

OPEN TENDER (4261570E) CHECKLIST

Sl. No.	Document Name	Vendor Confirmation (Signed copy to be submitted along with Techno Commercial Offer)
01	Annexure B	Submitted ☐ Not Submitted ☐
02	Annexure C	Submitted ☐ Not Submitted ☐
03	Technical Specification	Submitted ☐ Not Submitted ☐
04	CEBG and PBG (Stamped and Signed)	Submitted ☐ Not Submitted ☐
05	Integrity Pact	Submitted ☐ Not Submitted ☐
06	Pre-Qualification Criteria + Performance Certificate Documents	Submitted ☐ Not Submitted ☐
07	CQR+ Main Contractor Format+ NTPC Sub Supplier Questionnaire	Submitted ☐ Not Submitted ☐

TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEM FOR ESP
ITEM : SWITCH MODE POWER SUPPLY FOR ESP
PROJECT : M/S NATIONAL THERMAL POWER CORPORATION LTD (NTPC)

NAME		DESIGNATION	SIGNATURE	DATE
PREPARED	A K Palanisamy	SR.ENGINEER		14.02.2017
CHECKED	V.S.SURESHKUMAR	DGM		14.02.2017
APPROVED	M Jeyamuruganand	SDGM		14.02.2017

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EDC – ECI

Revision No: 03	Clause No: 2.2 Deleted Clause No: 3.2,8.6,8.22,8.23,11.2,16.2.3,20.1 Revised Clause No: 11.1 added	Release date: 14.02.2017
Revision No: 02	Clause No: 2.2 Revised Clause No: 4.9 Included	Release date: 01.02.2016
Revision No: 01	Clause No: 2.1, 3.2 & 14.2.1 Revised Clause No: 18.1.6, 20 Included	Release date: 02.01.2016
Revision No: 00		Initial Release date : 22.12.2015

Sl. No.	Specification	Vendor Confirmation (with documents)
1	Qualifying Requirements	
1.1	The offered Switched Mode Power Supply (SMPS) along with controllers should be from a Manufacturer, who has supplied at least 70KV/1000mA Silicone Oil filled Switched Mode High Frequency Transformer rectifier sets (either Stand Alone or in combination with conventional High Voltage Transformer) in one ESP of 200MW or higher rated coal fired units which is in successful operation for a minimum one (1) year as on 8 th January 2013.	
2	Scope	
2.1	Design, manufacture, test, pack & supply SMPS for Electrostatic Precipitator (ESP) of 400mm electrode spacing. The system shall be built with suitable high frequency transformer, IGBT based inverter module, control cabinet, controller, operator terminal and necessary accessories to make the system complete. The scope also includes Commissioning Supervision of SMPS unit at Thermal Power Station.	
2.2	SMPS unit shall be field-proven, type tested and tropicalized.	
2.3	Special tool & tackles, if any, are to be indicated and included in the scope.	
3	Project Information	
3.1	Ambient conditions	
3.1.1	Ambient temperature : 0°C to 50°C	
3.1.2	Humidity : Up to 95%	
3.2	Location : Panels – Indoor/Outdoor; HV Transformer – Outdoor, On Top of ESP.	
3.3	Altitude from mean sea level : Less than 1000m	
3.4	Quantity & Rating : As per enquiry	
3.5	Environment: The atmosphere will be very dusty, very high Abrasive nature, conducive to fungus growth.	
4	Applicable Standards	
	Bidder to comply all applicable latest Indian standards/international standards for the SMPS unit offered. Following standards requirement shall also be taken care	
4.1	EMC conformity : EN 61000-6-4 emission, EN 61000-6-2 Immunity	
4.2	Fast Transient : ANSI/ IEEE C37.90.1-2002/ IEC 60255-22-04-2008	
4.3	Low voltage directive : EN 50178 2006/95/EC	
4.4	Degree of protections, enclosure: IEC 529/1989/2/73, EN 60529	
4.5	Electronic equipment for use in Power installations : EN 50178	

Sl. No.	Specification	Vendor Confirmation (with documents)
4.6	Silicone oil shall meet transformer oil fire safety requirement specified in paragraph 450-23 of National Electric Code	
4.7	Transformer shall conform to IS:2026 /IEC60076	
4.8	SMPS shall meet local statutory regulations as applicable.	
4.9	SMPS Noise Level shall not exceed values specified in NEMA TR-1.	
5	Terminal Conditions	
5.1	Power supply Input :3 Phase, 415V, 50Hz AC	
5.2	Power supply variation	
5.2.1	Voltage: +10% to -10%.	
5.2.2	Frequency: + 3% to - 5%.	
5.2.3	Combined variation of Voltage & Frequency : 10%	
5.3	Any other voltage required for SMPS to be arranged by the vendor	
5.4	Capacitance of precipitator (pF): 200 x Rated output current in mA. (approx.)	
5.5	High voltage Negative Output terminal: Through single horizontal bushing of Porcelain type	
5.6	Rated output voltage, output current and quantity shall be as per Enquiry/PO.	
6	Design & Operational Requirements	
6.1	The bidder shall furnish control principle details under non-sparking and sparking mode for review.	
6.2	Soft start shall be provided during initial energization / switch on of the output. The soft start shall be effective till field current reaches set value.	
6.3	The SMPS unit shall be suitable for operation with Intermittent Energization (IE). On-time and Off -time shall be user settable.	
6.4	The precipitator is a dead load. The electrodes inside the Precipitator keep swinging slightly with frequency of 5 to 10 Hz. The unit shall be capable of operating at any secondary current provided the primary current is not exceeded. The unit shall be capable of operating under accidental no load condition. The unit may be subjected to short circuit condition when the ESP Electrodes gets snapped during operation. The SMPS unit shall be suitable for the above operating conditions.	
7	Major Components of SMPS	
7.1	The SMPS shall have typically 3 phase input rectifier, capacitor bank, pre-charging circuit, IGBT based inverter and high frequency high voltage rectifier transformer. The above components shall be selected / designed to	

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	meet the specification. Major components shall withstand 150% of rated KW for 60 sec. for every 10minutes. Bidder shall provide all technical datasheets of the above components for our review.	
7.2	The SMPS unit is meant as automatic constant current source of power to the ESP. The SMPS unit shall be suitable for 24 hours a day operation continuously, with frequent sparking in the precipitator load, occasionally having 200 sparks per minute. SMPS is to operate throughout the year in all climatic condition in ESP application.	
7.3	SMPS system shall regulate the output current to the set value within + / - 5 % for any non-Sparking load conditions between 10 to 100% of the rated output current for any / all of the following conditions:	
7.3.1	Variation in impedance of EP load	
7.3.2	Variation in input supply voltage between 415 + 10 % to 415 – 10 %.	
7.3.3	The Unit shall deliver the rated secondary voltage and current with load connected, when the Power supply input voltage is 415V.	
8	Construction & Design Features of SMPS	
8.1	Transformer shall be designed for the selected switching frequency. The core and winding material shall be specifically designed for the selected switching frequency.	
8.2	Transformer shall be filled with Silicone oil, nontoxic and shall have high flash point (above 300 Deg. C).Maximum temperature rise is 50 Deg. C above an ambient of 40 Deg. C.	
8.3	SMPS shall have a circuit breaker, contactor and fuses for protection of IGBT's as a minimum.	
8.4	The winding shall be of Electrolytic grade copper.	
8.5.	The core material of the transformer shall be Ferrite or equivalent and the lamination is of high grade Non-aging Cold Rolled Grain Oriented Silicone Sheet Steel type.	
8.6	A suitably rated Radio Frequency Choke/Resistor shall be located inside the Transformer Tank to protect the SMPS from the sparking that may occur in the ESP.	
8.7	The terminal side of the bushing shall have M10 threading.	
8.8	A suitable metallic duct enclosing the output negative bushing shall be provided with flange for the protection of the Bushing Insulator against adverse condition such as rain and accumulation of dust. An opening to clean the insulator shall be provided in the duct.The flange shall match with the flange provided in the Disconnecting Switch supplied by the buyer. The exact dimensions of the flange will be provided during ordering.	

