# GUJRAT STATE ELECTRICITY CORPORATION LIMITED VADODARA, GUJRAT

# 1X800MW WANAKBORI, TPS, Extn. UNIT#8

## VOLUME – IIB

## TECHNICAL SPECIFICATION FOR

## *LT FRLS HRPVC CONTROL CABLES*

**SPECIFICATION NO : *PE-TS-408-507-E003***
**REVISION : *0***


## BHARAT HEAVY ELECTRICALS LIMITED
**POWER SECTOR**
**PROJECT ENGINEERING MANAGEMENT**
**NOIDA, UP (INDIA) – 201301**

## CONTENTS



**TOTAL NO. OF SHEETS** (including cover sheet) **= 38**

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.**

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BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS)

## PREAMBLE

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:

**Volume – IA** This part contains Instructions to bidders for making bids to BHEL.

**Volume – IB** This part contains General Commercial Conditions of the Tender & includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

**Volume – IC** This part contains Special Conditions of Contract.

**Volume – ID** This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

**Volume – IIA** General Technical Conditions.

**Volume – IIB** Technical Specification including Drawings, if any.

**1.3 VOLUME – IIB**

This volume is sub-divided in to following sections:-

**Section – A:** This section outlines the Intent of Specification.

**Section – B**: This section provides "Projection Information".

**Section – C:** This section indicates Technical Requirements specific to Contract, not covered in Section – D.

**Section – D:** This section comprises of Technical Specifications of equipment complete with Data Sheets A and C.

**Data Sheet-A:** Specific data and other requirements pertaining to the equipments.

**Data sheet–C:** Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

**1.4 VOLUME – III TECHNICAL SCHEDULES (If Applicable)**

This volume contains Technical Schedule and Data Sheets–B, which are to be duly filled by bidder and the same shall be furnished with the technical bid.

**2.0** This requirements mentioned in Section – C followed by those of Data Sheet – A shall prevail in case of conflict between the stipulations of Section-C, Datasheet-A and Section-D.

## INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer :

    a. Unpriced BOQ-cum-Price Schedule (Annexure-A , writing 'Quoted' against items) with bidder's signature and company stamp.

    b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.

    c. A copy of previous sheet ("Contents"), with bidder's signature and company stamp.

    d. A copy of "Quality Plan including Annexure to QAP" sheet, with bidder's signature and company stamp

2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.

3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the cable description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [BOQ-cum-Price Schedule] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

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BIDDER'S STAMP & SIGNATURE

# SECTION – 'A'

# SCOPE OF ENQUIRY

## SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of **LT HRPVC CONTROL CABLES** as mentioned in different sections of this specification for **1 X 800 MW WANAKBORI TPS.**

2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.

3.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.

4.0 Requirements of the specification including the QP shall be agreed upon for total compliance by bidders without any deviations.

5.0 Price offers of only those bidders complying with this requirement shall be acceptable.

6.0 The documents shall be in English language and MKS system of units.

# SECTION – 'B'

# PROJECT INFORMATION

# CONTENT






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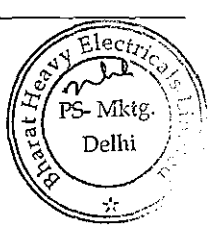

VOLUME : IIA

SECTION-II

# PROJECT SYNOPSIS AND GENERAL INFORMATION

## 1.00.00 INTRODUCTION

The proposed 1x800 MW Supercritical Thermal Power Project would be set up by Gujarat State Electricity Corporation Limited (GSECL) at Kheda district of Gujarat.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

## 2.00.00 APPROACH TO SITE

The proposed site is located in Kheda district about 13 kilometers from the nearest commercial town of Balasinor & 10 kilometers from Sevalia town. The National Highway, NH-08, connecting Dakor – Godhra is about 10 kilometers from the site. The State Highway SH – 59 connecting Balasinor – Sevalia is about 2 Kilometers from the site. Nearest railway station to the existing site is Sevalia, located about 8 kilometers from the site on Anand – Godhara main broad gauge line of Western Railway.

Nearby Air Ports are Ahmedabad at a distance of about 110 kilometers from the site and Vadodara at a distance of about 85 kilometers from the site.

## 3.00.00 LAND

The proposed extension unit will be developed in the existing Wanakbori Thermal Power Station and will be located north east side of the existing plot in the Kheda District of Gujarat. The land of the proposed plant will be filled in upto a desired level. Existing Ash Pond/ Dyke area will be utilized for the extension unit.

## 4.00.00 SOURCE OF COAL

Indian coal would be sourced from captive mines Machha Kata in Talcher, State – Orissa which are situated about 1800 Kms from the project site. GSECL will arrange for transportation of the coal required for the extension unit from these captive mines by the existing railway facilities for delivery of coal supply to the Wanakbori power station.

5.00.00 SOURCE OF WATER

The water required for the new unit shall be obtained from River Mahi, flowing by the side of the existing Wanakbori Power Station.

One (1) new jackwell will be installed on Mahi river for supply of water for new plant. In addition, existing Canal Water and Jackwell Water will have interconnection with new plant to cater plant water requirement of new plant.

6.00.00 ASH DISPOSAL AREA

Existing Ash Pond / Dyke area will be utilized for the extension unit. Fly ash silos will be located outside plant boundary wall (but within GSECL land) in the vicinity of the Ash Dyke area.

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

| | | |
|---|---|---|
| Elevation above MSL | : | 72 M |
| Max. daily average temp | : | 34 °C |
| Min. daily average temp | : | 11.7 °C |
| Max. Ambient air temp. (daily) | : | 34°C |
| Max. Ambient air temp. (yearly) | : | 30°C |
| Max. Ambient air temp. | : | 42°C |
| Wet bulb temperature | : | 28°C |
| Relative Humidity | : | RH varies within a range from 50% to 95%. |
| Average annual rainfall | : | 750 mm |

[Metrological data of Vadodara is attached for reference].

Gujarat State Electricity Corpn. Ltd. GSECL P&P Vadodara



Bharat Heavy Electricals Limited PS-Mktg. Delhi

# SECTION – 'C'

# SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

1.1 This enquiry covers the supply of 1.1 KV FRLS HRPVC Control cables conforming to this specification as detailed below.

1.2 General technical requirements of the cables are indicated in Section-D and Data Sheet-A. Project specific technical/ quality requirements/ changes are listed below.

1.3 Cables shall conform in all respects to the requirements stipulated in all the above parts of the specification.

1.4 The stipulations of Section-C, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-C, Datasheet-A and Section-D.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per Annexure-A (Bill of Quantities (BOQ)) enclosed.

