BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP
ENGINEERING MANAGEMENT

BHEL Document No.	**TB-388-316-E05**	**Rev No.**		**Prepared by**	**Checked by**	**Approved by**
		00	Name	MS	DKM	RS
Type of Document	**TECHNICAL SPECIFICATION**		Sign			
Title	**EXOTHERMIC WELDING MATERIALS**		Date	20/12/17	21/12/17	23/12/17
			Group	**TBEM**		

Customer	**BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL), BANGLADESH**
Projects	**400/220kV GIS FOR 2x660MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH**
Consultant	**M/s FICHTNER GmbH & Co KG, Stuttgart, GERMANY**

CONTENTS

Rev No.	Date	Altered	Checked		

Distribution						

CONTENTS:

NOTE: PACKING SHALL BE AS PER "TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS' DOC. NO. PE-TS-888-100-A001 (ATTACHED).

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

BIDDER'S STAMP & SIGNATURE

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

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

    a. Unpriced Price Schedule (Annexure-I: to Section-C: BOQ, as enclosed with the specification).
    b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer").
    c. A copy of previous sheet ("Contents").
    d. Datasheet-B duly filled by bidder.
    e. Catalogues
    f. Technical deviations/ clarifications (if any)

2. No technical submittal (unless specified in Technical specification) such as copies of test certificates, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.

3. No comments/ additions/ deletions shall be made by the bidder on the signed & stamped copy of the specification. Any such changes made by the bidder shall not be considered.

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

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

6. Any changes made by the bidder in the price schedule with respect to the cable description/ quantities, notes etc. from those given in Annexure-I to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

PREAMBLE

1.0 The tender document contains two (2) volumes. The bidder shall meet the requirements of all the two volumes.

1.1 **Volume-I** TECHNICAL **SPECIFICATIONS**

Technical requirements are stipulated in Volume-I which comprises of:-

Volume-IA : This part contains instructions to bidders for making technical bids to BHEL.

1.2.1 **Volume-II**

This volume is sub-divided into following sections:-

Section-A : This section outlines the scope of enquiry.

Section-B : This section provides "Project Information".

Section-C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section-D : This section comprises of technical specifications of equipment complete with Data-sheet A and B.

Data Sheet – A Specifies data and other requirements pertaining to the Equipment.

Data Sheet – B Specifies data to be filled by the bidder.

2.0 The requirements mentioned in Section-C / Data Sheets-A of section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D.

SECTION – A

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing of **Exothermic Welding Materials & Copper Clad steel rod** as mentioned in different sections of this specification for the project as indicated in Section B (Project Information).

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

3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the tender specification.

4.0 The bidder shall be responsible for and governed by all requirements stipulated hereinafter.

5.0 Deviations if any should be brought out very clearly on deviation sheet. Otherwise it will be presumed that the bidder's offer is in line with what has been stated/ asked for in this specification.

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

SECTION 'B'

PROJECT INFORMATION

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification. This shall include but shall not be limited to: engineering, manufacturing, shop testing, supply, supervision of erection, testing at site, commissioning, performance testing, training Employer's personnel.

The requirements stated in this Section of General Technical Requirements are valid for all sections of the specification, except only where additional and/or special requirements are specified.

In case of a contradiction between different Sections of this specification or mentioned standards, the more stringent requirements shall be applicable to Bidder/ Supplier.

The Equipment shall be new and clean, and designed, manufactured and arranged so that it will have a functional design and a pleasant appearance. All parts of the Equipment shall be arranged in such a manner as to facilitate surveillance by the operator and to ease maintenance, operation and control.

The parts of the Equipment shall be designed and arranged so that they can be easily inspected, leaned, erected and dismantled without necessitating large scale dismantling of other parts of the Equipment. They shall be designed, manufactured and put into operation in accordance with the latest recognized rules of workmanship, modern engineering practice and with good standards of prudence applicable to the international electricity generation industry which would have been expected to accomplish the desired result at the lowest reasonable cost consistent with reliability, safety and expedition.

The regulations, standards and guidelines listed in the Specification as well as all applicable laws and governmental decrees, regulations, orders, etc. shall be observed in the design, calculation, manufacture, erection, installation, testing, commissioning and start-up of all parts of the Equipment. The following shall be considered in the design and engineering of the Equipment facilities:

- All parts of the Equipment shall be suitable in every respect for continuous operation at maximum output as well as part loads and expected transient operating conditions peculiar to the site and shall be able to safely withstand the stresses arising from the operating conditions without any reduction in its planned life.

- The Supplier shall familiarize himself with the conditions on site.

- Suitable and automatically acting protection and safety measures shall be provided for automatic load reduction or shut down of equipment in case of abnormal operating conditions.

- Switchover to stand-by units shall be automatically, as far as required for continuous Plant operation without interruption of Plant operation.

- In case of equipment and/or system shut down process conditioned drainage of components (such as pipelines, tanks, etc.) shall be performed automatically from the control room.

- Minor equipment which, in case of failure would cause a failure of a power generation unit and/or the Plant is to be provided with a stand-by facility in order to ensure further operation of the power generation unit or the Plant.

- All live, moving and rotating parts shall be provided with appropriate effective protection in order to avoid danger to the operating staff. All metal parts shall be electrically grounded.

- All equipment shall be designed to ensure start-up from any condition, i.e. from long term shut-down, cold, warm or hot condition without necessitating special or preparatory measures.

- The project language shall be English.

- Material and personnel costs for tests and inspections which are mandated in legislation
- Material and personnel costs for site inspections
- Declaration of conformity with requirements from Bangladesh and markings for all machines
- Engineering design of complete supplied equipment including interface coordination
- All as-built documents (on data carriers; data formats as requested by the Employer)
- Quality control plan and safety plan
- Complete documentation as set out in the tender specification
- Operating manual (5 hardcopies and 3 electronic copies)
- Detailed operating and maintenance instructions/manual (5 hardcopies and 3 electronic copies)
- A maintenance program for all equipment of the Plant instructions (5 hardcopies and 3 electronic copies)
- For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDs shall be supplied in ACAD or other editable format, and all lists in Excel format.

Terminology:
Owner/ Employer: BIFPCL/ BHEL
Contractor: Supplier/ Bidder

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

Site conditions

The following information on local conditions is investigated or compiled by the Owner. The Contractor is hereby in no way relieved from his duties of carrying out all investigations required for satisfactory performance of his equipment/ works. The Contractor shall perform his own Site visits and investigations, prior to Contract award in order to familiarize him with the existing conditions of the Site and the surrounding area.

Location, accessibility and present condition of the Site

The site for the Maitree-STPP Project is geographically located between 22° 370'0'' N to 22°34'30''N and 89°32'0''E to 89°34'5''E, approximately 14 km northeast of the Mongla Port and 14 km northwest of the Sundarbans, is infringed by the Passur and Moidara Rivers to the west and south east respectively. The topographical survey indicates a natural ground level of +1.15 to + 1.35 meters above sea level. A severe cyclone in 2009 raised the level to 4.47 meters and it was decided to raise the Plant level to +5.00 meters. Politically, the site is located in Rampal Upazila of the Bagherat District in the Rajnagar Union.

Currently, the Site is accessible by boat only.

The nearest inland port is Mongla port at around 14km direct distance.

The proposed Khan Jahan Ali Airport is located at a distance of approximately 12 km from the project site.

Soil conditions

In general the subsoil conditions can be described as follows:

- top layer filled sand (with unknown silt content) in Plant area
- underlying layers of clay
- underlaying fine sand.

Seismic zone

Related to soil type as identified to Soil Investigation Report, the effect of local soils on earthquake ground motion shall be determined.

