in the format specified (**refer Annexure VII**). No deviation to this format will be allowed. However, in case BHEL changes the PBG format, bidder shall honor the same.
7. Bank Guarantee should be enforceable in Bangalore.
8. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in Bangalore.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)

b.1 Please note that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favor of the Indian Bank's (BHEL's Consortium Bank) branch in India. It shall be noted that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor.

b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 is required to be followed.

b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

9. Expired PBGs will be returned only after expiry of the claim period.

10. PBG shall not be applicable for spares.

I. PROVISIONS APPLICABLE FOR MSE VENDORS (MICRO AND SMALL ENTERPRISES) :

Benefits/facilities as applicable for Micro and Small Enterprises (MSEs) shall be available to MSEs registered with Government designated authorities as per the Purchase & Price Preference Policy of the Government subject to them becoming eligible otherwise.

Vendors who qualify as MSE vendors are requested to submit applicable certificates (as specified by the Ministry of Micro, Small and Medium Enterprises) at the time of vendor registration. Vendors have to submit the Udyog Aadhaar Memorandum (UAM) /UDYAM Registration certificate along with attested copy of a CA certificate (Annexure VIII) applicable for the relevant financial year (latest audited) along with the tender documents in the Part-I bid to avail the applicable benefits.

Date to be reckoned for determining the deemed validity will be the date of bid opening (Part-I in case of two-part bid and three-part bid).

Documents have to be notarized/attested by a Gazetted officer and must be valid as on the date of part I bid opening for the vendors to be eligible for the benefits applicable for MSE vendors. Please note that no benefit shall be applicable if any deficiency in the above required documents are not submitted before the price bid opening/Reverse Auction. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal.

Bidders to however note the documents that shall be furnished in order to establish credentials as MSE vendor should be as per the extant statutory requirements specified by the Ministry of Micro, Small and Medium Enterprises.

PURCHASE PREFERENCE FOR MSE VENDORS:

MSE vendors quoting within a price band of L1 + 15% shall be allowed to supply up to 25% of the requirement against this tender provided

1. The MSE vendor matches the L1 price.
2. L1 price is from a non MSE vendor.
3. L1 price will be offered to the vendor nearest to L1 in terms of price ranking (L2 - nearest to L1). In case of non-acceptance by the MSE vendor (L2), next ranking

MSE vendor will be offered who is within the L1 + 15% band (if L3 is also within 15% band).

4. 3% of the 25% will be earmarked for women owned MSEs.
5. 25% of the 25% (i.e., 6.25% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms provided conditions as mentioned in (1) & (2) are fulfilled.
6. In case where no SC/ST category firms are meeting the conditions mentioned in (1) and (2) or have not participated in the tender, the 6.25% of earmarked quantity for SC/ST owned MSE firms will be distributed among the other eligible MSE vendors who have participated in the tender.
7. In case after the bid opening it is seen that no MSE has become L1, then depending on the nature of the item, if it is not possible to split the tendered items/quantities on account of reasons like customer contract requirements of supplying one make for a given project or technical reasons like the tendered item being a system etc., then BHEL would not counter offer the L1 prices even though there may be MSE bidders within the +15% band of L1. Such information that tendered quantity will not be split shall be indicated in the SCC.

J. INTEGRITY COMMITMENT IN THE TENDER PROCESS, AND EXECUTION OF CONTRACTS:

1. Commitment by BHEL: BHEL commits to take all measures necessary to prevent corruption in connection with the Tender process and execution of the Contract. BHEL will, during the tender process, treat all bidder / suppliers in a transparent and fair manner, and with equity.
2. Commitment by Bidder(s)/ Contractor(s):
 - a. The Bidder(s)/ Contractor(s) commit(s) to take all measures to prevent corruption and will not directly or indirectly try to influence any decision or benefit which he is not legally entitled to.
 - b. The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding or any actions to restrict competition.
 - c. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant Acts. The Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain or pass on to others, any information or document provided by BHEL as part of business relationship.
 - d. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to the relevant guidelines issued from time to time by Government of India/ BHEL.

If the Bidder(s) / Contractor(s), before award or during execution of the Contract commit(s) a transgression of the above or in any other manner such as to put his reliability or credibility in question, BHEL is entitled to disqualify the Bidder(s) / Contractor (s) from the tender process or terminate the contract and/ or take suitable action as deemed fit.

K. Integrity Pact (IP):

- a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner.

A panel of independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL.

The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory who signs in the offer) along with techno-commercial bid. Only those Bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

- b) Please refer Section-8 of the IP for Role and Responsibilities of IEMs (Annexure IX). In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

Note: No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department.”

L. Fraud prevention policy:

The Bidder along with its associates/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL Website <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice. Fraud prevention policy and List of Nodal Officers shall be hosted on BHEL website, vendor portal of Units/Region intranet.

Annexure

Annexure I
Guidelines for Indian Agents

- **Definition of Indian Agent:** An Indian Agent of foreign principal is an individual, a partnership, an association of persons, a private or public company, that carries out specific obligation(s) towards processing of BHEL tender or finalization or execution of BHEL's contract on behalf of the foreign supplier.

In case of yes, vendor to note the following and reply accordingly:

- i. BHEL shall deal directly with foreign vendors, wherever required, for procurement of goods. However, if the foreign principal desires to avail of the services of an Indian agent, then the foreign principal should ensure compliance to regulatory guidelines - which require mandatory submission of an Agency Agreement.
- ii. It shall be incumbent on the Indian agent and the foreign principal to adhere to the relevant guidelines of Government of India, issued from time to time.
- iii. The Agency Agreement should specify the precise relationship between the foreign OEM / foreign principal and their Indian agent and their mutual interest in the business. All services to be rendered by agent/ associate, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier/ Indian agent. Any payment, which the agent or associate receives in India or abroad from the OEM, whether as commission or as a general retainer fee should be brought on record in the Agreement and be made explicit in order to ensure compliance to laws of the country.
- iv. Any agency commission to be paid by BHEL to the Indian agent shall be in Indian currency only.
- v. Tax deduction at source is applicable to the agency commission paid to the Indian agent as per the prevailing rules.
- vi. In the absence of any agency agreement, BHEL shall not deal with any Indian agent (authorized representatives / associate / consultant, or by whatever name called) and shall deal directly with the foreign principal only for all correspondence and business purposes.
- vii. The "Guidelines for Indian Agents of Foreign Suppliers" enclosed at annexure - 'A' shall apply in all such cases.

- viii. The supply and execution of the Purchase Order (including indigenous supplies/ service) shall be in the scope of the OEM/ foreign principal. The OEM/ foreign principal should submit their offer inclusive of all indigenous supplies/ services and evaluation will be based on 'total cost to BHEL'. In case OEM/ foreign principal recommends placement of order(s) towards indigenous portion of supplies/ services on Indian supplier(s)/ agent on their behalf, the credentials/ capacity/ capability of the Indian supplier(s)/ agent to make the supplies/ services shall be checked by BHEL as per the extant guidelines of Supplier Evaluation, Approval & Review Procedure (SEARP), before opening of price bids. In this regard, details may be checked as per Annexure-B (copy enclosed). It will be the responsibility of the OEM/ foreign principal to get acquainted with the evaluation requirements of Indian supplier/ agent as per SEARP available on www.bhel.com.

The responsibility for successful execution of the contract (including indigenous supplies/ services) lies with the OEM/ foreign principal. All bank guarantees to this effect shall be in the scope of the OEM/ foreign principal.