2.2 Delivery schedule (i.e. contractual calendar dates) for the package shall be given separately to the bidders for compliance. Supplies shall be completed conforming to the lot requirements stipulated in the BOQ within the overall delivery schedule.

2.3 The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the unit price schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

3.1 Specific technical requirements shall be as listed below *:*

3.1.1 Technical:

(i) Control cables shall be 1100 V grade, multi core, minimum 2.5 sq mm cross section, stranded copper conductor having minimum 7 strands, Extruded HRPVC insulated, HRPVC inner sheathed, galvanised steel wire armoured, overall FRLS HRPVC outer sheathed generally conforming to IS 1554 part-I.

(ii) The sheath shall be resistant to water, fungus, termite and rodent attacks.

(iii) The outer sheath of FRLS HRPVC compound shall meet the following performance requirements :

(a) The critical oxygen index value shall be minimum 29 when tested at 27±2°C as per ASTM- D- 2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863

(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994).

(c) Flammability

(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.

(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.

(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977).

(g) The finished cable shall pass the flammability tests as per IEC-332-1 (1993) and IEEE-383. In addition, it shall also pass flammability tests as per Class F3 of Swedish Standard SS-424-1475 (1977).

Specific requirement/ change :

(iv)

| SL.NO. | Reference Clause No. of Section – D (if any) | Specific requirement/ Change |
|---|---|---|
| 1. | 2.4.1.b,c,d | May be read as 2.4.1 (b). Additionally 'The type tests are required to be conducted as indicated in Annexure to QAP and the same shall be offered for inspection (conduction of type tests shall be witnessed by BHEL). Bidder to indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests. |
| 2 | 2.4.1 e | Refer SL. NO. 1 above. |
| 3 | 4.1 | Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:<br><br>(i) BOQ cum Unpriced Price Schedule (Annexure-A to Section-C, as enclosed with the specification) with bidder's signature and company stamp.<br><br>(ii) A copy of "Instructions to Bidders for Preparing Technical Offer" sheet, with bidder's signature and company stamp.<br><br>(iii) A copy of "List Of Contents" sheet, with bidder's signature and company stamp.<br><br>(iv) A copy of "Quality Plan including Annexure to QAP" sheet, with bidder's signature and company stamp.<br><br>No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer. |

3.1.2 Quality/ Inspection:

| SL. NO. | Reference Clause No. of Section – D (if any) | Specific requirement/ Change |
|---|---|---|

| | | |
|---|---|---|
| 1 | 2.2 | QP (including Annexure to QAP) enclosed with spec. shall be stamped and signed by bidders as token of acceptance. The QP shall be submitted during contract stage for Customer/ BHEL approval without any commercial implication to BHEL. |
| 2 | 2.4.1 (d) | All tests shall be conducted as per contract. Conduction of Testing requirements mentioned in Datasheet-A & Annexure to QAP. |

3.1.3 The successful bidder shall submit the standard list of raw material suppliers/ sub-vendors for approval without any commercial implications. Changes to the same, if proposed by any bidder, shall be to BHEL approval.

3.1.4 Quality Plan applicable for project :

BHEL Standard Quality Plan no. PE-QP-999-507-E003 Rev.00 (Enclosed with specification)

3.1.5 Document distribution schedule for the project shall be as below *:*

No. of prints to be submitted by vendor after award of contract shall be as under:

| S. NO. | DESCRIPTION | No. hard /soft copies | No. of CD-ROMs | REMARKS |
|---|---|---|---|---|
| 1 | Drawings / docs. for approval (First submission) | PDF File + 2 Hard copies | NIL | |
| 2 | Drawings /docs. for approval (Second & subsequent submission till approval) | PDF File + 2 Hard copies | NIL | |
| 3 | Final approval Drawings / docs. for Distribution after CAT-1. | PDF File + 10 Hard Copies | 1 CD -ROM | |
| 4 | As Built Drawings/ docs. | 6 Hard Copies | 4 CD-ROMS | |
| 5 | Type Test Certificates/ Reports for approval | PDF+ 2 hard Copies | NIL | |
| 6 | Type Test Certificates/ Reports for distribution | 6 hard Copies | 6 CD-ROMS | |

3.1.6 A label shall be securely attached to each end of the reel indicating the Purchaser's order number, length, type voltage grade, conductor size and number of cores of the cable. Also weight of cable drums with and without cables and type of end sealing to be indicated. A tag containing the same information shall be attached to the leading ends of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled.

| SL. No. | DOCUMENT TITLE | DWG. / DOCUMENT No. |
|---|---|---|
| 1 | Data Sheet for 1.1KV HRPVC Control Cables | PE-V0-408-507-E171 |
| 2 | Cross-sectional Drawings for 1.1KV HRPVC Control Cables | PE-V0-410-507-E173 |
| 3 | Type Test Procedure for 1.1KV HRPVC Control Cables | PE-V0-408-507-E174 |
| 4 | Quality Plan for HRPVC Control Cables | PE-V0-408-507-E919 |
| 5 | Type Test Reports for Tests conducted under this contract ( Ref. Cl. 2.4.1.c & 2.4.1.d of section-D) | PE-V0-408-507-E175 |

**1 X 800MW WANAKBORI,TPS,Extn, UNIT #8**

**ANNEXURE - A**

**BOQ-CUM-PRICE SCHEDULE FOR LT HRPVC CONTROL CABLES**

1.1 kV control cables with stranded plain annealed copper conductor, HRPVC Type-C insulation, core identification by colour coding and numbering at interval of 100 mm or less (IS : 1554 (Part-I)), distinct extruded inner Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables.Single core cables shall have no inner sheath.Filler shall be of same material as of innersheath i.e. ST2., GS round wire armour as per IS 3975, and extruded HRPVC Type ST2 outer sheath with FRLSH properties, generally conforming to IS:1554 (Part-1) and BHEL specification.

**1.1 kV COPPER CONDUCTOR ARMOURED CABLES**

| SL. NO. | CABLE SIZE (sq. mm) | ORDER QUANTITY (METRES) | LOT-I QUANTITY (METRES) | DRUM LENGTH (METRES) | UNIT PRICE (Ex-Works) | TOTAL PRICE (Ex-Works) | REMARKS |
|---|---|---|---|---|---|---|---|
| 1 | 5C X 2.5 | 95000 | 66000 | 1000 | | | |
| 2 | 7C X 2.5 | 37000 | 26000 | 1000 | | | |
| 3 | 9C X 2.5 | 15000 | 11000 | 1000 | | | |
| 4 | 12C X 2.5 | 20000 | 14000 | 1000 | | | |
| 5.0 | 5C X 4 | 8000 | 5000 | 1000 | | | |

NOTES:

1 Quantities indicated above shall be known as order quantities. The variation in quantities shall be limited from -30% to +30% of the total contract value derived on the basis of the Order Quantities.