For site class "S1" and "S", as expected for the Project, site specific studies shall be carried out to determine the design acceleration response spectrum. During field study minimum the following tests shall be executed:

- Seismic cross hole test; and
- Seismic refraction test.

Based on these results (Attached as Annexure-A) a site specific Response Spectra shall be established. Peak spectral acceleration shall be determined, but shall be not less than 0.12g, as mentioned in BNBC 2012, Table 2.5.2.

Bidder to design equipment based on parameters of Seismic report (attached as Annexure-A), other relevant electrical requirements, standard codes etc. Foundation loading shall be provided as per parameters of Seismic report.

Site climatic conditions

The Plant site is from the climatic point of view under maritime tropical conditions. The assumed meteorological conditions for the Site are as follows:

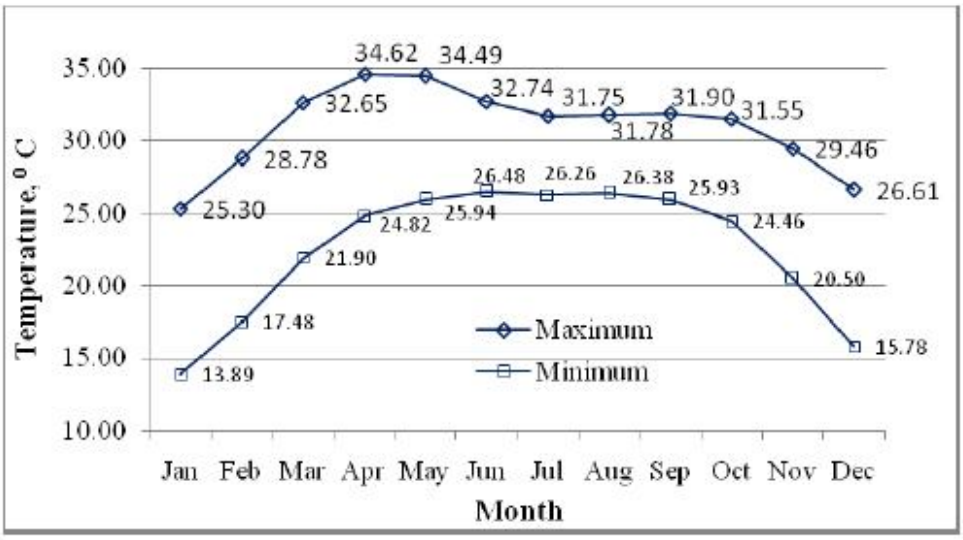
The project site is located in the country's South Central Zone consisting of three dominant seasons:

- summer season-March to May
- monsoon season-June to October
- winter season-November to February.

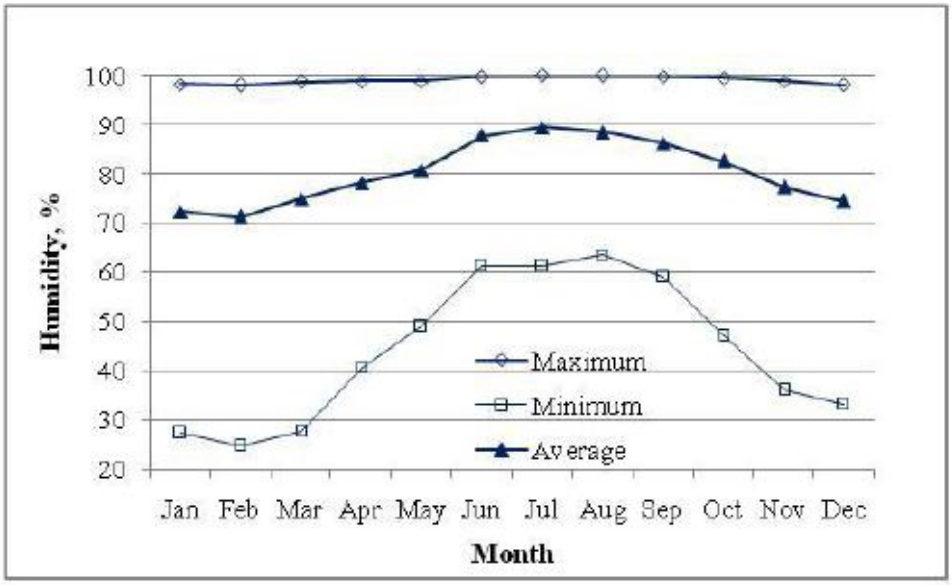
During the Monsoon Season occasional cyclonic storms can occur.

The climatic conditions in the area are continuously monitored by the Bangladesh Meteorological Department (BMD) at the Mongla Meteorological Station.

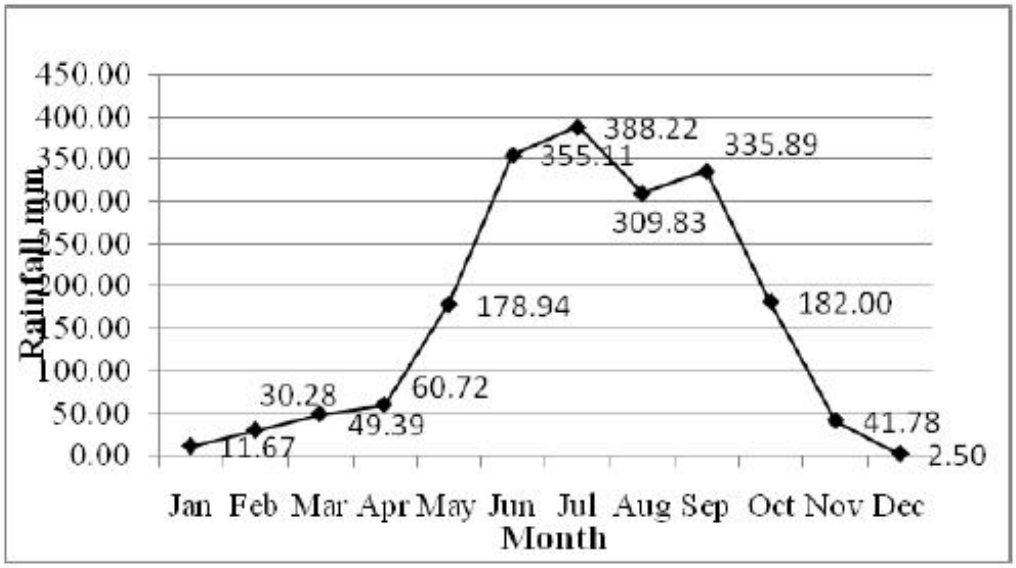
The temperature varies only slightly throughout the year with the highest temperature of 36.9°C and the lowest temperature of 12.2°C recorded in the period from 1989 to 2008. This distribution is depicted in figure below.



The relative humidity varies drastically during the Monsoon Season with 80% to 90% and the lowest levels of 20% to 30% during the Summer Season. The humidity profile recorded in the same period as the temperature is visualized in below figure.



The maximum rainfall occurs during the Monsoon Season by varying between 300 mm and 350 mm with almost no rainfall during the Winter Season.
The average evaporation in the project area varies between 3 - 5 mm/day with its peak of 16 mm/day during July. The average rainfall for the period between 1991 and 2008 is depicted in below figure.



Below definitions are to be used as typical data for the different climatically seasons at the site.