—X—

Vendor's Signature with Seal

Guidelines for Indian Agents of Foreign Suppliers

- 1.0 There shall be compulsory registration of agents for all Global (Open) Tender and Limited Tender. An agent who is not registered with BHEL shall apply for registration in the registration form in line with SEARP.
- 1.1 Registered agents will file an authenticated Photostat copy duly attested by a Notary Public/Original certificate of the Principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/ remuneration/ salary/ retainership being paid by the principal to the agent before the placement of order by BHEL.
- 1.2 Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.
- 2.0 **Disclosure of particulars of agents/ representatives in India, if any.**
- 2.1 Tenderers of Foreign nationality shall furnish the following details in their offers:
 - 2.1.1 The Bidder(s)/ Contractor(s) of foreign origin shall disclose the name and address of the agents/ representatives in India if any and the extent of authorization and authority given to commit the Principals. In case the agent/ representative be a foreign Company, it shall be confirmed whether it is existing Company and details of the same shall be furnished.
 - 2.1.2 The amount of commission/ remuneration included in the quoted price(s) for such agents/ representatives in India.
 - 2.1.3 Confirmation of the Tenderer that the commission/ remuneration, if any, payable to his agents/ representatives in India, may be paid by BHEL in Indian Rupees only.
- 2.2 Tenderers of Indian Nationality shall furnish the following details in their offers:
 - 2.2.1 The Bidder(s)/ Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any, indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents/ representatives.
 - 2.2.2 The amount of commission/ remuneration included in the price (s) quoted by the Tenderer for himself.
 - 2.2.3 Confirmation of the foreign principals of the Tenderer that the commission/ remuneration, if any, reserved for the Tenderer in the quoted price(s), may be paid by BHEL in India in equivalent Indian Rupees on satisfactory completion of the Project or supplies of Stores and Spares in case of operation items.
- 2.3 In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/ remuneration, if any payable to the agents/ representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.
- 2.4 Failure to furnish correct and detailed information as called for in paragraph 2.0 above will render the concerned tender liable to rejection or in the event of a contract materializing, the same liable to termination by BHEL. Besides this there would be a penalty of banning business dealings with BHEL or damage or payment of a named sum.

ANNEXURE - II
LIST OF INTERNATIONAL GATEWAY AIRPORTS

For air based consignment, terms of delivery will be on FCA basis from following listed airports only. Vendors are requested to verify this list for use before submission of offer.

SCHEDULE NO	COUNTRY	CURRENCY CODE	AIRPORT
D01	UK	GBP	LONDON (HEATHROW)
D02	UK	GBP	NEW CASTLE
D03	UK	GBP	OXFORD. CHETLAM
D04	UK	GBP	BRISTOL. WELLINGBOROUGH
D05	UK	GBP	BIRMINGHAM
D06	UK	GBP	EAST MIDLANDS
D07	UK	GBP	MANCHESTER
D08	UK	GBP	LEEDS
D09	UK	GBP	GLASGOW
D10	FRANCE	EURO	PARIS (ROISSY) & LYON
D11	SWEDEN	EURO	STOCKHOLM
D12	SWEDEN	EURO	GOTHENBERG & MALMO
D13	ITALY	EURO	ROMA, MILAN
D14	ITALY	EURO	TURIN, BOLOGNA, FLORENCE
D15	NETHERLANDS	EURO	AMSTERDAM, ROTTERDAM
D16	AUSTRIA	EURO	VIENNA, LINZ, GRAZ
D17	BELGIUM	EURO	ANTWERP, BRUSSELS
D18	DENMARK	DKK	COPENHAGEN
D19	JAPAN	JPY	TOKYO, OSAKA
D20	SINGAPORE	SGD	SINGAPORE
D21	CANADA	CAD	TORONTO
D22	CANADA	CAD	MONTREAL
D23	USA	USD	NEW YORK, BOSTON
D24	USA	USD	CHICAGO
D25	USA	USD	SAN FRANCISCO, LOS ANGELES
D26	USA	USD	ALANTA, HOUSTON
D27	GERMANY	EURO	MUNICH, KOLN, DUSSELDORF, HANNOVER, HAMBURG, STUTTGART, DAMSTADT, MANIHIEM, NURUMBERG
D28	GERMANY	EURO	FRANKFURT
D29	GERMANY	EURO	BERLIN
D30	SWITZERLAND	SFR	BASLE, ZURICH, GENEVA
D31	SPAIN	EURO	BARCELONA
D32	AUSTRALIA	AUD	SYDNEY
D33	AUSTRALIA	AUD	MELBOURNE
D34	AUSTRALIA	AUD	PERTH
D35	CZECH	EURO	PRAGUE
D36	HONG KONG	HKD	HONG KONG
D37	NEW ZELAND	NZD	AUCKLAND
D38	RUSSIA	USD	MOSCOW
D39	SOUTH KOREA	USD	KIMPO INTERNATIONAL, INCHEON
D40	FINLAND	EURO	HELSINKI
D41	ROMANIA	EURO	BUCHAREST
D42	NORWAY	EURO	OSLO
D43	IRELAND	EURO	DUBLIN
D44	ISRAEL	USD	TEL AVIV
D45	UAE	USD	DUBAI
D46	OMAN	USD	MUSCAT
D47	EGYPT	USD	CAIRO
D48	TAIWAN	USD	TAIPEI
D49	UKRAINE	USD	KIEV
D50	CHINA	USD	SHANGHAI, SHENZHEN
D51	PHILIPINES	USD	MANILA
D52	MALAYSIA	USD	KUALALUMPUR, PE NANG
D53	CYPRUS	USD	LARNACA
D54	SOUTH AFRICA	USD	JOHANNESBERG, DURBAN
D55	SLOVAKIA	EURO	BARTISLOVA
D56	SAUDI ARABIA	SAR	RIYADH
D57	TURKEY	EURO	ISTANBUL
D58	THAILAND	USD	BANGKOK
D59	BRAZIL	USD	SAO PAULO, RIO DE JANEIRO

ANNEXURE – III

DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID

Following guidelines will be followed in case of discrepancy in words & figures-quoted in price bid:

(a) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.

(b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

(d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

ANNEXURE - IV
Electronic Funds Transfer (EFT) OR
Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.

TYPE OF REQUEST(Tick one): ☐ CREATE ☐ CHANGE

BHEL Vendor / Supplier Code:

Company Name :

Permanent Account Number(PAN):

Address

City:

PINCODE

STATE

Contact Person(s)

Telephone No:

Fax No:

e-mail id:

1 Bank Name:

2 Bank Address:

3 Bank Telephone No:

4 Bank Account No:

5 Account Type: Savings/Cash Credit

6 9 Digit Code Number of Bank and branch

appearing on MICR cheque issued by Bank

7 Bank IFSC Code(applicable for NEFT)

8 Bank IFSC code(applicable for RTGS)

(Indian Financial System Code)

- A I hereby certify that the particulars given above are true, correct and complete and that I, as a representative for the above named Company, hereby authorise BHEL, EDN, Bangalore to electronically deposit payments to the designated bank account.
- B If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold BHEL / transferring Bank responsible.
- C This authority remains in full force until BHEL, EDN, Bangalore receives written notification requesting a change or cancellation.
- D I have read the contents of the covering letter and agree to discharge the responsibility expected of me as a participant under ECS / EFT.

Date:

Authorised Signatory:

Designation:

Telephone No. with STD Code

Company Seal

Bank Certificate

We certify that _____ has an Account No _____ with us and we confirm that the bank details given above are correct as per our records.

Date:

(.....)

