

TAMILNADU ELECTRICITY BOARD

CONSULTANT: DCPL, CHANNAI

**1 X 600 MW NORTH CHENNAI TPP
(STAGE-II, UNIT - 1)**

VOLUME II-B


**TECHNICAL SPECIFICATION
FOR
GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE**

SPECIFICATION No. PE-TS-307-100-M042



**BHARAT HEAVY ELECTRICALS LIMITED, POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**

BHEL - PS-PEM: PPEI BUILDING, SEC. 16A, NOIDA - 201301

	TITLE: PREAMBLE	SPECIFICATION NO. PE-TS-307-100-M042	
		VOLUME	
		SECTION	
		REV. NO.	DATE: 24.08.2012
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1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume-I (CONDITIONS OF CONTRACT)**

This consists of four parts as below:-

- Volume-IA : This part contains instructions to bidders for making bids to BHEL.
- Volume-IB : This part contains general commercial conditions of the tender & includes provision that vendor is responsible for the quality of item supplied by their sub-vendors.
- Volume-IC : This part contains special conditions of contract.
- Volume-ID : This part contains commercial conditions for erection & commissioning site work, as applicable.

1.2 **Volume-II (TECHNICAL SPECIFICATIONS)**

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

- Volume-IIA : General Technical Conditions
- Volume-IIB : Technical Specification including Drawings, if any.

1.2.1 **Volume-IIB**

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, B and C.

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


Data Sheet - B - Specifies data to be filled by the bidder (Data Sheet-B is contained in Volume-III).

Data Sheet - C - Indicates data/documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 **Volume-III (TECHNICAL SCHEDULES)**

This volume contains technical schedules and Data Sheets-B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No. PE-TS-307-100-M042 in Volume-III.


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

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SCOPE OF ENQUIRY

- 1.0 This specification covers the Design, Manufacture, Inspection & Testing at vendor's works, proper packing and delivery of the **GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE** as per the requirements mentioned in different sections of the specification for 1X600 MW NORTH CHENNAI TPP STAGE-II, UNIT-1).
- 2.0 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser, who will interpret the meaning of drawing and specification and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

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PROJECT INFORMATION

<u>1x600 MW NORTH CHENNAI TPP UNIT-1</u>		
1	Owner	TAMIL NDU ELECTRICITY BOARD
2	Consultant	DCPL, CHENNAI
3	Location and Approach	<p>The site is located adjacent to Ennore Port. The site is located between latitude, 13o13' to 13o18' North and Longitude 80o19' to 80o21' East, on the northern side of Ennore Creek, covering Ennore and Puluthivakkam villages in Ponneri Taluk of Thiruvallur district in the state of Tamil Nadu. It is flanked on east by Bay of Bengal, West by the Buckingham Canal and north of Kattupadi village.</p> <p>Well build approach road which connects the power plant to highway is already available. Similarly, railway siding and marshalling yard available for the existing units shall be suitably augmented to cater to the requirement of proposed expansion unit. Besides this, construction water/power supply is also available.</p> <p>Plant located in Athipattu, Ponneri Taluk of Thiruvallur district, Tamil Nadu.</p>
3.1	Nearest Railway Station	Athipattu Pudunagar on Chennai Howrah main line, 3 km from Site.
3.2	Name Airport	All weather road from Pattamandiri, 5 km from Site on Chennai – Ponneri district highway
	Nearest Port	Ennore Port – 3 km & Chennai Port – 20 km from Site

	TITLE: SPECIFIC TECHNICAL REQUIREMENTS GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE	SPECIFICATION NO. PE-TS-307-100-M042	
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1. GENERAL

- 1.1 The piping under this specification is meant for carrying cooling water piping for 1X600MW NORTH CHENNAI TPP STAGE-II UNIT-1. Major portion of the piping shall be buried in soil.
- 1.2 GRP pipes and fittings shall meet the technical requirements and conform to the standard technical specifications and Data sheet A of Vol. II B Section D. In addition, the requirements of this Section-C shall also be complied with. However, wherever the details given in standard technical specification of Section-D and Data sheet-A are different, the requirements of Data sheet A will prevail. Similarly in the event of contradictions between Section –C & Section –D/ Data sheet A, Section –C will prevail.
- 1.3 The technical requirements for GRP pipes and fittings shall, in general, be as per the attached standard Technical specification for GRP pipes, and Data sheet A of Vol. II B Section D.