Average Site Condition ASC
Ambient Temperature: 27.3 °C
Ambient Humidity 87 %
Ambient Pressure 1007.6 mbar
River Water Temperature: 29.8 °C

Summer Site Condition SSC
Ambient Temperature 36.9 °C
Ambient Humidity 60 %
Ambient Pressure 1007.9 mbar
River Water Temperature: 33 °C

Winter Site Conditions WSC
Ambient Temperature 12.2 °C
Ambient Humidity 100 %
Ambient Pressure 1017.2 mbar
River Water Temperature: 20°C

Reference Site Conditions RSC
Ambient Temperature 31 °C
Ambient Humidity 88 %
Ambient Pressure 1007 mbar
River Water Temperature: 32°C
Wind speed 1 m/s
Design ambient conditions for Electrical Systems

- Maximum design temperature (outdoor) 45°C
- Maximum daily average ambient shade temperature 38°C
- Maximum monthly average temperature (in the shade) 34.6°C
- Maximum annual average temperature (in the shade) 27.3°C

- Maximum design temperature of the electrical equipment installed indoors in air conditioned rooms 40°C
- Maximum design temperature of the electrical equipment installed indoors non in air conditioned rooms 45°C
- Minimum design temperature 0°C

Marine conditions

Two tides (e.g. flood and ebb) are regularly observed in the Passur River, which enters into the project site through numerous connected creeks.

The tidal range varies between 1.2 and 3.1 meters. The mean water level (CD) is about 0.87 meters (PWD=CD –1.17 meters). The mean high water level varies due to spring-neap tide conditions between +1.60 m and +2.6m PWD. The Highest High Water Level (HHW) is about +3.1m PWD and the Lowest Low Water Level (LLW) is about –1.4m PWD.

The salinity of the Passur River system varies with the amount of fresh water entering the system which is highly seasonal dependent. The surface water temperature ranges between 22.9°C and 33.0°C**.**

The marine conditions as recorded at Mongla Port Gauge Station (approx. 14 km south-east to the site) are as follows:

- Highest High Water Level (HHW) + 2.642 MSL
- Lowest Low Water Level (LWL) - 1.858 MSL

The Power Plant shall be designed for 100 years flood condition based on data provided by relevant Organization in Bangladesh and taking into account the Highest Astronomical Tide (HAT), the maximum wave conditions (including storm surges) and the potential event of Cyclone. The Contractor is responsible to verify the worst conditions.

These reference data are with respect to LAT, which corresponds to the Chart Datum (CD). The site land data is however with respect to the Bangladesh Land Survey Datum (BLSD), which corresponds to approx. +1.55 m CD (hence the MLSD corresponds to MSL).

Design Wave Height 2.0 m
Design Wave Period 6.0 sec
Sedimentation and Siltation: Soft to stiff clay and alternations of very sandy and stiff clay.

A water analysis from the area adjacent to the site giving salinity and water quality is shown below:

Location	Date	Temp.	pH	EC	Cl	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	7-Jan	27.4	7.74	3010	879	36	68.7	1565	1510	55	5.1	0.8	55	1.6
2	7-Jan	27.1	7.72	3020	878.8	36	68.5	1570	1510	60	5.1	0.8	55	1.6
3	7-Jan	27.8	7.71	3030	879	36	68.8	1565	1510	55	5.1	0.8	55	1.6
1	11-Feb	29.8	7.66	4380	1262	36	182	2390	2180	210	4.7	1	76	2.3
2	11-Feb	29.2	7.63	4380	1268	36	178	2390	2190	200	4.7	1	76	2.3
3	11-Feb	29.1	7.65	4380	1263	36	179	2380	2180	200	4.7	1	76	2.3
1	9-Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	6.7
2	9-Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	6.7
3	9-Mar	32.1	7.55	11780	2946.4	38	177	6090	5890	200	4.7	1.2	76	6.7
1	17-Apr	32.6	7.59	25300	8273	36	185.6	12950	12700	250	4.6	0.7	136	15.5
2	17-Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	138	15.5
3	17-Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5
1	5-May	32.6	7.59	29200	9480	36	198.6	14900	14600	300	4.5	1.2	177	17.6
2	5-May	32.9	7.54	29200	9470	36	198.6	14900	14600	300	4.4	1.2	177	17.6

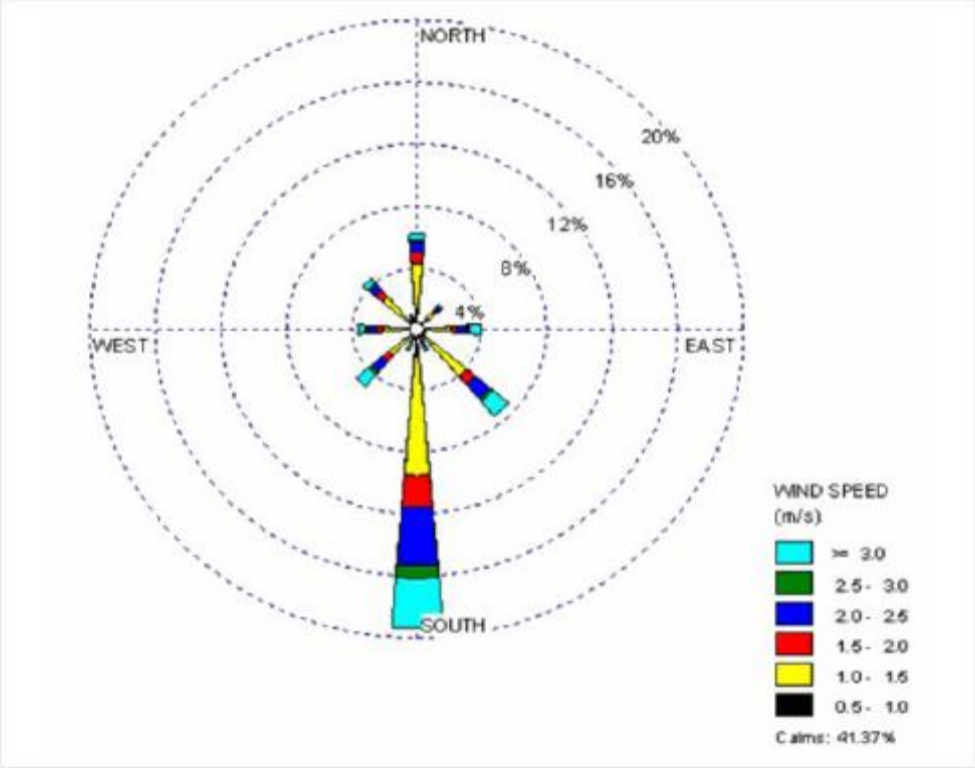
Figure 1 Water quality of the Passur River at Mongla point (Source: EIA-Report)

Location	Date	Temp.	pH	EC	Cl	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
3	5-May	33.2	7.57	29200	9470	36	199.6	14900	14600	300	4.5	1.2	177	17.6
1	13-Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	13-Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	13-Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8-Sep	31.6	7.76	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12-Oct	30.6	7.79	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
2	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
3	12-Oct	30.6	7.78	290	25.6	36	62.6	192	145	47	5.6	0.7	22	-
1	5-Nov	24.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
2	5-Nov	26.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
3	5-Nov	25.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
1	12-Dec	21.5	772	520	62.6	36	72.6	320	260	60	5.1	0.9	25	0.4
2	12-Dec	20.9	7.71	520	62.6	36	73.6	320	260	60	5.1	0.9	25	0.4
3	12-Dec	21.1	7.72	520	62.6	36	71.6	320	260	60	5.1	0.9	25	0.4

Figure 2 Water quality of the Passur River at Mongla point (Source: EIA-Report)

Wind data

The project region is characterized by southerly winds from the Bay of Bengal during the Monsoon Season and north-westerly winds from the Himalayas during the Winter Season. During the Summer Season, the wind blows from south-southwest to north-northeast. The annual average wind speed amounts to 1.7 meter/second and the wind rose for the entire year is shown in Figure 5.5.