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8.9	Power connections for LT supply shall be extended with adequate support such that power cables can be terminated vertically without bending the cable cores.	
8.10	There shall be a weather proof Marshaling box mounted on the SMPS unit. The marshaling box shall house current & voltage measurement terminals along with protections, terminations of protection, control and monitoring equipment etc. for safe & reliable operation of the SMPS unit. Interlocking type or colour coded ferrules of proper size shall be used for control and signal wiring.	
8.11	The fixing arrangement of SMPS shall be provided for review and approval.	
8.12	The SMPS unit shall be provided with bi-directional skids, lifting lugs and four jacking pads.	
8.13	The SMPS unit shall be provided with Danger Plate and Name plate.	
8.14	The High Frequency Transformer component of SMPS shall be designed to pass the Double voltage Double frequency testing.	
8.15	The General Arrangement of Components in Transformer unit, lay out inside the enclosure, Electrical power and Control Scheme are subject to BHEL approval.	
8.16	Cutouts as per the sketch indicated in the Annexure 1 shall be provided on the door for mounting a special rotary interlock, (supply & mounting by buyer at site) to de-energize the rectifier when the key of the special interlock is removed. This facility is intended for interlocking of the SMPS with the Precipitator for safety of operating personnel and equipment. Necessary wiring and terminations shall be made to include the NC contact of this key interlock in the Main Power contactor coil circuit without affecting the IP requirement.	
8.17	Anti-vibration pads, if required for the set shall be provided.	
8.18	All controls and instrumentation shall be insensitive to vibration, dust & humidity and shall be fully tropicalized.	
8.19	The bus bar support, if applicable, shall be of molded type, non-hygroscopic, anti-tracking and non- inflammable. The location of power terminals shall be sufficiently above gland plate for ease of cable termination. Bus-bar shall be tinned copper bus suitable to terminate four runs each incoming power & outgoing power cable. All power wiring shall be done with bars of suitable size to withstand 50 KA for 1 Sec.	
8.20	All internal wiring shall be neatly laid out. Ferrule numbering shall be adopted for wiring. Inter component wiring shall be done with extra flexible stranded copper conductor PVC insulated wires. More than two wires shall not be terminated in a terminal block. Each wire shall be provided with a separate lug for termination. Suitable pre-insulated Annealed Tinned Copper	

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	(ATC) lugs and clip on type terminals shall be used in wiring. For CT, shorting link shall be provided. All the wires shall be laid down through cable tray channel. For control and signal wiring, 1 sq mm copper PVC insulated stranded wires to be used.	
8.21	20% spare control terminal blocks shall be provided in the panel for each row / group of terminal. The current rating of terminal blocks shall be at least twice that of terminated wires.	
8.22	SMPS system shall be dust and vermin proof with enclosure meeting IP56 degree of protection for outdoor equipment & IP 42 or better degree of protection for indoor equipment. Neoprene gaskets / natural rubber shall be provided for all metal-to-metal joints. All hard wares such as bolts, nuts and be nickel / cadmium plated / zinc passivated.	
8.23	The LT/HT Power/Control/signal (instrumentation) cables, applicable cable glands & lugs (at both ends) are in vendor scope. Vendor shall supply entire cable for taking power from LTMSB to SMPS Control unit & HVR at ESP Roof top. Cable make and quality shall meet NTPC's requirement. The distance between LTMSB to ESP Roof Top is detailed in indent annexure & specification of cable to be followed are detailed in annexure-II. Calculation for cable size selection shall be submitted by the vendor for BHEL/NTPC approval. Data sheet/Type Test Report/QP shall be submitted by vendor for NTPC approval.	
8.24	<u>Cable Gland & Lugs:</u> a) Suitable double Compression, Nickel Coated Brass Type Cable Glands for incoming & outgoing cables for terminating the cables shall be supplied by the vendor. b) Annealed tinned copper crimping type lugs (lugs shall be of pre-insulated type for control cables) of the respective size in required quantity to terminate all cables shall be supplied by vendor. c) All cable glands shall be fitted on the cable Gland plate & provided with dummy plugs.	

Sl. No.	Specification	Vendor Confirmation (with documents)									
	<table> <tr> <th>Sl No</th><th>Item</th><th>NTPC approved Makes</th></tr> <tr> <td>1.</td><td>Cable Gland</td><td>Comet/Siemens/Sunil&Co/Bracco/Controls& Switchgear/Arup Engineering/Quality Precision/Lotus/CMI</td></tr> <tr> <td>2.</td><td>Lugs</td><td>Dowells/Jainson/Lotus/3D</td></tr> </table>	Sl No	Item	NTPC approved Makes	1.	Cable Gland	Comet/Siemens/Sunil&Co/Bracco/Controls& Switchgear/Arup Engineering/Quality Precision/Lotus/CMI	2.	Lugs	Dowells/Jainson/Lotus/3D	
Sl No	Item	NTPC approved Makes									
1.	Cable Gland	Comet/Siemens/Sunil&Co/Bracco/Controls& Switchgear/Arup Engineering/Quality Precision/Lotus/CMI									
2.	Lugs	Dowells/Jainson/Lotus/3D									
9	Grounding										
9.1	There shall be two separate grounding terminals with M12 bolt, nut and washers for Positive grounding of tank. The positive bushing terminal shall be connected by tinned copper strips to the earth terminal, externally. The positive terminal shall also be earthed, internally within the TR set.										
10	Component Identification and Labeling:										
10.1	All the components of SMPS shall be identified. Door mounted components shall be identified by fixing anodized Aluminium labels & for components mounted inside the panel / marshaling box shall be identified with Aluminium foil sticker.										
11	SMPS Controller										
11.1	The SMPS controller shall be an advanced, latest version with high degree of flexibility, converts the frequency to the required level, monitor, execute algorithms and adjust automatically the output to suit ESP operating conditions. Once programmed by the operator, it shall automatically adjust output without any manual intervention/adjustments. Adequate Alpha-Numeric display shall be provided for operator information/trouble shooting. All parameter setting& editing shall be pass word protected. Controller shall detect failure of any phase. The controller shall have record log of sequence of faults for diagnosis. List of alarms & Trip conditions for trouble free operation of the SMPS shall be provided.										
11.2	THE SMPS controller shall be controlled locally either through in-built local Keypad & display or a separate Remote Terminal Unit (RTU) or both.										
11.2	Following alarms/trip shall be provided as minimum.										
11.2.1	Oil temperature High										
11.2.2	Capacitor bank temperature										
11.2.3	IGBT power pack temperature										
11.2.4	Over load, over voltage										