2. SCOPE OF SUPPLY/SUPERVISION

- 2.1. The scope of supply of GRP Piping, coupling & lamination joints shall be as per datasheet-A.
- 2.2. The unit rate prices as quoted may be interpolated /extrapolated if needed during contract stage to care of changed sizes if required during contract stage.

3. EXCLUSIONS:


Erection & Commissioning of equipment at site are excluded from the bidder's scope.

4. QUALITY ASSURANCE

The Quality Plans enclosed with this specification specify minimum quality control requirement. During contract stage bidder shall furnish these Quality Plans duly signed & stamped for their compliance. Quality plans shall be approved by BHEL and customer (If necessary). All inspection and testing shall be carried out by BHEL and CUSTOMER (if necessary). In case inspection is by both BHEL and CUSTOMER, then the inspection can be carried out jointly or separately, which will be informed later.

5. DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

- 5.1. Bidder to submit pipe thickness, stiffness/pressure class and other applicable calculations as per AWWA M45 and design parameters/conditions as specified in DATA SHEET-A.
- 5.2. The bidder shall submit 'Quality Plan' as enclosed with Section-D duly stamped and signed as token of acceptance of it.
- 5.3. Schedule of Deviations if any. Any deviation from technical specification shall be brought out by bidder. In case no deviation is brought out, it will be assumed that technical specification is being fully complied with.
- 5.4. Schedules of Price & Unit Price.
- 5.5. Schedule of declaration.

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6. PACKING & TRANSPORTATION

- 6.1. Bidder to submit a write up for safe handling and stacking of pipes during transportation and at site.
- 6.2. Pipes to be properly stacked on wooden saddles with stoppers covered with rubber stick and nail to provide cushioning and shock absorption. Width, height and number of saddles to be determined depending of diameter of the pipe. The pipes should be lifted by means of the Nylon / Polyester Sling and lowered on to the runner whereby the entire length of the pipe is getting support from the wooden runner. Depending on the diameter of the pipes, 1 – 4 no of the pipes can be placed side by side on wooden runners and pipes should be strapped from both ends of the wooden runner which will ensure that the pipes do not move. The number of pipe layers to be decided based on pipe diameter & permissible height and 4Nos of wooden runners should be placed for each layer. Whole package is to be strapped with polyester/Nylon straps at two places before crimping with Aluminum seals.
- 6.3. Smaller diameter pipes may be nested into bigger diameter pipes if the packages consist of multiple diameter pipes. To avoid any kind of abrasion, thick rubber padding shall be used between pipes strapped with nylon straps.
- 6.4. Rubber gaskets, center registers, special fittings etc. should be wrapped in a Polyethylene bubble Sheet / Bag and sealed. For smaller sizes, all such items should be packed in a wooden box / crate and the inner surface of the wooden box should be lined with Bituminized Water Proof Paper Craft.
- 6.5. GRP pipes and fittings shall be prepared for shipment with the joining ends covered to protect from damage. The protection can be made of Covers or U-shaped profiles in plastic material wrapping with anti-shock and anti-abrasion plastic film or Wrapping with rubber tapes.
- 6.6. Marking shall be provided on the boxes/crates indicating position of boxes for handling, storage & nature of consignment. The ink used for this purpose as well as for marking dispatch instruction shall be Non-Washable Marking Ink. The front and rear side of the boxes/crates/packing would carry the following details, duly stenciled in black paint.
 - a) Name & address of the consignee
 - b) Consignee P.O. reference no. and date
 - c) Port of delivery
 - d) Consigner name and address
 - e) Country of origin
 - f) Dimension of the box/crate/packing (mm)
 - g) Net weight (Kg)
 - h) Gross weight (Kg.)
- 6.7. One copy of the packing list would be placed in a transparent polyethylene bag and nailed to the inside of the box/crate/packing.
- 6.8. Another copy of the packing list also wrapped in a transparent polyethylene bag would be nailed to the external surface of the box/crate/packing.
- 6.9. Each box/crate/packing will carry its separate identification number.
- 6.10. In case of transport by ship, packing shall be sea worthy so as to ensure safe delivery till site.

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1. GENERAL

This specification covers the design, materials, manufacture and testing of glass fibre reinforced plastics (GRP) pipe at Bidder's or/ and sub-Vendor's works inclusive of packing requirements.

2. CODES AND STANDARDS

- 2.1. The GRP pipe covered under this specification shall be designed and manufactured as per following codes and standards. Other international standards may be used provided they are equivalent or superior to those mentioned below.

