T E N D E R S P E C I F I C A T I O N

NO: BHE/PW/PUR/HZGG-CBL/747

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF ELECTRICAL CABLING PACKAGE, EARTHING AND LIGHTNING PROTECTION SYSTEM AND ASSOCIATED ITEMS FOR UNIT #1 OF 1x350 MW HAZIRA CCPP

AT

GUJARAT STATE ENERGY GENERATION LIMITED

NEAR HAZIRA, VILLAGE MORA

POST BHATHA, SURAT HAZIRA ROAD,
DISTT.-SURAT, PIN : 394510
GUJARAT

VOLUME – I

CONSISTING OF:

- **Notice Inviting Tender,**
- **Volume-IA : Technical Conditions of Contract-,**
- **Volume-IB : Special conditions of Contract,**
- **Volume-IC : General conditions of Contract**
- **Volume-ID : Forms & Procedures**

Bharat Heavy Electricals Limited
(*A Government of India Undertaking*)
Power Sector - Western Region
345-Kingsway, Nagpur-440001

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NIL	Notice Inviting Tender	10	(Part of **Vol-I-A-747**)
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Tender Specification Issue Details

Tender Specification No: BHE/PW/PUR/HZGG-CBL/747

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF ELECTRICAL CABLING PACKAGE, EARTHING AND LIGHTNING PROTECTION SYSTEM AND ASSOCIATED ITEMS FOR UNIT #1 OF 1x350 MW HAZIRA CCPP

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EARNEST MONEY DEPOSIT: Refer Notice Inviting Tender

LAST DATE FOR TENDER SUBMISSION . Refer Notice Inviting Tender

THESE TENDER SPECIFICATION DOCUMENTS CONTAINING VOLUME-I AND VOLUME- II ARE ISSUED TO:

M/s. ……

…….

PLEASE NOTE:
THESE TENDER SPECS DOCUMENTS ARE NOT TRANSFERABLE.

For Bharat Heavy Electricals Limited

AGM (Purchase)
Place: Nagpur
Date :

747

NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHE/PW/PUR/HZGG-CBL/747 Date: 28/07/2010

NOTICE INVITING TENDER (NIT)

NOTE: BIDDER MAY DOWNLOAD FROM WEB SITES OR PURCHASE TENDERS FROM THIS OFFICE ALSO

==========

To

Dear Sir/Madam

Sub : NOTICE INVITING TENDER

Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting PRE QUALIFICATION CRITERIA as mentioned in Annexure-I) for the subject job by the undersigned on the behalf of BHARAT HEAVY ELECTRICALS LIMITED as per the tender document. Following points relevant to the tender may please be noted and complied with.

1.0 Salient Features of NIT

SL NO	ISSUE	DESCRIPTION	
i	**TENDER NUMBER**	**BHE/PW/PUR/HZGG-CBL/747**	
ii	**Broad Scope of job**	HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF ELECTRICAL CABLING PACKAGE, EARTHING AND LIGHTNING PROTECTION SYSTEM AND ASSOCIATED ITEMS FOR UNIT #1 OF 1x350 MW HAZIRA CCPP**ATGUJARAT STATE ENERGY GENERATION LIMITED**NEAR HAZIRA, VILLAGE MORAPOST BHATHA, SURAT HAZIRA ROAD, DISTT.-SURAT, PIN : 394510 GUJARAT	
iii	**DETAILS OF TENDER DOCUMENT**		
a	Volume-IA	*Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc*	*Applicable*
b	Volume-IB	*Special Conditions of Contract (SCC)*	*Applicable*
c	Volume-IC	*General Conditions of Contract (GCC)*	*Applicable*
d	Volume-ID	*Forms and Procedures*	*Applicable*
e	Volume-II	*Price Schedule (Absolute value).*	*Applicable*
iv	**Issue of Tender Documents**	***1. Sale from BHEL PS Regional office at :*** ***Start : 28 /07/ 2010*** ***Closes: 10/08/2010 , Time :15.00 Hrs*** **2. From BHEL website (www.bhel.com)** Tender documents can however be downloaded from website till due date of submission	*Applicable*

v	**DUE DATE & TIME OF OFFER SUBMISSION**	***Date : 10 /08/ 2010 , Time :15.00Hrs*** ***Place :***	*Applicable*
vi	**OPENING OF TENDER**	***2 hours after the latest due date and time of Offer submission*** *Notes:* *(1) In case the due date of opening of tender becomes a non-working day, tenders shall be opened on next working day at the same time.* *(2) Bidder may depute representative to witness the opening of tender*	*Applicable*
vii	**EMD AMOUNT**	*Rs 1,50,000/- (Rupees One Lakh Fifty Thousand Only)*	*Applicable*
viii	**COST OF TENDER**	*Rs 2000/-.*	*Applicable*
ix	**LAST DATE FOR SEEKING CLARIFICATION**	*Date: Atleast 3 days before the due date of offer submission* *Along with soft version also, addressing to undersigned & to others as per contact address given below*	*Applicable*
x	**SCHEDULE OF Pre Bid Discussion (PBD)**	*Date : Not applicable.*	*Not applicable.*
xi	**INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)**	*Not Applicable*	*Not Applicable*
xii	**Latest updates**	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) **and not in the newspapers**. Bidders to keep themselves updated with all such information	

2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer. **Rates/Price including discounts/rebates, if any, mentioned anywhere/in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**

3.0 Unless specifically stated otherwise, bidder shall remit cost of tender and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Power Sector Regional HQ at Nagpur issuing the Tender, along with techno-commercial offer. Bidder may also choose to deposit the Tender document cost by cash at the Cash Office as stated above against sl no iv of 1, on any working day; and in such case copy of Cash receipt is to be enclosed with the Techno Commercial offer. Sale of tender Documents shall not take place on National Holidays, holidays declared by Central or State Governments and BHEL PS HQ at NAgpur, Sundays and second/ last Saturdays

4.0 Unless specifically stated otherwise, bidder shall deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Nagpur. For other details and for 'One Time EMD' please refer General Conditions of Contract.

5.0 **Procedure for Submission of Tenders**: The Tenderers must submit their Tenders to Officer inviting Tender, as detailed below:

- PART-I consisting of 'PART-I A (Techno Commercial Bid)' & 'PART-I B (EMD/COST of TENDER)' in two separate sealed and superscribed envelopes (ENVELOPE-I & ENVELOPE-II)
- PART-II (Price Bid) – in sealed and superscribed envelope (ENVELOPE-III)

6.0 The contents for ENVELOPES and the superscription for each sealed cover/Envelope are as given below. **(All pages to be signed and stamped)**

Sl no	Description	Remarks
	Part-I A	
	ENVELOPE – I superscribed as : PART-I (TECHNO COMMERCIAL BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**:-	
i.	Covering letter/Offer forwarding letter of Tenderer.	
ii.	Duly filled-in `No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. **Note:** a. In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be placed after document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. b. BHEL reserves the right to accept/reject the deviations without assigning any reasons, and BHEL decision is final and binding. i). In case of acceptance of the deviations, appropriate loading shall be done by BHEL ii). In case of unacceptable deviations, BHEL reserves the right to reject the tender	
iii.	Supporting documents/ annexure/ schedules/ drawing etc as required in line with Pre-Qualification criteria. It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact ph no, FAX no, etc.	
iv.	All Amendments/Correspondences/Corrigenda/Clarifications/Changes/ Errata etc pertinent to this NIT.	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory)	If applicable
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification/NIT	
vii.	Notice inviting Tender (NIT)	
viii.	Volume – I A : Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	
ix.	Volume – I B : Special Conditions of Contract (SCC)	
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	

xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	
xiii.	Any other details preferred by bidder with proper indexing.	

	PART-I B	
	ENVELOPE – II superscribed as: PART-I (EMD/COST of TENDER) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**:-	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender **OR** Documentary evidence for 'One Time EMD' with the Power Sector Region of BHEL floating the Tender 2. Cost of Tender (Demand Draft or copy of Cash Receipt as the case may be)	

	PART-II	
	PRICE BID consisting of the following shall be enclosed	
	ENVELOPE-III superscribed as: PART-II (PRICE BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**	
i	Covering letter/Offer forwarding letter of Tenderer enclosed in Part-I	
ii	Volume II – PRICE BID (Duly Filled in Schedule of Rates – rate/price to be entered in words as well as figures)	

	OUTER COVER	
	ENVELOPE-IV (MAIN ENVELOPE / OUTER ENVELOPE) superscribed as: TECHNO-COMMERCIAL BID, PRICE BID & EMD TENDER NO: NAME OF WORK: PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING:**	
i	o Envelopes I o Envelopes II o Envelopes III	

SPECIAL NOTE : All documents/ annexures submitted with the offer shall be properly annexed and placed in respective places of the offer as per enclosure list mentioned in the covering letter. BHEL shall not be responsible for any missing documents.

7.0 No Deviation with respect to tender clauses and no additional clauses/ suggestions/ in Techno-commercial bid/ Price bid shall normally be considered by BHEL. Bidders are requested to positively comply with the same.

8.0 BHEL reserves the right to accept or reject any or all Offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).

9.0 Assessment of Capacity of Bidders:

Bidders capacity for executing the job under tender shall be assessed as per the following:

I. **Assigning Weightages (A) for Similar Jobs Under-Execution**: Weightages shall be worked out and assigned based on the average number of Similar Works under execution including works yet to be commenced by the agency, in the following manner:

i). Number of Similar Jobs

a) No. of jobs in BHEL, PSER : Say 'J'
b) No. of jobs in BHEL, PSSR : Say 'K'
c) No. of jobs in BHEL, PSWR : Say 'L'
d) No. of jobs in BHEL, PSNR : Say 'M'
e) No. of jobs with other customers* : Say 'N' (*: Other than BHEL PSER, PSSR, PSWR & PSNR)
f) Average No. of Jobs is 'P'= (J+K+L+M+N) divided by 5

ii) Weightage "A" assigned to bidders based on Average Number of jobs "P";

a) If 'P' = 0-1, "A" will be equal to '3'
b) If 'P' = 2-3, "A" will be equal to '2'
c) If 'P' = 4-5, "A" will be equal to '1'
d) If 'P' is Above 5, "A" will be equal to '0'

II. **Weightage "B" for Quarterly Performance Reports of Vendors**: This shall be based on the averages of the net weighted score obtained by the bidder for the jobs under execution (excluding works not commenced) for the quarter previous to the last quarter reckoned from the date of latest due date of submission, in all four Regions i.e BHEL PSER, PSSR, PSWR & PSNR, in the following manner.

i). Ratings by Power Sector Region:

a) PS ER's Rating 'R**e**r' = ($X_1 + X_2 + .. + X_n$) divided by n
b) PS WR's Rating 'R**w**r' = ($X_1 + X_2 + .. + X_n$) divided by n
c) PS SR's Rating 'R**s**r' = ($X_1 + X_2 + .. + X_n$) divided by n
d) PS NR's Rating 'Rnr' = ($X_1 + X_2 + .. + X_n$) divided by n
e) **Over all Power Sector Region Rating 'R_{BHEL}'**= (R**e**r+ R**w**r+ R**s**r+ R**n**r) divided by 4

(where "X_1, X_2, X_3,…X_n" is the net weighted score obtained by the bidder as per the "Evaluation of Contractor Performance (Quarterly)" against the various contracts 'n' under execution in the respective Region).

ii) Weightage "B" assigned to bidders based on Overall Power Sector Rating **(R_{BHEL}):**

a) If **R_{BHEL}** is 80% and above, "B" will be equal to '6'

b) If R_{BHEL} is > 70% < 80%, "B" will be equal to '5'
c) If R_{BHEL} is > 60% < 70%, "B" will be equal to '4'
d) If R_{BHEL} is = < 60%, "B" will be equal to '0'

III. **Evaluation of Bidders capacity to execute the job under tender: shall be based on the sum of scores obtained in 'A' and 'B', as below:**

a) 6 or above : Considered 'Qualified' for the job under tender
b) Less than 6: Considered 'NOT Qualified' for the job under tender

IV. **Explanatory note**:

a) Similar work means Boiler or Turbine or Civil or Electrical or CI, etc irrespective of rating of Plant
b) Quarter shall be as per the quarter defined in the "Evaluation of Contractor performance (Quarterly)". For contracts where annexed Quarterly Evaluation performance was not part of the contract, 'Quarterly Performance Reports' previous to the last quarter reckoned from the date of latest due date of submission, given by the respective project site against the contract will be the basis for evaluation.

c) Vendors who are not executing any jobs presently in the Region and first timers to the Region, may be considered subject to satisfying all other tender conditions

d) 'Under execution' shall mean works in progress upto Boiler Steam Blowing (for Boiler and Auxilliaries) or Synchronisation (for all other jobs including Civil) shall be considered.

10.0 Since the job shall be executed at site**,** bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions. No additional claim shall be entertained by BHEL in future, on account of non-acquaintance of above.

11.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

12.0 BHEL may decide holding pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.

13.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.

14.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.

15.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if**

applicable, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (xi) of 1 above.**

16.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of pre-qualification evaluation/ techno-commercial bids, approval/ acceptance of customer (as applicable), etc. and date of opening of price bids shall be intimated to only such bidders.

17.0 In case BHEL decides on a `Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders.

18.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) or specified otherwise in SCC of tender.

19.0 BHEL reserves the right to decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure/ modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction. .

However, if reverse auction process is unsuccessful as defined in the RA rules/procedures, or for whatsoever reason, then the sealed 'PRICE BIDs' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.

20.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.

21.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.

22.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.

23.0 In case Consortium Bidding is allowed as per Pre Qualifying Requirement, then Prime Bidder and Consortium Partner shall enter into Consortium Agreement. Validity period of Consortium Agreement shall be 6 months after which the same can be re validated.

'Stand alone' bidder cannot become a '**prime bidder' or a 'consortium bidder' in a consortium bidding**. Prime bidder shall neither be a consortium partner to other prime bidder nor take any other consortium partners. However, consortium partner may enter into consortium agreement with other prime bidders. In case of non compliance, consortium bids of such Prime bidders will be rejected. .

24.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements" duly self certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

25.0 The bidder may have to produce original document for verification if so decided by BHEL.

26.0 Order of Precedence
In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be in the order below:

a. Amendments/Clarifications/Corrigenda/Errata etc issued in respect of the tender documents by BHEL
b. Notice Inviting Tender (NIT)
c. Price Bid
d. Technical Conditions of Contract (TCC)—Volume-1A
e. Special Conditions of Contract (SCC) —Volume-1B
f. General Conditions of Contract (GCC) —Volume-1C
g. Forms and Procedures —Volume-1D

for BHARAT HEAVY ELECTRICALS LTD

(SCT)

Enclosure

01. Annexure-1: Pre Qualifying criteria.
02. Annexure-2: Check List .
03 Other Tender documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF ELECTRICAL CABLING PACKAGE, EARTHING AND LIGHTNING PROTECTION SYSTEM AND ASSOCIATED ITEMS FOR UNIT #1 OF 1x350 MW HAZIRA CCPP**ATGUJARAT STATE ENERGY GENERATION LIMITED**NEAR HAZIRA, VILLAGE MORAPOST BHATHA, SURAT HAZIRA ROAD, DISTT.-SURAT, PIN : 394510 GUJARAT
TENDER NO	**BHE/PW/PUR/HZGG-CBL/747**

SL NO	**PRE QUALIFICATION CRITERIA**	**Bidders claim in respect of fulfilling the PQR Criteria**	
		Name and Description of qualifying criteria	Page no of supporting document
A	Submission of Integrity Pact duly signed	**NOT APPLICABLE**	
B	Assessment of Capacity of Bidder to execute the work as per sl no 9 of NIT	**NOT APPLICABLE**	
C	**Technical** C) Bidder must have, achieved any one of the following: C.1) Executed "Erection and Commissioning works of (i) Cabling, OR (ii) Electrical Systems containing Cabling works" any one of the listed works detailed hereunder: C.1..1) Executed One similar job of value not less than Rs 80 lakhs in any Industry or C.1.2) Executed Two similar jobs of value not less than Rs 50 lakhs each in any Industry or C.1.3) Executed Three similar jobs of value not less than Rs 40 lakhs each in any industry C.2) Bidder should have been Techno Commercially Qualified for Similar works by any Power Sector Region of BHEL, in the last 3(Three) years as on 30/06/2010.		

D 1	**Financial** **TURNOVER** Bidders must have achieved an average annual financial turnover (Audited) of Rs 30 Lakhs or more over last three Financial Years (FY) i.e 2007-08, 2008-2009, 2009-2010 if Annual Accounts for FY 2009-10 are audited or for 2006-2007, 2007-2008 and 2008-2009 if not audited		
2	NETWORTH Net worth of the Bidder based on audited accounts of 2009-10 (OR 2008-09 incase accounts for FY 09-10 has not been audited) should be higher than 50% of paid up capital in case of companies.		
3	PROFIT Bidder must have earned cash profit in any one of the three Financial Years as applicable in the last three years defined in 'D1 above based on latest Audited Accounts		
E	Approval of Customer Note: Names of bidders who stand qualified after compliance of criteria A to D shall be forwarded to customer for their approval. Price bid of only those bidders shall be opened who are approved by customer.	**APPLICABLE**	
F	Consortium criteria	**NOT APPLICABLE**	
	Explanatory Notes for QR 'A' 1. The word 'executed' means the bidder should have achieved the criteria specified in the QR even if the total contract has not been completed or closed 2. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as given above along with all annexures 3. Similar Works means "Erection and Commissioning works of (i) Cabling, OR (ii) Electrical Systems containing Cabling works"		

BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

ANNEXURE - 2

CHECK LIST

NOTE:- Tenderers are required to fill in the following details and no column should be left blank

1	Name and Address of the Tenderer		
2	Details about type of the Firm/Company		
3	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Fax No:	
4	EMD DETAILS	DD No: Date : Bank : Amount: Please tick (√) whichever applicable:- ONE TIME EMD / ONLY FOR THIS TENDER	
5	Validity of Offer	TO BE VALID FOR SIX MONTHS FROM DUE DATE	
		APPLICABILITY	BIDDER REPLY
6	Whether the format for compliance with **PRE QUALIFICATION CRITERIA** (ANNEXURE-I) is understood and filled with proper supporting documents referenced in the specified format	Applicable	YES / NO
7	Audited profit and Loss Account for the last three years	Applicable	YES/NO
8	Copy of PAN Card	Applicable	YES/NO
9	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable	YES/NO
10	Integrity Pact	Not Applicable	YES/NO
11	Declaration by Authorised Signatory	Applicable	YES/NO
12	No Deviation Certificate	Applicable	YES/NO
13	Declaration confirming knowledge about Site Conditions	Applicable	YES/NO
14	Declaration for relation in BHEL	Applicable	YES/NO
15	Non Disclosure Certificate	Applicable	YES/NO
16	Bank Account Details for E-Payment	Applicable	YES/NO
17	Capacity Evaluation of Bidder for current Tender	Not Applicable	YES/NO
18	Tie Ups/Consortium Agreement are submitted as per format	Not Applicable	YES/NO
19	Power of Attorney for Submission of Tender/Signing Contract Agreement	Applicable	YES/NO
20	Analysis of Unit rates	Applicable	YES/NO

NOTE : STRIKE OFF 'YES' OR 'NO', AS APPLICABLE

DATE : **AUTHORISED SIGNATORY**

(With Name, Designation and Company seal)

747

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CONTENTS

Sl.No.	Description	Details
1	Owner	Gujarat State Energy Generation Limited (GSEG)
2	Project Title	1x350 MW Combined Cycle Power Plant
3	Location	Hazira, next to existing GSEG's 156.1 MW CCPP, Near Hazira, Village Mora, Post Bhatha, Surat-Hazira Road, Hazira, Dist.-Surat-394510, Gujarat State, India
4	Power Station site Graded Level Elevation Above Mean Sea Level (MSL)	5.65 Meters above MSL
5	Latitude/ Longitude	72° 38' E/ 21° 08' N
6	Nearest Railway Station	Surat (distance about 30 Km)
7	Nearest Town	Surat (about 20 Km)
8	Nearest Airport	Surat- 20 Km, Mumbai– 300Km, by road
9	Road Approach	From State Highway NH08 running between Ahmedabad and Mumbai. The village –Mora in on NH08 and where the distance of plant is about 5 Km.
10	Site Ambient Conditions	
10.1	Highest ever temp recorded (Dry Bulb)	45.6 Deg C
10.2	Lowest ever temp recorded (Dry Bulb)	4.4 Deg C
10.3	Maximum Daily Average (Dry Bulb)	33.0 Deg C
10.4	Average Mean Dry Bulb Temp	33.0 Deg C
10.5	Average Mean Wet Bulb Temp	28.5Deg C
10.6	Relative Humidity	Max – 89%, Min – 10%, Average-70%
11.7	Basic Wind speed	8.1 Meter / Hr.
11.8	Average Rain fall	1203 mm.
11.9	Seismic Zone	Zone III

The bidder is advised to visit and examine the site of WORKS and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the CONTRACT. All costs for and associated with site visits shall be borne by the bidder.