2 The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-cum-price Schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.

3 Lot-I quantity indicated above shall be cleared for manufacturing along with LOI. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent lots if required shall be cleared for manufacturing based on progress of engineering and site requirements.

4 Overall tolerance on total dispatched quantity of each size for item shall be (-) 2% and (+) 0%. Cables consumed for testing and inspection shall be to bidder's account.

5 The drum length shall be 1000 m ( +/- 5% ). For each individual cable size, one short lengths of not less than 200m may be accepted only in the final drum length to complete the supply. The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).

6 In case of the quantities cleared by BHEL for manufacturing (in a lot) are manufactured and offered for inspection in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implication.

7 Bidder shall indicate unit price of cables inclusive of type test charges No separate type test charges are to be quoted by bidder.

8 Bidder shall qoute for all sizes/types of cables as per specification, failing which their offer shall be rejected.

9 Delivery schedule of Lot-I and subsequent lots shall be as per NIT

# DATASHEET A

## DATA SHEET-A

### I. SPECIFIC TECHNICAL REQUIREMENTS

| | | |
|---|---|---|
| 1.0 | Type of cable | LT CONTROL CABLE OF FRLS TYPE |
| | | |
| 2.0 | Standard applicable in general | IS:1554 PART (I) |
| | | |
| 3.0 | Voltage Grade | 1.1 kV |
| | | |
| 4.0 | Number of cores | As per BOQ (Annexure-A to section-C) |
| | Minimum size | |
| | | |
| 5.0 | **CONDUCTOR** | |
| (a) | Material | Standard, Non compacted Copper |
| | Grade and Class | Stranded, high conductivity, Class 2<br>85° C continuous rating under normal condition and<br>160° C under short circuit condition |
| (b) | Standard applicable | IS : 8130 |
| (c) | Shape | Circular as per IS |
| (d) | Min. number of strands | 7 |
| | | |
| 6.0 | **INSULATION** | |
| (a) | Material | EXTRUDED HRPVC, Type C |
| (b) | Standard applicable | IS : 5831 & IS : 1554 ( PART I) |
| (c) | Continuous withstand temperature | 70° C |
| (d) | Short circuit withstand temperature | 160° C |
| (e) | Method of Application | By extrusion; sleeve extrusion not permitted |
| | | |
| 7.0 | **CORE IDENTIFICATION** | |
| (a) | Control cables | Colour coded and numbering at interval of 100 mm or less (IS : 1554 (Part-I)) |
| | | |
| 8.0 | **INNER SHEATH** | |
| (a) | Material | Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables.<br>Single core cables shall have no inner sheath.<br>Filler shall be of same material as of inner sheath i.e. ST2. |
| (b) | Colour | Black |
| (c) | Whether FRLS | yes |
| (d) | Fillers | Acceptable |
| (e) | Material of fillers (if permitted) | Same as innersheath |
| (f) | Method of application | |
| 1 | Multi-core cables : | |
| i) | with fillers | Pressure/Vacuum Extruded |
| ii) | without fillers | Pressure Extruded |

| | | |
|---|---|---|
| 9.0 | **ARMOUR** | |
| (a) | Material | Galvanised Steel round |
| (b) | Minimum coverage | 90% |

| | | |
|---|---|---|
| (c) | Gap between armour wires | Shall not exceed one armour wire space (No cross-over/ over-riding) |
| (d) | Breaking load of joint | 95% of normal armour |
| | | |
| 10.0 | **OUTER SHEATH** | |
| (a) | Material | Extruded FRLS HRPVC Type *ST-2* as per IS : 5831 |
| (b) | Colour | Black |
| (c) | Whether FRLS | YES |
| (d) | Other properties | The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack |
| (e) | Method of application | Extruded |
| (f) | Marking (by embossing) | Cable size (cross section area and no. of cores) and voltage grade @ 1m (by embossing)<br>Type of insulation, Type of inner & outer sheath e.g. "FRLS" etc, @ 1m (by embossing)<br>Manufacturer's name and/ or trade name, and year of manufacture @ 1m (by embossing)<br>'BHEL-PEM' and GSECL' @1m (by embossing)<br>Progressive sequential marking @ 1m (by embossing)<br>IS number @ 1m (by embossing) |
| | | |
| 11.0 | **FRLSH CHARACTERISTICS** | |
| (a) | Oxygen index test | **YES** ,(Minimum 29 as per ASTM-D-2863-77) |
| (b) | Temperature Index test | **YES** ,(Minimum 250ºC at oxygen index value of 21 when tested as per ASTM-D-2863) |
| (c) | Halogen Acid gas generation test | **YES** ,(Max. 20% as per IEC-754-1) |
| (d) | Smoke density rating test | **YES** ,Max. 60% As per ASTM-D-2843.The FRLS cables shall meet the requirements of light transmission of minimum 40 % after test. |
| (e) | Flammability Test | As per IEC:60332-III CAT-B, IEC :60332-I, IEEE:383 & 424:1475 (Class-F3),IS :10810 |
| (f) | Flame retardance Test | Flame Retardance test on single cable and on bunched cables (both C1 & C2)<br>After the test, there should be no visible damages on the test specimen within 300mm from its upper end.<br>After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly. |
| (g) | Smoke density test | The test shall be smoke generation by the outer sheath under fire as per ASTM D 2483 |

| | | |
|---|---|---|
| (h) | . Rodent & termite repulsion property test | The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound |
| | | |
| | | |
| 12.0 | **TOLERANCE ON OUTER DIAMETER** | Upto 30mm; (+/-) 1.5 mm<br>Above 30mm; (+/-) 5% or (+/-)3 mm whichever is less |
| | | |
| 13.0 | **MINIMUM BENDING RADIUS** | 12 x O.D. |
| | | |
| 14.0 | **SAFE PULLING FORCE** | 50N/ sq. mm |
| | | |
| 15.0 | **CABLE DRUMS** | |
| (a) | Type & construction | As per IS 10418 (wooden) |
| (b) | Standard drum length | 1000m (+/-) 5% |
| (c) | Marking on drum | a) MSPGCL<br>b) Manufacturer's name or trade make<br>c) Type of cable & voltage grade<br>d) Year of manufacture<br>e) Type of insulation e.g. XLPE/HRPVC/IE2<br>f) No. of core and size of cables<br>g) Cable code e.g. FRLS/FS<br>h) Length of cable on drum<br>i) No. of length on drum, if more than one<br>j) Direction of rotation, by arrow<br>k) Approx. gross mass.<br>l) IS/IEC number and ISI mark |

# SECTION-D

## STANDARD TECHNICAL SPECIFICATION

## 1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for 1.1kV PVC control cables shall be as indicated in this section, in addition to those specified in Section- C and Data sheet-A as attached for project specific requirements.