Place:

Signature

Please return completed form along with a blank cancelled cheque or photocopy thereof to:

Bharath Heavy Electricals Ltd,

Attn:

Electronics Division, Mysore Road,

BANGALORE - 560 026

In case of any Query, please call concerned purchase executive.

ANNEXURE - V
PRESENT PROCEDURE FOR SALE IN TRANSIT (HIGH SEA SALES)

In case of High Sea Sales, vendor should submit following documents:

1. ORIGINAL HIGH SEA SALES AGREEMENT

- Sale agreement (on Rs. 200/- non-judicial stamp paper & notarised with 2 witnesses with identity) has to be signed between BHEL and the Party importing material. The date of the sale documents should be in between the date of House Air Way Bill / Bill of Lading and before landing of the goods in Indian origin.
- Following shall be included in the High Sea Sales Agreement:
"THE BUYER ALSO UNDERTAKE DISCHARGES, THE OBLIGATION AND FULFILLMENT OF CONDITIONS, IF ANY, ATTACHED TO THE IMPORTATION, ASSESSMENT AND CLEARANCE OF THE GOODS IN TERMS CUSTOMS TARIFF ACT 1975, THE CUSTOMS ACT 1962 & RULES & REGULATIONS MADE THERE UNDER AND OTHER RELEVANT ACTS, ORDERS, NOTIFICATIONS".

2. ORIGINAL INVOICES: INDIGENOUS RUPEE INVOICE & FOREIGN CURRENCY INVOICE

- Prices should be C.I.F., designated airport/seaport basis.
- I.E.C., C.S.T., K.S.T. Nos. to be mentioned.
- Description of item (Nomenclature), Unit & Quantity in both the Foreign Currency & the Indigenous Invoice in Rupee shall be exactly as per Purchase Order Description of item, Quantity and Unit. The Indigenous Invoice value shall be exactly as per Purchase Order value.
- Seller should give Foreign Currency Invoice from the original consignor. The Foreign Currency Invoice value should be at least 2% (two per cent) less than the Indigenous Rupee Invoice value in equivalent foreign currency.

4. ORIGINAL HOUSE AIR WAY BILL/ BILL OF LADING

- The sale agents should duly endorse House Air Way Bill (HAWB) for air shipments or original Bill of Lading (O.B.L.) for sea shipments and Foreign Currency Invoice in favour of BHEL-EDN.

5. ORIGINAL CARGO ARRIVAL NOTICE FROM FORWARDER.

6. ORIGINAL DELIVERY ORDER ISSUED IN NAME OF BHEL-EDN.

7. ORIGINAL PACKING LIST.

8. A LETTER TO THE COMMISSIONER OF CUSTOMS FOR EFFECTING ABOVE SALE.

9. A LETTER TO THE DEPUTY ASSESSOR (OCTROI) FOR EFFECTING ABOVE SALE IN FAVOUR OF BHEL.

REMARKS: In case vendor needs any clarifications on the above, the same may be sought in writing.



ELECTRONICS DIVISION, BANGALORE

Annexure-VI

BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

Bank Guarantee (BG) shall be issued from the following banks only:

Sl. No.	Nationalised Banks	Sl. No.	Public Sector Banks
1	Allahabad Bank	18	IDBI
2	Andhra Bank		
3	Bank of Baroda	Sl. No.	Foreign Banks
4	Canara Bank	19	CITI Bank N.A
5	Corporation Bank	20	Deutsche Bank AG
6	Central Bank	21	The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)
7	Indian Bank	22	Standard Chartered Bank
8	Indian Overseas Bank	23	J P Morgan
9	Oriental Bank of Commerce		
10	Punjab National Bank	Sl. No.	Private Banks
11	Punjab & Sindh Bank	24	Axis Bank
12	State Bank of India	25	The Federal Bank Limited
13	Syndicate Bank	26	HDFC Bank
14	UCO Bank	27	Kotak Mahindra Bank Ltd
15	Union Bank of India	28	ICICI Bank
16	United Bank of India	29	IndusInd Bank
17	Vijaya Bank	30	Yes Bank

Note:

- All BGs must be issued from BHEL consortium banks listed above.
- This list is subject to changes. Hence vendors are requested to check this list every time before issuing BGs.
- Bank Guarantees issued by Co-operative Banks/Financial Institutions cannot be accepted under any circumstance.

Annexure-VII

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____¹ through its Unit at.....(name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) with its registered office at _____² hereinafter referred to as the 'Vendor / Contractor / Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.....dated³ valued at Rs.....⁴ (Rupees -----)/FC.....(in words.....) for⁵ (hereinafter called the 'Contract') and the Vendor / Contractor / Supplier having agreed to provide a Contract Performance Bank Guarantee, equivalent to% (.... Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we,, (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount of Rs --⁶ (Rupees -----) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor / Contractor / Supplier in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Vendor / Contractor / Supplier shall have no claim against us for making such payment.

We thebank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract/satisfactory completion of the performance guarantee period as per the terms of the Contract and that it shall continue to be enforceable till

all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

WeBANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Vendor / Contractor / Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Vendor / Contractor / Supplier and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Vendor / Contractor / Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Vendor / Contractor / Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Vendor / Contractor / Supplier and notwithstanding any security or other guarantee that the Employer may have in relation to the Vendor / Contractor / Supplier 's liabilities.

This Guarantee shall remain in force upto and including.....⁷ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor / Contractor / Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the⁸we shall be discharged from all liabilities under this guarantee thereafter.

We, BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁶
- b) This Guarantee shall be valid up to⁷
- c) Unless the Bank is served a written claim or demand on or before⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated.....

Place of Issue.....

¹ NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited

² NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

⁴ CONTRACT VALUE

⁵ PROJECT/SUPPLY DETAILS

⁶ BG AMOUNT IN FIGURES AND WORDS

⁷ VALIDITY DATE

⁸ DATE OF EXPIRY OF CLAIM PERIOD

Annexure – VIII
(Applicable only for MSE Suppliers)

Certificate by Chartered Accountant on letterhead

This is to certify that M/s. _____
(hereinafter referred to as 'enterprise') having P A N Number _____ and
UDYAM Registration Number _____, registered office at
_____ is falling under the
category _____ (**Micro / Small / Medium**) under MSMED Act 2006. (Copy of UDYAM
Registration Certificate to be enclosed).

The said classification of _____ (**Micro / Small / Medium**) is arrived at based on the
Notifications / guidelines / clarifications issued under Micro, Small and Medium Enterprises
Development Act, 2006 including the notification S.O.2119 (E) dated 26th June 2020.

The Investment of the enterprise in Plant and Machinery or Equipment as at 31st
March'2020 as per Clause - 4 of the Notification is _____ (Rupees in Lakhs).

The turnover of the Enterprise for the period ending 31st March 2020 as per Clause - 5 of
the Notification is _____ (Rupees in Lakhs).

Date:

(Signature) Name-

Membership number-

Seal of Chartered Accountant with UDIN reference

Annexure-X

Restrictions under Rule 144(xi) of General Financial Rules, 2017 amendment dt: 23.07.2020

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.
- II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.
- III. "Bidder from a country which shares a land border with India" for the purpose of this Order means :-
 - a. An entity incorporated, established or registered in such a country; or
 - b. A subsidiary of an entity incorporated, established or registered in such a country; or
 - c. An entity substantially controlled through entities incorporated, established or registered in such a country; or
 - d. An entity whose *beneficial owner* is situated in such a country; or
 - e. An Indian (or other) agent of such an entity; or
 - f. A natural person who is a citizen of such a country; or
 - g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above
- IV. The *beneficial owner* for the purpose of (iii) above will be as under:
 1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation--

 - a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;
 - b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;
 2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;
4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;
5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड



Bharat Heavy Electricals Limited

(A Government of India Undertaking)

ELECTRONICS DIVISION

P. B. No. 2606, Mysore Road, Bengaluru - 560 026

SCPV: BOS: GCC- Rev 04

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT

These 'General Commercial Conditions for Contract for Purchase' herein after referred to as GCC apply to all enquiries, tenders, requests for quotations, orders, contracts and agreements concerning the supply of goods and the rendering of related services (hereinafter referred to as "deliveries") to Bharat Heavy Electricals Limited and any of its units, regions or divisions (hereinafter referred to as "BHEL" or the Purchaser) or its projects/ customers.