The wind load calculation for the buildings and structures shall be as per Bangladesh National Building Code -2012. Part 6. Chapter 2.4.

Basic wind speed, V, shall be taken as 73m/s. Three second gust at 10m above ground in exposure C, having a return period of 50 years.

3.2 Design requirements

The main design features (basic design reports, drawings, PFD, P&IDs, design data etc.) and the main vendors and subcontractors shall be subject to the approval by the Owner/ BHEL.

The Owner/ BHEL has the right to refuse design features and vendors or subcontractors, if the supplier cannot verify the reliability of the suggested design, vendor or subcontractor.

The Plant is expected to operate in base-load mode with high plant load factor. The design lifetime of the Plant shall be of not less than 30 years of operation or 200,000 full load operating hours, whichever is longer. The Plant and all its auxiliaries shall be designed to operate for the complete lifetime under the site conditions as described in this section and dedicated other part of this FTS.

All Plant equipment and material must be suitable for the range of ambient site conditions. In particular the saline atmosphere has to be considered.

Redundancy concept

All equipment shall be implemented with (n+1) redundancy – unless otherwise stated -, where n is the number of equipment required to maintain the maximum capacity of a unit. N+1 means that even in case

of outage of the biggest component sufficient capacity is available to maintain the maximum capacity of the Power Plant unit.

For all components which are not redundant, the supplier shall provide a maintenance and spare part concept to ensure that outage times are minimized and to ensure that the required availability is met.

Each equipment whose unavailability due to a failure could result in damages to another equipment shall be backed up by a stand-by equipment, one of them being fed by an emergency source in case of external black out.

Failure of any single item of auxiliary equipment including the Power Plant's DCS and electrical systems shall not result in a reduction in power evacuated from the Power Plant.

Replacement and repair of redundant components shall be possible without interrupting Plant operation.

Note: The Power Plant shall be designed for 100 years flood condition based on data provided by relevant Organization in Bangladesh and taking into account the Highest Astronomical Tide (HAT), the maximum wave conditions (including storm surges) and the potential event of Cyclone. The Contractor is responsible to verify the worst conditions.

3.3 SYSTEM PARAMETERS

NOMINAL VOLTAGE (kV)	**400 kV**	**230 kV**
HIGHEST SYSTEM VOLTAGE (kV)	420 kV	245kV
RATED FREQUENCY (Hz)	50	50
RATED SHORT CIRCUIT CURRENT (1 SEC)	50	50
RATED PEAK WITHSTAND CURRENT /(kAp)	125	125
CREEPAGE DISTANCE (mm/Phase Voltage in kV)	53.7	
CREEPAGE DISTANCE (mm/Line Voltage in kV)	31	

3.4 Latent Defects:

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

3.5 PACKING FOR SHIPMENT

The equipment complete with its accessories, spares, special tools and tackles shall be suitably protected by respective packing for shipment considering handling during transit, distance and weather conditions involved. The Contractor shall submit the packaging method for shipment to be adopted by him, if so desired by the Owner / Purchaser.

Each consignment shall be marked with Equipment name, Owner /Purchaser's name & address, Project details, handling instruction etc. It shall be complete with part list and identification details. The copies of the

part list of each consignment shall also be furnished to the Owner / Purchaser after dispatch.
Equipment shall be packaged for transportation so as to meet the space and weight limitation of transport facilities. The contractor shall obtain approval from concerned authorities for transportation of over dimensioned consignment/package, if any, before starting manufacture of such equipment.

3.6 TROPICAL PROTECTION

All electrical equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Fine mesh screen of corrosion resistant material shall be furnished on all ventilating openings to prevent entry of insects.

3.7 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

Common equipment and services

The following supplies and services are to be included in the corresponding Section prices:

3.8 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

1) **Drawings**
2) **Guaranteed Technical Particulars**
3) **Type Test Reports**
4) **Manufacturing Quality Plan `**

3.8.1 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	6	6	3
2	Drawings "As Built "	-	-	6	3
3	Type Test Reports	1	6	6	3
4	Erection Manuals	-	6	6	3
5	Operating manuals, maintenance and service manuals, component documentation, assembly documentation, drawing and listing etc.	-	-	6	3
6	Operation and Maintenance Manuals (shall be translated into Bangla and provided as paper copies in electronic format).	-	6	6	3
7	Manufacturing Quality Plan	1	6	6	3
8	Field Quality Plan	1	6	6	3
9	Inspection Test Reports	-	-	6	3

Electronic copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in printable non-proprietary document format (e.g. PDF).

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

3.8.2 AS-BUILT DRAWINGS

The Contractor shall furnish drawings and document in as-built condition as stipulated in the specification.
On completion of the project, contractor should submit Three Sets of As commissioned drawings, Three Sets of as Installed Bill of Materials and Three Sets of As Commissioned Data/ Specification /Parameter Sheets Duly Signed by the Competent Authority.

3.8.3 DRAWINGS, DATA, INFORMATION AND MANUALS

Drawings, data, information & manuals shall be submitted as indicated below:
To be submitted after award of the Contract.
a) Single line diagram giving rating of each equipment.
b) Design calculations in support of selection of equipment rating and system design.
c) Technical Date sheets, characteristic curves.
d) Equipment layouts, layout of switchyard with sections.
e) Grounding & lightning protection drawings and details.
f) Cabling, cable trench and tray layouts with section and details with cable sizing calculation.
g) Dimensional general arrangement drawing along with cross- sections for equipment.
h) Foundation plan and loading data: design calculation and detail drawing of foundation.
i) Design calculation and detail drawing for civil work related to this specification.
j) Design calculation, GA drawing for GI structure and equipment supporting structure, and subsequently detailed drawings.
k) Mounting details of equipment and structure.
l) Firefighting and sump arrangement.
m) Control & operation write up/Block logic diagrams.
n) Control schematic and wiring diagram.
o) Cable schedule and interconnection and cable routing.
p) Relay co-ordination.
q) Civil & structural analysis, design calculations and working drawings including bar bending schedule and fabrication.
r) Erection and maintenance manual.
s) Any other drawings & data as required for satisfactory installation, operation & maintenance.

3.8.4 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

(i) The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hardcopies.

(ii)The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

a) A complete inventory of all main items of plant, with identification details.

b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.

c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.

d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment,

recommended inspection point, information on detection, cause and rectifications of troubles & faults.

e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.

f) Manufacturer's literature.

(iii) The instruction manual shall be subject to the approval of Owner.

SECTION –C

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

1.1 This enquiry covers the supply of **Exothermic Welding materials & Copper clad steel rod** conforming to this specification.

1.2 General technical requirements of the Exothermic Welding materials and Copper clad steel rod are indicated in Section-D. Project specific technical/ quality requirements / changes are listed in Section-C.

1.3 The stipulations of Section-C followed by those of Datasheet-A shall prevail in case of any conflict between the stipulations of Section-C, Datasheet-A & Section-D.