## 2.0 QUALITY ASSURANCE REQUIREMENTS

2.1 Bidder shall confirm compliance with the BHEL Quality Plan as attached with the specification without any deviations.

2.2 In the event of BHEL Quality Plan not being applicable for a project (as indicated in section-C of the project specification), the successful bidder shall submit the Manufacturing Quality Plan (MQP) for approval by BHEL/ Owner (as applicable) during detailed engineering stage without any commercial implications.

2.3 Bidders shall submit their list of proven sub-vendors for raw materials, which will be subject to BHEL/ customer approval.

2.4 Type testing requirements and routine/ acceptance testing requirements shall be as detailed below.

2.4.1 Type Tests on Cables

a. All cables to be supplied shall conform to type tests as per relevant standards and proven type.

b. The bidder shall furnish the reports of all the type tests listed in Annexure to QAP (enclosed with quality plan) carried out in within last five years of the date of bid opening. These reports should be for the tests conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.

c. In case bidder is not able to submit report of type test(s) conducted in last five years, or in case type tests report(s) are not found to be meeting the specification/ relevant standard requirements, then all such tests shall be conducted under this contract by the bidder free of cost to BHEL, and reports shall be submitted for approval. No charges shall be paid for testing under such circumstances. BHEL reserves the right to witness the testing for which due notice shall be given by the vendor

d. Irrespective of the bidder furnishing type test report as indicated above, BHEL may get type tests as indicated in Annexure to QAP (enclosed with quality plan) on the lots offered for inspection (conduction of type tests shall be witnessed by BHEL). Separate price shall be quoted for the conduction of type testing per lot, which shall be used for cost comparison. A maximum of three lots shall be considered for price comparison purposes on account of type testing. However, type-testing charges shall be paid as per type test conducted.

e. Minor changes in the final Type Test Procedures (which shall be to approval during contract stage) shall be without any commercial implication.

2.4.2 Routine and Acceptance Tests

a. Routine testing shall be conducted in line with the applicable standards and as per the Manufacturing Quality Plan approved for the project for every lot offered for inspection.
b. Acceptance tests shall be conducted on every lot offered for inspection as per details indicated in Annexure to QAP (enclosed with quality plan)
c. Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.

2.4.3 Cost of cables consumed for testing shall be to bidder's account.

## 3.0 Packing

3.1 Cables shall be supplied in non-returnable heavy construction drums. All wooden parts shall be manufactured from seasoned wood treated with copper napthenates/ zinc napthenates (refer IS: 401). All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

## 4.0 PROJECT SPECIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

4.1 By All Bidders

As technical offer signed and stamped copy of following:

a. Section B (Project Information)
b. Section C (Specific Technical Requirements)
c. Annexure-A to Section-C, ( Bill of Quantities)
d. Data Sheet-A

**No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.**

4.2 By Successful Bidder (for approval during contract stage)

a. Data sheet C and derating factors in the format provided to the successful bidder along with LOI.
b. Cross-section drawings of the cables
c. Manufacturing Quality Plan in case BHEL SQP is not applicable.
d. List of sub-vendors/ suppliers of raw materials
e. Type test procedure
f. Field Quality Plan
g. Technical catalogues/ literature for the cables.

4.3 Two copies of the above documentation shall be submitted for first review. Number of copies to be submitted for second and subsequent submissions (till Cat-I approval is accorded), and those for final distribution prints of approved documentation and test certificates shall be as indicated separately in section C.

4.4 Wherever required, soft copy of all approved technical/ quality documentation shall be submitted as specified without any additional commercial implication. Soft copies may be required both in native file format (e.g. MS Word/ MS Excel) as well as PDF files.

# QUALITY PLAN

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHEL | QUALITY PLAN | | CUSTOMER : | | | PROJECT<br>TITLE 1X800MW WANAKBORI TPS | | | SPECIFICATION :<br>NUMBER : PE-TS-408-507-E003 | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PE-QP-999-507-E003, R-0 | | | SPECIFICATION<br>TITLE | | | |
| | SHEET 1 OF 8 | | SYSTEM | | | ITEM :HRPVC/ PVC POWER & CONTROL CABLE | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| **Instructions:**<br>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 final cable drum number or batch no.<br>2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not. | | | | | | | | | | | | |
| **1.0** | **RAW MATERIAL** | | | | | | | | | | | |
| 1.1 | Copper Rods/ Aluminum Rod/ Wires | **GENERAL :** | | | | | | | | | | |
| | (Al:- For Conductor & Armour)<br>(Cu:- For Conductor) | 1. Physical properties | MA | Physical Tests | Sample per Batch | IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet | IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | 2. Elec.Properties | MA | Electrical Tests | Sample per Batch | IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet | IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | **SPECIFIC CHECKS :** | | | | | | | | | | |
| | | a) Make | MA | Verify | 100% | Manufacturer approved source | Manufacturer approved source | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | b) Grade | MA | -do- | -do- | IS 613/IS 5082 & Approved datasheet | IS 613/ IS 5082 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | c) Resistivity | MA | Electrical Tests | Manufacturer std. | IS 613/ IS 5082 | IS 613/ IS 5082 | Log book/ Test Cert. | 3/2 | - | 1 | |
| 1.2 | PVC Compound (for insulation) | **GENERAL :** | | | | | | | | | | |
| | | 1. Physical properties | MA | Physical Tests | Sample per batch | IS 1554 Pt-1/ IS 5831 & Approved datasheet | IS 1554 Pt-1/ IS 5831 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | 2. Elec.Properties | MA | Electrical Tests | Sample per batch | IS 1554 Pt-1/ IS 5831 & Approved datasheet | IS 1554 Pt-1/ IS 5831 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | **SPECIFIC CHECKS :** | | | | | | | | | | |
| | | a) Make | MA | Verify | 100% | Manufacturer approved source | Manufacturer approved source | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | b) Type/ Grade | MA | Verify | 100% | Mfrs std./ Approved datasheet | Mfrs std./ Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | c) Shelf life/ Storage condition | MA | Verify | 100% | Compound Manufacturer std. | Compound Manufacturer std. | Log book/ Test Cert. | 3/2 | - | 1 | |
| 1.3 | Fillers (as applicable) | 1. Make | MA | Verify | 100% | Manufacturer approved source | Manufacturer approved source | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | 2. Flame retardant & moisture resistant.<br>(as applicable) | CR | Chemical/ Environ. | 100% | Approved datasheet | Approved datasheet | Log book/ Test Cert. | 3/2 | - | 2 | (Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of cable) |