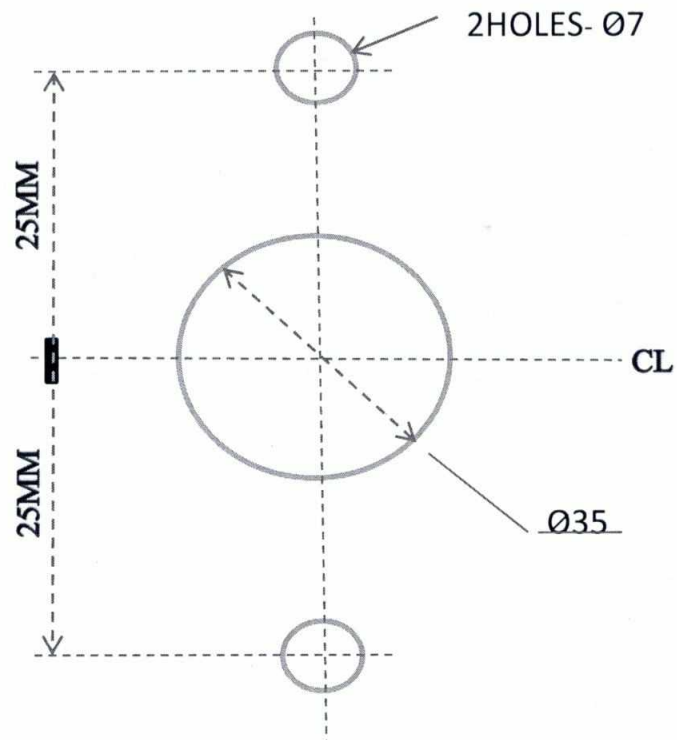
Sl. No.	Specification	Vendor Confirmation (with documents)
11.2.5	AC current High	
11.2.6	Low DC voltage	
11.2.7	High DC voltage	
11.2.8	Management Command Failure	
11.3	Details of SMPS Controller & RTU shall be furnished for our review.	
11.4	The controller shall have analog outputs of 4 to 20 mA corresponding to Rated mA and Maximum DC voltage.	
11.5	It shall be possible to communicate with Controller from Central Computer. Communication interface shall be MODBUS over RS485(2-wire) /Ethernet.	
11.6	User settings are to be retained suitably in memory even after power off condition.	
11.7	Communication cable for RTU, Central computer & SMPS controller with all interfaces like network switch & modem are to be supplied by vendor.	
12	Back corona	
12.1	Detection of Back-corona and optimization of operating parameters based on the VI characteristic/any proven parameter of the field to be provided.	
13	Type Tests For SMPS	
13.1	Type test to be conducted as per Contract Quality Requirement (CQR) indicated in Enquiry.	
14	Painting	
14.1	Painting for Transformer	
14.1.1	The internal and external surfaces including fluids filled chambers and structural steel work of transformer shall be sand blasted / approved equivalent method, to remove all rust, scales or foreign adhering material. All steel surfaces in contact with insulating fluid shall be painted with two coats of heat resistant fluid insoluble in insulating fluid. All sheet steel surfaces exposed to weather shall be given a primary coat of zinc chromate, second coat of weather resistant epoxy paint of colour distinct from primary. Finally two coats of glossy fluid and weather resistant non fading paint of shade RAL 5012 (BLUE) shall be provided. Minimum thickness of paint shall be 50 microns.	
14.1.2	If the transformer tank is made of material other than steel, the same shall be clearly brought out along with the process followed for metal treatment & painting.	

Sl. No.	Specification	Vendor Confirmation (with documents)
14.2	Painting for Controller Unit, Marshaling Box, Enclosure box etc.	
14.2.1	All sheet steel shall be pretreated in seven tank process in accordance with IS 6005/Equivalent International Standard. Degreasing, de-rusting, phosphating (Class C) shall be done for metal treatment. Stove lead oxide primer coating. After primer application, finishing synthetic enamel stoving paint shall be applied. Thickness of paint shall not be less than 50 microns. The final shade shall be RAL 9002 (GREY) in front and rear and RAL 5012 (BLUE) in the extreme end covers of panel. Peelable coating shall be applied on panel after final painting. If the approved drawing calls for any other painting process, then the same shall be followed.	
15	Makes of Components	
15.1	The make of components are subject to BHEL review & NTPC approval. Only the Make of components which are approved by NTPC during drawing approval by NTPC shall be used in the supply. There shall not be any commercial implication on account of such approvals.	
16	Documents to be submitted	
16.1	Documents to be submitted along with offer	
16.1.1	Filled in data sheet forming part of the enquiry.	
16.1.2	Over all General arrangement with dimensions, mounting details, weight, and external clearances required.	
16.1.3	Compliance to the technical specification and list of specific deviations if any. Clarifications will be construed as compliance.	
16.1.4	Brief operation /functioning of SMPS.	
16.1.5	Power and control scheme(Typical)	
16.1.6	Bill of materials of Major components with make & model number.	
16.1.7	List of customers where similar/identical SMPS supplied, year of supply& commissioning, Quantity, country and application like Thermal power /cement etc, Customer feedback on the performance(typical)	
16.2	Documents to be submitted on placement of Purchase order for BHEL review and NTPC approval:	
16.2.1	General arrangement of SMPS, controller unit & Marshaling box, inside component layout, Wiring drawing, Detailed Bill of material, Power and control scheme, Rating and Diagram plate and technical particulars of High frequency high voltage transformer.	
16.2.2	Detailed calculation for selection / sizing of KVA rating of transformer, RF choke, Diode stack, HV resistor column, IGBT etc. for review/information.	

Sl. No.	Specification	Vendor Confirmation (with documents)
16.2.3	Data sheet for transformer, Controller unit, functional/operational write up. Data sheet/Type Test report/QP of all type of cables.	
16.2.4	Interconnection diagram between HVTR and controller unit, Marshaling box, and external equipment interface requirements / other panels.	
16.2.5	Typical test certificate of similar /identical rating and test format for inspection.	
16.2.6	Quality plan with customer check points.	
16.2.7	Packing procedure and drawing.	
16.2.8	Six sets of the above drawings shall be submitted to BHEL for approval, before taking up with manufacture.	
16.2.9	Typical operation and maintenance supplied for identical / similar rating recently to customers.	
17	O&M Manual	
17.1	Operation & Maintenance manual in required numbers , as per Enquiry / Purchase order, shall be supplied along with the dispatch of the SMPS. The O&M manual shall be directly sent to BHEL / Ranipet Stores.	
17.2	The O & M manual shall contain the following as minimum requirement. Relevant GA drawings, power & control schemes, operational write up, wiring drawings, Rating and diagram plate, Do's and Don'ts, details on storage, handling, pre commissioning checks, commissioning procedure, Controller operating details, set parameters, trouble shooting, manufacturer's catalogue for various bought out components etc., List of recommended spares for three years trouble free maintenance spares with Quantity.	
17.3	The scheme drawings shall indicate all the components so that trouble shooting can be made easier.	
17.4	Exhaustive Bill of Materials indicating description, rating, quantity, make, model number , datasheet etc., for ordering components at a later date.	
18	Inspection & Testing	
18.1	The SMPS shall be tested based on the following documents:	
18.1.1	BHEL Purchase order (PO).	
18.1.2	BHEL Technical specification/ordering specification as finalised & indicated in the PO.	
18.1.3	Quality checklist / Quality Plan as finalised & indicated in the PO.	
18.1.4	Test Procedure TP: 110 (latest revision).	
18.1.5	BHEL/NTPC approved vendor drawings.	
18.1.6	Vendor shall provide specific confirmation to all the individual tests requirements.	