2.0 BILL OF QUANTITIES:

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

3.0 SPECIFIC REQUIREMENTS:

3.1 Technical:

S. No.	*Reference clause No. of Section D (if any)*	*Specific Requirement/ Change*

3.2 Quality/ Inspection:

S. No.	*Reference clause No. of Section D (if any)*	*Specific Requirement/ Change*

ANNEXURE – I TO SECTION - C

[BILL OF QUANTITIES]

ANNEXURE -I

BOQ-CUM-PRICE SCHEDULE FOR EXOTHERMIC WELDING MATERIALS

Sr. No.	Item code	Description	Unit		Ordered Quantity	UNIT PRICE (EX-WORKS) Rs
1	507-41044-A	18MM DIA. 3 M LONG COPPER CLAD STEEL RODS	NOS		150	
2	507-41003-A	BRUSH	NOS		20	
3	507-41070-A	IGNITOR GUN	NOS		20	
4	507-41032-A	GRAPHITE MOULD FOR 240X240 CROSS JOINT	NOS		20	
5	507-41033-A	GRAPHITE MOULD FOR 240X240T HOR. JOINT	NOS		5	
6	507-41034-A	GRAPHITE MOULD FOR 240X240 STRAIGHT JOINT	NOS		17	
7	507-41035-A	GRAPHITE MOULD FOR 240X240T VER. UP JOINT	NOS		100	
8	507-41036-A	GRAPHITE MOULD FOR 240X18 T VER. DN. JOINT	NOS		6	
9	507-41015-A	HANDLE CLAMP	NOS		150	
10	507-41038-A	WELD POWDER FOR 240 X 240 CROSS JOINT	NOS		600	
11	507-41039-A	WELD POWDER FOR 240X240 T HOR.JOINT	NOS		135	
12	507-41040-A	WELD POWDER FOR 240X240 STRAIGHT JOINT	NOS		500	
13	507-41041-A	WELD POWDER FOR 240X240 VER UP. JOINT	NOS		3000	
14	507-410442-A	WELD POWDER FOR 240X18 T VER. DN JOINT	NOS		175	

Notes :

1. All quantities shall be released for manufacture along with LOI

2. Manufacturing of quantities shall be released along with LOI after the approval of technical and quality documentation, and supply of same shall be completed within two months of date of approval of documents.

3. Subsequent lots, if any, shall be cleared for manufacture based on progress of engineering and site requirements. A lead-time of two months shall be given for completion of supply of each lot from the date of clearance of the quantities.

4. The quantity variation shall be limited to (+) 30% of the total contract value derived on the basis of the order quantities. Same shall be in line with NIT.

5. Any additional item (not indicated above) required for satisfactory performance & completion of job, shall be supplied free of cost by the bidder in adequate nos.

ANNEXURE- II

List of standard deliverables to be submitted by successful bidder after award of contract:

Sl. No.	Drawings/Document Description	Drawings / Document Number	Submission date by vendor
1	GA drawings of Exothermic Welding Material & Copper clad steel rod.	PE-V0-*421*-507-E081	Within two weeks from the date of LOI
2	Technical Datasheet	PE-V0-*421*-507-E082	Within two weeks from the date of LOI
3	Installation Procedure	PE-V0-*421*-507-E083	Within two weeks from the date of LOI
4	Test reports/ certificates	PE-V0-*421*-507-E084	Within two weeks from the date of LOI
5	Catalogues	PE-V0-*421*-507-E085	Within two weeks from the date of LOI
6	Export Seaworthy Packing details	PE-V0-*421*-507-E086	Within two weeks from the date of LOI
7	Quality Plan for Exothermic Welding Material & Copper Clad Steel Rod.	PE-V0-*421*-507-E911	Within two weeks from the date of LOI

ANNEXURE-III

Nos. OF DRAWINGS/ DOCUMENTS REQUIRED FROM VENDOR

Unless agreed otherwise, five (5) hard copies and three (3) sets of electronic copies of all documents are to be submitted in the English language. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, and DWG) as well as in a printable non-proprietary document format (e.g. PDF).

All documentation shall comply with uniform documentation instructions according to Customer/BHEL's requirements. Detailed requirements of documentation will be determined during contract execution by the Customer/BHEL.

SECTION-D

STANDARD TECHNICAL SPECIFICATION

1.0 SCOPE OF ENQUIRY

1.1 This specification covers the design, manufacture, assembly, testing and inspection at vendor's/sub vendor's works, Packing and despatch to site of **EXOTHERMIC WELDING MATERIALS & COPPER CLAD STEEL ROD** as described in various sections of this specification.

2.0 CODES & STANDARDS

2.1 Unless specified otherwise, the latest revision of relevant international standards / codes (like BS7430, BS970, IEEE-837 & UL-467) and other applicable rules and regulations are applicable and shall be referred to.

3.0 TECHNICAL REQUIREMENTS

3.1 FOR EXOTHERMIC WELD JOINTS

Exothermic Weld joints shall comprise of the following items:

3.1.1 Quantity of weld powder and starting powder required for each size & type of joints.

3.1.2 Quantity of handle Clamps of suitable type as required for each type of joint.

3.1.3 Quantity of Mould (Graphite) of suitable size as required for each type of joint.

3.1.4 Ignitor Guns (Flint/ Flame etc.) as required for igniting the powder & brush for cleaning purpose.

3.1.5 Though items required for Exothermic Weld joints are stipulated above, however if any additional item(s) are required for satisfactory performance & completion of job, same shall be supplied free of cost to BHEL.

3.2 FOR COPPER CLAD STEEL EARTH ELECTRODE

3.2.1 The electrode shall have a core of low carbon steel of grade 080A20 of BS970 with a high tensile strength of at least 600N/sq. mm. Threads (if any) for coupling of the rod shall be rolled onto the rod to ensure that even copper covering is maintained even at the root of the thread. 99.9% pure electrolytic copper shall be molecularly bonded onto the steel core in accordance with international standards to a thickness of 0.25 mm. There must not be any metal interface so that dissimilar metal reaction cannot occur and the copper cannot be separated from steel.

3.3 Installation Procedure/ Manual for Exothermic Welding Material shall be provided by the bidder along with storage requirements.

4.0 INSPECTION & TESTING

4.1 All tests and inspection of the equipment specified in this specification shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. Wherever equipment similar to the one being offered has already been tested; test reports of the same shall be submitted for scrutiny.

4.2 Following Tests for thermo weld joints and copper clad earthing electrodes shall be conducted by the bidder.

(i) Inspection for visual & dimensional checks with respect to standard drawings of the bidder.

4.3 The bidder shall include in his total price, the cost of carrying out all the tests as specified above.

5.0 PRICES

5.1 The bidder shall indicate the unit price of all the items required for Exothermic Weld joints for each size & type of joints and copper clad steel rod. The quantities indicated are tentative and liable to change during contract.

5.2 Based on project requirement, the quantities required shall be informed to bidders before the final price bids called for from the bidders & shall be known as ordered quantity. Addition / deletion of quantities shall be applicable at the quoted unit price. The quantity variation shall be limited to (+) 30% of total contract value derived on the basis of order quantities.

6.0 DELIVERY

The delivery shall be as per NIT (Notice Inviting Tender).

7.0 PACKING

Material should be packed to ensure protection against damage during transit, storage for prolonged periods of storage. For sea worthy packing of equipment/ items, Seaworthy packing for export jobs Doc. (No. PE-TS-888-100-A001) is to be followed.

8.0 DOCUMENTATION

8.1 Purchaser's documents as part of tender:
a) Technical specification along with BOQ.
b) Specification of sea-worthy packing forms part of the specification for exports jobs.