| BHEL | PARTICULARS | BIDDER/VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT<br>TITLE 1X800MW WANAKBORI TPS | | | SPECIFICATION :<br>NUMBER : PE-TS-408-507-E003 | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PE-QP-999-507-E003, R-0 | | | SPECIFICATION :<br>TITLE | | | |
| | | SHEET 2 OF 8 | SYSTEM | | | ITEM :HRPVC/ PVC POWER & CONTROL CABLE | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 1.4 | Galvanised steel wire/strip for Armour (if applicable) | **GENERAL :**<br>1. Make | MA | Verify | Manufacturer std. | Manufacturer approved source | Manufacturer approved source | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | 2. Dimension | MA | Measurement | Manufacturer std. | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log book/ Test Cert. | 3/2 | - | 2 | |
| | | 3. Phy.and Elec. Properties | MA | Physical & Electrical Tests | Sample* | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log book/ Test Cert. | 3/2 | - | 2 | * Sample from each size/ Batch/ Lot |
| | | 4.Galvanization Quality | MA | Galv.Tests | Sample* | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log book/ Test Cert. | 3/2 | - | 2 | |
| 1.5 | PVC compound for Sheath | **GENERAL :**<br>1. Physical properties | MA | Physical Tests | Sample per batch | IS 1554 Pt-1/ IS 5831 & Approved datasheet | IS 1554 Pt-1/ IS 5831 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | 2. Elec.Properties | MA | Electrical Tests | Sample per batch | IS 1554 Pt-1/ IS 5831 | IS 1554 Pt-1/ IS 5831 | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | 3. FRLS Properties (as applicable) | CR | Chemical/ Environ. | Sample per batch | IS 1554 Pt-1/ IS 5831 & Approved datasheet | IS 1554 Pt-1/ IS 5831 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1/2 | |
| | | **SPECIFIC CHECKS :**<br>a) Make | MA | Verify | 100% | Manufacturer approved source | Manufacturer approved source | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | b) Type/ Grade | MA | Verify | 100% | IS 1554 Pt-1/ IS 5831 & Approved datasheet | IS 1554 Pt-1/ IS 5831 & Approved datasheet | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | c) Shelf life/ Storage condition | MA | Verify | 100% | Compound Manufacturer std. | Compound Manufacturer std. | Log book/ Test Cert. | 3/2 | - | 1 | |
| 1.6 | Wooden drums | 1. Phy. & Constructional checks | MA | Visual | Mfr's Plant Std. | IS 10418 | IS 10418 | Log book/ Test Cert. | 3/2 | - | 1 | |
| | | 2. Anti termite treatment | MA | Chem. | Mfr's Plant Std. | Mfr's Plant Std. | Mfr's Plant Std. | COC | 3/2 | | 1 | |
| 1.7 | Steel drums # | 1. Dimension | MA | Meas. | Mfr's Plant Std. | Mfr's Plant Std. | Mfr's Plant Std. | Log book/ Test Cert. | 3/2 | - | 1 | # (If applicable) |
| | | 2. Surface finish | MA | Meas. | Mfr's Plant Std. | Mfr's Plant Std. | Mfr's Plant Std. | Log book/ Test Cert. | 3/2 | | 1 | |
| **2.0** | **IN PROCESS** | | | | | | | | | | | |
| 2.1 | Wire Drawing & Annealing. | 1. Size | MA | Dimensional | Plant Mfg. Std. | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | Log Book | 2 | - | 1 | |
| | | 2. Surface finish | MA | Visual | Plant Mfg. Std. | Surface shall be smooth | Surface shall be smooth | Log Book | 2 | - | 1 | |
| | | 3. % of Elongation | MA | Mechanical | Plant Mfg. Std. | IS 1554 Pt-1./ IS 8130 | IS 1554 Pt-1./ IS 8130 | Log Book | 2 | - | 1 | |
| 2.2 | Tinning (For Conductor) | 1. Size | MA | Dimensional | Plant Mfg. Std. | Approved datasheet | Approved datasheet | Log Book | 2 | - | 1 | (Applicable only for tin-coated copper conductor) |
| | | 2. Chemical test for Tinning (if applicable) | CR | Chemical Test | Sample | IS 1554 Pt-1/ IS:8130 & Mfrs Std | IS 1554 Pt-1/ IS:8130 & Mfrs Std | Log Book | 2 | - | - | |