Sl. No.	Specification	Vendor Confirmation (with documents)
19	Packing	
19.1	The equipment shall be properly packed with sea worthy packing to avoid any damage during transit / storage. The packing shall be weather proof and suitable for outdoor storage. Necessary provisions / marks for handling shall be provided. Each packing shall contain a packing slip showing all the components, supplier reference and Name, purchase order number, serial number of equipment, destination address, brief equipment description, one copy of instruction manual and relevant test certificates. Loose components if any, shall be clearly indicated in packing slip.	
19.2	Each SMPS unit shall be packed separately. Loose Items related to each SMPS unit shall be packed along with the SMPS for ease of identification.	
19.3	Each crate shall indicate the Purchase Order number, Name and address of the consignee, approximate weight, Name of equipment (SMPS), Shipping marking etc.	
20	Commissioning supervision & Training	
20.1	Commissioning supervision is required for 1 set of SMPS at Thermal Power Station. Required Training on Commissioning, Operational and Maintenance of SMPS are to be provided during the visit of Commissioning Supervision (with minimum 2 man days for training alone)	
20.2	Additional Commissioning Supervision Charges over and above the first Set of SMPS at Thermal Power Station shall be quoted separately as an optional item. Vendor to note that commissioning of SMPS may take up to 2 years from the date of supply.	

Annexure-I



DRILLING DATA ON PANEL FOR FIXING INTERLOCK

Annexure-II

I. Cable Route details

1.Project : Singrauli R &M (2x500MW)-95KV 800mA

- a) **Route 1:** Distance from LTMSB (located at ESP Control Room) to HFTR (located at ESP Roof Top)= 200 Mtrs.

Route 1 is applicable for 4 Nos of SMPS per boiler.

- b) **Route 2:** Distance from LTMSB (located at ESP Control Room) to HFTR (located at ESP Roof Top)= 250 Mtrs.

Route 2 is applicable for another 4 Nos of SMPS per boiler.

2.Project : Singrauli R &M (5x200MW)-95KV 600mA

Distance from LTMSB (located at ESP Control Room) to HFTR (located at ESP Roof Top)= 200 Mtrs.

This is applicable for 4 Nos of SMPS per boiler.

- I. Power cables of sizes having greater than 120 sq.mm shall be XLPE Insulated.
- II. Following specification of cables shall be followed and cables shall be produced only from the below listed NTPC approved vendors.

SL.NO	TYPE OF CABLE	APPLICABLE SPECIFICATION REF.	NTPC APPROVED MAKE
1.	LT POWER CABLE	TECI:NTPC:PCCAB:Rev 01	a) GEMSCAB – Bhiwadi b) Paramount Cables – Khushkhera c) Havell – Alwar d) Rallison – Bhiwadi e) Cords Cables – Bhiwadi f) INCAB – Pune g) Polycab Wires – Daman h) Universal Cable – Satna i) Torrent – Nadiad j) HVPL – Faridabad k) NICCO – Shyamnagar l) KEI – Biwadi m) Delton – Faridabad n) Radiant Cable – Hyderabad “DR Category (DR -Details Required) is to be submitted

			to NTPC/QA for their consideration and approval for following vendors o) Advance cable (DR) – Bangalore
2.	CONTROL CABLE	TECI:NTPC:PCCAB:Rev01	a) ELKAY TELELINKS – Faridabad b) DELTON Cables – Faridabad c) Torrent – Nadiad d) Poly Cab – Daman e) Paramount Cables – Alwar f) Cords Cables – Bhiwadi g) Radiant Cables – Hyderabad h) NICCO – Shyamnagar i) KEI – Bhiwadi j) GEMSCAB – Bhiwadi k) HVPL – Faridabad l) Universal Cables – Satna m) Havell – Alwar n) Rallison – Bhiwadi “DR” Category (DR -Details Required) is to be submitted to NTPC/QA for their consideration and approval for following vendors a. Advance Cable (DR) - Bangalore b. Goyolene(DR)- Silvasa
3.	SCREENED CABLE (INSTRUMENTATION)	TECI:NTPC:SCAB:Rev00	a) Universal cable - Satna b) KEI – Bhiwadi c) NICCO – Kolkatta d) Cords – Bhiwadi e) Polycab – Daman f) Paramount cable - Khushkhera g) Delton cables - Faridabad h) Thermo cables - Hyderabad

PRODUCT STANDARD
ELECTRICAL C & I
BAP/BHEL/RANIPET - 632 406.

TECI: NTPC: PCCAB: REV 01
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EFFECTIVE DATE: 16.09.2016

TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS FOR ESP
ITEM : POWER AND CONTROL CABLES.
CUSTOMER : NATIONAL THERMAL POWER CORPORATION LTD (NTPC)

NAME		DESIGNATION	SIGNATURE	DATE
PREPARED	A.K.PALANISAMY	Sr Engineer		16.09.2016
CHECKED	M.JEYAMURUGANAND	SDGM		16.09.2016
APPROVED	M.JEYAMURUGANAND	SDGM		16.09.2016

ISSUED BY

EDC - ECI

REVISION NO: 01 - XLPE SPECIFICATION ADDED

INITIAL RELEASE: 09.03.2009

1.0.0 SCOPE:

- 1.1.0 The scope of supply of cables includes, design, manufacture, inspection, testing, packing and delivery.

2.0.0 APPLICATION:

- 2.1.0 The cables to be supplied under this specification are intended to be used for the interconnection of various electrical equipments of Electrostatic Precipitator (ESP), such as Transformer Rectifier, Electronic Controller, Auxiliary Control panel, Rapping Motors, Heaters etc.

3.0.0 APPLICABLE STANDARDS

- 3.1.0 The cable shall be manufactured, tested and packed as per the following standards (latest issues and their amendments if any). In case of any conflict between these standards and this technical specification, the latter shall prevail to the extent of such difference.

- 3.1.1 IS 1554 (Part I) – For PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 V.
- 3.1.2 IS 7098 (Part - I) - For cross linked polyethylene (XLPE) insulated cables, for working voltages upto and including 1100V
- 3.1.3 IS 3961 - Recommended current ratings for cables.
- 3.1.4 IS 5831 - PVC insulation and sheath of electrical cables
- 3.1.5 IS 8130 - Conductors for insulated electric cables and flexible cords
- 3.1.6 IS 9938 - Recommended colours for PVC insulation for LF wires and cables
- 3.1.7 IS 10418 - Specification for drums for electric cables.
- 3.1.8 IS 10462 (Part-I) - Fictitious calculation method for determination of dimensions of protective coverings of cables
- 3.1.9 IS 10810 - Methods of test for cables.
- 3.1.10 IEEE 383 - Standard for type test of Class II electric cables, field splices and connections for Nuclear Power Generation stations.
- 3.1.11 ASTM D 2843 - Standard test method for density of smoke from the burning or decomposition of plastics.
- 3.1.12 ASTM D 2863 - Standard test method for measuring the minimum oxygen concentration to support candle like construction of plastics.

- 3.1.13 IEC 754 (Part-I). - Test on gases evolved during combustion of electric cables
- 3.1.14 SS 4241475 - Flammability testing of cables. (F3 CATEGORY)
- 3.1.15 IEC 332 (part 3) (category B) - Test on electric cables under fire condition.

4.0.0 SITE ENVIRONMENT:

- 4.1.1 Ambient Temperature : 5 deg.C to 50 deg.C
- 4.1.2 Relative Humidity : 100 %
- 4.1.3 Design Ambient Temp. : 50 deg.C
- 4.1.4 Fault Level : 50 KA for 1 sec.