1	IS 14402	GRP Pipes, Joints and Fittings for use for sewerage, industrial waste and water (other than potable).
2	IS 12709	GRP Pipes, Joints and Fittings for use in Potable Water Supply
3	IS 13916	Installation of GRP Piping system – code of practice
4	IS 5382	Rubber sealing rings for gas mains, water mains and sewers
5	IS 6746	Unsaturated polyester resin systems for low-pressure fibre reinforced plastic
6	IS 11320	Glass roving for the reinforcement of Polyester and epoxies resin system
7	IS 11551	Glass fibre chopped strand mat for the reinforcement of polyester resin system
8	IS 1367 (Part 1 to 20)	Technical supply conditions for threaded steel fasteners
9	AWWA M45	Fiberglass Pipe Design
10	AWWA C950	AWWA Standard for Fiberglass Pressure Pipe

- 2.2. In case of any conflict between the above Codes/Standards and this specification, the latter shall prevail and in case any further conflict in this matter, the interpretation of the specification by the Engineer shall be final & binding.

3. DESIGN REQUIREMENTS

3.1 PIPES

- 3.1.1 Pipes shall be supplied in nominal length of 6M/12M as specified in Data Sheet-A unless otherwise specified as per contract piping layout drawing /layout requirements. The tolerances on nominal lengths shall be within $\pm 25\text{mm}$ as per approved drawing by BHEL in line with shipping constraints. A max of 10% of pipe lengths shall be supplied in short lengths as per IS 14402 clause 7.2.
- 3.1.2 Pipe OD/ID dimensions and tolerance limits shall meet the requirements of IS 14402 or equivalent.
- 3.1.3 The minimum wall thickness at any point shall not be less than the wall thickness specified in Data Sheet-B by the bidder. It shall be ensured that the wall thickness specified by the bidder shall be such as to satisfy the inside or outside diameter specified in IS 14402. The wall thickness and outside diameter shall be measured to an accuracy of 0.1 mm with micrometer and pipe tape in accordance with IS 14402.
- 3.1.4 The basic structural wall should consist of Thermo setting Polyester resin with glass fiber reinforcement. The inner surface of a GRP pipes and fitting wall shall have a resin rich corrosion barrier compatible for water with a thickness of minimum 1.0mm Pipe shall have to be provided with UV stabilized resin coat as external layer.

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3.1.5 JOINTS

- a) The pipe shall have a joint system that provides fluid tightness for the intended service condition. Pipe joints shall be capable of withstanding internal pressure.
- b) Coupling: Two GRP pipes shall be joined with rubber gasket and central register for unrestrained portion of the piping.
- c) Butt strap joint (Lamination Joint): The Butt strap joints shall be used to join GRP piping in restraint portion of the piping.
- d) Flanged Joint: The flanged joints shall be used for connecting valves, pumps and other piping etc. They shall have EPDM gasket and hot galvanized IS bolting to IS1367 Class 4.6.

3.1.6 STRUCTURAL PROPERTIES OF PIPES

Each pipe length shall have sufficient strength to withstand the class AA loading in addition to the overburden of backfill load up to the required depth. The minimum initial ring stiffness for withstanding above load conditions with maximum 5% of long-term ring deflection shall be appropriately determined by manufacturer for actual execution

3.1.7 BEAM STRENGTH & LONGITUDINAL TENSILE STRENGTH

The pipe shall meet the minimum Beam strength test loads and longitudinal tensile strength as per relevant clauses of IS 14402 or equivalent international standard. Tests shall be performed in accordance with the above standard.

3.1.8 HOOP TENSILE STRENGTH

The pipe shall meet the minimum hoop tensile strength as per relevant clauses of IS 14402 or equivalent international standard. Test shall be performed in accordance with the above standard.

4. FITTINGS

- 4.1. All GRP fittings, such as bend/elbows, ends, tees, flanges and reducers etc. shall be equal to or superior in performance to pipe of the same classifications and shall have internal with smooth finish.
- 4.2. All GRP fittings are to be manufactured in factory. Dimensions of all fittings shall be as per approved fitting drawings. Fitting drawings shall be submitted to BHEL for approval before manufacturing.