| | | | |
|---|---|---|---|
| | **PARTICULARS** | **BIDDER/VENDOR** | |
| **BHEL** | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | CUSTOMER : | | | PROJECT TITLE 1X800MW WANAKBORI TPS | | | SPECIFICATION : NUMBER : PE-TS-408-507-E003 | | | | |
| | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0 | | | SPECIFICATION : TITLE | | | | |
| | SHEET 3 OF 8 | SYSTEM | | | ITEM :HRPVC/ PVC POWER & CONTROL CABLE | | | SECTION | | | VOLUME III | |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 2.3 | Stranding of wires | 1. No.of wires | MA | Counting | Plant Mfg. Std. | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | Log Book | 2 | - | - | |
| | | 2. Resistance | CR | Electrical | Plant Mfg. Std. | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | IS 1554 Pt-1./ IS 8130 & Approved Data Sheet | Log Book | 2 | - | - | |
| | | 3. Sequence, lay length & Direction | MA | Visual, Measurement | Sample | IS 1554 Pt-1/ Mfrs standard | IS 1554 Pt-1/ Mfrs standard | Log Book | 2 | - | - | |
| | | 4. Surface Finish | MA | Visual | 100% | Surface shall be smooth | Surface shall be smooth | Log Book | 2 | - | - | |
| | | 5.Dimension | MA | Measurement | One Sample of each size/ lot | IS 1554 Pt-1/ IS 8130/Appd. Data Sheet | IS 1554 Pt-1/ IS 8130/Appd. Data Sheet | Log Book | 2 | - | - | |
| 2.4 | Core Insulation (No repair permitted) | 1. Surface finish | MA | Visual | 100% | Free from bulging burnt particles lumps, cuts & Scratches. | Free from bulging burnt particles lumps, cuts & Scratches. | Log Book | 2 | - | 1 | |
| | | 2 Insulation thickness | CR | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 & Appd.data sheet | IS 1554 Pt-1 & Appd.data sheet | Log Book | 2 | - | - | |
| | | 3. Concentricity # | CR | Measurement | One Sample of each size/ lot | Mfrs Std/ IS 1554 Pt-1/ Approved Data Sheet | Mfrs Std/ IS 1554 Pt-1/ Approved Data Sheet | Log Book | 2 | - | 1 | # To be checked at starting & finish end of Extruded Length |
| | | 4 Dia over insulation | MA | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 | IS 1554 Pt-1 | Log Book | 2 | - | - | |
| | | 5. Core identification | MA | Visual | 100% | IS 1554 Pt-1 & Appd. Data Sheet | IS 1554 Pt-1 & Appd. Data Sheet | Log Book | 2 | - | - | |
| | | 6. Tensile Strength & % Elongation | MA | Mechanical | 100% | IS 1554 Pt-1/ IS 5831 | IS 1554 Pt-1/ IS 5831 | Log Book | 2 | - | - | |
| | | 7 Spark Test or Water Immersion test | CR | Electrical | 100% | Mfr's Std. | Mfr's Std. | Log Book | 2 | - | 1 | |
| 2.5 | Core Laying | 1. Dia over laidup core | MA | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 | IS 1554 Pt-1 | Log Book | 2 | - | - | |
| | | 2. Sequence of lay, Lay length & direction for laid up core | MA | Visual & Meas. | One Sample of each size/ lot | Mfrs Std | Mfrs Std | Log Book | 2 | - | - | |
| | | 3. Core Identification | MA | Visual | One Sample of each size/ lot | IS 1554 Pt-1 & Appd. Data Sheet | IS 1554 Pt-1 & Appd. Data Sheet | Log Book | 2 | - | - | |

| | PARTICULARS | BIDDER/VENDOR | |
|---|---|---|---|
| **BHEL** | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BHEL | QUALITY PLAN | | CUSTOMER : | | | PROJECT TITLE 1X800MW WANAKBORI TPS | | | SPECIFICATION : NUMBER : PE-TS-408-507-E003 | | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0 | | | SPECIFICATION : TITLE | | | | |
| | SHEET 4 OF 8 | | SYSTEM | | | ITEM :HRPVC/ PVC POWER & CONTROL CABLE | | | SECTION | | | VOLUME III | |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 2.6 | InnerSheath Extrusion (If applicable) | 1. Surface finish | MA | Visual | 100% | Surface shall be Smooth | Surface shall be Smooth | Log Book | 2 | - | - | (Pimple, fish eye, porosity & burnt particles not permitted) |
| | | 2. Sheath thickness | CR | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 & Approved Data Sheet | IS 1554 Pt-1 & Approved Data Sheet | Log Book | 2 | - | - | |
| | | 3.Dia over inner sheath | MA | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 & Approved Data Sheet | IS 1554 Pt-1 & Approved Data Sheet | Log Book | 2 | - | - | |
| 2.7 | Armouring (If applicable) | 1. No.of wires/Strips | MA | Counting | At the start of the process | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log Book | 2 | - | - | |
| | | 2. Lay Direction | MA | Visual | At the start of the process | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log Book | 2 | - | - | |
| | | 3. Lay Length | MA | Visual, Meas. | At the start of the process | IS 1554 Pt-1/ IS 3975 | IS 1554 Pt-1/ IS 3975 | Log Book | 2 | - | - | |
| | | 4. Coverage | MA | Measurement | At the start of the process | IS 1554 Pt-1/ IS 3975 & approved data sheet | IS 1554 Pt-1/ IS 3975 & approved data sheet | Log Book | 2 | - | - | |
| | | 5. Dia over armouring | MA | Measurement | At the start of the process | IS 1554 Pt-1 & Appd. Data Sheet | IS 1554 Pt-1 & Appd. Data Sheet | Log Book | 2 | - | - | |
| 2.7 | Outer Sheath Extrusion | 1. Surface Finish | MA | Visual | 100% | Surface shall be smooth | Surface shall be smooth | Log Book | 2 | - | - | (Pimple, fish eye, porosity & burnt particles not permitted) |
| | | 2.Sheath thickness | CR | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 & Appd. Data Sheet | IS 1554 Pt-1 & Appd. Data Sheet | Log Book | 2 | - | - | |
| | | 3. Dia over outer sheath | MA | Measurement | One Sample of each size/ lot | IS 1554 Pt-1 & Appd. Data Sheet | IS 1554 Pt-1 & Appd. Data Sheet | Log Book | 2 | - | - | |
| | | 4. Marking/ Color/ Embossing | MA | Visual | One Sample of each size/ lot | Appd. Data Sheet | Appd. Data Sheet | Log Book | 2 | - | - | Sequential marking shall be done by printing. |
| 2.8 | Finished Cable (INTERNAL) | 1. Routine Test (Refer Note-H) | CR | Electrical Tests & Measurement | 100% | IS 1554-I & Appd. Datasheet | IS 1554-I & Appd. Datasheet | Test Report | 2 | - | 1 | |

| | PARTICULARS | BIDDER/VENDOR | |
|---|---|---|---|
| BHEL | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT<br>TITLE 1X800MW WANAKBORI TPS | | | SPECIFICATION :<br>NUMBER : PE-TS-408-507-E003 | | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PE-QP-999-507-E003, R-0 | | | SPECIFICATION :<br>TITLE | | | | |
| | SHEET 5 OF 8 | | SYSTEM | | | ITEM :HRPVC/ PVC POWER & CONTROL CABLE | | | SECTION | | | VOLUME III | |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 | |
| 3.0 | Final Inspection | 1. Finish | MA | Visual | (See remark) | IS 1554 Pt-1/ Appd. Data Sheet | Free from Porosity, Bulging,Burnt particles, lumps, cuts & scratches | Test Report | 2 | 1 | - | One drum each for Power & Control cables in Lot. | |
| | | 2. Length | MA | Measurement | (See remark) | IS 1554 Pt-1/ Appd. Data Sheet | BHEL Spec./ Data Sheet | Test Report | 2 | 1 | | Length of each drum shall be as per tolerance given in the data sheet. | |
| | | 3. Dimension | MA | Measurement | As per IS | IS 1554 Pt-1/ Appd. Data Sheet | Approved Data Sheet | Test Report | 2 | 1 | - | | |
| | | 4. Armouring - Coverage No.of Wires/Strips | MA | Visual & Meas. | As per IS | IS 1554 Pt-1/ Appd. Data Sheet | Appd.Data Sheet | Test Report | 2 | 1 | - | | |
| | | 4. Marking/Colour Coding | MA | Visual | As per IS | IS 1554 Pt-1/ Appd. Data Sheet | IS 1554 Pt-1/ Appd. Data Sheet | Test Report | 2 | 1 | - | | |
| | | 5. Acceptance Tests (Refer Note-H) | CR | Phy & Elect. Tests FRLS tests | As per IS | IS 1554 Pt-1/ Appd. Data Sheet | IS 1554 Pt-1/ Appd. Data Sheet | Test Report | 2 | 1 | | | |
| | | 6. Type & FRLS Tests (Refer Note-H) | CR | Phy & Elect. Tests FRLS Tests | Sample# | BHEL Specn. Apprd.Data Sheet | BHEL Specn. Apprd.Data Sheet | Test Report | 2 | 1 | - | **Refer Annexure to QAP for Type & Acceptance Tests** | |
| 4.0 | Packing | Sealing Identification | MA | Visual | 100% | As per IS | As per IS | Test Report | 2 | 1 | - | | |