2.0 SCOPE OF WORK

The scope of work under the specification broadly covers the receipt of materials from BHEL/customer stores/storage yard, handling at stores/storage yard, transportation to site of work, preassembly, erection, testing, pre-commissioning tests and checks and handing over of Electrical Cabling package, trays, Earthing (Grounding) and Lightning Protection System Equipment & Associated items .

The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc of ongoing works, the contractor shall establish his own computer(s) and printer(s) at his site office, along with suitable operator(s), consumables, etc.

SCOPE OF WORK IS FURTHER DETAILED IN VARIOUS CLAUSES HEREAFTER

GENERAL REQUIREMENT

2.01

The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship for fabrication, engineering and construction management. The Bidder should ensure timely completion of work. The Bidder must have adequate quantity of tools, construction aids, equipments etc, in his possession. He must also have on his rolls adequate, trained, qualified and experienced supervisory staff and skilled personnel.

2.02

The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries and equipments, achieving various milestones till handing over of the unit to BHEL's customer. The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by engaging other agencies or departmentally and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges

2.03

The terminal points decided by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.

2.04

The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer, customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole

2.05

The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule.The contractor must have adequate quantity of tools, measuring instruments, calibrating equipment etc. in his possession. He must also have on his rolls adequately trained qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication involving microprocessor-based systems

2.06

Contractor shall erect, align and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods / sequences adopted in erection of similar sets elsewhere.

2.07

The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

2.08

All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory authorities are to be arranged by the contractor expeditiously at his cost and in time to ensure smooth progress of work.

2.09

The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to contractor's fault, the contractor shall dismantle and re-do the work

duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the contractor's bills towards expenditure incurred including cost of materials and 30% overhead charges of BHEL.

2.10
The contractor shall execute the work in the most substantial and workmanlike manner. The stores shall be handled with care and diligence.

2.11
BHEL reserves right to recover from the contractor any loss, which arises out of undue delay/discrepancy/shortage/damage, or any other causes due to contractor's lapse during any stage of work. Any loss to BHEL due to contractor's lapse shall have to be made good by the contractor.

2.12
All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, manpower, supervisors/engineers, consumables etc., except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.

2.13
During the course of erection, testing and commissioning certain rework/ modification / rectification / repair / fabrication etc. may become necessary on account of feedback / revision of drawing. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc., promptly and expeditiously. Daily log sheets signed by BHEL engineer and indicating the details of work carried out, man-hours etc. shall be maintained by the contractor for such reworks. Claim of contractor if any, for such works will be governed by clauses 13.1 to 13.8.

2.14
All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc., as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rates.

2.15

The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work (excepting those specifically included in BHEL scope). However, necessary steel will be provided from the scrap / surplus materials available at site.

2.16
The contractor shall take delivery of the components; equipments etc from the BHEL stores/ storage area after getting the approval of BHEL engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically. While taking delivery of items from store it may be necessary to handle (shift / relocate) other items (not necessarily those in the scope of the contractor). Separate payment will NOT be made if such situations arise.

2.17
Contractor shall plan and transport equipments, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, contractor shall do it most expeditiously. No claim for extra payment for such work will be entertained.

2.18
Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.

2.19
The services, tests and support to be provided by the agency for the work mentioned in various sections of this tender are indicative and not exhaustive, but not limited to these for completion of the work in all respects.

2.20
All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.

2.21
The weights & dimensions as mentioned against the individual items in the Tender Specification are indicative approximate and there may be variation in dimension & weight in actual supply of equipment. No rate variation shall be considered on this account.

2.22

The scope of work & description of system / equipment as given in the various clause of this tender specification and rate schedule are only for understanding the system requirement, contractor shall note this point and assess the volume of work prior to submit the offer. No compensation shall be considered later on.

2.23
The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL engineer's instructions. The machine surfaces/finished surfaces should be greased and covered.

2.24
At all stages of work, equipments/materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL.

2.25
The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses.

2.26
Contractor shall collect all scrap materials periodically from various area of work site, deposit the same at one place earmarked at site or shift the same to a place earmarked in BHEL/ client's stores. Loads of scraps are to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. ***1% value of each RA bill will be earmarked against compliance of the above, to be released only on satisfactory collection and deposit of scrap as stated above. In case of failure of contractor to comply with this requirement, BHEL will make suitable arrangement at contractor's risk and cost. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.***

2.27
The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor.

2.28
The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/excess utilisation of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental

charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.

2.29
For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL engineer.

2.30
Housekeeping in the erection and preassembly area is as important as the well-planned and orderly work. The access to site for inspection approaches by BHEL and customer engineers and leading of the material shall be made available by the contractor at all times. The shifting and resifting of erection materials, tools and plants and clearance of restrictions, filling of ditches, undulation near the pre-assembly and boiler area is the responsibility of the contractor. Contractor should visit the site and acquaint himself with all restrictions and difficulties that he may encounter during erection/ commissioning stages.

2.31
The contractor shall take delivery of equipment, materials from the storage yard/ stores/sheds of BHEL/customer he shall also make arrangements for verification of equipment, transportation up to site of work, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipments to erection site, assembly yards etc. should be done by the prescribed route without disturbing the other works and contractors and in the most professional manner. Special equipments such as measuring and control equipments, panels, console inserts, switches, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions.

2.32
The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to recover the cost of parts/materials used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

2.33
The contractor should take all reasonable care to protect equipment and materials under his custody either in his stores or at site. Certain Items forming an integral part of equipment or system are liable to greater damages / pilferages /theft / losses. It will be responsibility of contractor to arrange for adequate security round the clock for protection from such damages/pilferages/theft/losses.

2.34

The contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are erected in position.

2.35
Overhauling, cleaning, servicing of items during erection and commissioning stages will be arranged by the contractor. All equipments shall be preserved and protected before and after erection as per the advice of BHEL engineer.

2.36
Equipment erection like panels, Motors Transformers etc shall be done by other agencies for that equipment for which cabling, earthing & lightning protection work covered under this tender specification. The glands & lugs shall be supplied either loose or fitted with the equipments. Contractor shall take care of this aspect at the time of receipt of the Lugs glands etc from BHEL stores or other agencies and maintain proper records of Receipt and consumption of these items. Contractor shall account for the quantities received with equipments and shall hand over receipt for the same to other agency under intimation to BHEL Engineer. Contractor shall extend all necessary help & co-ordinate with the equipment erection agency during the course of work.

2.37
Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation / connection details if need be, that can be converted to "As-built" drawing.

2.38
All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory authorities are to be arranged by the contractor expeditiously at his cost in time to ensure smooth progress of work.

2.39 WELDING, NON-DESTRUCTIVE TESTING ETC.

A) Installation of equipment involves good quality welding, NDE checks etc.

B) Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's Customer after due qualification process/testing.

C) Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.

D) All the welders shall be tested and approved by BHEL engineer before they are actually engaged on work though they may possess IBR/other certificate. BHEL reserves the right to reject any welder without assigning any reason.

E) The welded surface shall be cleaned of slag and painted with primer paint to prevent corrosion. For this paint will be supplied by the contractor.

F) Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.

G) Certain types of coated welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the coated welding electrodes have to be carried in portable ovens.

2.40 TESTING, PRE-COMMISSIONING AND POST COMMISSIONING:

2.40.1
The contractor shall perform various activities during pre-commissioning, Integrated Testing, post-commissioning stages of equipment covered under this tender specification. It is responsibility of contractor to arranged tools & plants, test equipments, experienced engineers and technicians. Contractor shall earmark separate manpower for respective area of as specified in relevant clause and shall not be disturbed /diverted for other work. The contractor's commissioning group shall work as per the instruction of BHEL Engineer and they shall coordinate day-to-day activity with other agency and BHEL/ Customer. The testing activity may have to be repeated till satisfactory results are obtained and also to satisfy the requirement of Customer / statutory Authority.

2.40.2
The contractor shall simultaneously start testing & commissioning activities for equipments to match the milestone activities of the project.

2.40.3
The mobilization of the commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and work undertaken round the clock if required. It is responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools & tackles / testing equipments with BHEL Engineers and arrange for the same. If at any time the requisite manpower, consumables etc are not arranged then BHEL shall make alternative arrangements and necessary recoveries with overhead cost will be made from the running bills.

2.40.4

Contractor shall cut/open work, if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.

2.40.5
It shall be specifically noted that the contractor may have to work round the clock and in shifts during the pre-commissioning and commissioning period along with or without BHEL engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

2.40.6
In case any rework/ repair/rectification/modification/fabrication etc is required because of contractor's faulty workmanship which are noticed during the commissioning or at any stages, the same shall be rectified by the contractor at his cost. If during the commissioning any improvement/repair/rework/ rectification/fabrication/modification due to design improvement is required, the same shall be carried out by the contractor promptly and expeditiously. Claim if any, for such work from the contractor shall be governed by Section-13.

2.40.7
During the commissioning activities and carrying out various tests, if any of temporarily work such as mounting of test equipments/cabling etc is required, the contractor shall carry out such work without on any extra cost. The same shall be removed after completion of the activity.

2.40.8
During this period, though BHEL/client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required Tools & Plants, Consumables, Scaffolding and approaches etc, till such time the commissioned unit is taken over for trial operations.

2.40.9
The contractor shall carry out any other tests as desired by BHEL engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.

2.40.10
The pre-commissioning activities will start in phased manner to meet the various milestones and shall continue till equipments are commissioned fully with all connected drives/equipment to HT/LT switchgear or handed over for regular operation. In this duration cabling or other work shall be carried out even though HT/LT switchgear board are charged. In order to co-ordinate the work such as issue of safety permit, normalization and compliance of other requirement, contractor shall keep team of one

experience engineer/supervisor in each shift OR as decided by BHEL Engineer. The team shall carry out instructions of BHEL Engineer for day-to-day work and shall not be diverted for other work without BHEL Engineer's permission. No extra payment shall be made for their services.

2.41 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

2.41.1 For all payment purposes, measurement shall be made on the basis of actual execution in line with drawings/documents/site requirements.

2.41.2 The measurement for cable, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.

2.41.3 All the surplus, scrap and serviceable materials, out of the quantity issued to the contractor shall be returned to BHEL in good condition and as directed by the engineer

2.41.4 All materials returned to stores should carry an Aluminium tag indicating the size and type. More than 5 meters length shall be termed as serviceable and shall be returned size wise and category wise to the owner's stores/yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge. This shall be applicable only for the purpose of accounting the cables issued for installation.

2.41.5 While carrying out material appropriation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity(ies) will be taken as the net quantity (ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance percentage specified above. Any scrap/ wastage generated by the contractor in excess of the allowable percentage shall be charged at the rates decided by the Engineer whose decision shall be final and binding on the contractor.

2.41.6 For all site-fabricated steel items such as supports, racks, frame, Canopy etc. physical measurement shall be made and then converted to tonnage. For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.

2.41.7 Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard Performa prescribed for this purpose by the site in charge

2.41.8 The erection contractor shall make every effort to minimize wastage during erection work. Cutting and wastage allowance shall be computed on length/ weight of material actually used, measured and accepted. In any case, the wastage shall not exceed the following upper limits.

Sl. No.	Item	% Wastage
01.	Each iron/steel section	2
02.	Each size of power cables	As per data sheet –A (Annexure-I)
03.	Each size of control cables	As per data sheet –A (Annexure –I)

2.41.9 If the actual wastage is more than the specified limits, cost of the excess portion will be recovered from the contractor's bill.

2.41.10 The cable take off from drums shall be planned strategically such that jointing in the run of cables and wastage are avoided. For this purpose the exact route length between various equipment/panels as per the cable schedule shall be measured and the route length recorded before laying of the cables. Depending upon the route length the type of cable required for various destinations, the cable drums should be suitably selected for cable laying. Any jointing shall be approved by the BHEL engineer. All the cut pieces/bits of cables, which are not used/unused, shall be returned to the purchaser for accounting towards wastage. The cables damaged by the contractor shall have to be replaced by the contractor at his own cost.

NOTES:

Salvageable scrap shall mean lengths of pipes, multi core cables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of pipes, multi core cables and other cables etc.

Non - Salvageable scrap means the lengths of tubes, pipes, multi core cables, other cables etc., and they are from cut-pieces of tubes, pipes, multi core cables, other cables etc., that cannot be used at all one time or other.

2.41.11 **The bidders shall quote rates for laying of LT Power, Control & Signal cables inclusive of glanding and termination at both ends. Glands shall be supplied by BHEL & Lugs above 4 sq mm shall be supplied by BHEL. Lugs up-to 4 sq mm is in bidder's scope, bidder shall include such cost in the item rate for laying of cables.**

2.41.12 The Unit rates for HT cable termination are exclusive of Unit rates for laying. Glands & Termination Kits for HT Cables (3.3 KV & above) shall be supplied by BHEL.

2.42.0 For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, payments of these items/class of work shall be regulated on the basis of rate arrived at by either of the following methods:

A) Based on rate of identical/similar items in the rate schedule.

B) Based on the rate arrived from nearby items in the rate schedule.

C) Wherever any item rate for similar type of work or nearby item rate does not exist in the rate schedule, rate will be worked out on the basis of work element or from fundamentals of estimation.

Contractor shall provide necessary resources for completion of such work within the stipulated time schedule. Value of such work shall be included while computing the total value of work finally executed for all contractual purposes, particularly for contract variation purpose.

2.43 STRUCTURAL STEEL FABRICATION AND INSTALLATION

A. INSTRUMENT/ JUNCTION BOX FRAME/ CABLE TRAY & MISC STRUCTURES FABRICATION

I. Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied by BHEL in running meter and the same shall be used for fabrication of panel base frame, canopies for instruments/panels/drives/JB/ push buttons etc., instrument/junction box frames, impulse pipe/instrument air pipe supports and instruments etc.

II. This shall include cutting to size, contouring of ends for connections if required, welding, grinding of excess weld deposits/burrs, drilling of holes for mounting of device/instrument, installation at location, levelling, alignment, providing bracings and painting etc. No gas cut holes will be permitted. All paints, primers, etc are in the scope of the contractor.

III. All the fabricated supports/frames shall be painted as per painting specifications.

IV. Frame installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel structure by welding etc. **All consumables including anchor fasteners shall be arranged by the contractor.** Where required, as part of work, concrete floors may have to be chipped out to reinforcement depth for anchoring the frames. Wherever grouting is required, contractor shall arrange all the required material including cement/ grout mix, shuttering etc., necessary labour and meet all other requirements as part of work.

V. In case, structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.

VI. In certain packages, members of frames/rack for mounting of junction boxes/ instruments may be supplied readymade. These have to be assembled prior to installation. The installation rate as quoted shall include assembly of the frames.

VII. Gas cutting of tray/impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted.

B. METAL CHANNEL FLEXIBLE BOLTABLE CABLE SUPPORT SYSTEM

Flexible GI cable support system, consisting of single/double channels, base plates, cantilever arms are as per BOQ given below in section 16. Wherever necessary, the base plate beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams if necessary at 90 deg.

Angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Quoted Rate Rates shall be accommodated in support channel and cantilever arm erection. Brief scope of work is further defined as below:

a. Metal channel boltable GI cable support shall be supplied. Each cable rack assembly comprises of sub components such as single or double channel, base plate for single/ double channel, angle fitting, clamps, cantilever arm, anchor fastener, associated hardware (spring loaded nuts, bolts and washers) etc.

b. Channel shall be supplied in standard length of six meter. Contractor shall cut the channel and assembly the rack as per site requirement. Cantilever arm is to be fixed on channel support with spring loaded nuts / bolts as per installation drawing.

c. Base plate / angle fitting shall be continuously welded all around to steel members /plate insert if provided. Brackets / clamps shall be welded to steel surface with channel as applicable in position to ensure alignment of clamps / channels. Weld thickness shall be 6 mm minimum. In case steel surface in not available for welding, anchor bolts is to be used for fixing the base / angle fitting.

d. Main support for longitudinal cable tray run in the cable vaults shall be fixed at both ends at top as well at bottom as out lined above.

e. Galvanisation damaged due to welding / cutting shall be re-painted with cold galvanising paint (paint in contractor's scope).

f. Unit rate for **"Single / Double Channel"** shall include cutting channel in required lengths, fixing of angle fittings/ base plate / clamps / brackets / fasteners/ cantilever arms /, welding etc as required as per type of installation.

g. Unit rate for **"Cantilever Arm"** shall include fixing of angle fittings/ clamps / brackets / fasteners/ etc as required as per type of installation

2.44 CABLE LAYING (POWER/CONTROL/INSTRUMENTATION SHIELDED CABLES/ PLUG-IN CABLES/INTRA-PLANT BUS/DATA HIGHWAY, ARMOURED/ UN-ARMOURED, SINGLE/MULTI-CORE, PVC/HR PVC/FRLS/ TEFFLON/XLP INSULATION)

I. Cable lengths includes cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JB, providing printed ferrules **(ferrule printing machines to be provided by contractor for printing necessary cross ferruling details)** / PVC numerical/alphabetical ferrules **(where printed ferrules not possible at all)** machine engraved ferrules sleeve/ ferrule, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, crimp and soldering termination, plug-in connections with insert type crimping, providing identification cable tags, PVC/aluminium at both the ends and at appropriate interval throughout the route length, continuity checking, insulation resistance checking, high voltage test on HT cables. Contractor to arrange adequate numbers of his own ferrule printing machines.

II. Entry to the panels, JB may be at top, side or bottom. All cables are required to be supported and clamped near to the panel.

III. Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, pre-fab plug-in cables, for such cases, cables may have to be lifted inside the panel either making cut-out in gland plate and providing rubber profile for sharp edge protection or alternatively, provide 4/6" PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rate of cable laying.

IV. Supply of copper tinned lugs conforming to IS: 694 of various types (pin, ring, fork, snap-on) upto 4 sq.mm, PVC cable ties, printable ferrules, PVC button and tapes, cable identification tag of PVC/metal, clamping and dressing material with hardware, PVC sleeves etc. shall be supplied by contractor within the quoted rate for cable

laying. The quality and make of cable lugs shall be got approved from BHEL engineer prior to their use on job.

V. All care should be taken to avoid abrasion, tension, twisting, kinking and stretching of cables during installation.

VI. Cable shielding – all signal cables are supplied with bare shielded copper wire/with breaded wire shield, general sealed wire is kept isolated at instrument/field device end and continuity is maintained through JB and getting earth at panel end only. While terminated the sealed wire either in panel or JB, PVC sleeves is to be used to avoid two-point earthing.

VII. Wherever cable runs through the duct, conduit and valves etc. the entry and exit points shall be sealed using fire/weather proof compound. In addition to this, cable entry in panels, MCC/HT/LT breakers, instruments, electrical actuators etc. are also required to be similarly sealed. **The required material for doing so shall be included by contractor in the cable laying.**

VIII. Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.

IX. After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc. at his cost.

X. Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagram is to be done by contractor at no extra cost.

XI. Contractor shall carefully plan the cutting schedule of each cable drum in consultation with BHEL site engineer such that wastages are minimised. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.

XII. Unit rate quoted for cable lying shall include the activities as defined above from Sl. No. 1 to 11.

2.45 TERMINAL CONNECTIONS: The types of cable terminations are generally as detailed below:

SG package, TG package, Station C&I and Auxiliaries

1) All field cables in SG package are crimp type of different sizes.
2) All JBs are both side screw type.
3) All console tiles wiring: screwed or plug-in type to be fabricated at site.

2.46 CABLE TRAYS/CABLE DUCTS

A. Various types of sheet metal, galvanised cable tray, i.e. perforated, ladder type, sheet metal duct, solid bottom trays, pre-fabricated structural trays etc., will be supplied in standard lengths along with accessories and hardware viz coupler plate, tray covers and tray clamps etc.

B. Installation of cable tray/cable duct shall include cutting, laying, jointing, fixing tee/reducers/ bends/clamps, fixing of tray covers, hardware, welding of tray supports as per tray route layout etc.

C. Fabrication of bends/tee/ reducers from straight length of tray is within the scope of work and rate quoted shall be inclusive of this. All site welds of cable trays shall be painted with approved primer and cold galvanizing paint, which shall be arranged by the contractor.

D. In case structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.

E. Cable trays/duct etc may have to be routed underground in cable trench, over head on structure, along the walls, floors etc.

2.47 SCOPE OF ABOVE AND BELOW GROUND EARTHING

2.47.1 ABOVE GROUND EARTHING

2.47.1.1 The contractor shall carry out above ground earthing for all Electrical equipment, which may be erected by him, or some other agency. Different type of earthing materials shall be supplied and the contractor shall lay and connect the earthing materials as per site requirement and as detailed in drawings. Unit rate for earthing material shall be paid on running meter basis.

2.47.1.2 All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.

2.47.1.3 Generally risers are provided near the structure / equipment foundation, In case risers are not visible and buried below the foundation level, contractor shall carry out necessary earth excavation for connecting the above ground earthing strips. Wherever welding is involved necessary protective coating shall be applied on weld joints.