4.3. FITTINGS MADE FROM STRAIGHT PIPE

- 4.3.1 Fittings shall be fabricated from complete pipes or portions of straight pipe complying with this standard as applicable for the pipe classifications. The fitting shall comply with the declared design requirement and be suitably mitered. The miter shall be over wrapped externally and internally with liner, woven roving and/or chopped strand mat to ensure the longitudinal and circumferential tensile strength is at least equal by design to that of the pipe with which the fittings is to be used. All fittings should have sufficient end length of pipe to accommodate over wrapped length of fitting and pipe. All fittings should have internal, external reinforcing dimensions as per manufacturer standards.

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- 4.3.2 GRP tees with standard flanges matching PCD etc. should be provided for connection of Butterfly valve, air release valves, manholes etc. GRP shall be designed as per manufacturer standard. Flange bolting details shall be furnished to BHEL for approval before manufacturing of Flange.

4.4. FITTINGS MADE BY MOULDING

Moulded GRP fittings shall be made by hand lay-up, contact moulding, hot or cold press moulding or tape winding with internal liner.

4.5. TOLERANCES FOR GRP FITTINGS.

- Except for flanged pipe work, which may require closer tolerances, the permissible deviations from the stated value or the angle of change of direction of a fitting such as a bend, tee or junction shall not exceed (+/-) 1 degree.
- Except for flanged pipe work, which may require closer tolerances the permissible deviations on the manufacturer's declared length of a fitting, exclusive of the socket where applicable shall be $\pm 25\text{mm}$ taken from the point of intersection to the end of the fitting.

5. MATERIALS

The materials of construction GRP pipes & Fittings shall be specified in Data sheet-A.

6. MANUFACTURING AND WORKMANSHIP

- The method of manufacturing of GRP pipe shall be such that the form and diversions of the finished pipes are accurate within the limits specified in relevant clauses of IS standards or equivalent.
- Pipes shall be manufactured through Filament winding continuously advancing mandrel process or Continuous filament winding process with full automation. Bidders to confirm the manufacturing process categorically in their bids.
- The Resin shall be Isophthalic with grade of resin un-saturated Polyester Resin. Pipe shall have to be provided with UV stabilized resin coat as external layer.
 - The pipes shall be free from all defects including indentation, delaminating, bubbles, pinholes, cracks, pits, blister, foreign inclusions and resin staved areas that due to their nature degree or to the extent that detrimentally affects the strength and serviceability of the pipe. The pipe shall be as uniform as commercially practicable in color opacity, density and other physical properties as per relevant standard.
- The inside surface of each pipe shall be free of bulges, dents ridges and other defects. No glass fiber reinforcement shall penetrate the interior surface of the pipe wall.
- Joint sealing machined surface shall be free of dents, gouges and other surface irregularities that will affect the integrity of the joints.

7. MARKING

The marking on pipe shall include the following:

- The manufacturer's name of trademark
- The nominal pipe diameter

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- c) Class of pipe (Pressure & Stiffness)
- d) Batch no. or date of manufacture
- e) Pipe should also be marked with certification no.

8. INSPECTION AND TESTS

- 8.1. The items covered under this contract shall be subjected to inspection, testing and quality surveillance. The Inspection Agency shall, at all reasonable times have access to Bidder's works, Quality Control records and all facilities as reasonably required for carrying out the inspection and testing efficiently, and these shall be provided by the bidder free of cost
- 8.2. The minimum testing and inspection requirements for raw material, pipes & fittings shall be as per the attached Quality Plan. However, in case of order, final inspection and testing shall be carried out as per the final approved quality plan without any price implications.
- 8.3. Bidder to submit valid Type test / Long term test (Hydrostatic design basis & Chemical resistance test) to be vetted by BHEL. However if the conductance of test is found necessary by BHEL, material to meet delivery requirement will be supplied by bidder to site at his risk and cost till successful conductance of test at bidder's cost. Long-term hydrostatic design pressure test shall be carried out as per IS 12709 or equivalent international standard. Chemical resistance test shall be carried out as per IS 14402 or equivalent international standard.

9. PROTECTION FOR DESPATCH

GRP pipe ends shall be protected from external damage and sealed against the ingress of dirt by means of polythene caps/rubber end protectors.