Any deviations from or additions to these GCC require BHEL's express written consent. **The general terms of business or sale of the vendor shall not apply to BHEL.** Acceptance, receipt of shipments or services or effecting payment shall not mean that the general terms of business or sale of the vendor have been accepted.

Orders, agreements and amendments thereto shall be binding if made or confirmed by BHEL in writing. Only the Purchasing department of BHEL is authorized to issue the Purchase Order or any amendment thereof.

Definitions:

Throughout these conditions and in the specifications, the following terms shall have the meanings assigned to them, unless the subject matter or the context requires otherwise.

- 'The Purchaser' means Bharat Heavy Electricals Limited, Electronics division, Mysore road, Bangalore 560 026, a Unit of Bharat Heavy Electricals Limited (A Govt. of India Undertaking) incorporated under the Companies Act having its registered office at BHEL House, Siri Fort, New Delhi-110049, India and shall be deemed to include its successors and assigns. It may also be referred to as BHEL.
- 'The vendor' means the person, firm, company or organization on whom the Purchase Order is placed and shall be deemed to include the vendor's successors, representative heirs, executors and administrator as the case may be. It may also be referred to as Seller, Contractor or Supplier.
- 'Contract' shall mean and include the Purchase Order incorporating various agreements, viz. tender/ RFQ, offer, letter of intent/acceptance/ award, the General Conditions of Contract and Special Conditions of Contract for Purchase, Specifications, Inspection/ Quality Plan, Schedule of Prices and Quantities, Drawings, if any enclosed or to be provided by BHEL or his authorized nominee and the samples or patterns if any to be provided under the provisions of the contract.

- (d) 'Parties to the Contract' shall mean the 'The Vendor' and the Purchaser as named in the main body of the Purchase Order.

Order of Precedence:

In case of any inconsistency or contradiction between any of the documents, the order of precedence shall be Purchase Order, LOI / LOA, Special Conditions of Contract and General Conditions of Contract for commercial conditions; and specific agreement on technical conditions, RFQ/offer and specification for Technical Conditions.

Interpretation:

In the contract, except where the context requires otherwise:

- (a) Words indicating one gender include all genders;
- (b) Words indicating the singular also include the plural and words indicating the plural also include the singular;
- (c) Provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
- (d) "Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

APPLICABLE CONDITIONS:

1. **Price Basis:** All prices shall be firm until the purchase order is executed / completed in all respects. No price variations / escalation shall be permitted, unless otherwise such variations/ escalations are permitted for and agreed up on by BHEL in writing in the PO. In case Price variation/ Exchange rate variation clause if applicable, the same will be mentioned in Special Conditions of Contract (SCC), otherwise firm price only.
2. **Ordering and confirmation of Order:** Vendor shall send the order acceptance on their company letter head/ through e-mail within 1 (ONE) week from the date of receipt of Purchase Order or such other period as specified/ agreed by BHEL. BHEL reserves the right to revoke the order placed if the order confirmation differs from the original order placed. The acceptance of goods/services/supplies by BHEL as well as payments made in this regard shall not imply acceptance of any deviations.

The purchase order will be deemed to have been accepted if no communication to the contrary is received within 1 (ONE) week (or the time limit as specified/agreed by BHEL) from the date of receipt of the purchase order.

3. **Documentation:** After receipt of Purchase Order, vendor should submit necessary documents (if & as applicable) like drawings specified, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report, O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.

At any stage within the contract period, the vendor shall notify of any error, fault or other defect found in BHEL's documents /specifications or any other items for reference. If and to the extent that (taking account of cost and time) any vendor exercising due care would have discovered the error, fault or other defect when examining the documents/specifications before submitting the tender, the time for completion shall not be extended. However, if errors, omissions, ambiguities,

inconsistencies, inadequacies or other defects are found in the vendor's documents, they shall be corrected at his cost, notwithstanding any consent or approval.

4. Penalty:

For delay in delivery: In the event of delay in agreed contractual delivery as per Purchase Order, penalty @ 0.5 % (half percent) per week or part thereof but limited to a max of 10% (ten percent) value of undelivered portion (basic material cost) will be applicable. Delivery will commence from the date of issue of Manufacturing clearance along with approved document. The date for which Inspection call is issued by vendor along with test certificates / test reports /Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. In the absence of furnishing such document indicated above as proof of completion of manufacturing along with inspection call, actual date of inspection will be considered as date of deemed delivery and BHEL will not be responsible for delay in actual date of inspection.

Penalty for delayed delivery if applicable, shall be deducted at the time of first supply payment.

If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted. **GST as applicable will be recovered along with penalty amount.**

- 5. Contract variations (Increase or decrease in the scope of supply):** BHEL may vary the contracted scope as per requirements at site. If vendor is of the opinion that the variation has an effect on the agreed price or delivery period, BHEL shall be informed of this immediately in writing along with technical details. Where unit rates are available in the Contract, the same shall be the basis for such additional work. Vendor shall not perform additional work before BHEL has issued written instructions/ amendment to the Purchase Order to that effect. The work which the vendor should have or could have anticipated in terms of delivering the service(s) and functionality (i.e.) as described in this agreement, or which is considered to be the result of an attributable error on the vendor's part, shall not be considered additional work.
- 6. Pre Shipment Inspection:** Prior written notice of at least 10 days shall be given along with internal test certificates/Certificate of Conformance (COC) and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or BHEL nominated Third Party Inspection Agency (TPIA) or BHEL authorized Inspection Agency or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification/acceptance for issue of dispatch clearance. **BHEL reserves the right for conducting repeat test, if required.**

All costs related to inspections & re-inspections shall be borne by vendor. Whether the Contract provides for tests on the premises of the vendor or any of his Sub-contractor/s, vendor shall be responsible to provide such assistance, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such

other special tests shall be borne by BHEL only if specifically agreed to in the purchase order.

7. **Transit Insurance:** Transit insurance coverage between vendor's works and project site shall be to the account of BHEL, unless specifically agreed otherwise. However, vendor shall send intimation directly to insurance agency (*as mentioned in dispatch instructions issued by BHEL*) through fax/courier/e-mail, immediately on dispatch of goods for covering insurance. A copy of such intimation sent by vendor to insurance agency shall be given to BHEL along with dispatch documents (*Email communication to Insurance Agency must be "CC" to BHEL*). Dispatch documents will be treated as incomplete without such intimation copy. BHEL shall not be responsible for sending intimations to insurance agency on behalf of the vendor.

8. **Mode of dispatch:**

Indigenous Scope: By road on Door Delivery Consignee Copy attached basis through your approved transporter (unless otherwise indicated in Dispatch Instructions), only on receipt of Despatch Clearance from BHEL.

Imported Scope: By Air/Sea through BHEL approved Freight Forwarder/supplier approved Consolidator respectively as per agreed contractual terms, only on receipt of Dispatch Clearance from BHEL.