5.0.0 SPECIFICATION OF CABLE:

5.1.0 CONDUCTOR

- 5.1.1 Material :
i. Stranded Aluminium - H2 grade as per IS 8130.
ii. Copper - Annealed bare copper of electrolytic grade as per IS 8130.
Bare/tinned copper as per enquiry/purchase order
- 5.1.2 Construction : Multi stranded for any cross section for both ALUMINIUM and COPPER conductor cables.
- 5.1.3 Number of strands : Minimum 7 strands.
- 5.1.4 Shape : Compacted type for sizes above 10 Sq.mm
- 5.1.5 Cross section area : As per Purchase enquiry / purchase order. The specified area shall be maintained strictly as per enquiry immaterial of DC resistance.
- 5.1.6 Tensile strength : Minimum 100 N/mm² for aluminium conductor

5.2.0 INSULATION

- 5.2.1 Material : XLPE as per IS 7098 (Part-I) or PVC type A as per IS 5831 as per Enquiry/PO.

-
- 5.2.2 Method of application : Extrusion
- 5.2.3 Thickness : As per IS 1554 (Part-1) for PVC insulated cables as per IS 7098 (Part-1) for XLPE insulated cables.
- 5.2.4 Colour identification
- i) Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.
- ii)
- | | | |
|--------|---|-----------------------------------|
| 1 core | : | Red, Black, Yellow or Blue |
| 2 core | : | Red & Black |
| 3 core | : | Red, Yellow & Blue |
| 4 core | : | Red, Yellow, Blue and Black |
| 5 core | : | Red, Yellow, Blue, Black and Grey |
- 5.2.5 For 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 number 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 numerals shall not exceed 50 mm.
- 5.2.6 For reduced neutral conductors, the core shall be black.
- 5.2.7 Shade of insulation colour : As per IS 9938
- 5.3.0 FILLERS (if provided) :
- 5.3.1 Material : Non-hygroscopic, Fire Retardant, suitable for the operating temp. of cable.
- 5.4.0 **INNER SHEATH:**
- 5.4.1 Material : PVC type ST-1 as per IS 5831 for PVC insulated cable & PVC type ST-2 as per IS 5831 for XLPE insulated cable.
- 5.4.2 Method of application : Extrusion
- 5.4.3 Thickness : As per IS 1554 (Part-I)
- 5.4.4 Colour : Black for power & control cable
- 5.5.0 **ARMOURING** : No armouring shall be provided.

5.6.0 OUTER SHEATH:

- 5.6.1 Material : FRLS PVC type ST1 as per IS 5831 for PVC insulated cable & FLRS PVC type ST2 as per IS 5831 for XLPE insulated cable.
- 5.6.2 Method of application : Extrusion
- 5.6.3 Thickness : As per IS 1554 (Part-1) for PVC insulated cable & as per IS 7098 (Part-1) for XLPE insulated cable.
- 5.6.4 Colour
- i) For power cable : Black
 - ii) For control cable : Grey

**5.7.0 ADDITIONAL REQUIREMENT OF OUTER SHEATH:
(REQUIREMENT OF FRLS PROPERTIES)**

- 5.7.1 i. Oxygen index : Minimum 29 (As per ASTM D 2863)
ii. Temperature index : Not less than 250°C at 21 oxygen index (when tested as per ASTM D 2863)
- 5.7.2 Max. acid gas generation by weight : Maximum 20% (when tested as per IEC 754 – A Part-I)
- 5.7.3 Light transmission : Minimum 40% (when tested as per ASTM D 2843), Smoke density rating shall be max.60%. This is average value and not instantaneous value.
- 5.7.4 Flammability : All cables shall pass the flammability test Per IEC 332 part 3 (category B) and as per IEEE 383.
- 5.7.5 Flame resistance : All cables shall meet the flame resistance requirement as per Category F3 of SS 4241475.

5.8.0 GENERAL REQUIREMENTS:

- 5.8.1 The cable shall be designed to withstand all mechanical, electrical and thermal stresses under the foreseen steady state and transient / fault operation conditions. All cables shall be suitable for high ambient, high humid tropical Indian conditions.
- 5.8.2 Cable shall be 1100V grade, PVC/XLPE insulated, unarmoured having outer sheath of FRLS (Fire retardant low smoke) PVC ST1/PVC ST2.

- 5.8.3 All cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour.
- 5.8.4 The PVC cable shall be designed for a steady state continuous conductor temperature of 70 deg. C and short circuit withstand temperature of 160 deg C.
- 5.8.5 The XLPE cable shall be designed for a steady state continuous conductor temperature of 90 deg. C and short circuit withstand temperature of 250 deg C.
- 5.8.6 For outer sheath, polyethylene based halogen free material is not acceptable.
- 5.8.7 Allowable tolerance on overall diameter of the cable shall be + / - 2 mm maximum over the declared value in the technical data sheet .
- 5.8.8 The nominal current rating of all PVC insulated cables shall be as per IS 3961.
- 5.8.9 Repaired cables shall not be offered and the same will not be accepted. Pimples, fish eye, blowholes etc., are not acceptable.
- 5.8.10 In addition to manufacturer's identification on cables as per IS, following embossing/printing shall also be provided over outer sheath.
- 1) Cable size & voltage grade - To be embossed
 - 2) Word FRLS at every 5 metre - To be embossed
 - 3) Sequential marking of length of cables in metres at every one metre – To be embossed / printed
- The embossing/printing shall be progressive, automatic, in line and shall be legible and indelible.
- 5.8.11 The cables shall be supplied in non-returnable wooden or steel drums in coil form of length 1000 metres $\pm 5\%$.
- 5.8.12 Progressive markings to read "FRLS" at every 5 metres shall be provided by embossing on the outer sheath of all cables.
- 5.8.13 The cable cores shall be laid up with fillers between the cores wherever necessary. The fillers should not be stick to insulation and inner sheath.

6.0.0 PACKING AND MARKING:

- 6.1.0 The cable shall be wound on a non-returnable drum in length of 1000 metres $\pm 5\%$ and packed. Cables of size 1C-240 sq.mm / 2C-185 sq.mm and above sizes can be supplied in 500 mtrs drum length or as mentioned in enquiry/purchase order. The packing shall be suitable for keeping it in outside which shall withstand heavy rain & dusty environment. The remaining length shall be supplied in a single drum. Cut bits or not acceptable. Over all quantity tolerance against each size shall be +0%, -2%.
- 6.1.1 The wooden drum shall be provided as per IS 10418.

- 6.1.2 The ends of the cable 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.
- 6.1.3 The information as detailed in Clause 18.2 of IS 1554 (Part-I) shall be stencilled on each drum.
- 6.1.4 Non – hygroscopic PVC/ POLYETHYLENE sheet shall be provided on the surface of the barrel of the drum and over outermost layer of the cable.
- 6.1.5 Wood preservative anti-termite treatment shall be applied to the enter drum.
- 6.1.6 Each dream shall carry manufacturer's name, Purchaser's name, address, item number, contact number and type, size and length of cable and net gross weight stencilled on both sides of 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.

7.0.0 DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

The data sheet shall be submitted in soft media, within 10 days from the date of order, for approval.

8.0.0 INSPECTION AND TESTING:

- 8.1.0 The cable shall be inspected and tested based on the following documents.

1. NTPC approved Quality Plan
2. BHEL Technical Specification (TEP)
3. BHEL Purchase order
4. BHEL approved suppliers data sheet

- 9.0.0 This specification meets NTPC contract specification. Hence no deviation shall be taken by the supplier.