NOTES:-

(A) JOINTS IN WIRE SHALL BE AS PERMITTED BY MFRS STANDARD. VENDOR TO CERTIFY THE SAME.
(B) NO REPAIR OF CORE INSULATION PERMITTED
(C) CABLE ENDS SHALL BE SEALED AS PER VENDOR'S SPECIFICATION.
(D) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.
(E) FILLERS/DUMMY CORES ETC. SHALL BE AS PER APPROVED DATA SHEET
(F) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS 'SAMPLE' & NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN.
(G) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER IS/ BHEL SPECIFICATION.
(H) FOR LISTS OF ROUTINE TESTS , ACCEPTANCE TESTS & TYPE TESTS REFER ANNEXURE TO QAP.

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL 2-VENDOR 3- SUB VENDOR CHP: CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE.

| | PARTICULARS | BIDDER/VENDOR | |
|---|---|---|---|
| **BHEL** | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

# ANNEXURE TO QAP

## II. TYPE/ ACCEPTANCE TEST REQUIREMENTS

### A. Type Test Conduction:

1. Tests for which an asterisk sign (*) is indicated in the 'Conduction Required as Type Test' column shall be conducted on each size of cable to be selected by purchaser at the time of testing as type tests. The same may be witnessed by BHEL/ Owner, for which due notice shall be given by the vendor.

### B. Acceptance Test Conduction:

1. Tests for which a hash sign (#) is indicated in the 'Conduction Required as Acceptance Test' column shall be conducted as acceptance tests.

2. Sampling:
Sampling for acceptance tests shall be as per Appendix-A (Clause 15.2.1) of IS: 1554 Part-I.

| S. No. | TEST | APPLICABLE FOR | CONDUCTION REQUIRED AS | |
|---|---|---|---|---|
| | | | Type Test | Acceptance Test |
| 1.0 | **Tests for Conductor** | | | |
| | Annealing test | Copper conductor | * | # |
| | Resistance test | Copper conductor | * | # |
| | | | | |
| 2.0 | **Tests for Armour Wires** | | | |
| | Measurement of dimensions | GS wire | * | # |
| | Tensile test | GS wire | | # |
| | Elongation test | GS wire | * | # |
| | Torsion test | GS round wire | * | # |
| | Resistance test | GS wire | * | # |
| | Zinc coating test | G. S. wires | * | # |
| | | | | |
| 3.0 | **Physical Tests for PVC Insulation & PVC sheath** | | | |
| | Test for thickness | PVC insulation, PVC inner sheath & PVC outer sheath | * | # |
| | Tensile strength and elongation test | PVC insulation & PVC outer sheath | * | |
| | (a) Before ageing | | * | # |
| | (b) Before & after ageing | | * | |
| | Ageing in air oven | PVC insulation & PVC outer sheath | * | |
| | Loss of mass test | PVC insulation & PVC outer sheath | * | |
| | Hot deformation test | PVC insulation & PVC outer sheath | * | |
| | Heat shock test | PVC insulation & PVC outer sheath | * | |

| S. No. | TEST | APPLICABLE FOR | CONDUCTION REQUIRED AS | |
|---|---|---|---|---|
| | | | Type Test | Acceptance Test |
| | Shrinkage test | PVC insulation & PVC outer sheath | * | |
| | Thermal stability test | PVC insulation & PVC outer sheath | * | |
| | | | | |
| **4.0** | **FRLSH/ Flammability Tests** | | | |
| | Oxygen index test | PVC outer sheath only | * | # |
| | Smoke density test | PVC outer sheath only | * | # |
| | Halogen Acid gas generation test | PVC outer sheath only | * | # |
| | Flammability test as per IEC-332-1 (1993) and IEEE-383 | Complete cable | * | |
| | Flammability test as per IS-10810-Part-53, Part-61 & Part-62 | Complete cable | * | # |
| | Swedish chimney test to SEN SS 424 1475 | Complete cable | * | # |
| | Flame retardance Test | Complete cable | * | # |
| | Rodent & termite repulsion property test | PVC outer sheath only | * | # |
| | Temperature index test | PVC outer sheath only | * | # |
| | | | | |
| **5.0** | **Electrical Tests** | | | |
| | High Voltage Test (Water Immersion test) | On cores | * | |
| | High Voltage Test at room temperature | Complete cable | * | # |
| | Insulation Resistance Test (Volume resistivity method) | Complete cable | * | # |
| | | | | |
| **6.0** | **Fungus, Rodent & Termite Test** | Complete cable | * | |

NOTE :

Sampling plan for type test shall be as per Quality Plan.