9. **Changes in Statutory levies:**

If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the execution of Contract, which was or will be assessed on the bidder in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between BHEL and the bidder /agent of foreign bidder (if applicable). These adjustments shall not be applicable on procurement of raw materials, intermediary components etc. by the bidder /agent.

10. **Availing duty/tax exemption benefits by bidder, wherever applicable:** BHEL shall issue the required Certificate/s, as per relevant policies of the Govt. of India, to facilitate the bidders to avail any such benefits under the Contract. In case of failure of the bidders to receive the benefits partly or fully from the Govt. of India and/or in case of any delay in receipt of such benefits, BHEL shall neither be liable nor responsible in any manner whatsoever.

11. **Taxes against sub-vendor dispatches:** All taxes/levies, as applicable in respect of all components, equipment and material to be dispatched directly from the sub-vendor's works to Site irrespective of the fact whether such taxes and levies are assessable and chargeable on Vendor or the BHEL, shall be to the vendor's account and no separate claim in this regard will be entertained by BHEL.

12. **High Sea Sales (HSS):** Customs clearance of the consignment landed on Indian Sea/Air ports will be done by BHEL based on the original HSS documents provided by vendors.

Any delay in submission of complete/correct HSS documents to BHEL may incur demurrage charges. All demurrage charges on account of incomplete /incorrect HSS

documents submission by vendor will be to vendor's account and all such charges will be recovered from any of the available vendor bills with BHEL.

13. **Packaging and dispatch:** The Seller shall package the goods safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea/ Air / Rail/ Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures/ hooks and sling marks as may be required for easy and safe handling. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols / instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations.

The packing, shipping, storage and processing of the goods must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Any Imported/Physical Exports items packed with raw/ solid wood packing material should be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary / Fumigation certificate. If safety information sheets (MSDS – Material Safety Data Sheet) exist for an item or the packaging, vendor must provide this information without fail along with the consignment.

Each package must be marked with Consignee name, Purchase order number, Package number, Gross weight and net weight, dimensions (L x B x H) and Seller's name. Packing list of goods inside each package with PO item number and quantity must also be fixed securely outside the box to indicate the contents of each box. Total number of packages in the consignment must also be indicated in the packing list.

Separate packing & identification of items should be as follows.

- (a) Main Scope - All items must be tagged with part no. & item description.
- (b) Commissioning accessories/spares - All items must be tagged with part no. & item description.
- (c) Mandatory spares - All items must be tagged with part no. & item description.

Nevertheless, vendor shall adhere to dispatch & packing instructions issued by BHEL at the time of dispatch. Approximate Package Dimension shall be indicated in Offer/Quotation ____L (ft) x ____B (ft) x ____H (ft). Any Over Dimensional Consignment (ODC) in any consignment dimension ____40__L (ft) x ____8__B (ft) x ____8__H (ft) the same shall be indicated in offer.

14. **Assignment of Rights & Obligations; Subcontracting:** Vendor is not permitted to subcontract the delivery or any part thereof to third party or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from BHEL. Any permission or approval given by the BHEL shall, however, not absolve the vendor of the responsibility of his obligations under the Contract.
15. **Progress report:** Vendor shall render such report as to the progress of work and in such form as may be called for by the concerned purchase officer from time to time. The submission and acceptance of such reports shall not prejudice the rights of BHEL in any manner.

16. **Non-disclosure and Information Obligations:** Vendor shall provide with all necessary information pertaining to the goods as it could be of importance to BHEL. Vendor shall not reveal any specified confidential information that may be divulged by BHEL to Vendor's employees not involved with the tender/ contract & its execution and delivery or to third parties, unless BHEL has agreed to this in writing beforehand. Vendor shall not be entitled to use the BHEL name in advertisements and other commercial publications without prior written permission from BHEL.

17. **Cancellation /Termination of contract:** BHEL shall have the right to completely or partially terminate the agreement by means of written notice to that effect. Termination of the Contract, for whatever reason, shall be without prejudice to the rights of the parties accrued under the Contract up to the time of termination.

BHEL shall have the right to cancel/foreclose the Order/ Contract, wholly or in part, in case it is constrained to do so on account of any decline, diminution, curtailment or stoppage of the business.

18. **Risk Purchase Clause:** In case of failure of supplier, BHEL at its discretion may make purchase of the materials / services not supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase.

In case of items demanding services at site like erection and commissioning, vendor should send his servicemen/representatives within 7 days from the service call. In case a vendor fails to attend to the service call, BHEL at its discretion may also make arrangements to attend such service by other parties at the **RISK & COST** of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to BHEL any loss due to risk purchase/service including additional handling charges due to the change.

19. **Shortages:** In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages, *caused by supplier's act or omission*, shall be made good at *free of cost* within a reasonable time that BHEL may allow from such intimation.

Transit Damages: In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, supplier shall make good of all such damages within a reasonable time from such intimation by BHEL. *In case BHEL raises an insurance claim, the cost of material limited to insurance settled amount less handling charges will be reimbursed to supplier.*

20. **Remedial work:** Notwithstanding any previous test or certification, BHEL may instruct the vendor to remove and replace materials/goods or remove and re-execute works/services which are not in accordance with the purchase order. Similarly, BHEL may ask the vendor to supply materials or to execute any services which are urgently required for any safety reasons, whether arising out of or because of an accident, unforeseeable event or otherwise. In such an event, Vendor shall provide such services within a reasonable time as specified by BHEL.

21. **Indemnity Clause:** Vendor shall comply with all applicable safety regulations and take care for the safety of all persons involved. Vendor is fully responsible for the safety of its personnel or that of his subcontractor's men / property, during execution of the

Purchase Order and related services. All statutory payments including PF, ESI or other related charges have to be borne by the vendor. Vendor is fully responsible for ensuring that all legal compliances are followed in course of such employment.

22. **Product Information, Drawings and Documents:** All specified drawings, technical documents or other technical information received by Vendor from BHEL or vice versa shall not, without the consent of the other party, be used for any other purpose than that for which they were provided. They may not, without the consent of the Disclosing party, otherwise be used or copied, reproduced, transmitted or communicated to third parties. All information and data contained in general product documentation, whether in electronic or any other form, are binding only to the extent that they are by reference expressly included in the contract.

Vendor, as per agreed date/s but not later than the date of delivery, provide free of charge information and drawings which are necessary to permit and enable BHEL to erect, commission, operate and maintain the product. Such information and drawings shall be supplied in as many numbers of copies as may be agreed upon.

All intellectual properties, including designs, drawings and product information etc. exchanged during the formation and execution of the Contract shall continue to be the property of the disclosing party.

23. **Intellectual Property Rights, Licenses:** If any Patent, design, Trade mark or any other intellectual property rights apply to the delivery (goods/related service) or accompanying documentation shall be the exclusive property of the Vendor and BHEL shall be entitled to the legal use thereof free of charge by means of a nonexclusive, worldwide, perpetual license. All intellectual property rights that arise during the execution of the Purchase Order/ contract for delivery by vendor and/or by its employees or third parties involved by the vendor for performance of the agreement shall belong to BHEL. Vendor shall perform everything necessary to obtain or establish the above mentioned rights. The Vendor guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Vendor shall do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties. The Vendor shall indemnify BHEL against any (alleged) claims by third parties in this regard and shall reimburse BHEL for any damages suffered as a result thereof.

24. **Force Majeure:** Notwithstanding anything contained in the purchase order or any other document relevant thereto, neither party shall be liable for any failure or delay in performance to the extent said failures or delays are caused by the "Act of God" and occurring without its fault or negligence, provided that, force majeure will apply only if the failure to perform could not be avoided by the exercise of due care and vendor doing everything reasonably possible to resume its performance.