PRODUCT STANDARD
ELECTRICAL C & I
BAP/BHEL/RANIPET – 632 406

TECI: NTPC: SCAB: REV 00
Page 01 of 09
EFFECTIVE DATE: 09.03.2009

TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS FOR ESP
ITEM : SCREENED CABLE
CUSTOMER : NATIONAL THERMAL POWER CORPORATION LTD (NTPC).

NAME		DESIGNATION	SIGNATURE	DATE
PREPARED	G.M.KUMAR	SAE	G.M. Kumar	09.03.2009
CHECKED	T.VENUGOPAL	DY.MGR	T. Venugopal	09.03.2009
APPROVED	T.VENUGOPAL	DY.MGR	T. Venugopal	09.03.2009

ISSUED BY

EDC – ECI

REVISION NO :00

INITIAL RELEASE : 09.03.2009

1.0.0 SCOPE :

1.1.0 The scope of supply of SCREENED CABLES includes design, manufacture, inspection, testing, packing and delivery.

2.0.0 APPLICATION:

2.1.0 The cable to be supplied under this specification is intended to use for carrying the following signals in ELECTROSTATIC PRECIPITATOR.

1. Micro-amp., milli-volt DC analogue signals from High Voltage Rectifier Transformer and the Electronic Control cubicle.
2. 4-20mA DC analogue signals from DUST DENSITY MONITOR to the IOS panel.
3. ± 10 mA current loop serial communication between various sub units of IOS system.

3.0.0 APPLICABLE STANDARDS:

3.1.0 The screened cable shall be manufactured, tested and packed as per the following standards (Latest issues and their amendments). In case of any conflict between these standards and this Technical specification, the later shall prevail to the extent of such difference. In case of any conflict between these standards, the most stringent condition shall prevail

- | | | | |
|-------|------------|---|--|
| 3.1.1 | IS 3961 | - | Recommended current ratings for cables. |
| 3.1.2 | IS 9938 | - | Recommended colours for PVC insulation for LF wires and cables. |
| 3.1.3 | IS 10418 | - | Specification for drums for electric cables. |
| 3.1.4 | IEEE 383 | - | Standard for type test of Class II electric cables, field splices & connections for Nuclear power generating stations. |
| 3.1.5 | ASTMD 2843 | - | Standard test method for density of smoke from the burning or decomposition of plastics |
| 3.1.6 | ASTMD 2863 | - | Standard test method for measuring the min. oxygen concentration to support candle like construction of plastics. |
| 3.1.7 | IEC 754 | - | Test on gases evolved during combustion of Electric cables (Part-I). |
| 3.1.8 | SS 4241475 | - | Flammability testing of cables. |

- 3.1.9 VDE 0207 - Insulation and Sheathing compounds for cables and flexible cords.
- 3.1.10 VDE 0472 - Rules for testing insulated cables and flexible cords.
- 3.1.11 VDE 0815 - Wiring cables for telecommunication and data processing system.
- 3.1.12 VDE 0816 -
- 3.1.13 IS 1554 (Part-1) PVC insulated (heavy duty) electric cables for working voltage upto and including 1100V.
- 3.1.14 IS 10810 Method of tests for cables.
- 3.1.15 IEC 332 (Part-3 category-B) Test on electric cables under fire conditions.

4.0.0 SITE ENVIRONMENT:

- 4.1.0 Ambient Temperature : 5 deg.C to 50 deg.C.
- 4.1.1 Design Ambient Temperature : 50 deg.C.
- 4.1.2 Relative Humidity : 100 %.

5.0.0 CONSTRUCTION OF SCREENED CABLE:

The conductors shall be formed by multi strands. Such multi strand conductors shall be insulated with PVC. Two such cores shall be twisted with 50mm (MAX) lay, and shall be MELINEX tapped with of thickness 0.028mm (min.) with 100% cover age and min.20% (min) overlap. Such taped pair shall be 100% screened with 20% (min) overlap using 0.06mm thick Aluminium Mylar tape. A drain wire of size 0.51 sq.mm. Annealed Tinned copper conductor formed by 7 strands, shall be provided for individual pair screen touching aluminium. Then a POLYSTER TAPE of thickness 0.028mm (min.) shall be provided on such screened pair with 100% coverage and 20% (min.) overlap for screen isolation.

Two such screened pairs shall be laid up, collectively 100% screened with 20%(min) overlap using 0.06mm thick ALUMINIUM MYLAR TAPE. Then a drain wire of 0.51 sq.mm Annealed Tinned Copper conductor formed by 7 strands shall be provided touching aluminium.

Such laid-up cables shall be provided with FRLS-PVC outer sheath.

6.0.0 SPECIFICATION OF SCREENED CABLE:

6.1.0 CONDUCTOR:

- 6.1.1 Material : High conductivity Annealed Bare copper of electrolytic grade, as per IS VDE 0815.
- 6.1.2 Cross section area of conductor : 1.5 sq.mm.
- 6.1.3 Construction : Multistranded (7 X 0.53 mm).
- 6.1.4 Number of strands : 7.
- 6.1.5 Shape : True circular before stranding, uniform quality free from defects.

6.2.0 INSULATION:

- 6.2.1 Material : PVC compound Y13 as per VDE 0207 (part 4).
- 6.2.2 Method of appln. : Extrusion.
- 6.2.3 Thickness : 0.8 mm (Nominal) However higher thickness shall be provided if required , to meet clause 6.14.1 to 6.14.7 of this specification and to meet the HV test.
- 6.2.4 Colour : Red + blue, Grey + yellow.
- 6.2.5 Shade of colour : As per IS 9938.
- 6.2.6 Maximum Lay length of twin cores : 50mm (approximate).
- 6.2.7 Sequence of twisting of twin cores. : Right hand.

6.3.0 TAPING OVER LAID UP CORES:

- 6.3.1 Material : MELINEX.
- 6.3.2 Thickness : 0.028mm (min).

Ch. Not covered in the spec.

6.3.3 Coverage : 100%.

6.3.4 Overlap : Min. 20%.

6.4.0 INDIVIDUAL PAIR SCREENING:

6.4.1 Material : ALUMINIUM MYLAR TAPE.

6.4.2 Coverage : 100%.

6.4.3 Overlap : 20% (min.).

6.4.4 Thickness : 0.06mm(min).

6.5.0 DRAIN WIRE (INDIVIDUAL SCREEN):

6.5.1 Material : Annealed tinned copper.

6.5.2 Area of cross sec. : 0.51 sq.mm (20 AWG).

6.5.3 Construction : Multistranded.

6.5.4 No. of strands : 7.

6.6.0 SCREEN ISOLATION:(INDIVIDUAL PAIR SCREEN)

6.6.1 Material : POLYESTER TAPE

6.6.2 Coverage : 100%.

6.6.3 Overlap : 20% (min.).

6.6.4 Thickness : 0.028mm (min).

6.7.0 OVERALL SCREEN:

6.7.1 Material : ALUMINIUM MYLAR TAPE

6.7.2 Coverage : 100%.

6.7.3 Overlap : 20% (min.).

6.7.4 Thickness : 0.06mm(min)

6.8.0 DRAIN WIRE (OVERALL SCREEN)

- 6.8.1 Material : Annealed tinned copper
- 6.8.2 Area of cross section : 0.51 sq.mm (20 AWG).
- 6.8.3 Construction : Multistranded.
- 6.8.4 No.of strands : 7.

6.9.0 FILLERS (IF PROVIDED) :

- 6.9.1 Material : Non-hygroscopic, flame retardant, moisture resistant, suitable for the operating temp of cable.

6.10.0 INNERSHEATH & ARMOURING:

Inner sheath and armouring are not required.