## DATASHEET C

**GUARANTEED TECHNICAL PARTICULARS (TO BE SUBMITTED BY SUCCESSFUL BIDDER)**

| | | | |
|---|---|---|---|
| 1.0 | **GENERAL** | | |
| 1.1 | Name of manufacturer | : | |
| 1.2 | Place of manufacture | : | |
| 2.0 | **STANDARDS APPLICABLE** | | |
| 2.1 | **IS-1554 (Part-I)**<br>For general specification of PVC cables | : | YES |
| 2.2 | **IS:8130**<br>For conductor material | : | YES |
| 2.3 | **IS-5831**<br>For material of insulation, innersheath & outersheath. | : | YES |
| 2.4 | **IS:3975/ IS:8130**<br>For armour multi core/ single core cables) | : | YES/NO/NA |
| 2.5 | **IS:10810**<br>For method of tests | : | YES |
| 2.6 | **IS:10418**<br>For cable drums | : | YES |
| 2.7 | **ASTMD-2863**<br>For oxygen index test | : | YES |
| 2.8 | **SS:424-14-75,**<br>**IEC-332-Part-III and Part-I (Category-A),**<br>**IEEE 383/74**<br>For flammability test | **:** | YES |

| | | | | |
|---|---|---|---|---|
| 2.9 | **IEC-754-1**<br>For acid gas generation test | : | YES | |
| 2.10 | **ASTMD-2843**<br>For smoke generation test | : | YES | |
| 2.11 | **IS:5831**<br>For heat shock test, loss of mass test and thermal heat stability test | : | YES | |
| 2.12 | Current rating of cables conforms to | : | | |
| 2.13 | Short circuit rating conforms to | : | | |

3.0 **CABLE CONSTRUCTION**

3.1 **Conductor :**

Conductor material to IS:8130 (Class/Grade)

a) Control cables :

3.2 **Insulation**

| | | | | |
|---|---|---|---|---|
| a) | Material | : | | |
| b) | Dielectric constant at normal frequency | : | | KV/mm |
| c) | Insulation resistance constant (min.) | | | |
| | i) at 27 deg. C | : | | Mega-ohm km |
| | ii) at 70/85 deg.C | : | | Mega-ohm km |
| d) | Minimum volume resistivity | | | |
| | i) at 27 deg. C | : | | Mega-ohm km |
| | ii) at 70/ 85 deg.C | : | | Mega-ohm km |
| e) | Minimum tensile strength | : | | N/mm2 |
| f) | Minimum % Elongation at rupture | : | | |
| g) | Tolerance on thickness | : | | |

3.3 **Inner Sheath**

| | | | |
|---|---|---|---|
| a) | PVC Type ST1 to IS: 5831 | : | YES |
| b) | Whether FRLS | : | YES/NO |
| c) | Method of application | | |
| i) | with filllers | | |
| ii) | without fillers | : | Pressure extruded |
| d) | Type & shape of fillers (if used) | : | |
| e) | Colour | | |

3.4 **Armour**

| | | | |
|---|---|---|---|
| a) | Galvanised steel wire/ formed wire conforming to IS:3975 for multi-core cables. | : | YES |
| b) | Hard drawn aluminium wire H4 grade conforming to IS:8130 | : | YES/NA |
| c) | Method of joining | : | |
| d) | Breaking load of joint | : | |

3.5 **Outer Sheath**

| | | | |
|---|---|---|---|
| a) | PVC Type ST1 to IS: 5831 | : | YES |
| b) | Whether FRLS | : | YES |
| c) | Method of application | : | |
| d) | Minimum Tensile strength | : | N/mm2 |
| e) | Minimum % elongation at rupture | : | |
| f) | Colour | | |
| g) | Tolerance on thickness | : | |
| h) | Whether progressive sequential length marking provided. | : | |

4.0 **PERMISSIBLE VOLTAGE AND FREQUENCY VARIATION**

a) Voltage : (±) %

b) Frequency : (±) %

c) Voltage-frequency combined combined : |ABS| %

5.0 Permissible Conductor Temp. for

a) Maximum Continuous Rating : °C
b) Short Circuit : °C

6.0 Installation Conditions for specified current rating

a) ambient air temperature in deg. C : °C
b) ground temperature : °C

c) depth of laying of cables buried in ground : : cm

d) thermal resistivity of soil : °C cm/W

e) thermal resistivity of insulation : °C cm/w

7.0 Formula for calculating short circuit current for different durations

8.0 **CHARACTERISTICS OF FRLS SHEATH**

a) Oxygen index :

b) Temperature index :

c) Acid gas generation :

d) Smoke density rating :

9.0 **CABLE DRUMS**

a) Type & construction :

b) Standard drum length :
c) Tolerance on drum length :

10.0 **DOCUMENTATION**

Whether following enclosed

| | | | |
|---|---|---|---|
| a) | X-sectional drawing with construction details | : | YES |
| b) | BHEL's Quality Plan with seal of acceptance | : | YES |
| c) | Derating factors as stipulated in Section-D | : | YES |
| d) | Packing drawing | : | YES/NO |

(TO BE FILLED IN FOR EACH SIZE OF CABLE IN THE FORM OF TABLE)

| | | | |
|---|---|---|---|
| 11.0 | No. of cores x size | : | |
| 12.0 | Voltage grade | : | kV |
| 13.0 | Base current ratings (*) based on cl.5.0, cl.6.0 | | |
| | a) In air | : | Amp |
| | b) In ground | : | Amp |
| | c) In ducts | : | Amp |
| 14.0 | Short circuit rating | : | kA, sec. |
| 15.0 | a) D.C. resistance of conductor at 20 °C | : | ohm/km |
| | b) A.C. resistance of conductor at 70 °C/ 85 °C | : | ohm/km |
| | c) Reactance of cable at normal frequency | : | ohm/km |
| 16.0 | CONDUCTOR | | |
| | a) Material, type & grade | : | |
| | b) No & dia of wires in each core before stranding | : | no x mm |

| | | | | |
|---|---|---|---|---|
| | c) Shape | : | | |
| 17.0 | Nominal thickness of insulation | : | mm | |
| 18.0 | Inner sheath thickness (min.) | : | mm | |
| 19.0 | Sizes of armour | : | no x mm | |
| 20.0 | Nominal thickness of outersheath | : | mm | |
| 21.0 | DIAMETERS | | | |
| | a) i) Fictitious diameter of insulated conductor | | : | mm |
| | ii) Approximate cable diameter of insulated conductor | | : | mm |
| | b) i) Fictitious cable diameter of under armour/ over innersheath | | : | mm |
| | ii) Approximate cable diameter under armour/ over innersheath | | : | mm |
| | c) i) Fictitious cable diameter of under armour/ over innersheath | | : | mm |
| | ii) Approximate cable diameter over armour | | : | mm |
| | d) i) Fictitious overall diameter of cable | | : | mm |
| | ii) Approximate overall diameter of cable | | : | mm |
| 22.0 | Tolerance on overall diameter | : | (±) mm. | |
| 23.0 | Minimum bending radius | : | x O.D. | |
| 24.0 | Safe pulling force | : | kg. | |
| 25.0 | Weight of cable | : | kg./km | |
| 26.0 | Dimension of drum | : | mm | |
| 27.0 | Shipping weight | : | kg. | |
| 28.0 | Identification mark on outersheath | : | | |
| 29.0 | Identification marks on drum | : | | |