A party affected by an event of force majeure which may include fire, tempest, floods, earthquake, riot, war, damage by aircraft etc., shall give the other party written notice, with full details as soon as possible and in any event not later than seven (7) calendar days of the occurrence of the cause relied upon. If force majeure applies, dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused.

Notwithstanding above provisions, in an event of Force Majeure, BHEL reserves for itself the right to cancel the order/ contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of deliveries and other schedules.

25. Warranty:

Wherever required, and so provided in the specifications/ Purchaser Order, the Seller shall ensure that the goods supplied shall comply with the specifications laid down, for materials, workmanship and performance.

If the vendor fails to take proper corrective action to repair/replace defects satisfactorily within a reasonable period, Purchaser shall be free to take corrective action as may be deemed necessary at Vendor's Risk and Cost after giving notice to Vendor, including arranging supply of goods from elsewhere at sole risk and cost of Vendor.

Unless otherwise specified in SCC, warranty period shall be applicable for a period of 24 months from the date of delivery of goods or 18 months from the date of commissioning of goods, whichever is earlier. The warranty period as described above shall apply afresh to replaced, repaired or re-executed parts of a delivery. Unless otherwise specifically provided in the Purchase Order, Vendor's liability shall be co terminus with the expiration of the applicable warranty period.

26. Limitation of Liability: Vendor's liability towards this contract is limited to a maximum of 100% of the contract value and consequential damages are excluded. However, the limits of liability will have no effect in cases of criminal negligence or willful misconduct.

The total liability of Vendor for all claims arising out of or relating to the performance or breach of the Contract or use of any Products or Services or any order shall not exceed the total Contract price.

27. Liability during Warranty: Vendor shall arrange replacement / repair of all the defective materials / services under its obligation during the warranty period. The rejected goods shall be taken away by vendor and replaced / repaired. In the event of the vendor's failure to comply, BHEL may take appropriate action including disposal of rejections and replenishment by any other sources at the cost and risk of the vendor. In case, defects attributable to vendor are detected during Warranty period or where the commissioning call is issued within the warranty period, vendor shall be responsible for replacement/ repair of the goods as required by BHEL at vendor's cost even after expiry of warranty period.

Further if the equipment or any part thereof cannot be used by reason of such defect and/or making good of such defect, the warranty period of the equipment or such part, as the case may be, shall be extended by a period equal to the period during which the equipment or such part cannot be used by BHEL because of any of the aforesaid reasons. Upon correction of the defects in the facilities or any part thereof by repair/replacement, such repair/replacement shall have the warranty period for a

period of twelve (12) months from the time such replacement/repair of the equipment or any part thereof has been completed.

28. **Liability after warranty period:** At the end of the warranty, the Vendor's liability ceases except for latent defects. For the purpose of this clause, latent defects shall be the defects inherently lying within the material or arising out of design deficiency which do not manifest themselves during the warranty Period, but later. The Contractor's liability for latent defects warranty for the equipment including spares shall be limited to a period of six months from the end of the warranty period of the respective equipment including spares or first time commissioning, whichever is later but not later than one (01) year from the date of expiry of warranty period.
29. **Compliance with Laws:** Vendor shall, in performing the contract, comply with all applicable laws. The vendor shall make all remittances, give all notices, pay all taxes, duties and fees, and obtain all permits, licenses and approvals, as required by the laws in relation to the execution and completion of the contract and for remedying of any defects; and the Contractor shall indemnify and hold BHEL harmless against and from the consequences of any failure to do so.
30. **Settlement of Disputes:** Except as otherwise specifically provided in the Purchase Order, decision of BHEL shall be binding on the vendor with respect to all questions relating to the interpretation or meaning of the terms and conditions and instructions herein before mentioned and as to the completion of supplies/work/services, other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, instructions, orders or these conditions or otherwise concerning the supply or the execution or failure to execute the order, whether arising during the schedule of supply/work or after the completion or abandonment thereof. Any disputes or differences among the parties shall to the extent possible be settled amicably between the parties thereto, failing which the disputed issues shall be settled through arbitration. Vendor shall continue to perform the contract, pending settlement of dispute(s).
31. **Arbitration Clause in case of Contract with vendors other than Public Sector Enterprise (PSE) or a Government Department:**

ARBITRATION & CONCILIATION

The parties shall attempt to settle any disputes or difference arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, or in connection with this contract through friendly discussions. In case no amicable settlement can be reached between the parties through such discussions, in respect of any dispute; then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the sole arbitration of an arbitrator appointed by Head of the BHEL-EDN. Such Sole Arbitrator appointed, shall conduct the arbitration in English language.

The Arbitrator shall pass a reasoned award and the award of the Arbitration shall be final and binding upon the Parties.

Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be Bangalore. The cost of arbitration shall be borne as decided by the Arbitrator upon him entering the reference. Subject to the Arbitration Clause as above, the Courts at Bangalore alone shall have exclusive jurisdiction over any matter arising out of or in connection with this Contract.

Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the parties shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and efficiency in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

Arbitration Clause in case of Contract with a Public Sector Enterprise (PSE) or a Government Department:

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred by either party for Arbitration to the Sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any Party aggrieved by such Award may make further reference for setting aside or revision of the Award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the Parties hereto finally and conclusively. The Parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.'

32. **Applicable Laws and Jurisdiction of Courts:** Prevailing Indian laws both substantive and procedural, including modifications thereto, shall govern the Contract. Subject to the conditions as aforesaid, the competent courts in Bangalore alone shall have jurisdiction to consider over any matters touching upon this contract.
33. **General Terms:** That any non-exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents.

That the headings used in this agreement are for convenience of reference only.

That all notices etc., to be given under the Purchase order shall be in writing, type script or printed and if sent by registered post or by courier service to the address given in this document shall be deemed to have been served on the date when in the ordinary course, they would have been delivered to the addressee.

Self-Certification on the letter head of the company

In line with Government Public Procurement Order No. P-45021/2/2017-BE-II dt. 15.06.2017, P-45021/2/2017-PP (BE-II) dated 28.05.2018, P-45021/2/2017-PP (BE-II) dated 29.05.2019 and P-45021/2/2017-PP (BE-II) dated 16.09.2020, we hereby certify that

.....
(Supplier name) are local supplier meeting requirement of minimum local content (50%) defined in as above orders for the material against Enquiry No

.....
.....
.....
Details of location at which local value addition will be made is as follows:

.....
.....
.....
We also understand, false declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.

Date:
Place:

Signature:
Name and Designation:
Mobile no:
Office Telephone No:
Email ID:
Office Seal:



GUIDELINES FOR REVERSE AUCTION - 2020

**(AA:SSP:RA:04)
revised as on 04.03.2020**

(applicable for all NITs issued on or after 04.06.2020)

Note: Abridged version for information of the bidders

**SOURCING STRATEGY & POLICY
CORPORATE OPERATIONS MANAGEMENT**

BHARAT HEAVY ELECTRICALS LIMITED

Regd. Office: BHEL House, Siri Fort, New Delhi – 110049, India

Website: www.bhel.com

CIN: L74899DL1964GOI004281

1.0 Scope

This document describes the guidelines to be followed by each Unit/ Division/ Region for conducting Reverse Auction (RA) for procurement of material/ works/ services. These guidelines will be applicable for all purchases/ contracts to be awarded under Purchase/ Works policy and the RA shall follow the philosophy of English Reverse (No ties).