6.11.0 OUTER SHEATH:

- 6.11.1 Material : YM1 PVC as per VDE 0207 PART 5, with FRLS property.
- 6.11.2 Method of appln. : Extrusion.
- 6.11.3 Nominal thickness : As per VDE 0816 guide-lines. However the thickness shall not be less than 1.8 mm, in any case.
- 6.11.4 Colour : Sky Blue.

**6.12.0 ADDITIONAL REQUIREMENT OF OUTER SHEATH:
(REQUIREMENT OF FRLS PROPERTIES)**

- 6.12.1 Oxygen index : Not less than 29 (when tested as per ASTM D 2863).
- 6.12.2 Temperature Index : Not less than 250 Deg.C at 21 oxygen index (when tested as per ASTM D 2863)
- 6.12.3 Max.acid gas generation by weight : Not more than 20% (when tested as per IEC 754 - I).

-
- 6.12.4 Smoke density rating : 60% max. when tested as per ASTM D 2843. The supplier shall plot the graph as per the referred standard & to show that the average area under the curve shall not be more than 60 % .
- 6.12.5 Flammability : Complete cable shall pass the flammability test as per IEEE 383 and IEC 332 (part 3 category B).
- 6.12.6 Flame resistance : Complete cable shall meet the flame resistance requirement as per SS 4241475. Complete cable shall be as per category F3.

**6.13.0 SPECIAL REQUIREMENT OF SCREENED CABLE
(AT 20 deg C +/- 3 deg C)**

- 6.13.1 Characteristic impedance : 230 (max.) at 1 KHz.
- 6.13.2 Mutual capacitance between conductors at 0.8 KHz : 100 nF/km (max.).
- 6.13.3 Noise interference : Better than 60 dB.
- 6.13.4 Attenuation at 1 KHz : Max. 0.8 dB/Km.
- 6.13.5 Cross talk at 0.8 KHz : Better than 60 dB.
- 6.13.6 Conductor resistance : 13.3 Ohm/km (max)
- 6.13.7 Insulation resistance : 100 M Ohm/km (min)

7.0.0 GENERAL REQUIREMENTS:

- 7.1.0 The cable shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operation conditions. The cable shall be suitable for laying in wet & dry locations in trays, conduits, ducts, trenches etc.
- 7.1.1 The cable shall be designed for a steady state continuous conductor temperature of 70 deg.C.

- 7.1.2 The cable shall comply with latest edition of VDE 0815, VDE 0207 part 4 & 5 & 6 VDE 0816, VDE 0472 standards including the amendments, read along with this specification. However the voltage grade of the cable shall be 1100V AC.
- 7.1.3 Allowable tolerance on overall diameter of the cable shall be ± 2 mm (max.) over the declared value in the technical data sheet. The variation in diameter & the ovality at any cross section shall not be more than 1.0 mm.
- 7.1.4 The cable shall be capable of withstanding a conductor temperature of 160°C during a short circuit.
- 7.1.5 The nominal current rating of all PVC insulated cables shall be as per IS 3961.
- 7.1.6 Repaired cables shall not be offered and the same will not be accepted.
- 7.1.7 Progressive automatic on line sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of all cables.
- 7.1.7 Progressive markings to read "FRLS" at every 5 metres shall be provided on the outer sheath of all cables.
- 7.1.8 The cable shall be supplied in Non-returnable drum in coil form of min. length of 1000 meters $\pm 5\%$.
- 7.1.9 The cable shall be provided with markings including manufacturer's name, insulation material, conductor size, number of pairs, voltage rating, type of cable.
- 7.1.10 The pairs of cable shall be identified by colour coding. The colour coding and cable identification shall be as per VDE 0815.
- 7.1.11 Non – hygroscopic PVC/ POLYTHELENE sheet shall be provided on the surface of the barrel of the drum & over outermost layer of the cable.
- 9 7.1.12 Cable accessories such as harnessing components, markers, bedding, binding tape etc. shall also have flame retardant quality.
- 7.1.13 The dielectric strength shall be as follows :
- | | |
|------------------------|------------------|
| Conductor to conductor | 3KV for 5 min. |
| Conductor to screen | 0.5KV for 5 min. |

8.0.0 PACKING AND MARKING:

8.1.0 The cable shall be wound on a non-returnable drum in length of 1000 metres $\pm 5\%$ and packed. The packing shall be suitable for keeping it in outside which shall withstand heavy rain & dusty environment. The remaining length shall be supplied in a single drum. Cut bits or not acceptable. Over all quantity tolerance against each size shall be +0%, -2%. *add*

8.1.1 The drum shall be provided as per IS 10418.

8.1.2 The ends of the cable shall be sealed by means of non-hygroscopic sealing material.

8.1.3 The information as detailed in Clause 18.2 of IS 1554 (Part-I) shall be stencilled on each drum.

9.0.0 DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

The data sheet shall be submitted in SOFT MEDIA for approval, within 10 days from the date of order.

10.0.0 INSPECTION AND TESTING:

10.1.0 The cable shall be inspected and tested based on the following documents.

1. NTPC approved Quality Plan.
2. BHEL Technical Specification (TEP).
3. BHEL Purchase order.
4. BHEL approved suppliers data sheet.

11.0.0 This specification meets NTPC contract specification. Hence no deviation shall be taken by the supplier.

PERFORMANCE CERTIFICATE

END USER CERTIFICATE FOR THE PROPOSED EQUIPMENT (ATLEAST FROM ONE END USER) COMPLYING TO CLAUSE 1.1 OF BHEL TENDER SPECIFICATION (TECI:NTPC:SMPS:REV 00) SHOULD NECESSARILY CONTAIN THE FOLLOWING INFORMATION:

1. Name of the Power station and its location :
2. Name of Client/Owner with full address, Fax No. & Tel.No. :
3. Name and Designation of the responsible contact person in client's/owner's organization :
4. Name of Package/Contract :
5. Contract/Order No. and date :
6. *Capacity in MW of Coal Fired Unit* :
7. *Date of commissioning* :
8. *Date of commencement of successful operation* :
9. Total quantity of HFTR Sets (in Numbers) supplied in the above Unit (project) in the above contract
10. Technical Particulars of the equipment supplied: _____ KV _____mA
 - (a) Make :
 - (b) KVA rating at 50 C ambient :
 - (c) Rated DC voltage (KVp) :
 - (d) Rated secondary current (Milli Ampere) :
 - (e) Type of oil filled : Silicone Oil
11. Specific mention about the satisfactory operation of the above equipment supplied for one year period from the date of Commissioning
12. Signature with seal and date

PROJECT: SINGRAULI STAGE – I & II (5X200MW + 2X500MW)		CONTRACT QUALITY REQUIREMENTS (CQR) for <u>Switch Mode High Frequency Transformer Rectifier sets(HFTR).</u>	PAGE :Page 1 of 2 DATE : 15 04 2015	## BHEL Enquiry No: ##Supplier Name: ##Offer reference: ##Date:
Sl. NO.	DESCRIPTION	BHEL/NTPC Requirements		##Specific confirmations by the vendor

All marked details to be necessarily filled up by the vendor at the time of offer itself otherwise their offer may not be considered w.r.t Quality Requirements being the specific requirements of ultimate customer