8.2 Documents to be submitted by the bidder along with the bid.
a) A copy of sheet "Contents" with bidder's signature & company stamp
b) A copy of sheet "Instructions to bidders for preparing Technical offer" with bidder's signature & company
stamp.
c) Unpriced copy of "Annexure-I to Section-C (Bill of Quantities)" with bidder's signature & company stamp.
d) "Datasheet-B" (Duly filled by bidder)
e) Catalogues.
f) Technical deviations/ clarifications (if any)
g) PQR documents (if required)

No other documentation is required to be submitted as technical offer. Any information contained

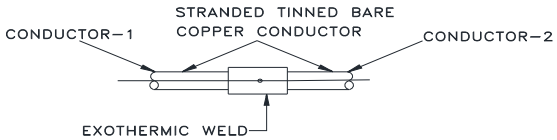
in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

8.3 List of Deliverables shall be as per Annexure-II.

8.4 Vendor drawings/ document schedule shall be as per Annexure-III.

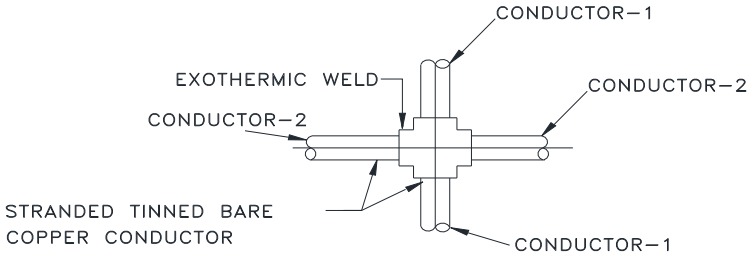
DATASHEET-A

1) STRAIGHT JOINT



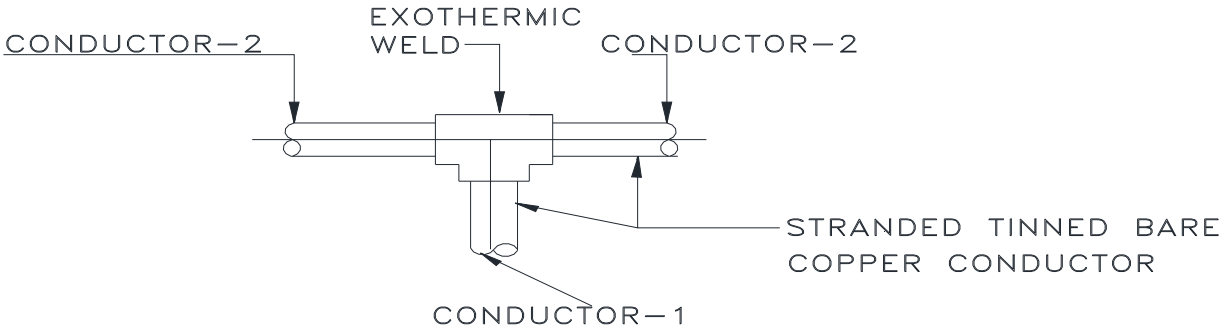
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)
1	*240*	*240*

2) CROSS JOINT



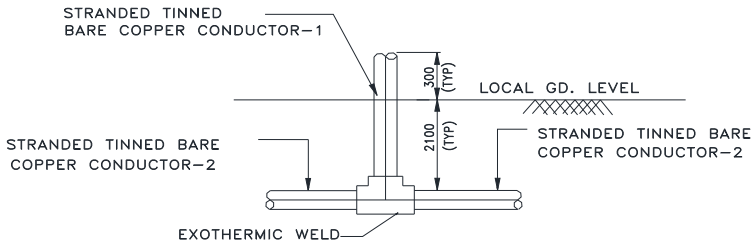
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)
1	*240*	*240*

3) T JOINT (HORIZONTAL)



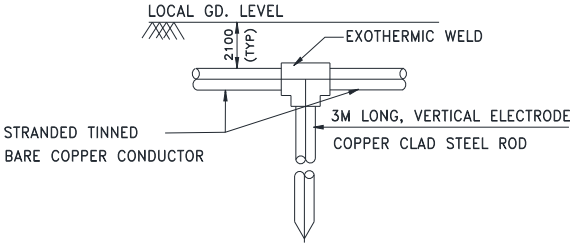
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)
1	*240*	*240*

4) T JOINT (VERTICAL UP)



S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)
1	*240*	*240*

5) T JOINT (VERTICAL DOWN)



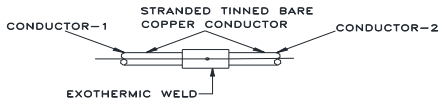
S.No.	Conductor area (Sq.mm.)	Rod dia (mm.)
1	*240*	*18*

DATASHEET-B

TECHNICAL PARTICULARS TO BE SUBMITTED ALONG WITH THE OFFER

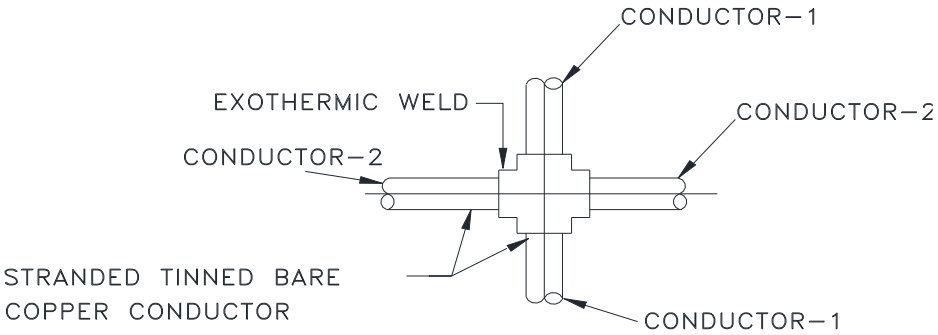
1) **BRAND/ MAKE OF MATERIAL :**

2) **STRAIGHT JOINT**



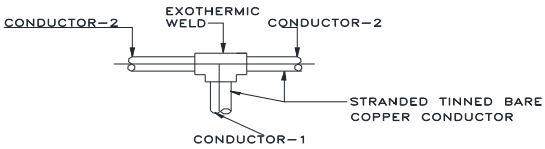
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)	Weld powder /Joint (Weight in gms. x no. of packets)
1	*240*	*240*	

3) **CROSS JOINT**



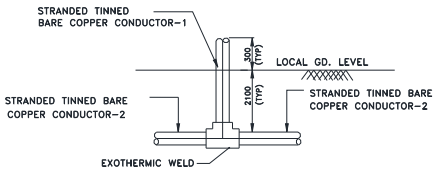
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)	Weld powder /Joint (Weight in gms. x no. of packets)
1	*240*	*240*	

4) T JOINT (HORIZONTAL)



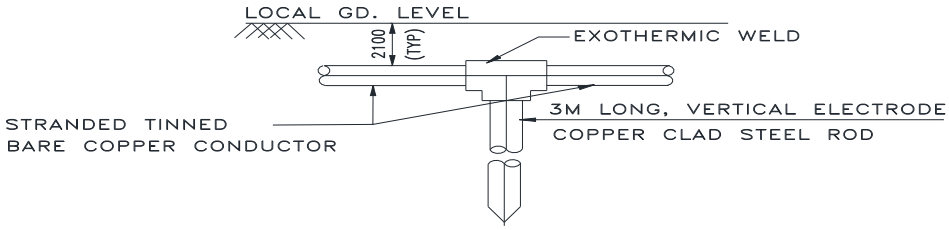
S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)	Weld powder /Joint (Weight in gms. x no. of packets)
1	*240*	*240*	

5) T JOINT (VERTICAL UP)



S.No.	Conductor-1 area (Sq.mm.)	Conductor-2 area (Sq.mm.)	Weld powder /Joint (Weight in gms. x no. of packets)
1	*240*	*240*	

6) T JOINT (VERTICAL DOWN)



S.No.	Conductor area (Sq.mm.)	Rod dia (mm.)	Weld powder /Joint (Weight in gms. x no. of packets)
1	*240*	*18*	

7) Minimum number of joints catered per mould :

8) Minimum number of Moulds catered per handle clamp :

9) Minimum number of Joints catered per Ignitor gun :

10) Minimum number of Joints catered per Brush :

*__NOTE:__

Bidder to ensure the correctness of numbers mentioned above, from execution point of view at site. In case of failure of material to achieve the data indicated above; bidder to compensate the same by supplying additional quantity free of cost to BHEL. This additional quantity shall be mutually agreed between BHEL & bidder, derived on the basis of feedback received from site on actual execution of the job.