English Reverse (No ties) is a type of auction where the starting price and bid decrement are announced before start of online reverse auction. The interested bidders can thereupon start bidding in an iterative process wherein the lowest bidder at any given moment can be displaced by an even lower bid of a competing bidder, within a given time frame. The bidding is with reference to the current lowest bid in the reverse auction. All bidders will see the current lowest quoted price and their rank. The term 'No ties' is used since more than one bidder cannot give an identical price, at a given instant, during the reverse auction. In other words, there shall never be a tie in the bids.

3.0 Upfront declaration in NIT

Wherever it is felt that procurement may be done through Reverse Auction, the bids shall be invited in two parts/ three parts or single part bid (Price Bid) where Techno-Commercial MoU already exists. Wherever, the evaluation is done for individual line item, separate sealed envelope price bid for each line item shall be taken.

Decision to go for RA would be taken before floating of the tender. In case it is decided to go for RA, same shall be declared upfront in NIT by inserting the following **clause**:

"BHEL shall be resorting to Reverse Auction (RA) (Guidelines as available on www.bhel.com) for this tender. RA shall be conducted among all the techno-commercially qualified bidders.

Price bids of all techno-commercially qualified bidders shall be opened and same shall be considered as initial bids of bidders in RA. In case any bidder(s) do(es) not participate in online Reverse Auction, their sealed envelope price bid along with applicable loading, if any, shall be considered for ranking."

6.0 Business rules for RA

Model Annexure-I is attached.

7.0 Role of Service Provider

- Acknowledge the receipt of mandate from BHEL.
- Contact the bidders, provide business rules and train them, as required.
- Get the process compliance form signed by all the participating bidders before RA event.
- Conduct the event as per the contract and business rules.
- Submit the Login Reports, Results, History sheet and authorized final bid from the bidders.
- To obtain price breakup from successful bidder and submit the same to BHEL.

10.0 Reverse Auction Process

10.1 Reverse Auction will be conducted if three or more bidders are techno-commercially qualified. In case of more than four techno-commercially qualified bidders, H1 bidder (whose quote is highest in sealed envelope price bid) shall not be allowed to participate in RA. However, there will be no H1 removal in case H1 happens to be MSE or qualifying under PPP-MII, Order 2017 irrespective of the number of bidders qualifying techno-commercially.

In case of multiple H1 bidders, all H1 bidders (excluding MSEs and bidders qualifying under PPP-MII, Order 2017) shall be removed provided minimum three bidders remain in fray, else no H1 removal.

10.2 During RA, all bidders will see their rank and current L1 price and their ranking L1, L2 etc. on the screen. Once the RA is done, the ranking status would be based on the last quoted price of the bidder(s) irrespective of the quote received in RA or sealed envelope price bid.

10.3 No bidder shall be allowed to lower its bid below the current L1 by more than 5 decrements at one go.

13.0 Processing of case after RA

- 13.1 Wherever the evaluation is done on total cost basis, after Reverse Auction, prices of individual line items shall be reduced on pro-rata basis.
- 13.2 In case of splitting requirement, H1 bidder(s) who were removed from participation in RA may also be considered for counter offer if the pre-stated (NIT) numbers of suppliers do not accept the counter offer.

15.0 Others

- 15.2 In case of enquiry through e-Procurement, the sealed electronic price bid (e-bid) is to be treated as sealed envelope price bid.
- 15.3 BHEL will inform bidders the details of service provider who will provide business rules, all necessary training and assistance before commencement of online bidding.
- 15.4 Bidders are advised to read the 'Business Rules' indicating details of RA event carefully, before reverse auction event.

---XXX---

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

This has reference to tender no **{tender number....date...}**. BHEL shall finalise the Rates for the supply of **{item name}** through Reverse Auction mode. BHEL has made arrangement with M/s. **{Service provider}**, who shall be BHEL's authorized service provider for the same. Bidders should go through the instructions given below and submit acceptance of the same.

The technical & commercial terms are as per (a) BHEL Tender Enq. No. {...} dated {...}, (b) Bidders' technical & commercial bid (in case of two part bid) and (c) subsequent correspondences between BHEL and the bidders, if any.

1. Procedure of Reverse Auctioning

- i. Price bids of all techno-commercially qualified bidders shall be opened.
- ii. **Online Reverse Auction:** The 'bid decrement' will be decided by BHEL.
- iv. Bidders by offering a minimum bid decrement or the multiples thereof can displace a standing lowest bid and become "L1" and this continues as an iterative process. However, no bidder shall be allowed to lower its bid below the current L1 by more than 5 decrements at one go.
- v. After the completion of the online reverse auction, the Closing Price (CP) shall be available for further processing.
- vi. Wherever the evaluation is done on total cost basis, after Reverse Auction, prices of individual line items shall be reduced on pro-rata basis.

2. Schedule for reverse auction: The Reverse Auction is tentatively scheduled on {date}: ;{start time}: ;{Close Time: }.

3. Auction extension time: If a bidder places a bid in the last {...} minutes of closing of the Reverse Auction and if that bid gets accepted, then the auction's duration shall get extended automatically for another {...} minutes, for the entire auction (i.e. for all the items in the auction), from the time that bid comes in. Please note that the auto-extension will take place only if a bid comes in those last {...} minutes and if that bid gets accepted as the lowest bid. If the bid does not get accepted as the lowest bid, the auto-extension will not take place even if that bid might have come in the last {...} minutes. In case, there is no bid in the last {...} minutes of closing of Reverse

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

Auction, the auction shall get closed automatically without any extension. However, bidders are advised not to wait till the last minute or last few seconds to enter their bid during the auto-extension period to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.

The above process will continue till completion of Reverse Auction.

Complaints/ Grievances, if any, regarding denial of service or any related issue should be given in writing thru e-mail/ fax to M/s. {Service provider} with a copy to BHEL within 15 minutes prior to initial closing time of Online Reverse Auction.

4. **Bid price:** The Bidder has to quote the {.....} Price inclusive of Packing & Forwarding charges, all the routine & type tests as per tender scope, taxes, duties, freight and insurance as specified in tender document, including loading (if indicated by BHEL due to deviations in technical/ commercial terms) for the Items specified. Details are as shown in Excel Sheet for calculation of total cost to BHEL (To be specified by Unit as per NIT conditions).
5. **Bidding currency and unit of measurement:** Bidding will be conducted in Indian Rupees per Unit of the material as per the specifications {...}

In case of foreign currency bids, exchange rate (TT selling rate of State Bank of India) as on scheduled date of tender opening (Part-I bid) shall be considered for conversion in Indian Rupees. If the relevant day happens to be a Bank holiday, then the forex rate as on the previous bank (SBI) working day shall be taken.
6. **Validity of bids:** Price shall be valid for {... days} from the date of reverse auction. These shall not be subjected to any change whatsoever.
7. **Lowest bid of a bidder:** In case the bidder submits more than one bid, the lowest bid at the end of Online Reverse Auction will be considered as the bidder's final offer to execute the work.
8. Unique user IDs shall be used by bidders during bidding process. All bids made from the Login ID given to the bidders will be deemed to have been

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

made by the bidders/ bidders' company.

9. **Post auction procedure:** BHEL will proceed with the Lowest Bid in the Reverse Auction for further processing.
11. Computerized reverse auction shall be conducted by BHEL (through M/s {Service Provider}), on pre-specified date, while the bidders shall be quoting from their own offices/ place of their choice. Internet connectivity shall have to be ensured by bidders themselves.

During the RA process if a bidder is not able to bid and requests for extension of time by FAX/ email/ phone then time extension of additional 15 minutes will be given by the service provider provided such requests come before 5 minutes of auction closing time. However, only one such request per bidder can be entertained.