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DESIGN INPUT FOR GRP PIPING			
SLNO	DESCRIPTION	UNIT	
1.0	Working fluid	-	Sea Water
1.1	Working Pressure	Kg/cm ² (g)	1.7
1.2	Design Pressure	Kg/cm ² (g)	5.0
1.3	Design Vacuum	mm of Hg	Full
1.4	Design Temperature	Deg C	52°
1.5	Design Flow	m ³ /Hr	55000
1.6	Pipe Inner Diameter	mm	2800
1.7	Max pressure during surge condition	Kg/cm ² (g)	5.0
1.8	Vehicular/Moving Load	T	As per ASSTHO-HS20
2.0	Type of soil	AWWA-M45 AASSTHO classification	Granular slightly compact MS _n = 20.7 MPa
2.1	Type of Backfill soil		SC ₃
2.2	Bearing capacity of the soil MS _n	MPa	20.7
2.3	Bearing capacity of Backfill soil MS _b	MPa	5-6
2.4	Backfill compaction		95%
2.5	Ground water level	Mt	0.0
3.0	Maximum soil cover	Mt	3.0
3.1	Minimum soil cover	Mt	1.5
3.2	Trench Width	Mt	~ 4.0
PIPE SPECIFICATION			
1	Size	DN2800	
2	Pressure Class	PN6	
3	Stiffness Class	SN2500	
4	For OD And Thickness, Refer Sheet 2 Of Datasheet-A		



TITLE:
DATA SHEET-A
GLASS REINFORCED PIPE (GRP)

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DATA SHEET-A

GLASS REINFORCED PIPE (GRP)

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DATA SHEET-A

1X 600 MW NORTH CHENNAI STPP UNIT-1

BOM OF GRP PIPE

1.0 SCOPE OF SUPPLY: Following are the Requirements of GRP pipe:

Sl. No.	LINE DESCRIPTION	DESIGN		PIPE MATERIAL		PIPE		BENDS / ELBOWS				REDUCERS		TEES		FLANGE			MISCELLANEOUS			SPECIAL FEATURES	PIPE WEIGHT (TONS)	FITTING WEIGHT (TONS)	TOTAL WEIGHT (TONS)	REMARKS	
		PRESS. Kg/cm2 (g)	TEMP (°C)	SPECIFICATION	OD (mm)	THK (mm)	LENQTY. (M)/(No.)	SIZE (NB)	R	θ dg	SIZE (NB)	No	SIZE (NB)	No	SIZE (NB)	No	SIZE (NB)	No									
SUPPLY FOR UNIT-1																											
P&ID: CW & ACW SYSTEM (PE-QG-308-165-N101)																											
1	C.W.MAIN HEADER (NORMAL PIPE)	5	60	GRP	2860 (+8.5/-2.0)	33.5 (min)	120M	-	-	-	-	-	-	-	-	-	-	-	-	-	With one coupling per 12M pipe	-	-	-	-		
2	C.W.MAIN HEADER (DOS PIPE)	5	60	GRP	2860 (+2.0/-2.0)	33.5 (min)	60M	-	-	-	-	-	-	-	-	-	-	-	-	-	Pipe with (+/-)2.0mm tolerance & Without coupling	-	-	-	-		
3	C.W.MAIN HEADER (ROCKER PIPE)	5	60	GRP	2860 (+2.0/-2.0)	33.5 (min)	24M	-	-	-	-	-	-	-	-	-	-	-	-	-	Pipe with (+/-)2.0mm tolerance & grooves at every 2M for cutting of Rocker pipe & Without coupling	-	-	-	-		

NOTE: 1- Following materials shall be used for the manufacturing of GRP pipes:

RESIN: A thermosetting polyester resin(isophthalic) to be used and quality parameter should as per IS14402-96 (latest) or equivalent international standards mentioned elsewhere in the tender.

GLASS FIBER REINFORCEMENT: Glass fiber reinforcement shall be of commercial grade Boron free electrical and corrosion resistance glass type and shall conform to IS 11273-1992, IS11320-1985 or IS11551-1986 as appropriate or equivalent international standard like ASTM D2343. The same shall be procured from renowned manufacturer. BS 5480 also to be referred.


REINFORCEMENT: E or ECR (preferable) glass fiber procured from renowned fiberglass manufacturer shall be used.

OTHER MATERIALS:

- a)-Aggregates: Siliceous and or a size range between 0.05 mm and 0.8mm may be incorporated in the composite structure.
- b)-Filler: Inset fillers (with particles size below 0.05mm) may be incorporated either own or with aggregates.
- c)- Additives: Additives may be incorporated for modifying the properties of the resin.