2.47.1.4 The earthing conductors shall be mild steel/G.I. strips/wires. All connections from the equipment to the main earthing conductors shall be made as illustrated in

earthing drawings. A copy of earthing drawing shall be provided to the successful bidder.

2.47.1.5 A continuous earthing conductor shall be installed in all cables trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run on parallel a continuous earthing conductors shall be provided on one tray only with tap-offs to the control cable trays. All valve and damper motor and rapping motors will be earthed to this conductor.

2.47.1.6 If the equipment is not available at the time of earthing conductor laying tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200 mm spare length left for further connections to equipment earthing terminals

2.47.1.7 Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/IS code of practice IS 3043-1947 and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.

2.47.1.8 Parts of all electrical equipment and machinery not intended to be live shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240 V and below may have single earth connections.

2.47.1.9 If any outer shops and buildings as well as the electrical sub-stations and electrical rooms are also in contractor's scope, a ring main earthing system will be provided. Ring main earthing systems shall again be inter connected as a net work to power plant main earthing mat. Internal earthing ring in the electrical equipment room provided by the contractor whether equipment of the area is in their scope of not.

2.47.1.10 For different floors in a building, localized internal earthing ring shall be formed and connected to the ground earthing through vertical risers. The earthing mat shall be common to both power and lighting installations.

2.47.1.11 A minimum of two spare earth rings will be provided in each floor of the building for earthing future building.

2.47.1.12 Each RCC steel column of the building will be interconnected to the floor-earthing grid in basement/ground floor.

2.47.1.13 For protective earthing separate conductor shall be used for flow of earth fault current as elaborated below:

2.47.1.14 Contractor shall carry out minor civil i.e. chipping of floor (where earth strip is to be laid on floor), removal of topsoil for laying earth strip in switchyard area etc.

2.47.1.15 It is the responsibility of contractor to provide skilled manpower for periodic maintenance after the initial commissioning till handing over the system to customer. During this period the activities are to be carried out such as checking the electrolyte & specific gravity of individual battery, topping up of electrolyte, cleaning etc.

2.47.2 BELOW GROUND EARTHING

Treated test pits, Test Links, Earth Electrodes, Column earth connections for various areas will be as per Drawing available at site. Supply of all items (except the electrode rod, as indicated in the drawing) including charcoal, salt, civil items is also is in the scope of the contractor. However, the contractor shall carry out tapering of one end of the above electrode rod and carry out erection / testing. Civil works are also to be carried out by the contractor.The contractor shall also connect this pit to the earth grid (by other agency) at nominal distances of 3 to 5 meters by 40 mm rods, Details are given elsewhere in tender specification.

2.48 LIGHTNING PROTECTION SYSTEM:

The scope of work is to be carried out as per details given in Typical Details of Lightning Protection System. The items are covered in Rate Schedule. **All Hardwares (Bolts, Nuts washers etc) required for fabrication/assembly at site are to be supplied by the bidder, who shall include such cost in the corresponding item rate for erection etc as in Rate Schedule.**

2.49 FIRE SEALING WORK:

Fire sealing work below panels, at walls and at floors shall be the part of work. Materials shall be supplied by BHEL. Coating materials of around 90 sq mm size shall be supplied which shall be applied as part of unit rate for fire stops. No extra rate will be allowed for the same.

2.50 FINAL PAINTING

A. The contractor shall provide all the primer, paint, and other consumables like brush, cleaning agents etc. All T&P, manpower, supervision is in contractor's scope. Painting shall be carried out as per colour scheme approved by BHEL/ BHEL customer.

B. All metal parts of the equipment including supports, structures, etc., as applicable shall be painted after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc, by wire brush, scrapping, sand blasting etc; as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/paint. Also, where the shop primer/paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/paint coat from shop. The surface of such items shall be cleaned as per specifications, coated with

suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site. The scope of painting work is for the following areas. Primer and paint shall be sourced only from the following manufacturers or any other manufacturers approved by BHEL.

1. Berger Paints (I) Ltd.
2. Asian Paints ltd.
3. Goodlass Nerolac Paint Ltd.
4. Jenson & Nicholson Ltd.
5. Shalimar paints Ltd.

In order to have consistency in painting system, it is preferable that all the supplies are sourced from one single manufacturer.

C. All the fabricated frames, racks, supports, panel base frame etc. wherever applicable shall be painted primer and with two coats of paint as specified earlier herein.

D. The primer shall be compatible with the final coat paint schedule.

E. Supply of paint, primers, other consumables etc for above and any other scope in these specifications shall be in Contractor's scope.

F. Irrespective to scopes of painting & supply of paint mentioned elsewhere it is to be noted that supply of paint, primers, other consumables etc for all primer/painting works to be done by the contractor, shall be in Contractor's scope. No dispute shall be entertained on the above matter.

2.50.1 STRUCTURALS

Structural components may be supplied without any primer/paint coat from shop. The surface of such items shall be **cleaned as mentioned at 2.50.B** and then coated with two coats of Primer.

2.50.2 PANELS, JUNCTION BOXES

Panels and Junction Boxes shall be touch-up painted as and where original shop paint is peeled off. Necessary surface cleaning and preparation shall be done by the contractor as per relevant painting codes followed by necessary coats of Primer and Finish Paint.

2.50.3 Primers, Paints etc.

The contractor shall provide the Primer (ROZC as per IS:2074) for the scope of painting work indicated in Section-4 as well as for protection of site weld joints and gas cut locations. Contractor shall also arrange to provide the required thinner and other consumables, T&P etc required for application of ROZC Primer. All paints and thinners shall be sourced only from BHEL approved manufacturers.

2.51 ESTABLISHMENT OF OFFICE

The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc of ongoing works, the contractor shall establish his own computer(s) and printer(s) at his site office, along with suitable operator(s), consumables, etc*. Non-establishment of above equipment will attract penalty @ Rs 10000 (Rs Ten thousand only) per month.*

BHEL uses its own software SOMS (Site Operation and Management System) for total project execution and billing. The contractor shall also provide adequate and suitable manpower for updating / entries into SOMS in BHEL computers at site.

2.52 TROUBLESHOOTING DURING PLANT OPERATION

During pre commissioning / commissioning stages when the plant will be under various stages of operation, it will be necessary to have continuous (day and night) presence of suitable manpower along with required tools to attend to any defects etc that may arise during such operation. The contractor will be required to put such personnel in shifts in electrical area. The bidder must also take this aspect into consideration.

2.53 Equipments / instruments etc., under the above scope of erection and commissioning are generally despatched from BHEL's manufacturing units / vendor's works at site well before start of erection. Sometimes, such despatched materials may get stuck up with transporters/railways. The contractor shall provide support / manpower for necessary chase up for removal of such bottlenecks in transportation. Also, for smaller items, it could be necessary to depute his person to personally carry certain items from works to site. Requirement of such activities, which will be decided by BHEL engineer and chase up activities, if required, shall be performed under authorization by BHEL. The above services shall be provided within the quoted rates.

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.1	**ESTABLISHMENT**			
3.1.1	**FOR CONSTRUCTION PURPOSE**:			
a	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner. Only small open space as per available location will be provided by customer free of charge
b	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipments, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Fire fighting equipments like buckets, extinguishers etc		Yes	

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			
a	Open space for labour colony (as per availability)	Yes		Location will be finalized after joint survey with owner
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.0	**ELECTRICITY**			
3.2.1	**Electricity For construction purposes** of Voltage 415/440 V **(to be specified whether chargeable or free)**			**FREE** Construction Power will be provided at one Point near the site approximatly 300 meters from erection site free of Charge. However the contractor shall provide energy meter (calibrated) for measuring the consumption of power in their works.
a	Single point source	Yes		At a distance of …300.M from site (Distance is only estimated, it may vary upto an extent depending on site condition)

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	contractor shall provide energy meter (calibrated) for measuring the consumption of power in their works
c	Duties and deposits including statutory clearances if applicable		Yes	all cables, fuses, distribution boards, switches, switchboards, bus bars, earthing arrangements, protection devices e.g. ELCB if any and any other installation as specified by statutory authority/client in this regard for drawl of construction power and further distribution shall be arranged by the contractor.
3.2.2	**Electricity for the office, stores, canteen etc of the bidder (to be specified whether chargeable or free)**		**YES**	Contractor has to make own arrangement
a	Single point source		**YES**	Contractor has to make own arrangement
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	Contractor has to make own arrangement

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
c	Duties and deposits including statutory clearances if applicable		Yes	Contractor has to make own arrangement
3.2.3	**Electricity for living accommodation of the bidder's staff, engineers, supervisors etc**		**YES**	Chargeable(Applicable Tariff)
a	Single point source		**YES**	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.3.0	**WATER SUPPLY**			
3.3.1	**For construction purposes: (to be specified whether chargeable or free)**	**YES**		BHEL will provide water for construction purpose at a single point **FREE** of charge, however any taxes, duties, levies, charges shall be borne by the contractor. all arrangements for further distribution with necessary meter and metering arrangement has to be made by the contractor.

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
a	Making the water available at single point	Yes		In case of inadequate supply / non-availability of construction water from customer, contractor shall have to arrange construction water at his own expenses .
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.2	**Water supply for bidder's office, stores, canteen etc**		**YES**	Contractor has to make own arrangement
a	Making the water available at single point		**YES**	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3	**Water supply for Living Purpose**		Yes	
a	Making the water available at single point		**YES**	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.4.0	**LIGHTING**			

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5.0	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
a	Telephone, fax, internet, intranet, e-mail etc		Yes	
3.6.0	**COMPRESSED AIR wherever required for the work**		**YES**	

Sl.No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.7.0	**Demobilization of all the above facilities**		**YES**	
3.8.0	**TRANSPORTATION**			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage or frequency or interruptions in power supply

Sl.No	Description **PART II** **3.9.0 ERECTION FACILITIES**	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.9.1	Engineering works for construction:			
a	Providing the erection drawings for all the equipments covered under this scope	Yes		
b	Drawings for construction methods	Yes	Yes	In consultaztion with BHEL
c	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		**YES**	″
d	Shipping lists etc for reference and planning the activities	Yes		″
e	Preparation of site erection schedules and other input requirements		Yes	″
f	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	″
g	Weekly erection schedules based on Sl No. e		Yes	″
h	Daily erection / work plan based on Sl No. g		Yes	″

Sl.No	Description **PART II** **3.9.0 ERECTION FACILITIES**	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
i	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
j	Preparation of preassembly bay		Yes	
k	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself		Yes	
L	Arranging the materials required for preassembly		YES	

Tentative List of Major T&P and MMD to be deployed by the Contractor

A. T&P FOR ELECTRICAL WORKS

SN	DESCRIPTION	MINIMUM QUANTITY
0109	HV TEST KIT AC, 0 –50 KV &DC, 0- 100 KV PREFERSBLY WITH DRY TYPE TRANSFORMER	1 NO. EACH
1022	SOLDERING IRON "SOLDRON" MAKE 25 WATT	2 NOS.
1403	MULTIMETRES	
04	A)DIGITAL 3 1/2 DIGIT OF REPUTED MAKE B) ANALOG MOTWANE MAKE	4 NOS. 3 NOS. 1NO.
05	INSULATION TESTER HAND OPERATED 25OV/500V/1000 V RATED MAINS/BATTERY OPERATED	1 NO. EACH
06	INSULATION TESTER MAINS OPERATED 2500/5000V	1 NO.
07	PHASE SEQUENCE INDICATOR	1 NO.
08	TONG TESTER AC 5/10, 25/60/300 AMP RANGE REPUTED MAKE	1 NO. EACH
09	TONG TESTER DC 30/60/300 AMP	1 NO.
10	DC RESISTANCE METER	
11	STOP WATCH	1 NO.
12	TARPOLIN FIRE PROOF	As required
13	TELETALK 2 WIRE SYSTEM	6 SETS
14	TORQUE WRENCH (12-60Nm, 50-225 Nm)	1 NO EACH
15	FERRULE PRINTING MACHINE	1 NO

B. T&P FOR MECHANICAL WORK

SN	DESCRIPTION	MINIMUM QUANTITY
	HANDLING EQUIPMENTS	
1	TURN BUCKLES	AS PER REQMT
2	'D' SHACKLES	AS PER REQMT
3	STEEL WIRE ROPES	AS PER REQMT
4	MANILA ROPES	AS PER REQMT
5	CHAIN PULLEY BLOCK/TIRFUR	AS PER REQMT
	MAJOR T&P	
1	PIPE BENDING MACHINE – 2" SIZE	2 NOS
2	GRINDING MACHINE	2 NOS
3	DRILLING MACHINES 1/4", 1/2", 3/4" & 1"	1 NO. EACH
5	DYE SETS FOR THREADING UPTO 2" PIPE.	2 NOS
6	SPIRIT LEVEL	2 NOS.
7	TAP SETS FOR BOTH BSP AND MPT THREADS UPTO 1" EACH	1 SET EACH
9	WELDING GENERATORS	1 NO.
10	WELDING TRANSFORMER	1 NO.
12	MECHANICAL TOOL KIT FOR FITTERS	4 NOS.
13	ELECTRICIAN TOOL KIT	4 NOS.
14	CRIMPING TOOL UPTO ALL SIZE OF CABLES UNDER SCOPE OF WORK	4 NOS.
15	FLOOD LIGHT FITTINGS	2 NOS.
16	FIRE EXTINGUISHERS	3 NOS.
17	DISTRIBUTION BOARDS WITH POWER CABLE COMPLETE AS REQUIRED	1 SET
18	PAINTING BRUSH	AS PER REQMT.
19	FIRE PROOF TARPAULIN	AS PER REQMT.

SN	DESCRIPTION	MINIMUM QUANTITY
	HANDLING EQUIPMENTS	
20	SAFETY BELTS AND SAFETY HELMETS	AS PER REQMT
21	24V A/C TRANSFORMER & HAND LAMPS	4 NOS.
22	MIG WELDING MACHINE WITH ACCESSORIES AIR COOL TYPE	2 NOS.
23	CRIMPING TOOL HYDRAULIC UPTO 600 SQ.MM	1 NO.
24	TORQUE WRENCH SET	1 SET
25	HYDRAULIC JACKS 250T CAPACITY/100T	4 NOS.EACH
26	TUFFER CAPACITY 15T	2 NOS.
27	CHAIN PULLEY BLOCKS 5/10T	1 NO.EACH

OTHER THAN THE AFORESAID, ONE COMPUTER, PRINTER AND OTHER NECESSARY PERIPHERALS WILL HAVE TO BE MAINTAINED BY THE CONTRACTOR IN HIS SITE OFFICE.

NOTE:

THE LIST OF INSTRUMENTS / EQUIPMENTS TO BE BROUGHT BY THE CONTRACTOR AS SHOWN ABOVE SECTIONS-A AND B ARE ONLY INDICATIVE. ANY OTHER INSTRUMENTS / EQUIPMENTS REQUIRED FOR THE EXECUTION OF THE WORK IS TO BE NECESSARILY ARRANGED BY THE CONTRACTOR WITHIN THE QUOTED RATES.

THE TESTING/CALIBRATION INSTRUMENTS WHICH ARE USED TO BE DULY CALIBRATED IN THE INTERVAL PRESCRIBED BY BHEL ENGINEERS FROM THE REPUTED AGENCIES DECIDED BY BHEL AND TEST CERTIFICATE TO BE FURNISHED.

ANY OTHER MAJOR T&P REQUIRED FOR SATISFACTORY COMPLETION OF THE WORKS.

C:MEASURING AND MONITORING EQUIPMENTS (MME):

AS PER REQUIREMENT TO BE FINALIZED AT SITE.

NOTE :

THIS ABOVE LIST IS ONLY INDICATIVE AND NEITHER EXHAUSTIVE NOR LIMITING. QUANTITIES INDICATED ABOVE ARE ONLY THE MINIMUM REQUIRED. CONTRACTOR SHALL DEPLOY ALL NECESSARY T&P TO MEET THE SCHEDULES & AS PRESCRIBED BY BHEL ENGINEER AND REQUIRED FOR COMPLETION OF WORK.

SN	DESCRIPTION & CAPACITY OF T&P	QUANTITY	PURPOSE
01	EOT CRANE IN TG HALL		FOR HANDLING AND ERECTION WITHIN TG HALL ON SHARING BASIS AS AVAILABLE AND SUBJECT TO THEIR ACCESSIBILITY AND APPROACHABILITY .

While all efforts will be made for amicable sharing of the above, non-availability of the above due to any reason shall not absolve the contractor of performing his responsibilities in time. The contractor shall undertake sufficient pre-planning and arrange his own handling/transport equipment as deemed necessary.

NOTE :

Above T&P will be provided for specific erection/commissioning activities wherein these equipment will be required. While taking delivery, contractor shall check for proper working of the equipment and the same shall be returned after the work is completed to BHEL stores in good working condition subject to normal wear and tear.

6.1 TIME SCHEDULE & MOBILIZATION

6.1.1 INITIAL MOBILIZATION AND TENTATIVE SCHEDULE

Contractor shall reach site, make his site establishment and be ready to commence the work within **two weeks** from the date of fax Letter of Intent or as per directions of Construction Manager/ Project Manager of BHEL.

The contractor has to subsequently augment his resources in such a manner that the entire related works are completed to achieve the following **tentative** schedule:

ACTIVITY	**TENTATIVE SCHEDULE OF COMPLETION FOR FIRST UNIT (i.e. Unit-1) #**
SYNCHRONIZATION OF GTG	30 DEC 2010
COMMISSIONING OF HRSGS	30 Oct 2010
SAFETY VALVE FLOATING AND STEAM BLOWING	22 Dec 2010
SYNCHRONIZATION OF STG	30 DEC 2010
STABILISATION & RELIABILITY RUN IN COMBINED CYCLE MODE	03 jan 2011

- INDICATES THE NO. OF MONTHS FROM THE START OF CONTRACT PERIOD.

6.1.2

In order to meet above schedule and other intermediate targets/activities as set by BHEL Engineer In charge at site, to meet customer requirements/project schedule, contractor shall arrange all necessary resources and work force in consultation with BHEL engineer at site to under take works concurrently in all possible fronts as made available to contractor.

6.1.3

Contractor shall specifically note that there is likely to be some delay in supplies of materials / release of work fronts / other reasons. Contractor shall have to work round the clock on such critical activities as a part of catch up programme to meet the project requirement to the extent possible and shall also provide required resources as part of scope of work.

6.2 Contract Period

The total contract period for completion of entire work **will be 12 (twelve) months from the date of start of** Erection of the first major equipment**.** Erection, Testing, Calibration and Commissioning of permanent equipments required for completion of system shall be completed within the time schedule given above.

The contract shall commence from the date of deployment of contractor's T&P, proper site setup and erection of first equipment. All the above three conditions are to be fulfilled (certified by BHEL engineer) for deciding the date of commencement of the contract.

BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule by upto 15%. This will result in advancement of various milestones. Contractor shall plan his activities and mobilise additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.

BHEL engineer within the quoted rates.