ITEMS : Exothermic weld material & copper clad steel rod **SCOPE**: Supply : YES; Erection & Commissioning : NO	
1	Vendor should be a manufacturer of Exothermic welding material & Copper clad steel rod as per relevant national/ International standards. In case the vendor is not a manufacturer, the vendor to furnish an undertaking / agreement from OEM of offered make for support in design, manufacture, inspection & testing of 'Exothermic welding material & Copper clad steel rod'.
2	Vendor shall furnish relevant test reports/certificates for Exothermic weld material and copper clad steel rods.
3	Vendor should have supplied exothermic Weld material and copper clad steel rods from the same OEM, in minimum Two (2) orders.
4	Option-1: Performance certificates for min. 2 years of trouble free operation at minimum 1 installation/ site for Exothermic weld material. Performance certificate should be from end user only. OR Option- 2: Repeat order received from one purchaser/ end user for Exothermic weld material & copper clad steel rod with a time gap of more than 2 years.
5	Minimum two (2) nos. purchase orders for Exothermic weld material & copper clad steel rod shall be submitted which should not be more than five (5) years old from the date of application for registration or date of techno-commercial bid opening (as applicable) for establishing continuity in business.

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidders, if applicable.

2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

3. Any other project specific requirement shall be as per Annexure-I and bidder shall submit relevant supporting documents.

4. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

5. After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

VOLUME IIB

TECHNICAL SPECIFICATION
FOR
SEAWORTHY PACKING FOR EXPORT JOBS

SPECIFICATION NO. PE-TS-888-100-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI, INDIA

	TITLE	SPECIFICATION NO. **PE-TS-888-100-A001**
	TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING FOR EXPORT JOBS	VOLUME II B
		SECTION D
		REV. NO. 0 DATE 10/08/2010
		SHEET 1 OF 52

1.0 Purpose

The purpose of this specification is to describe minimum packing requirements for the different items/equipment for all export Project and also to define marking and shipping requirements during transportation by ship, road and air for all export jobs.

2.0 **SCOPE**

For export jobs, sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required. Workmanship and materials used shall be of high standard meeting the technical requirements and in accordance with best commercial export packing practices. Vendor shall be responsible for sea worthy export packing, however it shall meet the minimum requirements specified herein. Equivalent or better packing methods may be deployed subject to approval of the BHEL/Purchaser. Vendor shall submit the packing procedure for its equivalent for purchaser's approval during detailed engineering.

The scope this specification is to define VENDOR's responsibilities in terms of:

- Preservation of the GOODS/items/equipments before packing.
- Packing of the GOODS for road, rail, sea and/or air transportation to desired destination i.e. project site
- Making cases/crates
- Chemical Treatment/Fumigation before packing to prevent fungus, damage due to termite, borer, rats, etc.
- Marking of cases/crates.
- Other Services required.

3.0 Application

This specification is applicable to all the goods to be transported to project site and requires to be in transit for longer duration. *However, for "Misc cable erection items", "Fire sealing system" & "Exothermic welding material", the packing requirements shall be as per the procurement specification.*

4.0 Definitions

"BHEL" : Main EPC vendor

"OWNER" : Customer for a particular export project.

"VENDOR" : Company(ies)/VENDOR(s) to whom the BHEL has placed Purchase Order for GOODS/ items/system/package.

"GOODS": means all or part of the articles, material, equipment supplies including technical documentation, as described in the Purchase Order, to be supplied by VENDOR.

"PACKER": Packaging Company to whom VENDOR intends to sub-contract the packing in case they do not have own packing capability/facilities .

"FREIGHT FORWARDER" : Means the Company responsible for performing freight forwarding activities.

5. General Information

The following requirements are intended as minimum requirements, and compliance to these requirements in no way absolves or relieves VENDOR of any responsibility or obligation outlined in the Purchase Order. In all circumstances, the packing will be designed and constructed in order to support GOODS during transportation as well as to prevent the Goods from damage due to impact, extreme climatic conditions, sun and rain. It must be ensured that the delivery of the GOODS to the jobsite by sea, road or air, in good condition.

GOODS shall be export packed in compliance with the best-established practices for international projects, in accordance with the following instructions. In the event of any conflict between these specified requirement and the established practices, specification requirement shall govern.

Due to climatic conditions and the complex transport operation(s), it is essential that protection and packing is of the highest standard. Packing means to efficiently protect the GOODS during the total transport operation; from the moment they leave the factory until they are delivered to the jobsite, including handling operations (loading/unloading) and storage.

When VENDOR do not have packing capabilities/facilities of their own and therefore intends to sub-contract, VENDOR have to inform BHEL/Purchaser of the name and address of proposed PACKER(s) for approval.

6.0 Criteria for Selection of Packaging

Packages are to be made according to categories, described in articles 8.1 to 8.5, depending on the type of materials, their fragility and size.

These categories have been established for the protection of equipment and material during multi-mode transports, i.e.: combination of overland and sea transport; containerization, air transportation.

In a general manner, the GOODS have to be packed in such a way that crates, bundles, pallets can be stored into General Purpose containers, wherever possible.

If VENDOR has any doubt about the correct method of protection or packing, he should contact BHEL/Purchaser in order to mutually agree on the adequate type of packing to be used.

Materials can be classified in following categories

- Hazardous Material
- Non-Hazardous Material
-

Further to above categorisation, non-hazardous materials can be sub- categorised for selection of packing.

6.1 Hazardous Materials

Though handling of hazardous material may is not applicable in the scope of this specification. All hazardous material must be packed in adherence to the detailed requirement relating to packing, marking and labelling set out in the most recent report of the Board's Standard Advisory Committee on the Carriage of Dangerous Goods in Ships for sea freight, and the Restricted Articles Regulations, laid down by the International Air Transport Association for airfreight.

6.2 Non-Hazardous GOODS

The scope of this specification is to provide necessary guidelines for packing for power plant equipment, components, Pipings & Valves, Fittings, other structural items, electrical items, spare parts and erection materials. The procedure is defined in subsequent paragraphs in details in clause no. 8.0.

7. 0 Marking Instructions & Despatch details, Storage Code

7.1 Marking Instructions & despatch details

Packages and crates will be marked with indelible black paint, resistant to seawater. Marking must be perfectly legible.

The shipping marks, which will be as per fig-13, shall be stencilled on two sides and one end in clear characters at least 5 centimetres high (where crate size permits, otherwise use optimum size for each package dimension).

When the GOODS are to be shipped in containers then marking may be stencilled on one end only. However, packages must be stowed in a manner that shows these marks.

Crates containing fragile articles must be packed with special precaution against risk of breakage and must be stencilled on all sides "FRAGILE - HANDLE WITH CARE". Where crates are not to be overturned, VENDOR must show on the crates, clear and readily visible identification as per fig-12, to ensure they are kept in the correct position.

Packages/equipment of 2,000 kg or more must be marked with slinging points on all sides, in addition to the centre of gravity marks.

Number packages consecutively i.e. 1 of 10, 2 of 10, etc. Do not duplicate package numbers. VENDOR is responsible for any loss or damage caused by incorrect marking.