2. Vendor to confirm acceptance of OD & Thickness along with tolerances indicated for item at Sl. No. 2 & 3 above.

Signature of the bidder with name, designation, date and company's seal

	QUALITY PLAN		CUSTOMER: TNEB	PROJECT: 1x600MW NORTH CHENNAI UNIT-1	PO No.:	-
	BIDDER/VENDOR: -			SPEC. NO : PE-TS-307-100-M042	QP No.:	PE-QP-307-100-M053 Rev-00
	SYSTEM: GRP PIPING SYSTEM			ITEM: GRP PIPES & FITTINGS	Issue Date :	24.08.2012

S.No	Component/ Operation	Characteristics Checked	Category	Type/ Method of Check	Extent of Check	Reference Document/ Standard	Acceptance Norms	Format of Records	Agency			Remarks
1.0	2	3	4	5	6	7	8	9	P	W	V	11
1.0	Raw Material Control											
1.1	Polyester Resin (ISO PHTHALIC)	1.Relative Density	MA	Physical & Chemical	1 sample for every Batch	IS 6746:1994, ISO 2555, ISO 2535, ISO 584, ASTM D 2196, ISO/R 3251, FTEC & VENDER SPEC	1.11 +/- 0.01	MANUFACTURERS TEST REPORT	2	1	1	Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative. Test certificates of Vender tested samples to be verified and Two samples from Lot of 100MT to be Witnessed by BHEL/BHEL Authorised Representative/ Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative.
		2.Viscosity	MA				600 cps +/- 20 %		2	1	1	
		3.Acrid Value	CR				11 +/- 4 mgKOH / gm		2	1	1	
		4.Volatile Content	MA				37 +/- 3 % by mass		2	1	1	
		5.Gel Time	MA				18 minutes+/- 20 %		2	1	1	
1.2	Fiber Glass	6. Reactivity	MA	Physical & Chemical	One sample from every Lot of 10MT Per Type	IS 11320 & vender spec	<40 min@ 25-exotherm peak	MANUFACTURERS TEST REPORT	2	1	1	Test certificates of Vender tested samples to be verified and One samples from Lot of 20MT per Type to be Witnessed by BHEL/BHEL Authorised Representative. Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative.
		7. Exotherm peak	MA				140 - 180 deg cen		2	1	1	
		8. appearance	MA				clear no haze		2	1	1	
		1.Roving Weight (Tex)	MA				600 gm/ km+/-10% 1200/2400/4400/4800 gm/km + /- 8%		2	1	1	
		2. Moisture Content	MA				Max 0.3 %		2	1	1	
1.3	Silica Sand	3.Loss on Ignition	MA	Physical , Chemical & Visual	One Composite Sample from every lot of 20MT	IS 14402 & vender spec	+/-20% OR 0.2% FROM THE NOMINAL VALUE STATED BY SUPPLIER (WHICHEVER IS GREATER TOLERANCE)	MANUFACTURERS TEST REPORT	2	1	1	Test certificates of Vender tested samples to be verified and One samples from Lot of 20MT per Type to be Witnessed by BHEL/BHEL Authorised Representative. Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative.
		4.Conductivity	MA				Max 12.5 mS/m		2	1	1	
		1.Sieve Analysis (Particle Size)	MA				0.05 - 0.8 mm		2	1	1	
		2.Moisture Content	MA				Max 0.1%		2	1	1	
		3.Loss on Ignition	MA				Max 0.5%		2	1	1	
1.4	Rubber Gasket	4.Wettability	MA	Physical & Visual	5 % for dimensional & 25 % for Physical Appearance in every Lot	IS 5382 & vender spec	Max 200 Seconds	TEST CERTIFICATES REPORT	2	1	1	Test certificates of Vender tested samples to be verified and One samples from Lot of 40MT to be Witnessed by BHEL/BHEL Authorised Representative.
		5. Carbonate Content	MA				Max 2.5%		2	1	1	
		6.Microscopic observation	MA				ROUND / OVAL PARTICLES FREE FROM SHARP EDGES		2	1	1	
		1.Shore "A"Hardness	MA				50 + 5 / - 4		2	1	1	
		2.Dimension Check	MA				As per IS 5382:1985 CI 3.6 & Approved Drawings		2	1	1	
1.4	Rubber Gasket	3.Material of Construction	MA	Compliance certificate	100%	IS 5382 & vender spec	EPDM (Type 2)	Compliance certificate of Sub-vender	-	-	1, 2	

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURES	
	DATE	
BIDDER/VENDERS COMPANY SEAL		