In order to ward-off contingent situation of connectivity failure bidders are requested to make all the necessary arrangements/ alternatives whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power or loss of connectivity at the premises of bidders during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and neither BHEL nor M/s. {Service provider} is responsible for such eventualities.

12. Proxy bids: Proxy bidding feature is a pro-bidder feature to safe guard the bidder's interest of any internet failure or to avoid last minute rush. The proxy feature allows bidders to place an automated bid in the system directly in an auction and bid without having to enter a new amount each time a competing bidder submits a new offer. The bid amount that a bidder enters is the minimum that the bidder is willing to offer. Here the software bids on behalf of the bidder. This obviates the need for the bidder participating in the bidding process until the proxy bid amount is decrementally reached by other bidders. When proxy bid amount is reached, the bidder (who has submitted the proxy bid) has an option to start participating in the bidding process.

The proxy amount is the minimum amount that the bidder is willing to offer. During the course of bidding, the bidder cannot delete or change the

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

amount of a proxy bid.

Bids are submitted in decrements (decreasing bid amounts). The application automates proxy bidding by processing proxy bids automatically, according to the decrement that the auction originator originally established when creating the auction, submitting offers to the next bid decrement each time a competing bidder bids, regardless of the fact whether the competing bids are submitted as proxy or standard bids. However, it may please be noted that if a manual bid and proxy bid are submitted at the same instant manual bid will be recognized as the L1 at that instant.

In case of more than one proxy bid, the system shall bid till it crosses the threshold value of 'each lowest proxy bid' and thereafter allow the competition to decide the final L1 price.

Proxy bids are fed into the system directly by the respective bidders. As such this information is privy only to the respective bidder(s).

13. Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc from M/s {Service provider}.
14. M/s. {Service provider}, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {Service provider}, shall also explain the bidders, all the business rules related to the Reverse Auction. Bidders are required to submit their acceptance to the terms/ conditions/ modalities before participating in the Reverse Auction in the process compliance form as enclosed. Without this, the bidder will not be eligible to participate in the event.
15. Successful bidder shall be required to submit the final prices (L1) in prescribed format for price breakup, quoted during the Online Reverse Auction, duly signed and stamped as token of acceptance without any new condition (other than those already agreed to before start of auction), after the completion of auction to M/s. {Service provider} besides BHEL within two working days of Auction without fail.
16. Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

process and will invite action by BHEL as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

17. Bidders' bid will be taken as an offer to execute the work/ supplies the item as per enquiry no. {...} dt. {...}. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines for suspension of business dealings (as available on www.bhel.com).
18. Bidders shall be able to view the following on their screen along with the necessary fields during Online Reverse Auction:
 - a. Leading (Running Lowest) Bid in the Auction (only total price of package)
 - b. Bid Placed by the bidder
 - c. Start Price
 - d. Decrement value
 - e. Rank of their own bid during bidding as well as at the close of auction.
19. BHEL's decision on award of contract shall be final and binding on all the Bidders.
20. BHEL reserves the right to extend, reschedule or cancel the Reverse Auction process at any time, before ordering, without assigning any reason, with intimation to bidders.
21. BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.
22. Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.
23. If there is any clash between this business document and the FAQ available, if any, in the website of M/s. {Service provider}, the terms & conditions given in this business document will supersede the information contained in the FAQs. Any changes made by BHEL/ service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been

Guidelines for Reverse Auction – 2020

Doc. No. AA:SSP:RA:04
Dated: 04.03.2020

Business Rules for Reverse Auction

Annexure – I

accepted if the bidder continues to access the portal after that time.

24. Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action as per extant *BHEL guidelines for suspension of business dealings* (as available on www.bhel.com), shall be initiated by BHEL.

ABRIDGED VERSION

On the letter head of the bidder

REF: <<<internal reference of vendor>>>

Declaration to be mandatorily submitted by the Bidder, as a compliance to Rule 144(xi) of GFR, 2017 amendment dt 23.07.2020 issued by Ministry of Finance, Govt. of India.

“I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfils all requirements in this regard and is eligible to be considered.”

DATE:

Authorized signatory

Office seal

Place:

ANNEXURE C

List of Documents to be submitted by Vendors/Subcontractors for SPV Contracts.		Confirmation on submission	DEVIATION OR REMARKS
IR Documents (Type - A): For all Civil & I&C & O&M			
Sl No.	Documents		
1	Wage Sheet (Form 17)	YES	
2	Attendance Register (w.r.t Sl No.1)	YES	
3	Workman Policy & Additional Insurance (Automotive Liability, Group Service Insurance Policy etc)	YES	
4	PF Challan	YES	
5	ESI (Employee State Insurance)	YES	
6	ECR (Electronic Challan Receipt)	YES	
7	Bank Statement for PF deposit	YES	
8	RCS (Remittance Confirmation Slip)	YES	
Quality Documents (Type - B): For all MMS Civil Works			
Sl No.	Documents		
1	FQA (Field Quality Assurance)	NA	
2	Field Content, Slump Test	NA	
3	Gradation of Aggregate (10mm, 20mm)	NA	
4	Fine Aggregate Test (for Sand)	NA	
5	Cube Test Registered	NA	
6	Material Test Certificate for Steel & Cement	NA	
7	Consumption Register for Steel & Invoice	NA	
8	Pour Card for Concreting purpose	NA	
9	Royalty Reports (10mm, 20mm, Sand)	NA	
10	Sand Soundness Test Reports	NA	
11	Slump Test Register	NA	
12	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA	
13	Moisture Content Coarse and Fine Aggregate - Register to be maintained	NA	
14	Water Test Report for Concrete	NA	
15	Design Mix Report for Concrete	NA	
Quality Documents (Type - B): For all Civil related Works			
Sl No	Documents		
1	FQA (Field Quality Assurance)	NA	
2	Field Content, Slump Test	NA	
3	Gradation of Aggregate (10mm, 20mm)	NA	
4	Fine Aggregate Test (for Sand)	NA	
5	Cube Test Registered	NA	
6	Material Test Certificate for Steel & Cement	NA	
7	Consumption Register for Steel & Invoice	NA	
8	Pour Card for Concreting purpose	NA	
9	Royalty Reports (10mm, 20mm, Sand)	NA	
10	Sand Soundness Test Reports	NA	
11	Warpage of Bricks Test Reports	NA	
12	Core Cutting (Compaction Test) - Roads & Pathways	NA	
13	Slump Test Register	NA	
14	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA	
15	Moisture Content Coarse and Fine Aggregate - Register to be maintained*	NA	
16	Brick Test Reports	NA	
17	Plastering profile and thickness	NA	
18	Compaction test beneath floor of all buildings. - Reports	NA	
19	Test Certificates for Paint, Glan, Glazing, etc.	NA	
20	Test Certificates Aluminium Section for doors and windows (Anodisation Certificates also)	NA	
21	BBS for Buildings	NA	
22	Water Test Report for Concrete	NA	
23	Design Mix Report for Concrete	NA	

Quality Documents: for Electrical & Mechanical Installation Works (BOS)			
Sl No	Documents		
1	FQA (Field Quality Assurance)	YES	
2	Inspection Reports	YES	
3	Guarantee Certificates	YES	
4	Factory Acceptance Test Reports	YES	
5	Commissioning Reports	YES	

NOTE:

* This list of documents is indicative and intended towards all Solar Projects.

* Apart from the above, any other document required by the Customer and which are mandatory for Billing by BHEL to the Customer, the same respective vendors.