The contractor shall complete all the work in the scope of this contract within the contract period

The progressive payment for erection, testing and commissioning on accepted price of contract value for Cabling Package rates will be released as per the break up given hereinafter:

TERMS OF PAYMENT FOR ELECTRICAL WORKS

Sl. No.	Activity/Work Description	% of unit rate
I	**PRO RATA PAYMENTS (85%)**	
1.0	**Cable tray and accessories**	
1.1	Fabrication and fixing/welding/bolting in position	60%
1.2	Earthing of cable trays	10%
1.3	Tagging of cable trays (including touch up painting & cable tray numbering on sides)	8%
1.4	Covering of trays where ever envisaged	7%
	Total =	**85%**
2.0	**Cable laying including earthing wires**	
2.1	Laying of cables/Wires	45%
2.2	Glanding and termination (except HT terminations)	15%
2.3	Testing and charging	10%
2.5	Dressing and clamping	15%
	Total =	**85%**
3.0	**Junction box/Push button station (local)**	
3.1	Erection including fixing of terminal blocks where ever applicable	75%
3.2	Name plate fixing where ever applicable and labelling (inside and outside)	10%
	Total =	**85%**
4.0	**Misc. Structural steel including cable tray supports, Canopies etc, Conduits, pipes etc**	
4.1	Fabrication/Pre asembly	45%
4.2	Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	40%
	Total =	**85%**
5.0	**DG sets/Switch Gears/MCC/PCC/Distribution Boards/Marshalling Box/Starter Units/ Dry Transformers / Electrical Hoists/ Panels/Cubicles/Desks/UPS/ Batteries/ Chargers/VFD/ LA assy/ NGT/ NGR/ SP/Miscellaneous Equipments/ etc**	

5.1	Placement, Alignment and coupling/interconnection where ever applicable, erection of associated accessories etc	50%
5.2	Precommissioning checks and tests	10%
5.3	Charging, Loop testing and commissioning	15%
5.4	System commissioning	10%
		85%
6.0	**Earthing/Lightning protection strips, Earthing pits**	
6.1	Fabrication, erection, alignment, welding/bolting of earthing/lightning protection strips; earth pits completion	60%
6.2	Testing/commissioning	25%
		85%
7.0	**LT /HT Bus Ducts**	
7.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc complete with supporting structure	50%
7.2	Pre commissioning checks	20%
7.3	Testing, Charging and Painting (as applicable)	15%
		85%
8.0	**Oil Filled Transformers (Generator, Station, UAT, Station Service etc)**	
8.1	Placement on foundation and alignment	25%
8.2	Erection of associated auxilliaries/assemblies, oil filling, etc	25%
8.3	Dry out including oil filtration	15%
8.4	Precommissioning checks	10%
8.5	Testing, Charging and Painting (as applicable)	10%
		85%
9.0	**Testing/Commissioning of Equipment (like motors, actuators, ESP trfr, misc equipments, etc) erected by other agencies**	
9.1	Local testing	40%
9.2	Remote testing, Loop testing, and commissioning	40%
9.3	System commissioning	5%
		85%
10.0	**Other items**	
10.1	Rubber mats/ Display Boards/Miscellaneous items/etc : on installation	85%
10.2	Specialised Commissioning Services - on pro rata basis.	85%
10.3	Civil Works - Prorata on completion of actual work.	85%
10.4	Termination, HT Termination, Straight through jointing etc : on pro rata basis	85%

II	**STAGE/MILESTONE PAYMENTS (15%)**	
1	Boiler Light Up	1%
2	ABO	1%
3	Steam Blowing	0%
4	Safety Valve Floating	1%
5	Oil Flushing (TG)	0%
6	Barring Gear (TG)	0%
7	Rolling and Synchronisation	2%
8	Coal Firing	0%
9	Full Load	2%
10	Trial Operation of Unit	3%
11	Painting	0%
12	Area cleaning, temporary structures cutting/removal and return of scrap	1%
13	Punch List points/pending points liquidation	1%
14	Submission of 'As Built Drawings'	1%
15	Material Reconciliation	1%
16	Completion of Contractual Obligation	1%
	Total for Stage/Milestone Payments (15%)	**15%**

8.1.0 TAXES, DUTIES, LEVIES

8.1.1

The contractor shall pay all (save the specific exclusions as enumerated in this contract) taxes, fees, license charges, deposits, duties, tools, royalty, commissions or other charges which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

However, provisions regarding Service Tax and Value Added Tax (VAT) on output services and goods shall be as per following clauses.

8.1.2 Service Tax & Cess on Service Tax

Service Tax and Cess on Service Tax as applicable on output Services are excluded from contractor's scope; therefore contractor's price/rates shall be **exclusive** of Service Tax and Cess on Output Services. In case, it becomes mandatory for the contractor under provisions of relevant act/law to collect the Service Tax & Cess from BHEL and deposit the same with the concerned tax authorities, such applicable amount will be paid by BHEL.

Contractor shall submit to BHEL documentary evidence of Service Tax registration certificate specifying name of services covered under this contract. **Contractor shall submit serially numbered Service Tax and Cess Invoice, signed by him or a person authorized by him in respect of taxable service provided, and shall contain the following, namely,**

I. **The name, address and the registration number of the contractor,**
II. **The name and address of the party receiving taxable service,**
III. **Description, classification and value of taxable service provided and,**
IV. **The service tax payable thereon.**

All the four conditions shall be fulfilled in the invoice before release of service tax payment.

Contractor shall obtain prior written consent from BHEL before billing the amount towards such taxes.

With introduction of Cenvat Credit Rules 2004, which came into force w.e.f. 10.09.2004, Excise Duty paid on Input Goods including Capital Goods and Service Tax paid on Input Services that are used for providing the output services can be taken credit of against the Service Tax payable on output services. However BHEL may opt for availing the abatement provision in which case cenvat credit may not be available on input duty.

8.1.3 VAT (Sales Tax /WCT)

As regards Value Added Tax (VAT) on transfer of property in goods involved in Works Contract (previously known as Works Contract Tax) applicable as per local laws, the price quoted by the contractor shall be **exclusive** of the same. Where such taxes are required to be paid by the contractor, this will be reimbursed on production of proof of payment made to the authorities by the Contractor. In any case the Contractor

shall register himself with the respective Sales Tax authorities of the state and submit proof of such registration to BHEL along with the first RA bill. The contractor has to take all necessary steps to **minimize tax on input goods** by purchasing the materials from any registered dealer of the concerned state only. In case contractor opts for composition, it will be with the prior express consent of BHEL. Deduction of tax at source shall be made as per the provisions of law unless otherwise found exempted. In case tax is deducted at source as per the provisions of law, this is to be construed as an advance tax paid by the contractor and no reimbursement thereof will be made unless specifically agreed to.

8.1.4 Modalities of Tax Incidence on BHEL

Wherever the relevant tax laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL will have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.

8.1.5 New Taxes/Levies

In case the Government imposes any new levy/tax on the output service/ goods/work after award of the contract, the same shall be reimbursed by BHEL at actual.

In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same **before opening of Price Bid**. Claim for any such impact after opening the Price Bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.

No reimbursement/recovery on account of increase/reduction in the rate of taxes, levies, duties etc. on input goods/services/work shall be made. Such impact shall be taken care of by the Price Variation/Adjustment Clause (PVC) if any. In case PVC is not applicable for the contract, Bidder has to make his own assessment of the impact of future variation if any, in rates of taxes/duties/ levies etc. in his price bid.

SPECIFIC INCLUSIONS

9.0 ELECTRICAL INSPECTORATE'S APPROVAL /STATUTORY INSPECTION

9.1 Contractor shall have/obtain valid Electrical Contractors License to carry out the Erection & Testing work on High/Low Voltage Electrical cabling, Earthing (Grounding) and Lightning Protection System Equipments under scope of work from the appropriate statutory authority of the concerned State or Central Electricity Authority, as the case may be. All fees and expenses in this regard shall be in the contractor's account.

9.2 Contractor shall arrange inspection of concerned Statutory Authority for the installation, testing & commissioning of High / Low voltage cabling, earthing and lightning protection system covered under the scope of work in this tender specification and obtain their approval in appropriate format prior to charging of the equipments.

9.3 Contractor shall be responsible for all necessary liasioning work with Statutory Authority towards the certification of installation / works. BHEL shall reimburse Statutory Fees as per actual on submission of original receipt, however all incidental expenses shall be borne by Contractor. BHEL/ BHEL's Customer shall be providing technical assistance, drawing & document for submission to Statutory Authority.

9.4 The installation of all electrical equipments shall be carried out only by persons holding valid certificates of Competency for the voltage classes as defined in this tender specification, issued by appropriate state or central Statutory Authority. Contractor shall submit the particulars of Licenses held by him.

9.5 CONSUMABLES/ITEMS TO BE PROVIDED BY BHEL FREE OF CHARGE

01) CABLE GLANDS

02) LUGS BEYOND 4 sq. mm. SIZE.

10.0 EXLUSIONS

The Following works are excluded from Vendor's Scope.

a) Supply of Cables.

b) Supply of cable trays & accessories, structural steel, termination kits and straight through joints, cable glands, conduits, pipes, marshalling boxes.

c) Major civil works like excavation and concreting of concrete trenches, plate embedment on cable trenches, ceiling and floors.

d) Civil works for ducting for crossing of roads & rail tracks.

e) Conduits and pipes embedded in walls, floors etc as explained in Section-16

Note:

The aforesaid exclusions should not be construed as exhaustive. They are meant for general guideline. BHEL reserves the right to include or exclude any item which is required for completing the job as per rates indicated in rate schedule. Contractor should carry out all such jobs as per the instructions of BHEL engineer.

CONTENTS:

11.1.0 GENERAL

1.1 This specification covers the activities mentioned below, as applicable to various areas of power station:

a) Installation of cable tray support system and respective cable tray accessories.

b) Laying and termination of cables.

c) Testing and charging of cables.

d) Supply and erection of miscellaneous items for completion of the cabling system.

e) All associated work for completion of cabling system.

f) Receipt of cables and cabling materials supplied by purchaser/others.

g) Site handling and storage of material.

h) Minor civil works.

1.2 The installation work shall generally be carried out as per purchaser's drawings and documents. As part of cable installation, the scope shall also include exact detailing / adaptation of the system to specific site needs, to Engineers approval.

1.3 The scope of supply of cabling materials as a part of cable installation work includes supply of all accessories including, but not limited to, cable clamps, clamping materials, ferrules, cable tags, nuts, bolts, and consumables like anti-corrosive paints, welding electrodes etc. required to complete the cabling system. All other sundry materials for minor civil work shall also be supplied by vendor.

1.4 The vendor's scope of cabling installation shall include cutting, bending, supporting, drilling, welding, clamping, bolting, painting etc., of the materials for providing a complete system for all the buildings and structures of the areas under the scope, as indicated in the drawings.

1.5 The scope under this specification also covers furnishing of all labour, material & equipment, site testing of the system and performance of all operations necessary for complete installation of cabling system.

1.6 Conduits, GI pipes etc. embedded in walls, roof slabs, floors, etc. will, in general, be furnished in place, wherever necessary, by the purchaser. However, in places where such facilities have not been provided the scope will include provision of such facilities as required as per approved drawings. This shall include all civil works like breaking walls, floors and refinishing walls, floors as may be required for fixing these pipes/conduits.

1.7 Vendor may be asked to carry out certain supply and/or erection works which are not specifically mentioned in the specification but are required to be done during project execution stage. Payment for such works shall be done as per laid-down criteria.

1.8 The vendor shall also be responsible for estimation of bill of quantities on the basis of the inputs provided by purchaser in the form of drawings etc., depending upon the scope. Any shortfall or surplus in the estimated quantities shall be intimated to the purchaser periodically during project execution stages. Plan for reporting the estimated quantities shall be mutually agreed upon.

1.9 WORKS EXCLUDED FROM VENDOR'S SCOPE

a) Supply of cables.

b) Supply of cable trays & accessories, structural steel, termination kits and straight through joints, cable glands, cable lugs, conduits, pipes, marshalling boxes. However, supply of these items shall be the scope of vendor if the same is covered under the scope in Section C and the technical requirements are covered in other specifications.

c) Major civil works like excavation and concreting of concrete trenches, plate embedment's on cable trenches, ceiling and floors.

d) Civil works for ducting for crossing of roads & rail tracks.

e) Conduits and pipes embedded in walls, floors etc.

11.2.0 CODES AND STANDARDS

2.1 Installation of cabling work shall comply with the latest edition of following Indian standards rules, regulations and acts. However, if Data Sheet A specifies conformance to any other international standard, equivalent BS / IEC / ISO / any other standard shall be applicable.

a) IS: 1255 Code of practice for installation and maintenance of power Cables up to and including 33 kV rating.

b) IS: 732 Electrical wiring installations (system voltage not exceeding 650 V).

c) IS: 5216 Guide for safety procedures and practices in electrical works.

d) IS: 226 Structural steel (Standard Quality).

e) IS: 800 Code of practice for use of structural steel.

f) IS: 316 Code of practice for use of metal arc welding for general construction in mild steel.

g) IS: 1363 Hexagonal bolts, nuts and screws.

h) IS: 1572 Electroplated coatings of cadmium on iron and steel.

i) IS: 2629 Code of practice for hot dip galvanizing for iron and steel.

j) IS:2633 Method of testing uniformity of coating on zinc coated articles.

k) Indian Electricity Act.

l) Indian Electricity Rules.

m) Fire insurance regulations.

n) Regulations laid down by the Chief Electrical Inspector of the State.

o) Regulations laid down by the Factory Inspector of the State.

p) Any other regulations laid down by the authorities.

2.2 In case any clause of contradictory nature arises between standards and this specification, the latter shall prevail.

11.3.0 DESIGN REQUIREMENTS

11.3.1 ITEMS OF SUPPLY FOR CABLING INSTALLATION WORK

The supply of below listed items shall be considered to be part of cabling installation work for which no separate BOQ shall be given by the purchaser.

11.3.1.1 Trefoil Cable Clamps

a) Clamps required for single core cables carrying alternating current shall be suitable for holding three cables together in delta formation.

b) Clamps shall be of aluminium alloy or nylon material as per Data Sheet A.

c) Design of clamps shall generally conform to the BHEL's drawing no. PE-4-999-507-003 enclosed with the tender.

d) Clamps shall be of suitable sizes to firmly hold the cables of various outer diameters including the tolerance in OD.

e) Purchaser may ask for conducting the Short Circuit Withstand Test on at least one size of clamp selected randomly. The requirement of the test, if required, is stipulated in Data Sheet A.

f) Trefoil clamps shall be of BHEL approved make only.

11.3.1.2 Omega Cable Clamps

a) Omega clamps shall be of aluminium alloy or mild steel and shall be used to fasten the individual multi-core cables.

b) Clamps shall be of simple construction, made of 2mm thick, 25mm wide strip of omega shape and suitable for clamping on the rungs / perforated sheet of tray with the help of two bolts.

c) Clamps shall be of different sizes for different outer diameters of cables. Omega cable clamps shall be used for individual cables above 35mm outer diameter.

d) Steel clamps shall be hot dip galvanized as per the requirements of Data Sheet A.

11.3.1.3 Strip Cable Clamps

a) Strip clamps shall be of mild steel or aluminium and shall be used to fasten the group of multi-core cables up to 35mm diameter only on a full or part of the tray width.

b) Clamps shall be of simple construction, made of 4mm thick (Al.) or 3mm thick (Steel), 25mm wide strip to cover the entire width up to 300mm wide tray and part of the tray for more than 300mm wide trays. Strip shall have two right angle bends at each end for fixing on to the rung/ perforated sheet of tray with the help of two bolts.

c) Clamps shall be of different sizes for different sizes of tray width. However, the maximum size of clamp shall be 300mm and for cable trays of greater width, two clamps shall be used.

d) Clamps shall be hot dip galvanized.

11.3.1.4 Self Locking Clamps

a) Clamps shall be of nylon material.

b) Clamps shall have self locking feature when the cord is looped.

c) Clamps shall be provided with manual lock release.

d) Clamp cord shall not move in the backward position once it has been locked, unless the lock release is applied.

e) Type test certificates to ascertain the strength of clamps shall be submitted for purchaser's approval.

f) Not more than four (4) cables shall be clamped together, wherever collective clamping is permitted.

g) Clamp length shall be selected such that not more than 80% of lockable length is utilised for clamping.

h) Sizes and other parameters of clamps shall be as per Data Sheet A.

i) Self locking clamps shall be of BHEL approved make only.

11.3.1.5 Ferrules

a) Ferrules shall be required for individual core of control cables; hence they shall be suitable for the insulated conductor diameter.

b) Ferrules shall be of plastic material.

c) Numbering on the ferrules shall be engraved type with contrast colour to the base. Colour of ferrule and engraving shall be as per Data Sheet A. Engrave colouring shall be of durable quality to match the entire life of the plant.

d) Engraving shall be legible from a distance of 600mm.

e) Ferrules shall be interlocked type such that the interlocked ferrules take the shape of tube with complete ferrule number arranged in a straight line.

11.**3.1.6 Tags**

a) Cables shall be provided with cable number tags for identification.

b) Cable tags shall be of durable fiber, aluminium or stainless steel sheets as per Data Sheet A.

c) Cable numbers shall be engraved type in case of aluminium or stainless steel tags, and printed type in case of fiber sheet.

d) Tags shall be of durable quality of size 60mm x 12mm with a tie hole at each end.

e) Samples of tags shall be approved by the purchaser before delivery.

f) Tags shall be provided with non-corrosive wire of sufficient strength for tagging.

11.**3.1.7 Miscellaneous items**

Items required for the buried cables such as cable markers, bricks, sand, protective slabs etc. shall be to the approval of purchaser.

11.3.2 CABLING CONCEPTUAL DESIGN

11.3.2.1 In the plant building, substations, switchgear rooms, control rooms etc., power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and technological structures as the case may be.

11.3.2.2 In case of multicore cables of diameter up to 30 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of 750 mm or less.

11.3.2.3 Power & control cables installed along buildings, structures, ceilings, walls, etc., which are required to be protected against mechanical damage, shall be taken in GI conduits.

11.3.2.4 GI Conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.

11.3.2.5 Entry of cables from trenches/tunnels into buildings shall be by means of one of the methods indicated in drg no PE-4-999-507-002 as applicable for different buildings.

11.3.2.6 Cables laid exposed in racks/trays and routed from trenches/tunnels/basements etc to individual drive/ control devices etc shall be taken in embedded/exposed/surface-grouted rigid GI conduits and / or flexible conduits unless directly terminated to the equipment in the panels located above trenches, tunnels or basement.

11.3.2.7 All cables routed along walls or in equipment rooms shall be protected by means of laying them through G.I. pipes or by providing sheet metal covers up to a height of 2000 mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be enclosed type.

11.3.2.8 Tray covers shall not be provided for the cable trays within trenches, tunnels, and basements. Non-perforated type sheet steel covers shall be provided for the trays in the areas susceptible to accumulation of coal dust / atmospheric abuses etc.

11.3.2.9 Cable trays shall be supported on ISA 50x50x6mm MS/GI brackets. Brackets shall be welded to steel plate inserts in the trenches/tunnels or supporting channel angle/inserts in other areas.

11.3.2.10 Where direct heat radiation from equipment/pipes exists, heat isolating barriers for cabling system shall be adopted. System shall be to the approval of purchaser.

11.3.2.11 For 415 V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded/exposed GI conduits or rigid PVC pipes as applicable.

11.3.2.12 If required, in exceptional cases, a few number of cables may be directly buried into the earth.

11.3.2.13 wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth.

11.3.2.14 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.

11.3.2.15 In corrosive atmosphere, PVC conduits shall be used for cables.

11.3.2.16 Single core cables, when pulled individually, shall be taken through PVC pipes only.

11.3.2.17 Cable routes shall be segregated unit wise, to the extent possible. Similarly, cables for the standby drives shall preferably be taken through the alternative route. Separate routes shall also be preferred for duplicate control supply cables, first and second channel protection cables, and cables to common station service of two or more units.

11.3.2.18 Cables shall be avoided below oil pipes and in the vicinity of steam pipes.

11.3.2.19 Cable trays may be laid in vertical formation in boiler, mill and ESP areas to avoid accumulation of coal-dust / ash on cables and cable-trays. Alternatively, cable trays may be laid in horizontal formation with GI covers on each tray.

11.3.3 ERECTION OF CABLE TRAYS, SUPPORTS AND ACCESSORIES

11.3.3.1 Cable tray/racks, tray fittings, (such as elbows, reducers, tees etc.) & tray support structure shall be erected by the vendor.

11.3.3.2 Constructional details and supporting arrangement for the cable trays shall be as shown in the drawings which will be handed over to the successful bidder. All cable trays, vertical raceways and supporting steel work shall be installed along the routes as indicated in the drawings and as per the instructions of the Engineer.

11.3.3.3 Wherever specified or directed by Engineer, the vendor shall install galvanized MS sheet covers over cable trays. The width of the covers shall be same as that of cable trays. Bolting shall be done to fasten covers to the cable trays, elbows, reducers, tees, crosses etc.

11.3.3.4 The vendor shall install all angles, channels, beams, hangers, brackets, clamps etc. as may be necessary to suit the actual site conditions to support the cable trays.

11.3.3.5 Straight pieces of standard MS angles/channels shall be used for fabrication of supports/racks. All welded joints shall be smooth enough to provide a good appearance and shall not cause injury to working personnel.

11.3.3.6 Cable trays within cable trenches, tunnels and basements shall be of ladder type. Bottom most tray within plant buildings for overhead runs of trays shall be of perforated type. Cable trays in the areas exposed to coal dust shall be installed in vertical formation. Wherever, due to layout constraints, it is not possible to install the trays in vertical formation, laying of trays in horizontal formation may be considered with Engineer's prior permission.

11.3.3.7 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way, maintenance of adjacent equipment, if any.

11.3.3.8 For installation of cables in GI conduits, complete conduiting system shall be installed first without cables but having suitable pull wires laid in conduits.

11.3.3.9 For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, transition adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor terminal block.

11.3.3.10 GI conduits shall run without moisture or water traps and shall be arranged to drain towards the ends.

11.3.3.11 The entire GI conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the GI pipes entering them.

11.3.3.12 Bends of GI pipes/conduits shall be made without causing damage to the pipes/ conduits.

11.3.3.13 Occupancy of conduits shall not be greater than 40%.

11.3.3.14 The adopter for coupling rigid GI pipe/ conduit and flexible conduit shall be of aluminium or galvanized steel.

11.3.4 WELDING

11.3.4.1 All welded connections shall be made by electric arc welding. All welding work shall be carried out by qualified and experienced welders.

11.3.4.2 All arc welding shall be carried out with low hydrogen content electrode.

11.3.4.3 All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on them. No artificial cooling should be adopted to cool welded joints.

11.3.4.4 The welding shall have adequate strength.

11.3.4.5 Before welding, the conductors shall be clamped tightly to ensure good surface contact at welding points.

11.3.5 SURFACE TREATMENT

Surface treatment of all materials supplied/ erected shall be done in an approved manner and as per the specific requirements given in the Data Sheet A. The materials supplied by the purchaser may be fully treated or partially treated. In case of partially treated items the remaining surface treatment shall be given to the materials after erection.

11.3.5.1 UNTREATED STEEL MATERIALS shall be given the following surface treatment

a) Surface cleaning: In the first step complete surface shall be cleaned with sand paper and/or cotton cloth to remove accumulated dust, dirt and rust.

b) Pre-treatment: Pre-treatment shall conform to the requirements of IS: 6005. The clean and dry pre-treated surface shall be given a coat of red oxide primer paint and shall be left for natural drying.

c) Surface Finish: Two coats of abrasion resistant synthetic enamel of desired colour shall be applied on the pre-treated surface with sufficient time interval for drying up. Surface finish after the painting shall be smooth, uniform and free from spots.

11.3.5.2 PARTIALLY TREATED materials which are supplied with a single coating of primer paint shall be given the following treatment:

Two coats of abrasion resistant synthetic enamel of desired colour shall be applied on the pre-treated surface with sufficient time interval for drying up. Surface finish after the painting shall be smooth, uniform and free from spots.

11.3.5.3 GALVANIZED ITEMS shall be given a surface treatment only at the welded joints and at the places where the galvanization has been damaged. Welded joints shall be

applied with two coats of cold zinc paint whereas damaged portions of galvanizing shall be applied with single coat of zinc paint.

11.3.5.4 In addition to the above, the vendor shall ensure after completion of cable erection work that the final finish of all surfaces of trays and support materials is in good condition and wherever needed a touch up of enamel/ cold zinc paint, as applicable, shall be given.

11.3.5.5 The final finish of all erected materials shall be uniform, clean, smooth and free from spots.

11.3.6 TRANSPORTATION & STORAGE OF CABLE DRUMS

11.3.6.1 Transportation and storage of cable drums shall generally conform to the requirements of IS: 1255. BHEL approved Field Quality Plan shall also be adhered to.

11.3.6.2 All the cables shall be supplied to vendor free of cost from purchaser's store/storage area. Transportation of cables from purchaser's storage area to the work site shall be the responsibility of vendor.

11.3.6.3 The cable drums shall be transported on wheels to the place of work.

11.3.6.4 Empty cable drums shall be the property of purchaser.

11.3.7 LAYING OF CABLES

11.3.7.1 Laying and installation of power control and special cables shall generally conform to IS: 1255.

11.3.7.2 The cables shall be paid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).

11.3.7.3 In case of higher size cables, the paid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks/trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.

11.3.7.4 All possible care shall be given while handling un-armoured cables.

11.3.7.5 Suitable extra length of cables shall be provided for all feeders for any future contingency. Additional lengths shall be as under:

a) Power cables: one loop with permissible bending radius.

b) Control cables: 1 - 1.5 metre

11.3.7.6 Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS:1255.

11.3.7.7 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables, at each bend, and both sides of floor/wall crossings.

11.3.7.8 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.

11.3.7.9 Single core cables for a. c. circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of nonmagnetic material.

11.3.7.10 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacings not less than one cable diameter of bigger diameter cable.

11.3.7.11 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanized MS saddles/ aluminium strips/ nylon cable ties as specified in Data Sheet A or as agreed for the contract. Cables above 35mm outer diameter shall be clamped individually.

11.3.7.12 Control cables shall be laid touching each other and may not preferably be taken in more than two layers.

11.3.7.13 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formations:

a) HT cables shall be laid in the top tier(s).

b) LT power cables to be laid in the tray(s) below the HT cable trays.

c) LT control cables to be laid in the tray(s) next below to the LT power Cable tray(s).

d) Special control cables including screened control cables to be laid in the bottom most tray(s).

11.3.7.14 For vertical formations, the tray closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However where there is no clear distinction of bottom/ top trays, the order convenient for linking the horizontal and vertical formations shall be followed.

11.3.7.15 When it may not be possible to accommodate cables as per the criteria indicated in the clauses 3.7.12 & 3.7.13 above, the following rules shall override the criteria. However prior approval of the Engineer will be required.

In hierarchical order:

a) Control cables are mixed up with the special control cables with clear minimum gap of 100mm between them.

b) LT power cables are mixed up with control cables with clear minimum gap of 150mm between them.

c) LT power cables are mixed up with HT power cables with clear minimum gap of 200mm between them.

However, under no circumstances HT power cables can be mixed up with control cables of any type.

11.3.7.16 The vendor shall bring it to the notice of Engineer if the routes indicated in the cable schedules supplied by the purchaser defy the criteria indicated in above clauses for general arrangement of various types of cables in different trays.

11.3.7.17 In case of duplicate feeders to essential loads, the respective cables shall be laid through separate raceways. Alternatively, such cables shall be laid on the opposite sides of a trench/tunnel/basement.

11.3.7.18 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanized.

11.3.7.19 For laying cables along concrete walls, ceilings etc., the cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using rawl plugs and MS flat spacers of minimum 6mm thickness.

11.3.7.20 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic soap or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.

11.3.7.21 No single core cable shall pass through a GI conduit or duct singly except DC single core cables. AC single core cables shall pass through GI conduits/pipes in trefoil formation only.

11.3.7.22 In case of 3-phase, 4 wire system, more than one single phase circuit, unless originating from the same phase shall not be taken in the same GI conduit.

11.3.7.23 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for purchaser's consideration.

11.3.7.24 Wherever specific cable routes are not shown in cable schedules cables shall be laid as directed by Engineer.

11.3.8 SUPPORT SPACING & CLAMPING

Support spacing and clamping shall be as per Data Sheet A

11.3.9 LAYING OF CABLES DIRECTLY BURIED IN GROUND

11.3.9.1 Laying and installation of directly buried cables in ground shall conform to the requirements of IS:1255.

11.3.9.2 The part of the cable which is not buried shall comply with the requirements of clause 3.7 above, as applicable.

11.3.9.3 The desired minimum depth of laying from ground surface to the top of cable shall be as per Data Sheet A.

11.3.9.4 Bidder shall submit drawing indicating the proposed arrangement for buried cables. Drawing shall include the details of type of sand, protective covers and the overall arrangement.

11.3.10 CABLE TERMINATION AND JOINTING

11.3.10.1 Vendor shall carry out cable terminations at various electrical and electronic equipment terminals.

11.3.10.2 When the equipment are provided with undrilled gland plates for cable/conduit entry into the equipment, the vendor shall perform all drilling & cutting on the gland plate and any minor modification work required to complete the job at no extra cost to the purchaser. The vendor shall prepare a drawing showing the holes for cable entry in the gland plate and take Engineer's approval before drilling holes. Gas cutting shall not be allowed.

11.3.10.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the vendor. Looping of cores/ wires at terminals and, if required, between the panels is to be done by the vendor at no extra cost.

11.3.10.4 All cable entries in the equipment shall be sealed by cable glands / or as per site engineer's instructions. The supply sealing materials like plugs etc shall be part of scope at no extra cost to the purchaser.

11.3.10.5 Adequate length of cables shall be pulled inside the switchboards, control panels, terminal boxes etc so as to permit neat termination of each core/conductor.

11.3.10.6 Power cable terminations shall be carried out in a manner such as to avoid strain on the terminals by providing suitable clamps near the terminals.

11.3.10.7 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes/nylon ties and suitably supported to keep them in position at the terminal block. All spare cores shall be connected to spare terminals wherever possible. If spare terminals are not available, spare cores shall be neatly dressed and suitably taped at both ends.

11.3.10.8 Screened control cables of small cross sectional area, e.g. 0.5 sq mm, shall be terminated by means of Maxi-termi termination system. Vendor shall ensure the availability of all tools, tackles and accessories such as Maxi-termi guns, clips, wire etc. required for the termination of small cross section screened control cables by this method. Compressed air supply for Maxi-termi guns shall also be the responsibility of vendor.

11.3.10.9 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents supplied by the purchaser.

11.3.10.10 End sealing/termination of HT cables shall be done by means specified in the specification for terminations. The system shall be suitable for types of cables specified and complete with stress relief system.

11.3.10.11 Termination and jointing of aluminium/ copper conductor power cables shall be done by means of compression method using compression type aluminium/ tinned copper lugs as indicated in Data sheet A.

11.3.10.12 Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.

11.3.10.13 Cable joint, not more than one in a circuit, shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to purchaser's approval. Prior approval of Engineer shall be taken for deciding location of joint.

11.3.10.14 Junction boxes shall be used, wherever required, for jointing of control cables.

11.3.10.15 Termination and jointing shall generally conform to the requirements of IS: 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

11.3.11 EARTHING OF CABLING SYSTEM

11.3.11.1 Scope of earthing of support system shall be as per Data Sheet A. Scope, if included, shall be applicable for cable tray support structures, cable trays, conduits and pipes. All the conduits, trays and support structure on which the cables have been installed shall be bonded to the main earthing system. All the support arrangement shall be tested for electrical continuity and permanent connection to earth. Gas/water or other pipes shall not be used as earth medium.

11.3.11.2 Armour earthing:

a) Armour of the HT cables and LT single core cables shall be earthed only at one end of cable.

b) Armour of other cables shall be earthed at both ends of cable.

11.3.11.3 Screen Earthing:

a) Screen of HT power cables shall be earthed at one end only.

b) Screen of C&I screened control cables shall be earthed at one end.

c) Screen of electronic earthing system cables shall be earthed as per the requirements to be furnished to the vendor during contract stage.

11.4.0 INSPECTION & TESTING

11.4.1 INSPECTION

11.4.1.1 The following stages of fabrication/manufacture shall be stage inspected by the Purchaser or Engineer at site.

a) Inspection of raw materials including hardware items such as bolts, nuts etc.

b) Inspection of storage and material handling.

c) Inspection of fabrication processes such as shearing, punching, bending, welding, galvanizing, painting etc.

d) Inspection at intermediate stages of erection.

e) Final inspection after erection.

11.4.1.2 The actual inspection shall be carried out as per the approved Quality Plan. Purchaser's standard Quality Plan is enclosed in Section-C of this specification.

11.4.1.3 All erection, fabrication, installation, testing & commissioning work shall be inspected in line with the requirements of IS: 1255 and the approved Field Quality Plan.

11.4.2 TESTING

11.4.2.1 The vendor shall take full responsibility of testing at erection, pre-commissioning and commissioning stages of the cabling system being installed by him under the overall supervision of the Engineer. It shall be the overall responsibility of the vendor to arrange and complete all activities in complete coordination with equipment commissioning agency keeping in view the overall commissioning programme. The vendor shall submit to the Engineer a checklist for testing and commissioning and the activities shall be carried out in accordance with the check list.

11.4.2.2 Testing and electrical measurement of cable installations shall conform to IS:1255.

11.4.2.3 Prior to installation, cables shall be tested for

a) Continuity of conductors.

b) Insulation resistance between conductors & earth.

c) Insulation resistance between conductors.

11.4.2.4 After installation cables shall be tested for

a) Insulation resistance between conductors.

b) Insulation resistance between conductors & earth.

c) Conductor resistance (dc).

d) Capacitance between conductors (for cables above 11 KV grade).

e) Capacitance between conductor & earth (——do——).

f) DC High voltage test (for all HT cables & LT power cables of sizes 300 sq. mm and above).

g) Absence of cross phasing.

h) Firmness of terminations.

11.4.2.5 The checks and commissioning tests shall be carried out as part of the installation work and the vendor shall not be paid any extra amount for same.

11.4.2.6 The Owner may ask for such additional tests at site as in his opinion are necessary to determine that the works comply with the specification, manufacturer's instruction or the applicable IS code of installation. The vendor shall be responsible for conducting the tests and shall bear the cost of such additional tests.

11.4.2.7 The vendor shall perform all tests necessary to ensure that materials supplied and workmanship conform to the relevant standards and that such tests are adequate to demonstrate that the equipment will comply with the requirements of this specification.

11.4.2.8 The vendor shall have to bring all testing equipment & instruments in sufficient numbers to carry out the job simultaneously in more than one area. All instruments shall be calibrated to the satisfaction of the Engineer before actual testing and tests shall be conducted by qualified & experienced personnel.

11.4.2.9 All documents/records regarding test data and all other measured values shall be submitted to Engineer for approval and subsequent record and reference. All cables shall be energized only after certification from commissioning personnel. The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalization of contract.

11.5.0 PRICES

Unit prices listed out in this clause shall be applicable for payment to the vendor for activities covered under this specification. The following shall be kept in consideration while quoting the prices:

a) Unit price of supply shall include design, manufacture, testing at works, packing, supply, transportation to site, handling and storage at site.

b) Unit price of installation shall include transportation of materials from Vendor's/Owner's storage yard to work site, handling, testing before erection, testing after erection and commissioning of materials including supply and installation of all associated materials and consumables, carrying out of all associated minor civil works and furnishing of all skilled /unskilled labour, supervisory and commissioning staff.

c) Wherever materials are supplied by the purchaser e.g. lugs, glands as part of equipment supply, vendor shall in no case make any claim for the supply of these materials.

d) The unit prices quoted shall be for supply and/or installation as explained in detail in the clauses in subsequent paragraphs. No other prices shall be applicable for the purpose of payment.

e) **While quoting the prices the supply and installation of following shall be considered as part of job:**

i. Nylon ties for cable clamping, other types of clamps, Trefoil clamps for single core cables, PVC straps, aluminium strips, MS saddles, interlocking type ferrules, aluminium/stainless steel tags as per the project requirements.

ii. Fasteners like nuts, bolts, washers, spring washers, rawl plugs, anchoring bolts and lugs etc.

iii. Conduit plugs, gaskets, couplers, and insulated bushings.

iv. Sealing materials for wall and floor openings.

v. Consumables like electrodes for welding etc.

vi. Materials for minor civil works.

f) The following shall be arranged by the vendor at no extra cost :

i. All unskilled and skilled labour.

ii. All supervisory and commissioning staff.

iii. All facilities/equipment for site fabrication such as cutting, bending and drilling equipment.

iv. Welding sets.

v. Material handling equipment.

vi. All special tools and tackles for erection.

vii. All testing equipment.

g) Requirement of Quality Plan and Field Quality Plan shall be considered in the quoted prices.

11.5.1 Unit rate of INSTALLATION OF CABLE TRAY SUPPORT MATERIAL shall be applicable for the no. of pieces installed under the following categories:

a) ISA 50x50x6 upto 1000mm length welded at one end.

b) ISA 50x50x6 upto 1500mm length welded at intermediate point with a channel/beam.

c) ISMC 100 upto 1500 mm length, welded at one end.

d) ISMC 100 upto 1500 mm length, welded at two ends.

e) ISMC 150 upto 1500 mm length, welded at one end.

f) ISMC 150 upto 3000 mm length, welded at two ends.

g) ISMB 150 upto 3000 mm length, welded at two ends.

11.5.2 Unit rates of INSTALLATION OF CABLE TRAYS & ACCESSORIES shall be applicable for the lengths installed and measured at the centre line of trays and accessories. Unit rates of installation shall be uniform for trays and accessories of the same width.

11.5.3 Unit rate of INSTALLATION OF CONDUITS AND PIPES (ALL TYPES) shall be applicable for the length of the various sizes of conduits installed as below :

a) upto 25mm

b) above 25mm upto 50mm

c) above 50mm upto 75mm

d) above 75mm upto 100mm

11.5.4 Unit rate of INSTALLATION OF TRAY COVERS shall be applicable for the lengths installed and measured at the centre line of trays and accessories of various sizes.

11.5.5 Unit rate of CABLE LAYING shall be applicable for cable lengths actually installed. Unit rates shall include laying/pulling of cables in horizontal/vertical runs in trays, ducts, conduits; supply and erection of clamps, cable tags and markers etc.

11.5.6 Unit rate of CABLE TERMINATIONS shall be applicable for the no. of terminations installed for various sizes of cables. Unit rates shall include drilling of gland plates, fixing of glands, ferrules and lugs and connection to the equipment. Each cable end shall be treated as separate termination.

11.5.7 Unit rate of LAYING OF CABLES DIRECTLY BURIED IN GROUND shall be applicable for lengths of cables laid and shall be measured between the two points of cables entering into the ground. Following shall be the break-up of prices for directly buried cables:

a) Unit rate of laying shall be same as that for the cables of same size laid in cable tray.

b) Unit rate of earth work in excavation and back-filling shall be quoted separately for the buried cables. earth work shall be measured in cubic metre of earth specifically excavated for the purpose of buried cables.

c) Unit rate of supply and filling of sand shall be applicable for the quantity of sand in cubic metres.

d) Unit rate of supply and erection of protective covering shall be applicable for the area of protective covering and shall be measured in terms of per square metre of protective cover.

11.5.8 Unit rate of ERECTION OF MARSHALLING BOX shall be applicable for no. of boxes actually installed in various locations. Price shall include supply of supporting material and fabrication of support work. Price of cable termination shall be exclusive of this price.

11.5.9 Unit rate of SUPPLY AND ERECTION OF STEEL INSERT PLATES shall be applicable for the no. of such plates provided in various locations. Price shall include all associated steel work such as minor chippings and provision of fasteners/anchor bolts etc.

11.5.10 Unit rate of INSTALLATION OF MS PROTECTIVE SHEETING shall be applicable for the sheeting provided in various locations. Price shall include cutting and fabrication of sheet and all associated work such as providing fasteners/anchor bolts etc. Sheeting shall be measured in square metre of sheet actually installed.

11.5.11 Unit rate of SAND FILLING OF TRENCHES shall be applicable for supply and filling of trenches with sand wherever applicable and shall be measured in terms of the trench volume in cubic metres. Trench volume shall be measured as if there were no trays and cables. However unit price shall include sealing of the filled up trenches by provision of brick walls and sealants within the trench in an approved manner.

11.5.12 Unit rate of SUPPLY OF GALVANIZED STEEL MATERIALS shall be applicable for the weight of steel material measured in tons. These materials shall include short fall quantities of channels/ angles/ beams etc. which are generally the scope of other specification.

11.6.0 MEASUREMENT & WASTAGES

11.6.1 QUANTITY MEASUREMENT AND RETURN OF SURPLUS QUANTITY

11.6.1.1 For all payment purposes, measurement shall be made on the basis of the execution drawings/physical measurements. Physical measurements shall be made by the vendor in the presence of the Engineer.

11.6.1.2 The measurements for cable laying shall be made on the basis of length actually laid from lug to lug including that of loops provided and paid accordingly.

11.6.1.3 All the surplus, scrap & serviceable cables cut out of the cables quantity i.e. issued by the Owner to the vendor shall be returned by the vendor to the Owner's stores/yard in good condition and as directed by the Engineer.

11.6.1.4 All cables being returned to stores should carry an aluminium tag indicating the size and type of cable. Cable of less than 5m length will be termed as scrap. Cable of length 5m and above shall be termed as serviceable material and shall be returned size wise and category wise to the owner's stores/yard.

11.6.1.5 Cable of serviceable lengths being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum (s) shall be noted and certified by the Engineer. This shall be applicable only for the purpose of accounting the cables issued by the Owner for installation.

11.6.1.6 While carrying out material appropriation with vendor, all the above points will be taken into account. All serviceable material returned by the vendor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity (ies) will be taken as the net quantity (ies) issued to the vendor. Material appropriation shall then be done and allowable scrap quantity calculated as per wastage allowance percentage specified above.

11.6.1.7 Any scrap/wastages generated by the vendor in excess of the allowable percentage shall be charged at the rates decided by the Engineer whose decision shall be final and binding on the vendor.

11.6.1.8 For steel material supplied by vendor all scrap shall be returned to purchaser's stores with due accounting.

11.6.2 CUTTING & WASTAGE ALLOWANCE

11.6.2.1 Vendor shall carefully plan the cutting schedule of each cable drum in consultation with Engineer such that wastages are minimised and any resultant short lengths can be used where appropriate route lengths are available.

11.6.2.2 The wastage allowances as permissible for various items are indicated in Data Sheet

11.6.2.3 Cutting and wastage allowance shall be computed on the lengths of cables and weight of steel actually used, measured and accepted.

11.7.0 <u>ADDITIONAL POINTS OF CONSIDERATION</u>

11.7.1 The vendor shall carry out total installation work as per the requirements of the complete specification and instructions of Engineer. Notwithstanding any stipulations of this section of specification, any additional requirements stipulated in Section-C shall be taken care of.

11.7.2 The installation work shall be carried out in a neat workman-like manner by skilled, experienced and competent workmen, particularly with experience in jointing and termination of aluminium/copper conductor cables with XLPE/PVC/Elastomeric insulations.

11.7.3 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services Any such adjustment shall be done with the approval of Engineer.

11.7.4 All materials, equipment, instruments, hardware, tools, consumables, fasteners, accessories etc whether specifically mentioned or not in the specification but required

for complete installation and testing in all respects and to the satisfaction of the Engineer will be in the scope of vendor and no extra cost shall be paid for the same.

11.7.5 The vendor shall provide at no extra cost, skilled and unskilled labour, supervisory and administrative personnel, erection tools and tackles, transport vehicles and transport cranes, equipment for erection, testing and commissioning and implements necessary for timely and efficient execution of the contract.

11.7.6 For items to be supplied by the purchaser, the vendor shall at no extra cost to purchaser, take delivery (from stores, unloading bay etc.) of the items, transport safely to site of erection, undertake opening and inspecting the material and reporting damages. He shall also be responsible for storing the same at plant site with suitable weather protection.

11.7.7 All materials being supplied or consumed during erection by the vendor in the process of erection work shall be of the best quality and according to the relevant standards. All materials shall be got inspected and approved by the Engineer before the same is used for erection work. Also regarding the inspection of work the purchaser shall have the right to inspect the same at any time during erection, testing and commissioning.

11.7.8 All apparatus, connections and cable work shall be designed and arranged to minimise the risk of fire and ingress of water. All material required to achieve the same shall be included in the cost of installation of cables.

11.7.9 The drilling and welding of building steel work for fixing supports and brackets will not be done without the prior approval of Engineer.

11.7.10 Any work like chipping/breaking of existing structure like walls, floors, fabrications, etc. shall be done after taking prior approval of Engineer.

11.7.11 Motors for all mechanical equipment for the process like, pumps, fans etc. will be set in place by other agencies. The vendor shall make power, space heater and auxiliary cable connections to the equipment and shall work in complete coordination with other vendors and/or equipment suppliers/ representatives in obtaining correct direction of rotation and the commissioning of the equipment.

11.7.12 The below listed jobs shall also be considered as normal jobs and shall be carried out by the vendor at no extra cost to the purchaser and to the satisfaction of Engineer.

a) Modifications such as rotating the terminal box through 90 deg or 180 deg as required.

b) Enlargement of cable entry holes, if necessary, by chipping and finishing the same properly.

c) Drilling of gland plates of equipment if not done already.

d) Reasonable amount of drilling, cutting, reaming and relocating holes at actual point of entry of cable or conduit in terminal boxes, outlet boxes, pull boxes etc, cleaning off the debris/trapped material from conduit/ducts.

e) Supply of all cement, sand etc, required for grouting necessary supports for cable trays, conduits etc.

f) Sealing of all openings between conduits/pipes and the encasing wall/ floor.

g) All supporting and clamping arrangement.

h) In case any existing structure is affected/damaged due to installation work of cables the vendor shall repair the same to the satisfaction of Engineer.

i) Changes in line and grade or addition of off-sets by means of cutting standard tray sections and inserting additional tray fittings to match with the existing arrangement.

j) Small modifications in the cable tray routings.

k) Cleaning and minor chipping work, dewatering of trenches if necessary, minor civil works and other associated works. Securing the supports on walls, ceilings, floor or trenches by suitable anchoring may also have to be done, if required.

l) All excavations shall be back filled to the original level with good consolidation.

m) Any wrong erection shall be removed & re-erected promptly to comply with the design requirements to the satisfaction of Engineer.

n) All steel items which are not galvanized or areas where galvanization has been affected in the course of fabrication and erection shall be given at least two coats of anti-corrosive paint. The quality of paint shall be to purchaser's approval. Anti corrosive paint (zinc paint) shall be applied after applying red oxide paint.

o) Looping of cores/wires at terminals as per interconnection diagrams.

11.7.13 While testing and commissioning if the system to which the cabling is connected is observed to be not functioning, it shall be the responsibility of the vendor to check, establish and demonstrate in close coordination with the commissioning agencies that there is no defect in the cabling. The vendor shall put his supervisor and workmen along the commissioning agencies to check the interconnecting cables.

11.7.14 Any modification/rework required to be done on account of wrong practices (like connections with wrong sequence at drive/equipment end) shall be at vendor's cost.

11.7.15 Before energisation, physical inspection (of Terminal Boxes, Junction boxes etc) shall be carried out and all foreign bodies shall be removed and loose connecting bolts etc. shall be tightened.

11.7.16 Complete cabling work shall be carried out as per following drawings/documents furnished by purchaser and the instructions of Engineer.

a) Cable trench layout drawings.

b) Cable tray layout drawings.

c) Cable schedules (covering details like From, To, Route, cable Details etc.).

d) Cable interconnection diagrams.

e) Relevant civil drawings.

f) Equipment layout drawings.

11.8.0 UNSPECIFIED WORK

8.1 Vendor shall take up all unspecified work as requested by purchaser for supply and/or erection.

8.2 Complete work shall comply with the purchaser's requirements for which specification and completion schedule shall be handed over to the vendor.

8.3 All work shall comply with the applicable standards. All material and workmanship shall be to the approval of Engineer.

11.9.0 PERFORMANCE GUARANTEE

11.9.1 Bidder shall guarantee that the system offered shall meet the requirement as indicated in this specification and as confirmed through various clauses of Data Sheets. If it is proved that the system doesn't conform to performance guarantee, the bidder should be ready to replace the faulty components / equipment without any loss or extra cost to the purchaser.

11.10.0 DOCUMENTATION

11.10.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Data Sheet-C.

b) Final Field Quality Plan.

c) Quality Plan.

11.10.2 The following shall be furnished after testing and inspection.

- Test certificates of various tests conducted at site.

11.10.3 As Built Drawings

After successful completion, testing & commissioning of installation work, purchaser's drawings (cable raceway drawings) and documents (Cable Schedules) shall be updated in line with the actual work carried out at site.

Two marked up copies of the drawings and documents shall be submitted by the vendor within one month of completion of each major activity.

All marked up copies shall have the approval of Engineer at site.

DATASHEET A

SPECIFIC TECHNICAL REQUIREMENTS

1.0	STANDARDS APPLICABLE	:	As per respective specification
	SUPPLY ITEMS		
2.0	TREFOIL CLAMPS		
2.1	Material:		Nylon / Aluminium alloy
2.2	Type & Design:		Conforming to BHEL's drg. no. PE-4-999-507-021
2.3	Sizes:		To suit the ODs of cables and tolerances in ODs.
2.4	Whether short circuit test: required on a sample selected randomly		YES/NO (see section C part-A)
3.0	OTHER CLAMPS		
3.1	Material & type:		[ ] Nylon self locking ties
3.2	Surface Treatment for steel:		Galvanized with weight of zinc not less than 610 gms. per sq. meter.
3.3	Nylon self locking tie strips (If specified in 2.1 above)		

	Usage :	Width Tensile strength
a)	Collective clamping: upto 35mm OD (max. group of 4 cables)	4.0mm :30 kg
b)	Individual multicore : cable above 35mm OD upto 55mm OD	4.0mm :20 kg
c)	Individual multicore: above 55mm OD	7.0mm :60 kg

3.4 Sizes (Other than Nylon ties):To meet the requirements of clause 3.1 of Section D

4.0 FERRULES

a)	Colour of ferrules:	Yellow / White

b) Colour of engraving: Black

5.0 TAGS

5.1 Material: Aluminium/fibreglass/Stainless steel

5.2 Markings: Engraving /Embossing /Printing

5.3 Size: As per site approval

ERECTION

6.0 SURFACE TREATMENT: As per clause 3.5 of Section D and clause 7.0 listed below for the following items as supplied by purchaser with the treatment as indicated.

6.1 Support Material: Hot Dip Galvanized

6.2 Cable Trays

a) Type: Ladder and Perforated

b) Treatment: Hot Dip Galvanized

7.0 SITE SURFACE TREATMENT AFTER ERECTION OF TRAY & SUPPORT MATERIAL

7.1 Support Material

a) If already galvanized : Two coats of cold zinc paint at welded joints and touch up where needed.

7.2 Cable Trays, tray covers and accessories

a) If already galvanized: Two coats of cold zinc paint at welded joints and touch up where needed.

8.0 SUPPORT SPACING

8.1 Angle iron support for trays

a) Horizontal runs: 2000 mm (max.)

b) Vertical/inclined run: Spacing 1000 mm (max.)

9.0 VERTICAL SPACING BETWEEN TRAYS: 300 mm

10.0 CLAMP SPACING

10.1 Trefoil clamps

a) Horizontal run spacing: 1000 mm (max.)

b) Vertical run spacing: 1000 mm (max.)

c) Axial spacing between: Double the diameter of larger adjacent trefoils cable or 150 mm whichever is less.

10.2 Other Clamps

10.2.1 Power cables

a) above 35 mm OD

i) Horizontal runs: Individually clamped at 3000 mm interval (max.)

ii) Vertical runs: Individually clamped at 1000 mm interval (max.)

b) upto 35 mm OD

i) Horizontal runs: Collectively clamped at 3000 mm interval (max.)

ii) Vertical runs: Collectively clamped at 1000 mm interval (max.)

10.2.2 Control Cables

i) Horizontal runs: Collectively clamped at 3000 mm interval (max.)

ii) Vertical runs: Collectively clamped at 1000 mm interval (max.)

11.0 SPACING FOR CABLES SUPPORTED ALONG STRUCTURE/CEILING

a) Clamp spacing

i) in horizontal runs: 750 mm (max.)

ii) in vertical runs: 750 mm (max.)

b) Spacing between cables: 30 mm (min.)

NOTE:

a) Supports shall also be provided at each bend.

b) For any change in above spacing, prior approval of Engineer will be taken.

12.0 BURIED CABLES

a)	Scope:	Required
b)	Depth of laying:	As per IS: 1255
c)	Type of protective: covering	Conc. Slabs

13.0 OTHER CONDITIONS OF INSTALLATION IN SPECIFIC AREAS

13.1	Sand filling of trenches: required	YES
13.2	Fire barriers required:	COVERED ELSEWHERE
13.3	Scope of earthing of support:	By vendor /material Covered in above ground earthing specification

14.0 CABLE TERMINATION

14.1 Type of lugs

a)	Power cables:	See section C clause no 4.1 (xxi)
b)	Control Cables:	See section C clause no 4.1 (xxi)

14.2 Type of glands

a)	Material:	Brass
b)	Type:	Double compression non-Insulated type

15.0 WASTAGE ALLOWANCE

a)	HT cables:	1%
b)	LT cables above 70 mm^2:	1%
c)	LT cables up to 70 mm^2:	2%

d)	Control & special cables:	3%
e)	Fire Survival cables:	1%
f)	Steel materials: (For cable trays/ tray support installation/ supplied by vendor.)	1% by weight

16.0 Purchaser's drawing list :

a)	PE-4-999-507-021	Trefoil cable clamp

DATA SHEET C

GURANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

1.0	GENERAL		
1.1	Name of the vendor:		
1.2	Address:		
2.0	Standards Applicable		
2.1	IS:1255	For installation of cables:	YES
2.2	IS:732	For wiring installation:	YES
2.3	IS:2062	For structural steel:	YES
2.4	IS:800	For use of structural steel:	YES
2.5	IS:316	For metal arc welding:	YES
2.6	IS:1363	For Hexagonal bolts, nuts and screws:	YES
2.7	IS:1572	Electroplated cadmium coatings:	YES
2.8	IS:2629	For hot dip galvanizing	
2.9	IS:2633	For testing uniformity of zinc: coating	YES
2.10		Indian Electricity Rules:	YES
3.0.	SUPPLY ITEMS		
3.1	TREFOIL CLAMPS		
3.1.1	Material:		
3.1.2	Type & Design:		
3.1.3	Sizes:		
3.1.4	Whether short circuit test: already conducted		YES

3.2 OTHER CLAMPS

3.2.1 Material & type: [ ] Nylon self locking ties as per clause 3.1 of Section D

3.2.2 Surface Treatment of steel: clamps

a) Type: Galvanized / Ungalvanized

b) Weight of zinc: gms./sq. m

3.2.2 Nylon self locking tie strips (If specified in 2.1 above)

	Usage:	Width	Tensile strength
a)	Collective clamping: upto 35mm OD (max. group of 4 cables)	mm	kg
b)	Individual multicore: cable above 35mm OD upto 55mm OD	mm	kg
c)	Individual multicore: above 55mm OD	mm	kg

3.3 FERRULES

a) Colour of ferrules:

b) Colour of engraving:

3.4 TAGS

3.4.1 Material: Al. /fiberglass /Stainless steel

3.4.2 Markings: Engraving /Embossing /Printing

3.4.3 Size:

4.0 ERECTION

4.1 Surface Treatment of purchaser supplied items

a) Support Material:

b) Cable Trays:

4.2 Support Spacing

4.2.1 Cantilever arm support for trays

a) Horizontal runs:

b) Vertical/inclined run: spacing

4.2.2 Vertical spacing between trays:

4.2.3 Clamp Spacing

a) Trefoil clamps

i. Horizontal run:

ii. Vertical run:

iii. Axial spacing: (between adjacent trefoils)

b) Other Clamps

i. Power cables (above 35 mm OD)

A. Horizontal runs:

B. Vertical runs:

ii. Power Cables (upto 35 mm OD)

A. Horizontal runs:

B. Vertical runs:

iii. Control Cables

A. Horizontal runs:

B. Vertical runs:

4.2.4 Spacing for cables supported along structure / ceiling

a) Clamp spacing

i. in horizontal runs:

ii. in vertical runs:

b) Spacing between cables:

4.2.5 Buried cables

a) Depth of laying:

b) Type of protective: covering

4.2.6 Other conditions of installation in specific areas

a) Sand filling of trenches considered: considered — YES

b) Fire barriers considered: — NO

c) Scope of earthing of support material: Included support material

5.0 CONFIRMATION

5.1 Vendor to confirm that installation practice: — YES
in terms of scope, workmanship, technical requirements and pre- & post-installation shall conform to requirements of Section C & D and Data Sheet A of Vol IIB.

6.0 DOCUMENTATION

Whether following enclosed for purchaser's approval

a) All relevant drawings: — YES/NO

b) Purchaser's drawings with bidder's signature and seal: — YES/NO

c) Quality Plan(where applicable): — YES/NO

d) Final Field Quality Plan: — YES/NO

CABLING ERECTION PHILOSPHY

1.0 Scope

1.1 This document is intended to cover the aspects of cable raceway design and installation, laying and termination of various types of cables for the project.

1.2 Design calculations for cable sizing and selection are covered in a separate document.

1.3 Latest revisions of all drawings / documents shall be referred.

2.0 Cable Raceway System

2.1 Cables shall generally be laid in galvanised MS cable trays in multi-tier arrangement. The trays shall in turn be supported on flexible cable tray support systems in cable vaults, along structural members/ concrete surfaces inside plant buildings, cable trenches below switchboards/ MCC in auxiliary plant buildings, and interconnecting pipe-cum-cable trestles. The trays shall be fixed to supports by means of bolting. Clamping of trays to the cantilever arms shall be resorted to where due to fabrication mismatches, there are misalignments between the respective locations of holes in trays and the cantilever arms.

2.2 Cable trays shall be oriented horizontally in all areas, except in areas subject to coal dust or ash deposition (such as boiler platforms, raceways along C-row of Main Power House area, interconnecting overhead cable tray paths between boiler area and ESP area, etc). Cable trays may be oriented vertically in other areas also if so required due to reasons such as space restriction, accessibility, plant aesthetics, operational clearances, etc. as per approved layout drawings.

2.3 Cable trays shall be ladder type for power and control cables, while perforated type cable trays shall be used for instrumentation cables. However, in vertical cable tray risers, all trays shall be ladder type.

2.4 Suitable cable tray accessories such as horizontal and vertical bends, crosses, tees, reducers etc. shall be used in conjunction with straight runs of cable trays wherever required as per approved layout drawings to ensure a continuous and break-free tray support system for cables.

Cable tray accessories shall be factory fabricated for use at site as per approved drawing titled "TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES", (drawing no. PE-DG-214-507-E002). For specific site requirements (e.g. irregular angle bends such as 30º/60º bends, etc) as per layout conditions, tray accessories shall be fabricated at site from the straight length of respective sizes as required. Galvanisation damaged during cutting / welding operations shall be made good with cold galvanisation paint to be applied before installation of the accessories.

2.5 The flexible cable tray support system shall comprise of galvanised MS single channel (SC1) or double channel (DC1) members as main supports, to which galvanised MS cantilever arms of sizes commensurate with the tray being supported shall be fixed by means of spring nuts. Along overhead cable tray paths employing trays installed in vertical orientation, trays may be fixed directly to the vertical channel supports (e.g. along cable trestles) through bolting/ clamping.

2.6 Cable tray risers in plant buildings shall be supported on cage structures made from double channels as vertical members along the four vertices of a rectangle and single channel horizontal members connected to the vertical members at every 1000mm. Each tray of the risers will be fixed directly to one horizontally fixed single channel available at every 1000 mm within this cage.

2.7 The main supports (single/ double channels) shall be fixed to concrete/ steel surfaces by means of clamps/ brackets with spring nuts. The clamps/ brackets shall be fixed to the corresponding surfaces as permitted by site conditions in any of the following ways as per approved Document No. PE-DG-214-507-E006, Installation Details for Metal Channel Boltable Cable Support Systems:

a) Fixed with anchor bolts directly to concrete surface

b) Welded to steel inserts where available in the concrete surface

c) Clamped to steel structural members

d) Welded to steel structural members (except vertical bracings)-wherever clamping is not possible.

2.8 Running lengths of single / double channels shall be cut to required lengths for installation. Galvanisation damaged due to cutting shall be repaired with cold galvanisation paint prior to installation.

2.9 Single channels in vertical orientation, when fixed from both top and bottom, shall be used for supporting up to and including three trays. When supported from one end only, no more than two trays shall be supported on a vertically oriented single channel. Single channel in horizontal orientation shall similarly be used for supporting up to and including three trays with two points clamping. For supporting more than three trays the single channel shall be clamped once for every two trays symmetrically between two trays. In case clamping in this fashion is not possible, double channel with two point clamping shall be used.

2.10 Inside main cable vaults, as well as in other areas where more than three trays are supported on both sides of the double channel (double channels in vertical orientation), the channels shall be fixed both at the top as well as the bottom for main runs. Double channels supported from either the top or bottom and installed in vertical orientation, shall be used for supporting up to and including three trays either on one or both sides. For cross runs in cable vaults, single/ double channel supports as required as per approved layout drawings supported only from the top shall be used.

2.11 Horizontal runs of cable trays shall be supported at intervals of 2000mm approximately. Vertical runs (risers) shall be supported at approximately every 1000mm interval.

Spacing between cable trays shall normally be kept 300mm for cable laying convenience and effective heat dissipation. However, wherever layout constraints do not permit this spacing, the same may be reduced to 250mm, for trays carrying control and instrumentation cables.

2.12 The cable tray numbering shall be provided at every 10 meter and at each end of cable tray & branch connection.

2.13 All galvanisation damaged due to cutting/ welding operation required to be carried out for the installation of the system (trays, accessories and support system) shall be made good with application of cold galvanisation paint.

2.14 The cable trays and supports system shall be type tested, of approved makes, and conforming to their respective approved drawings.

2.15 Cable trays shall be grounded as per the provisions of the approved grounding document for the project.

2.16 For laying cables along building steel structures or masonry structures, the cables shall be fixed by clamping with GI saddles screwed to the GI flats welded/ embedded to the structures.

2.16 For laying cables along concrete walls, ceilings etc., the cables shall be clamped with GI saddles screwed to the GI flats welded to the inserts. Where inserts are not available the saddles may be directly fixed to the walls using anchor bolts and MS flat spacers of minimum 6mm thickness.

2.17 Provisions of IS: 1255 and CSEB specification shall be followed for cables buried directly in ground. For road/rail crossings, buried HDPE pipes encased in PCC shall be used. Directly buried cable shall not have concentration of more than 4 cables. Buried cable routes shall be protected with concrete slabs with route markers at every 20 meters along the route and at every bend.

2.18 Cable trays will not pass through wall openings required for interplant cabling. Instead, pipe sleeves in walls as under will be provided for each cable tray for transiting the cables from one side to the other:

a) For each 600mm wide tray: 3 nos. 200 diameter PVC pipes.

b) For each 450/ 300mm wide tray: 2 nos. 200 diameter PVC pipes.

c) For each 150/ 100mm wide tray: 1 no. 200mm diameter PVC pipes.

The trays shall be stopped approximately 200mm short of the wall on both sides and cables passed through the pipe sleeves as above, the pipe sleeves being aligned horizontally with the respective cable trays. This method is adopted for smooth passage of cables and effective sealing of cable openings.

2.19 Local cabling in various auxiliary plants or pump houses from the main tray runs to equipment terminal boxes shall be through notches in floor, which will be filled up with sand and then provided with lean concrete covering matching with the floor after completion of cable laying.

2.20 In Transformer yard area, cables shall be laid in concrete trenches with RCC covers. The main cable routes coming out from Main plant building and crossing the Transformer yard shall be laid in overhead trestles/duct banks. Minimum clear height of trestle shall be 2.5M and for rail/road crossing, it shall be as rail/road crossing norms.

3.0 **General Philosophy of Cable Installation**

3.1 Laying, dressing, clamping and jointing/termination process of power, control and instrumentation cables shall follow the requirements of IS:1255 & general engineering practice.

3.2 All precautions as per IS: 1255 & Field Quality Plan (FQP) shall be taken while handling the cables.

3.3 Cable runs shall be uniformly spaced, properly supported and protected. All bends in runs shall be as per specification and made with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers or that specified in IS: 1255.

3.4 For the purpose of cable laying, the cables are categorised as under:

a) HT: Power cables of 6.6kV/ 3.3kV grade

b) LT: Power cables of 0.6/1.1kV grade, catering to loads at 415V AC/ 230V AC/ 220V DC/ 24V DC

c) Control: Control cables of 0.6/1.1kV grade generally carrying control signals at 220V DC/ 110V AC.

d) Instrumentation: (Also called screened control cables): Screened cables of cross-sections 1.5sqmm or lower generally carrying very low voltage very low current signals.

3.5 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Cable tags shall be fixed at terminal ends, at tray intersection / bend and at each side of floor/ wall/ duct crossings etc and at every 20m in cable trench/tray or buried run.

3.6 Single core cables for a. c. three phase circuits, when laid on trays, shall be in trefoil formation (each trefoil with RYB phases formation), with each trefoil two `D' apart from the next trefoil in the tray. The trefoil formation shall be duly secured to the cable tray by means of trefoil clamps of nonmagnetic material at every 1000mm interval. 'D' is the diameter of cable.

3.7 Multi-core cables above 1100 V grade when laid on trays, shall be in one layer, touching and clamped by means of nylon cable ties.

3.8 1100 V grade multi-core power cables carrying continuous current when laid on trays shall be placed in single layer, touching and clamped by means of nylon cable ties. Cables of sizes indicated below, shall be clamped individually.

(a) Single core cables : 500 sq mm or higher (when not laid in trefoil formation- e.g. dc circuits)/ neutral cables)

(b) Two core cables : 120 sq mm or higher

(c) Three core cables : 95 sq mm or higher

(d) Three & half core cable: 95 sq mm or higher

3.9 Control and instrumentation cables shall be laid in multi layers, but not exceeding three layers in any section. Special purpose cables (e.g. IPB, WAN etc.) shall be laid as per system manufacturer/ supplier recommendations with due regard to segregation of routes for redundant circuits.

3.10 While power, control and instrumentation cables shall generally be laid in separate trays, low current carrying power cables (valve/ damper actuator power cables) may be laid along with control cables. In most such cases, the cable sizes shall be 2.5 sq mm; however, in exceptional cases higher sizes as per approved cable sizing calculations (required due to voltage drop criterion) may be used.

3.11 Cables shall be placed on trays on the basis of their types and functions as under for horizontal formations:

a) HT cables: in the top tier(s).

b) LT power cables: in the tray(s) below the HT cable trays.

c) Control cables: in the tray(s) next below to the LT power cable tray(s).

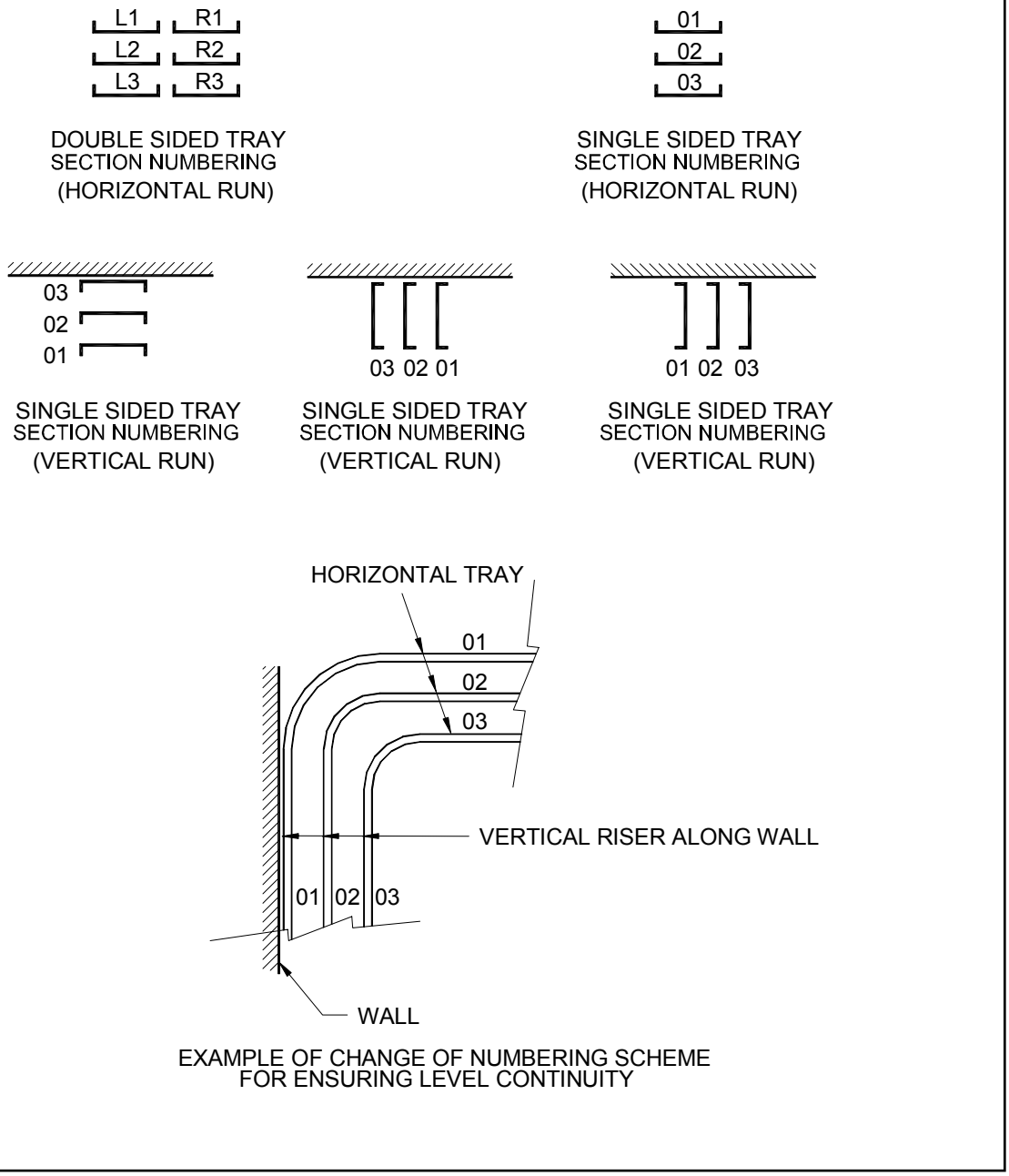
d) Instrumentation cables (screened control cables): in the bottom most tray(s).

HT Power, LT Power and LT Control/Instrumentation cables shall be separated from each other by at least 300mm.

3.12 For vertical formations, the outermost tray shall be considered as the topmost tray and the order indicated in clause 3.11 shall be followed. In rare cases, where there is no clear distinction of bottom/ top trays, the order convenient for linking the horizontal and vertical formations avoiding criss-crossing, or exit of cables shall be followed.

Typical examples of tray numbering are given overleaf.

3.13 Wherever it is not possible to accommodate cables as per the criteria indicated in the clauses 3.11 & 3.12 (due to layout constraints) for very short field runs, control cables may be laid in the same tray with the instrumentation cables with clear minimum gap of 100mm between the two types of cables.



EXAMPLE OF CHANGE OF NUMBERING SCHEME
FOR ENSURING LEVEL CONTINUITY

3.14 All cables associated with the unit shall be segregated from cables of other units. Interplant cables of station auxiliaries shall be laid in such a way that not more than half of the drives are lost in case of single incident of fire. Power and Control cables for ac drives and corresponding ac or dc drives shall be laid in segregated routes. Cable route for one set of auxiliaries of same unit shall be segregated from the other set. Segregation means physical isolation to prevent fire jumping or minimum one hour fire rating. Cables of unit critical drives shall be segregated in such a way that not more than

half of the drives are lost in case of single incident of fire. In switchyard, control cables of each bay shall be laid on separate racks / trays.

3.15 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic soap or other dry inert lubricant may be used. However any material harmful to the cable sheaths shall not be used.

3.16 No single core cable shall pass through a GI conduit/ pipe or duct singly except DC single core cables. AC single core cables shall pass through GI conduit/ pipe in trefoil formation only, or through PVC pipes. Conduit/pipe occupancy shall not exceed 40% of the conduit/pipe cross-section area. Pipes/ conduits if used in corrosive areas shall have anti-corrosive coating both inside & outside.

3.17 Wherever specific cable routes are not shown in cable schedules, cables may be laid through the shortest route as per the above criteria, as directed by site Engineer.

3.18 Cable clamping spacing for cables laid in cable trays shall be generally as under:

(a) Trefoil clamps:

1) Horizontal run spacing: 1000 mm (max.)

2) Vertical run spacing: 1000 mm (max.)

(b) Other Clamps

1. Power cables of sizes indicated under

(i) Single core cables: 500 sq mm or higher

(when not laid in trefoil formation- e.g. dc circuits)

(ii) Two core cables: 120 sq mm or higher

(iii) Three core cables: 95 sq mm or higher

(iv) Three & half core cable: 95 sq mm or higher

Horizontal runs: Individually clamped at 3000 mm interval (max.)

Vertical runs: Individually clamped at 1000 mm interval (max.)

2. Power cables of other sizes

Horizontal runs: Collectively clamped at 3000 mm interval (max.)

Vertical runs: Collectively clamped at 1000 mm interval (max.)

3. Control Cables

Horizontal runs: Collectively clamped at 3000 mm interval (max.)

	Vertical runs:	Collectively clamped at 1000 mm interval (max.)

3.19 Clamp spacing for cables supported directly along structure/ ceiling shall be as under:

a) Clamp spacing

1. In horizontal runs: 750 mm (max.)
2. In vertical runs: 750 mm (max.)

b) Spacing between cables: 30 mm (min.)

c) Supports shall also be provided at each bend.

3.20 Fire sealing system rated for one hour and based on suitable block system (using individual blocks with suitable framework) or Room Temperature Vulcanising (RTV) Silicon foaming system of approved make/ source shall be provided for all cable penetrations in walls, floors and below panels. However, fire-sealing system shall not be provided below panels mounted on trenches in auxiliary plant areas.

4.0 Cable Termination & Jointing

4.1 Termination and jointing of cables shall conform to the requirements of IS: 1255 and shall be carried out as per the recommendations of termination and jointing kit supplier. Cable terminations at various electrical and electronic equipment terminals shall be done as per approved scheme/ interconnection diagrams. Joints for less than 250m run of cable shall not be provided. Extra length shall be provided for one LT and two HT joints at a later stage.

4.2 When the equipment are supplied with undrilled gland plates for cable/ conduit entry into the equipment, all drilling & cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site as per cable glanding requirement. A plan showing the holes for cable entry in the gland plate shall be developed at site in consultation with site engineer for drilling holes (gas cutting is not allowed). Types of glands to be used are as under.

I. Material: Nickel- Chromium plated brass, heavy duty conforming to BS: 6121

II. Type: Double compression

4.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished. Shorting & looping of cores/ wires at terminals and between the panels if required shall be carried out as per approved scheme.

4.4 All cable entries in the equipment shall be sealed by cable glands supplied with the equipment. Any discrepancy in cable glands/ lugs with respect to cable size shall be brought to the notice of site engineer.

4.5 Adequate length of cables shall be pulled inside the switchboards, control panels, terminal boxes etc so as to permit neat termination/ dressing of each core/ conductor.

4.6 Power cable terminations shall be carried out in specified manner to avoid strain on the terminals.

4.7 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC tapes/ nylon ties and suitably supported to keep them in position at the terminal block. All spare cores shall be neatly dressed and suitably grounded/ insulated with blank ferrules.

4.8 Screened control cables of small cross sectional area, (0.5 sq mm) shall be terminated by means of cage clamp termination system.

4.9 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents.

4.10 Termination and jointing of HT cables shall be done with heat shrinkable/ Push-on/ Taped type/ elastimold or equivalent fully insulated pre moulded type termination/ jointing kits of proven design & type tested as per IS : 13573.

4.11 Termination of aluminium/ copper conductor cables shall be done by means of suitable tools as indicated below:

Type of lugs

I. HT Power Cables: As per DIN 46329

II. LT Power Cables : Tinned copper (solderless crimping type)

III. LT Control Cables : Tinned copper (solderless crimping type)

4.12 Cable joint(s) shall normally be made at an appropriate point (s) in the straight run of cables only when the length of the run is more than the standard drum length supplied by the cable manufacturer, or when a joint is necessitated due to site constraints. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit. Prior approval of Engineer shall be taken for deciding location of joint.

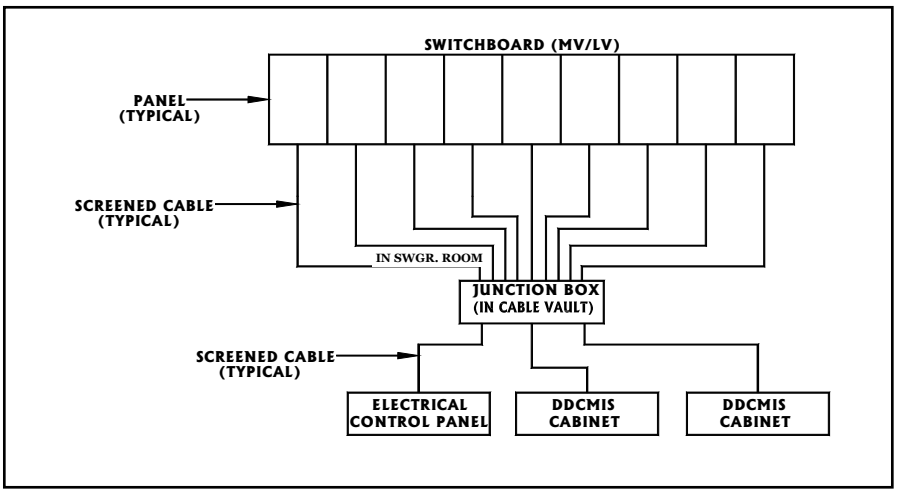
4.13 Junction boxes may be used, wherever required, for jointing/ marshalling of control and instrumentation cables.

4.14 Screened control cables for circuit breaker control / indication / measurement functions from switchgear / MCC to DDCMIS system / Electrical Control Panel (ECP) shall be marshalled if required, as under:

a) Individual cables from a number of adjoining/ close-by switchgear panels of a switchboard to a junction box located in the respective switchgear room.

b) Trunk cables from the junction box (s) to DDCMIS panels/ ECP.

Typical arrangement is shown below.



5.0 Grounding of Cabling System

5.1 Grounding of cable support system shall be as per approved grounding documents for cable tray support structures, cable trays, conduits and pipes. All the conduits, trays and support structure on which the cables are laid shall be bonded to the main grounding system. All the support arrangement shall be tested for electrical continuity and permanent connection to earth. Gas/ water or other pipes shall not be used as grounding medium.

5.2 Armour grounding:

a) Armour of the HT cables and LT single core cables shall be grounded only at one end of cable.

b) Armour of other cables shall be grounded at both ends of cable.

5.3 Screen Grounding:

a) Screen of multi-core cables shall be grounded at both ends.

b) Screen of single-core power cables shall be grounded at one end.

c) Screen of electronic grounding system cables shall be grounded as per the Control System panel manufacturer recommendation.

6.0 Testing Of Cable Installation

6.1 Testing of cables during pre-erection, pre-commissioning and post commissioning stages of the cabling system shall be carried out under the overall supervision of the Engineer. It shall be ensured to complete all activities in coordination with equipment commissioning agency keeping in view the overall commissioning programme. A

checklist for testing and commissioning activities shall be prepared in consultation with site engineer and the activities shall be carried out in accordance with the agreed checklist.

6.2 Testing and electrical measurement of cable installations shall conform to the requirement of IS: 1255.

6.3 Prior to installation, cables shall be tested for

a) Continuity of conductors for all cores of cables.

b) Insulation resistance between conductors and earth.

c) Insulation resistance between conductors of multi core cables.

6.4 Pre installation checks for cable tray installation shall be as under:

a) Availability of clear passage/ path for the cable tray network as per approved drawings.

b) Cold galvanisation / paint treatment for all damaged portions of galvanisation due to cutting / repairs etc.

c) Correctness of installation of number and type of tray / tray accessories /support material as per approved drawings.

d) Firmness/ tightness of all bolted joints

e) Alignment / inter tray separation as per approved layout drawings.

f) Grounding connections for trays / cable boxes / marshalling boxes

6.5 After installation cables shall be tested for

a) Continuity of conductors for all cores of cables.

b) Insulation resistance between conductors.

c) Insulation resistance between conductors & earth.

Check for earth continuity for armour / screen (where applicable).

and proper earth connection for cable glands, cable boxes etc.

d) DC High voltage test (for all HT cables & LT power cables of sizes 300 sq. mm and above).

e) Check for correct polarity & phasing of cable connections

f) Firmness/ tightness of terminations.

g) For correctness of all connections as per relevant wiring diagram.

h) For provision of correct cable tags, core ferrules etc.

6.6 All documents/ records regarding test data and all other measured values shall be duly vetted by the site Engineer before energizing the circuit and kept for future record and reference. The results of all tests shall conform to the specification requirements as well as any other specific performance guarantee.

7.0 Additional Points Of Consideration

7.1 The installation work shall be carried out in accordance with the specifications, and instructions of Engineer. Notwithstanding any stipulations of this document, any additional statutory or regulatory requirements as applicable shall be taken care of.

7.2 The installation work shall be carried out with neat workmanship by skilled, experienced and competent workmen, particularly with experience in jointing and termination of aluminium/ copper conductor cables with XLPE/PVC/ Elastomeric insulations.

7.3 Cable installation shall be properly coordinated at site with other services and wherever necessary, suitable adjustment/ modification shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services. Any such adjustment shall be done with the prior approval of Engineer.

7.4 The drilling and welding of building steel work for fixing supports and brackets will not be done without the prior written approval of Site Engineer.

7.5 Any work like chipping/ breaking of existing structure like walls, floors, fabrications, etc. shall be done after taking prior written approval of Site Engineer.

7.6 Complete cabling work shall be carried out as per following approved drawings/ documents and also the instructions of Engineer, if any.

a) Cable tray layout drawings.

b) Typical cable tray and support installation drawings.

c) Cable schedules.

d) Cable interconnection diagrams.

e) Relevant civil drawings.

f) Equipment layout drawings.

Drawing for below Ground Earthing is attached as below:

TYPICAL BELOW GROUND
EARTHING DETAILS

REV.	DATE	ALTD	CHD	APPD
01	21.07.08			

•Revised in line with M/S GESG comments dated. 19.05.08

CONSULTANT: FICHTNER Consulting Engineers (india) Private Limited

GUJARAT STATE ENERGY GENERATION LIMITED (GESG)
350 MW CCPP HAZIRA, GUJARAT

293

CONTRACT

DISTRIBUTION

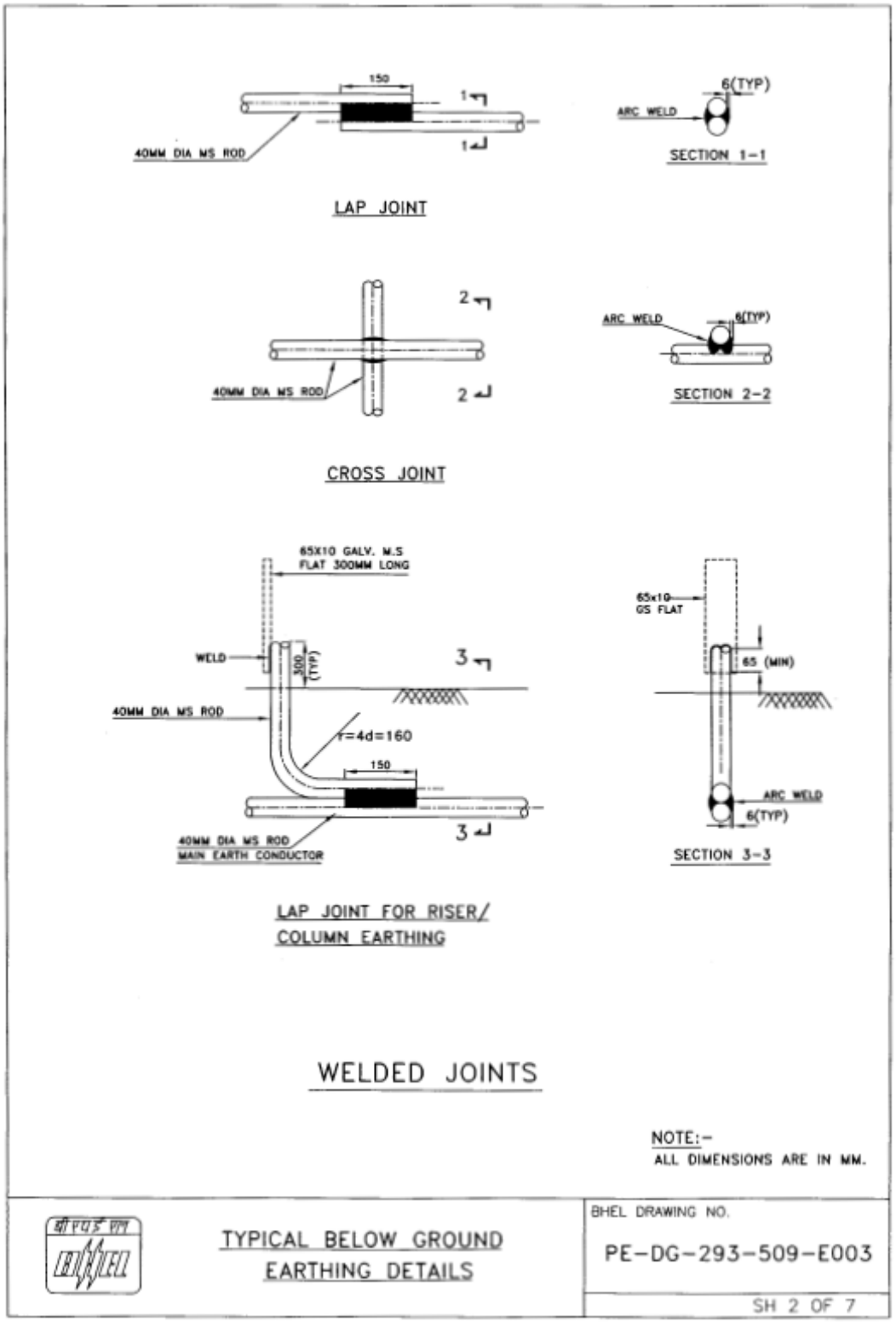
BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

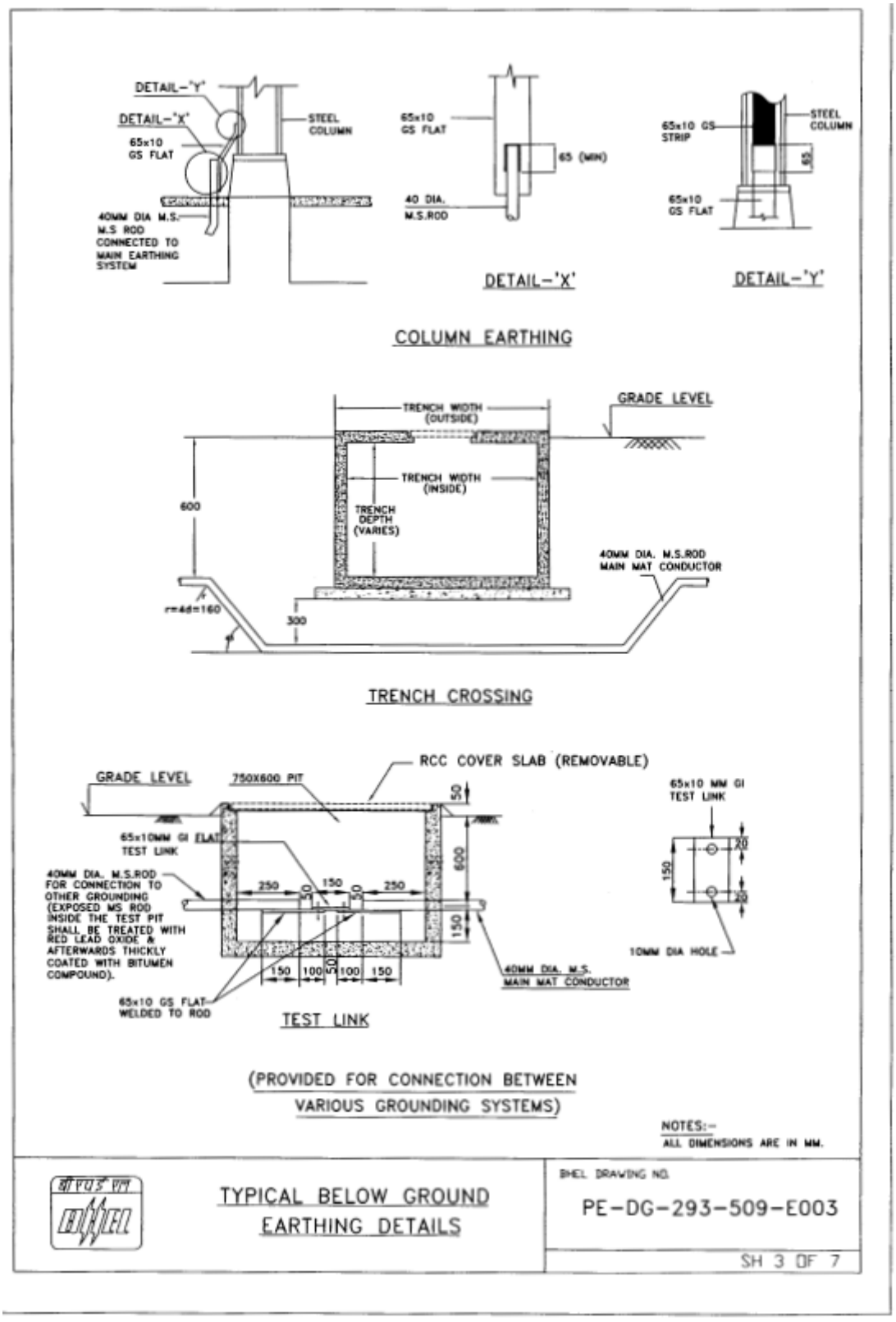
DEPT CODE		NAME	SIGN	DATE
E	DRN	DDJ	-sd-	26.04.08
	DSGN	AKR	-sd-	28.04.08
	CHD	RN	-sd-	28.04.08
	APPD	KKK	-sd-	28.04.08

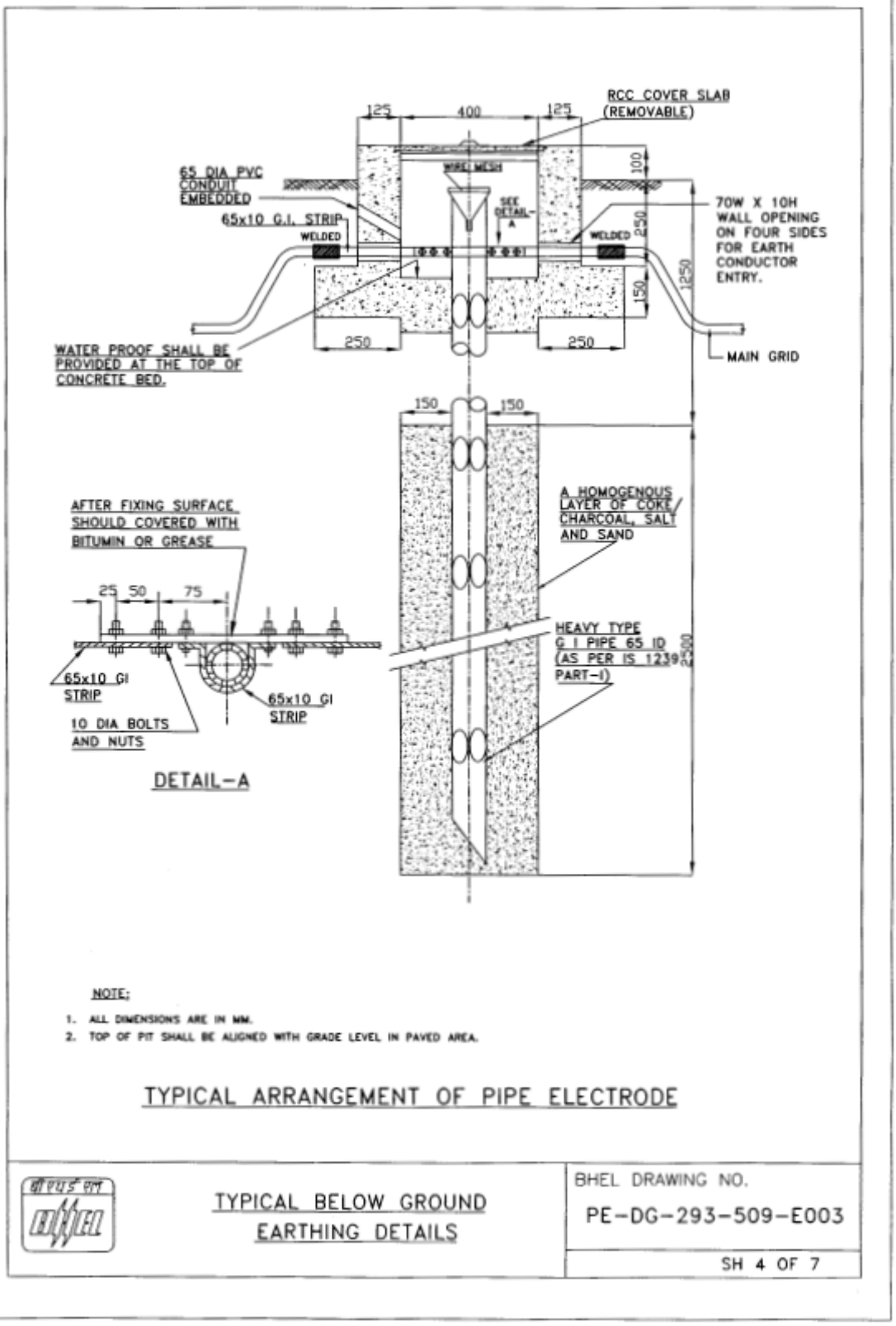
TITLE TYPICAL BELOW GROUND EARTHING DEATAILS

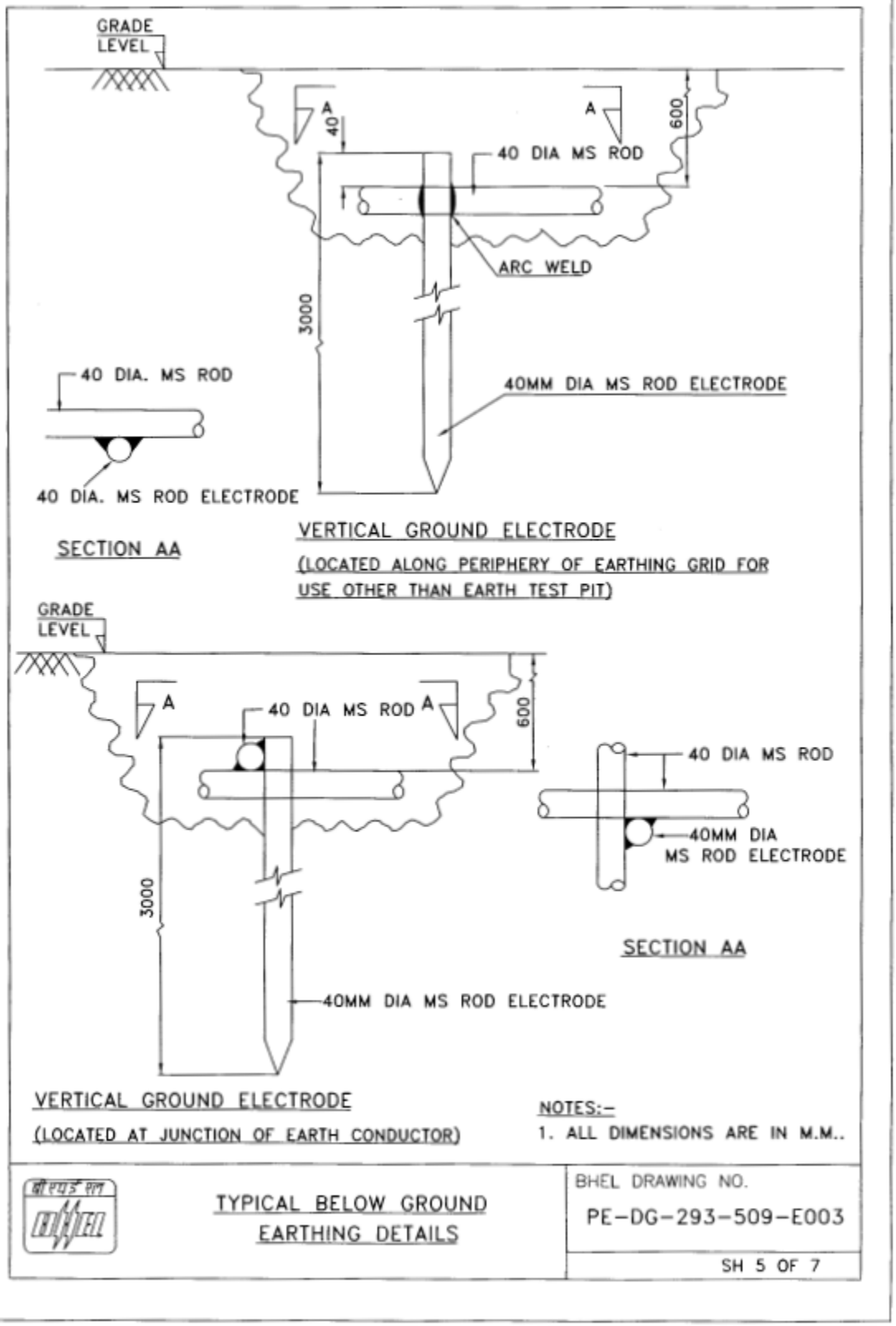
DRAWING NO. PE-DG-293-509-E003

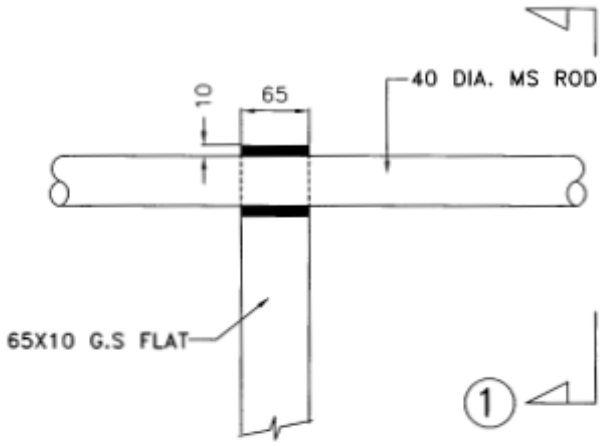
SHEET 1 OF 7 REV. 01

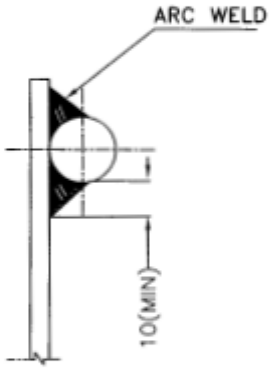

150
1
1
40MM DIA MS ROD
6(TYP)
ARC WELD
SECTION 1-1
LAP JOINT
2
2
40MM DIA MS ROD
ARC WELD
6(TYP)
SECTION 2-2
CROSS JOINT
65X10 GALV. M.S
FLAT 300MM LONG
WELD
300
(TYP)
3
40MM DIA MS ROD
r=4d=160
150
3
40MM DIA MS ROD
MAIN EARTH CONDUCTOR
65x10
GS FLAT
65 (MIN)
ARC WELD
6(TYP)
SECTION 3-3
LAP JOINT FOR RISER/
COLUMN EARTHING
WELDED JOINTS
NOTE:-
ALL DIMENSIONS ARE IN MM.
TYPICAL BELOW GROUND
EARTHING DETAILS
BHEL DRAWING NO.
PE-DG-293-509-E003
SH 2 OF 7


DETAIL–'Y'
DETAIL–'X'
65x10 GS FLAT
STEEL COLUMN
40MM DIA M.S. M.S ROD CONNECTED TO MAIN EARTHING SYSTEM
65x10 GS FLAT
65 (MIN)
40 DIA. M.S.ROD
65x10 GS STRIP
STEEL COLUMN
65
65x10 GS FLAT
DETAIL–'X'
DETAIL–'Y'
COLUMN EARTHING
TRENCH WIDTH (OUTSIDE)
GRADE LEVEL
TRENCH WIDTH (INSIDE)
TRENCH DEPTH (VARIES)
600
40MM DIA. M.S.ROD MAIN MAT CONDUCTOR
r=4d=160
300
TRENCH CROSSING
GRADE LEVEL
750X600 PIT
RCC COVER SLAB (REMOVABLE)
50
65x10MM GI FLAT TEST LINK
40MM DIA. M.S.ROD FOR CONNECTION TO OTHER GROUNDING (EXPOSED MS ROD INSIDE THE TEST PIT SHALL BE TREATED WITH RED LEAD OXIDE & AFTERWARDS THICKLY COATED WITH BITUMEN COMPOUND).
250
150
50
250
600
150
150
100
50
100
150
65x10 GS FLAT WELDED TO ROD
40MM DIA. M.S. MAIN MAT CONDUCTOR
TEST LINK
65x10 MM GI TEST LINK
150
20
20
10MM DIA HOLE
(PROVIDED FOR CONNECTION BETWEEN VARIOUS GROUNDING SYSTEMS)
NOTES:–
ALL DIMENSIONS ARE IN MM.
TYPICAL BELOW GROUND EARTHING DETAILS
BHEL DRAWING NO.
PE–DG–293–509–E003
SH 3 OF 7


RCC COVER SLAB (REMOVABLE)
125
400
125
100
WIRE MESH
65 DIA PVC CONDUIT EMBEDDED
65x10 G.I. STRIP
WELDED
SEE DETAIL-A
WELDED
250
70W X 10H WALL OPENING ON FOUR SIDES FOR EARTH CONDUCTOR ENTRY.
1250
150
250
250
WATER PROOF SHALL BE PROVIDED AT THE TOP OF CONCRETE BED.
MAIN GRID
150
150
A HOMOGENOUS LAYER OF COKE, CHARCOAL, SALT AND SAND
AFTER FIXING SURFACE SHOULD COVERED WITH BITUMIN OR GREASE
25
50
75
HEAVY TYPE G.I PIPE 65 ID (AS PER IS 1239 PART-I)
65x10 GI STRIP
65x10 GI STRIP
10 DIA BOLTS AND NUTS
DETAIL-A
NOTE:
1. ALL DIMENSIONS ARE IN MM.
2. TOP OF PIT SHALL BE ALIGNED WITH GRADE LEVEL IN PAVED AREA.
TYPICAL ARRANGEMENT OF PIPE ELECTRODE
TYPICAL BELOW GROUND EARTHING DETAILS
BHEL DRAWING NO.
PE-DG-293-509-E003
SH 4 OF 7


GRADE LEVEL
A
40
A
600
40 DIA MS ROD
ARC WELD
3000
40MM DIA MS ROD ELECTRODE
40 DIA. MS ROD
40 DIA. MS ROD ELECTRODE
SECTION AA
VERTICAL GROUND ELECTRODE
(LOCATED ALONG PERIPHERY OF EARTHING GRID FOR USE OTHER THAN EARTH TEST PIT)
GRADE LEVEL
A
40 DIA MS ROD
A
600
40 DIA MS ROD
40MM DIA MS ROD ELECTRODE
3000
SECTION AA
40MM DIA MS ROD ELECTRODE
VERTICAL GROUND ELECTRODE
(LOCATED AT JUNCTION OF EARTH CONDUCTOR)
NOTES:-
1. ALL DIMENSIONS ARE IN M.M..
TYPICAL BELOW GROUND EARTHING DETAILS
BHEL DRAWING NO.
PE-DG-293-509-E003
SH 5 OF 7





SECTION – (1)

CROSS JOINT

BETWEEN M.S ROD & G.S FLAT

NOTES:–

1. ALL DIMENSIONS ARE IN M.M

BHEL	TYPICAL BELOW GROUND EARTHING DETAILS	BHEL DRAWING NO. PE–DG–293–509–E003 SH 6 OF 7

NOTES:–

1. WELDING OF GALVANISED FLAT/ MS ROD SHALL BE CARRIED OUT AS FOLLOWS:–
   a) CLEANING OF WELD AREA WITH WIRE BRUSH.
   b) REMOVAL OF GALVANISATION COATING IN THE WELD AREA.
   c) WELDING OF THE CONDUCTOR SHALL BE AS PER IS : 816.
   d) NATURAL COOLING OF WELDING JOINTS.
2. EARTH CONDUCTOR SHALL BE ROUTED BELOW ROADS/ TRENCHES WITH MINIMUM CLEARANCE OF 300MM.
3. DETAILS OF EARTH TEST PIT / TEST LINK PIT ARE INDICATIVE. ACTUAL DETAILS SHALL BE SHOWN IN CIVIL DRAWINGS & IS IN CIVIL SCOPE.
4. DRG. FOR DEPTH OF BURIAL OF MAIN CONDUCTOR SHALL BE FURNISHED. HOWEVER THE DEPTH OF BURIAL SHALL BE 600MM.

भेल BHEL	TYPICAL BELOW GROUND EARTHING DETAILS	BHEL DRAWING NO. PE–DG–293–509–E003 SH 7 OF 7