	QUALITY PLAN			CUSTOMER: TNEB	PROJECT: 1x600MW NORTH CHENNAI UNIT-1	PO No.:	-
	BIDDER/VENDOR: -				SPEC. NO : PE-TS-307-100-M042	QP No.:	PE-QP-307-100-M053 Rev-00
	SYSTEM: GRP PIPING SYSTEM				ITEM: GRP PIPES & FITTINGS	Issue Date :	24.08.2012

S.No	Component/ Operation	Characteristics Checked	Category	Type/ Method of Check	Extent of Check	Reference Document/ Standard	Acceptance Norms	Format of Records	Agency	Remarks
1.0	2	3	4	5	6	7	8	9	10	11
3.0	GRP PUSHFIT GASKETED COUPLING									
3.1	Acceptance Tests	Hydrotest	CR	Annex C, IS 14402	100%	IS 14402 :1996	IS 14402:1996, Cl.12.2 (Two times Pressure Class)	INSPECTION REPORT	2 1, 4 -	Two Sample from every 100 Coupling to be witnessed by BHEL +Test certificates of 100% couplings tested by Vendor to be verified by BHEL/BHEL Authorised Representative.
4.0	GRP FITTINGS									
4.1	Workmanship		MA	Visual	100%		As per Vendor SPEC/STD/ARPPD DWGS	INSPECTION REPORT	2 1 -	One Sample per Type & Lot to be witnessed by BHEL +Test certificates of 100% fittings by Vendor to be verified by BHEL/BHEL Authorised Representative.
4.2	Dimensions		MA	Measurement			As per Approved Drawings	INSPECTION REPORT	2 1 -	
4.3	Acceptance Tests	Hydrotest	MA	Visual	For Bends, Lamination joint strength may be alternatively checked at shop by hydrotesting of straight pipe (One number per size) with lamination joint at pressure twice pressure class. For other fittings, One number of fitting each type & size shall be hydro tested at shop at pressure twice pressure class.	IS:14402 :1996	Fittings shall not show any leakage or Burst when tested at twice pressure class for 1 min at room temperature.	INSPECTION REPORT	2 1 -	Lamination joint shall be as per manufacturer standards and Pipe will be offered for testing after completion of lamination joint. Samples as per Col.6 to be selected by BHEL/BHEL Authorised Representative.
5.0	PACKING									
5.1	Acceptance Tests	Workmanship	MA	Visual	100%		As per SPEC/STD/ARPPD DWGS	INSPECTION REPORT	2 - -	Compliance certificates for packing to be submitted by Vendor.
		Dimensions	MA	Measurement			As per Approved Drawings	INSPECTION REPORT	2 - -	

Notes :

- In case of Long Term tests are required to be carried out as per IS14402, the dispatches to be made pending the test results to meet delivery requirement.
- Factory Hydro Test for Pipes, Couplings & Fittings will be done at pressure Twice the pressure class & Holding Time of One Minute as per IS:14402.
- P = Performed by, W = Witnessed by, V = Verified by, 1= BHEL /BHEL Authorised Representative, 2 = Vendor , 3 = sub vendor , 4= Customer / Customer Representative, MA = Major , CR = Critical , IS - Indian Standard
- BHEL /Customer or Authorised Representative may witness at any stage as deemed necessary during the contract execution.
- Samples selected by BHEL for HYDRO test will only be identified by marking.
- Lot size is the quantity offered in one inspection call/one inspection visit.

BHEL		PARTICULARS	BIDDER/VENDOR
		NAME	
		SIGNATURES	
		DATE	
		BIDDER/VENDERS COMPANY SEAL	

	TITLE: DATA SHEET-C GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE	SPECIFICATION NO. PE-TS-307-100-M042	
		VOLUME : IIB	
		SECTION: D	
		REV. NO.: 00	DATE: 24.08.2012
		SHEET 1	OF 1

DATA SHEET - C

DRAWINGS, DOCUMENTS & DATA TO BE FURNISHED BY VENDOR AFTER AWARD OF CONTRACT

Drawings/documents distribution schedule to be followed by the successful bidder:

- 1- The successful bidder shall submit the following drawings/documents within two weeks after award of contact.
 - a) Pipe thickness, stiffness and other calculations as per AWWA M45
 - b) GA drawings of Pipe with marking details and dimensions
 - c) GA drawings of Coupling with marking details and dimensions
 - d) GA drawings of Rubber gasket & center register dimensions
 - e) Quality Plan duly signed & stamped with bidder's seal.
 - f) Type test Reports of Hydrostatic design basis & Chemical resistance test
 - g) Method Statement for Underground Installation, handling & storage of GRP Pipes
 - h) Method statement for Butt Wrap Joining of GRP Pipes
 - i) Data sheet 'B' of Volume-III