All cases/crates shall also be marked with the appropriate international standard graphic symbols for handling as shown in Fig 12.

As a minimum, all cases/crates are to be marked clearly on all four sides with:

- "HANDLE WITH CARE"
- "RIGHT SIDE UP"
- **"KEEP DRY"**

In the case of packages with a single gross weight totalling 2,000 kg and/or a height of more than 1m, the centre of gravity shall be clearly marked with the symbol on two adjoining sides. For all items of equipment with an eccentric centre of gravity this symbol shall be marked at the bottom, side and top of the package.

The slinging and lashing points shall be marked with a chain symbol.

When packing in cases/crates, these packages shall also have metal corners at the slinging points. (Fig-11)

External front and rear sides of the boxes to be planed for writing instructions.

Dispatch details such as consigner/consignee address, contract and case details, country of origin, port of delivery, stacking instructions shall be written on one side of the boxes. An anodized aluminum plate as per details and specifications given in fig-13 shall be provided on one side of the boxes.

One copy of packing slip wrapped in polyethylene bag covered with aluminum packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag is to be kept inside the box at the pertinent place.

7.2 Storage Code

The type of storage required is required to be specified, it will be shown on each packaging in **RED colour.**

X Crates or packages to be stored outdoor without covers
XX Crates or packages to be stored under tarpaulin
XXX Crates or packages to be stored in covered or enclosed premises
XXXX Crates or packages which must be stored in air-conditioned premises

8.0 GUIDELINES FOR PACKING GOODS

8.1 In the subsequent paragraphs details of different types of packings for different types of GOODS are defined. Vendor shall make packing details/procedure based on the guidelines and submit for approval.

8.1.1 Packing for Pipe, Fittings, Flanges and Valves, Structural Steel

Particular attention should be brought to pipe, fittings, flanges, valves and structural steel. Packing categories for piping and fittings will differ according to the diameter and wall thickness of these products. VENDOR shall comply with the following established practice.

IMPORTANT NOTE:
Depending on the project schedule and availability of ocean vessels, the piping and structural steel may be shipped in containers. In this event, VENDOR has to arrange the packages in such a way it allows the stuffing into Open Top in gauge containers.

8.1.2 Pipe

Where practicable, pipe lengths shall be limited to 11.8 meters.
All pipes **2"** included and below shall be packed in crates. All pipes to be capped and ends sealed with waterproof tape.

Pipes over 2" up to 6", shall be bundled and banded in bundles of uniform length. Bundling is carried out with U-IRON or traversal planks, joined with threaded connecting rods with locknuts. Quantities and strapping positions depend on the lengths, with a 120 cm spacing to prevent distortion. Bundle weight shall not exceed 2,000 kg. All pipes are to be capped and ends sealed with waterproof tape (tape is not necessary if end caps are of the pre-shrunk or self-sealing type).

Pipes larger than 6" shall be shipped as single lengths with the ends capped. End caps are to be of the recessed type to enable the use of soft faced hooks, but still completely sealing the end and also protecting the weld.
All stainless steel piping must be packed separately in wooden crates. Any banding of bundles is to be with the same material.

8.1.3 Pipe Fittings, Flanges and Valves

All pipe fittings, flanges and valves up to 6", are to be packed in cases/crates. For items over 6", these may be fixed securely to a pallet base and enclosed in a crate, for protection. Where valves have actuators attached, rigidity must be ensured for the valve and actuator. The vulnerable parts of the actuator are to be completely protected within a wooden crate.

All stainless steel fittings, flanges and valves of all sizes, must be packed separately in wooden crates. Any strapping is to be with the same material.

8.1.4 Structural Steel

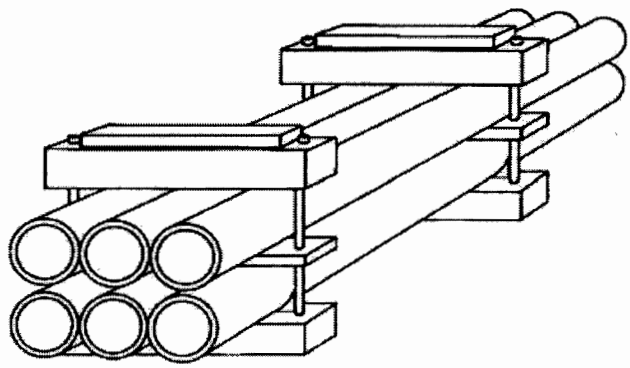
Structural Steel, reinforcing rods, bars, etc., should be packed in bundles of uniform length. Refer to articles 8.1.2, for strapping requirements. Bundle weight not normally to exceed 2,000 kg. Fabricated structures and structural steelwork, etc, should be bundled and packed using wooden beams and long bolting to secure the load.

8.2 Bundling – Packing Category I

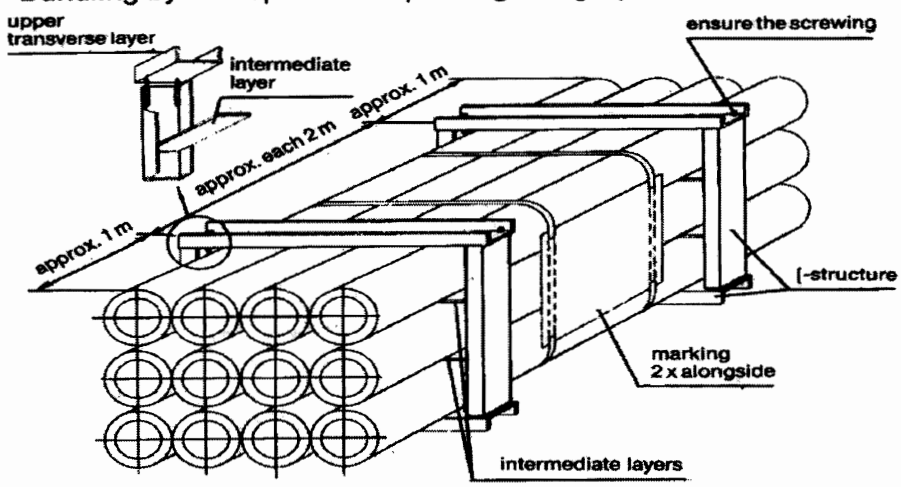
8.2.1 Type of Equipment

Equipment which is not subject to damage by corrosion or mechanical effect, i.e. pipes, piping, structural steel.

Packing category I



Bundling by U-shaped iron – packing category I A



8.2.2 Type of Construction

Bundling has to be effected

- By squared timber and threaded rods.
- With an intermediate layer (threaded on tightening bolts) according to the weight of the package.
- Wedge-shaped timbers must be added at the outer points of lower layer.
- Between the bolts a spacer must be nailed.
- The bolts must be secured (e.g. by locking nut).
- If single parts could protrude, an appropriate protection must be installed (flat iron or plates).
- Bundling with steel straps or PVC straps is not accepted.

8.3 Skids, Square Timber Constructions, Casings – Packing (Category II)

8.3.1 Type of Equipment

Voluminous apparatus, tanks and/or heavy pieces those are not vulnerable to mechanical or corrosive effects.

8.3.2 Type of Construction

- The construction skid can be made of wood or of metal.
- The fastening of the packages on the skid will be made by steel straps (flat iron) which have to be elastically lined, non-slip and securely bolted onto the skids.
- Flange openings have to be closed with gaskets and blind flanges or, if necessary, provided with cover.
- Skid constructions may not be less than the dimensions of the package in length or in width.
- Tanks and apparatus with their own support cradles must be supplied with an anti-slip lining.

PACKING CATEGORY-II