01	Sub Qualification Requirements	The manufactured should have already supplied at least 70KV/1000mA silicon oil filled switch mode high frequency transformer rectifier sets (either stand alone or in combination with HVTR) in one ESP of 200MW or higher rated coal fired coal fired unit which is in successful operation for a minimum one year as on date 08 01 2013.	
02	Quality plan requirements	1.Manufacturing Quality Plan (MQP) shall be submitted for BHEL/NTPC for review and approval. 2. If the supplier is already possession of NTPC approved Reference Quality Plan (RQP), the same may be submitted to BHEL. 3. In case of supplier having NTPC approved RQP, an endorsement sheet duly signed by vendor shall be submitted along with RQP for BHEL/NTPC approval.	
03	Type test requirements	1. Vendor shall submit the type test reports of all the type tests as listed in SL NO: 5 and carried out with in 5 years from the data of NTPC bid opening (08.01.2013). These reports should be for the test conducted on the similar equipment to those proposed to be supplied under this enquiry and test(s) should have been either conducted at an independent laboratory (or) should have been witnessed by TPI/ BHEL/NTPC.	
		2. However if vendor is not able to submit the similar type test report as per above condition (or) in the case of type test reports are not found to be meeting the tender specification requirement, the vendor shall conduct all the tests at no additional cost to BHEL either at third party lab (or) own lab in the presence of Third party inspection agency (TPI)/BHEL/NTPC and submit the reports for approval.	
		3. Type Test reports review and approval by NTPC is a must.	
		4. Specific confirmation /details like Type test certificate reference, Date of test and venue etc shall be given as per annexure-I (Enclosed by purchase) at the time of offer itself.	

PROJECT: SINGRAULI STAGE – I & II (5X200MW + 2X500MW)		CONTRACT QUALITY REQUIREMENTS (CQR) for <u>Switch Mode High Frequency Transformer Rectifier sets(HFTR).</u>	PAGE :Page 2 of 2 DATE : 15 04 2015	## BHEL Enquiry No: ##Supplier Name: ##Offer reference: ##Date:
Sl. NO.	DESCRIPTION	BHEL/NTPC Requirements		##Specific confirmations by the vendor

All marked details to be necessarily filled up by the vendor at the time of offer itself otherwise their offer may not be considered w.r.t Quality Requirements being the specific requirements of ultimate customer

03	Type test requirements Continued...	5. Applicable list of type test for HFTR of SMPS i. Temperature rise test at rated DC current ii. Lightening impulse voltage test iii. Measurement of harmonic current in no load current iv. Pressure Relief Device test (If applicable) v. Short circuit test vi. Vacuum test on tank vii. Pressure test on tank viii. Induced over voltage ix. Measurement of no load losses and current x. Measurement of Impedance voltage/Short circuit impedance and losses. xi. Measurement of IR xii. Measurement of Noise level xiii. Degree of protection test (IP 55 test) for Marshaling box xiv. Measurement of capacitance and Tan Delta. 6. Applicable type test for Electronic controller panel (Switch mode power supply/TR set Controller). i. Temperature rise test ii. Fast transient Surge withstand capability test(SWC) as for ANSI/IEEE C37.90.1-2002/IEC 60255-22-04-2008 (At Third party Lab) iii. Measurement of harmonic current test iv. Degree of protection test (IP 56). v. Damp Heat vi. Dry heat	
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##Supplier signature with seal

**BHEL-BHARAT HEAVY ELECTRICAL LIMITED (OVER ALL EQUIPMENT SUPPLIER)
NTPC-NATIONAL THERMAL POWER CORPORATION LIMITED (PLANT OWNER).**

	CORPORATE QUALITY ASSURANCE SUB-VENDOR QUESTIONNAIRE	

i.	Item/Scope of Sub-contracting			
ii.	Address of the registered office	Details of Contact Person (Name, Designation, Mobile, Email)		
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured	Details of Contact Person: (Name, Designation, Mobile, Email)		
iv.	Annual Production Capacity for proposed item/scope of sub-contracting			
v.	Annual production for last 3 years for proposed item/scope of sub-contracting			
vi.	Details of proposed works			
1.	Year of establishment of present works			
2.	Year of commencement of manufacturing at above works			
3.	Details of change in Works address in past (if any)			
4.	Total Area			
	Covered Area			
5.	Factory Registration Certificate	Details attached at Annexure – F2.1		
6.	Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)	Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design Details attached at Annexure – F2.2 (if applicable)		
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)	Details attached at Annexure – F2.3		
8.	After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)	Applicable / Not applicable Details attached at Annexure – F2.4		
9.	Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any	Details attached at Annexure – F2.5		

	CORPORATE QUALITY ASSURANCE SUB-VENDOR QUESTIONNAIRE
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10.	Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing	Details attached at Annexure – F2.6												
11.	Manufacturing facilities (List of machines, special process facilities, material handling etc.)	Details attached at Annexure – F2.7												
12.	Testing facilities (List of testing equipment)	Details attached at Annexure – F2.8												
13.	If manufacturing process involves fabrication then-	Applicable / Not applicable												
	List of qualified Welders	Details attached at Annexure – F2.9												
	List of qualified NDT personnel with area of specialization	(if applicable)												
14.	List of out-sourced manufacturing processes with Sub-Vendors' names & addresses	Applicable / Not applicable Details attached at Annexure. –F2.10 (if applicable)												
15.	Supply reference list including recent supplies	Details attached at Annexure – F2.11 (as per format given below)												
	<table border="1" style="width: 100%;"> <tr> <th style="width: 10%;">Project/ package</th> <th style="width: 10%;">Customer Name</th> <th style="width: 30%;">Supplied Item (Type/Rating/Model /Capacity/Size etc)</th> <th style="width: 15%;">PO ref no/date</th> <th style="width: 15%;">Supplied Quantity</th> <th style="width: 20%;">Date of Supply</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	Project/ package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)	PO ref no/date	Supplied Quantity	Date of Supply							
Project/ package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)	PO ref no/date	Supplied Quantity	Date of Supply									
16.	Product satisfactory performance feedback letter/certificates/End User Feedback	Attached at annexure - F2.12												
17.	Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating) Note:- Reports need not to be submitted	Applicable / Not applicable Details attached at Annexure – F2.13 (if applicable)												
18.	Statutory / mandatory certification for the proposed product	Applicable / Not applicable Details attached at Annexure – F2.14 (if applicable)												
19.	Copy of ISO 9001 certificate (if available)	Attached at Annexure – F2.15												
20.	Product technical catalogues for proposed item (if available)	Details attached at Annexure – F2.16												
Name:		Date:												
Desig:		Sign:												

Company's Seal/Stamp:-

	CORPORATE QUALITY ASSURANCE MAIN CONTRACTOR EVALUATION REPORT			

i.	Main Contractor					
ii.	Project					
iii.	Package Name		Package No			
iv.	Proposed Item/Scope of Sub-contracting					
v.	Item covered under	Schedule-1		As per contract clause No-		
		Schedule-2				
vi.	If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled-					
vii.	Name and Address of the proposed Sub-vendor's works					
viii.	PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network					
ix.	Item Description (Type/Size/Rating/Scope of Sub-Contracting)	Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc)	Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc)	Per month quantity requirements as per project schedule	Actual monthly production capacity viz-a-viz the monthly proposed order requirement	
x.	Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (<i>Note:- Only relevant experience details wrt proposed item/scope of subcontracting to be brought out here</i>)					
	Project/Package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)	PO ref no/date	Supplied Quantity	Date of Supply
We confirm that as per our assessment, the proposed sub-vendor has requisite capabilities and supply experience for the proposed item/scope of sub-contracting.						
Name:		Desig:		Sign:		Date:

Company's Seal/Stamp:-

Format No. : QS-01-QAI-P-04/F1-R3

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