TAMILNADU ELECTRICITY BOARD

CONSULTANT: DCPL, CHANNAI

**1 X 600 MW NORTH CHENNAI TPP
(STAGE-II, UNIT - I)**

VOLUME III

**TECHNICAL SCHEDULE
FOR
GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE**

SPECIFICATION No. PE-TS-307-100-M042



**BHARAT HEAVY ELECTRICALS LIMITED, POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**


	TITLE: TECHNICAL SCHEDULES GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE	SPECIFICATION NO. PE-TS-307-100-M042	
		VOLUME : III	
		SECTION:	
		REV. NO.: 00	DATE: 24.08.2012
		SHEET 1	OF 1

CONTENTS

<u>S.No.</u>	<u>DESCRIPTION</u>
1.	DATA SHEET - B
2.	COMPLIANCE SHEET
3.	SCHEDULES OF DEVIATIONS
4.	SCHEDULE OF DECLARATIONS
5.	SCHEDULE OF UNIT PRICES (As per enclosed format only)

	TITLE: TECHNICAL SCHEDULES GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE	SPECIFICATION NO. PE-TS-307-100-M042	
		VOLUME : III	
		SECTION:	
		REV. NO.: 00	DATE: 24.08.2012
		SHEET 1	OF 1

DATA SHEET-B			
	<u>DATA TO BE FILLED BY THE BIDDER</u>		
1.0	Outside Diameter	mm	
1.1	Nominal reinforced Wall thickness	mm	
1.2	Liner Thickness	mm	
1.3	Total Wall Thickness	mm	
1.4	Hoop Tensile Modulus of Elasticity	N/mm ²	
1.5	Hydrostatic Design Basis -for Stress basis	N/mm ²	
1.6	Hydrostatic Design Basis -for Strain basis	%	
1.7	Long Term Ring Bending Strain	%	
1.8	Deflection Lag factor	-	
1.9	Standard permitted deflection	%	
2.0	Stiffness Class	SN2500	
2.1	Pressure Class	PN6	
3.0	Standard permitted deflection	%	
3.1	Max. allowable long term vertical deflection (rel)		
	<u>Calculations at min soil cover</u>		
4.0	Predicted deflection		
4.1	Combined loading working strain due to		
4.2	internal pressure	%	
4.3	max permissible deflection	%	
5.0	Buckling pressure		
5.1	Allowable calculated value	N/mm ²	
5.2	Max value due to vacuum, ground water & soil pressure	N/mm ²	
5.3	Max value due to traffic, ground water & soil pressure	N/mm ²	
	<u>Calculations at max soil cover</u>		
6.0	Predicted deflection		
6.1	Combined loading working strain due to		
6.2	internal pressure	%	
6.3	max permissible deflection	%	
7.0	Buckling pressure		
7.1	Allowable calculated value	N/mm ²	
7.2	Max value due to vacuum, ground water & soil pressure	N/mm ²	
7.3	Max value due to traffic, ground water & soil pressure	N/mm ²	

	TITLE: COMPLIANCE SHEET GLASS FIBRE REINFORCED PLASTICS (GRP) PIPE	SPECIFICATION NO. PE-TS-307-100-M042	
		VOLUME : III	
		SECTION:	
		REV. NO.: 00	DATE: 24.08.2012
		SHEET 1 OF 1	

PROJECT:.....

A) Technical Details: Bidder to tick whichever is applicable.

1.	Technical requirements as per Data sheet-A sheet 1 of 2 and sheet 2 of 2 & Standard technical Specification of Vol IIB Section-D	Accepted	Not Accepted
2.	Quality Plan	Accepted	Not Accepted
3.	Specific Technical Requirements of Vol IIB Section-C	Accepted	Not Accepted
4.	Documentation requirement as per Data sheet-C	Accepted	Not Accepted

B) Deviations to the technical specification are not acceptable. However, if there are any deviations due to unavoidable reasons then the same to be clearly specified in the schedule of deviation. In case of no deviations, schedule of deviations to be filled as NIL by bidder.

C) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty.

D) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for foreign bidders shall be included in the base price of the equipment by the bidder. This 3rd party inspection agency shall be approved by BHEL and will be decided in contract stage.

E) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval.

F) GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL