2x660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI

TECHNICAL SPECIFICATION
FOR

GLASS REINFORCED PLASTIC (GRP) PIPING
(UNDERGROUND)

SPECIFICATION No: PE-TS-412-100-M042

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

CONTENTS

SCOPE OF ENQUIRY

1. PROJECT SCOPE

i. **Bidder's scope** covers **Detailed Design, Engineering, Manufacturing, Transportation, Site-Storage, Erection and Hydro-testing** of Glass Reinforced Plastic (GRP) piping - Underground for 2x660 MW Ennore SEZ Supercritical Thermal Power Project.

ii. Complete piping system with fittings (Tees, elbows, expander, reducer, end caps etc.) along with flanged tapping (for main/branch pipe connections, drains, vents etc.) shall be in bidder's scope. Isolation valves drain and vents, measuring instruments shall be supplied by BHEL with flanged ends, as free supply items.

iii. Bidder's scope also covers to provide Civil Design/ Civil inputs e.g. Thrust Block requirement with load details.

iv. Based on the bidder's civil inputs, Civil Works i.e. excavation and concrete encasing for the below ground GRP pipes shall be done by BHEL during project execution. It shall be Bidder's responsibility to supervise and ensure correct installation of GRP piping by coordinating with BHEL's civil execution agency.

v. Bidder to note that the following Annexures are attached as a part of this specification:

Annexure-1 comprises of estimated BOM based on the drawing attached with the specification. Bidder to note that his scope includes supply of all items required for complete installation till Hydro-test of piping (other than those mentioned as free supply by BHEL) as per drawing including tools /tackles.

Annexure-2 comprises of Piping & Instrumentation Diagram for the GRP piping of "Sea Water Intake scheme" and "CW Blowdown scheme".

Annexure-3 comprises of Piping Layout drawing showing the routing details of GRP piping for this project.

Annexure-4 comprises of Technical Datasheet for Below Ground GRP piping which shall be duly filled by Bidder and submitted to BHEL for concurrence.

2. It is not the intent to specify herein all the details of design, manufacture, installation, testing etc. Bidder shall quote his standard, proven product, which shall conform in all respects to high standards of design, engineering, installation, inspection and workmanship and shall be capable of performing the required duties in a manner acceptable to the Engineer/Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

3. The omission of specific reference to any component / accessory/ design data necessary for the intended performance of the piping system shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.

4. General Arrangement drawings/Material Specification/ Design Calculations/ Installation procedures/ Pipe support details/ Materials test certificates etc. for complete GRP piping shall be approved by BHEL/ Customer.

5. BHEL's / CUSTOMER'S representatives shall be given access to the shop in which the products are being manufactured or tested and all test records shall be made available to them. Pipe and fittings shall be tested as per approved Quality Plan.

6. BHEL/ CUSTOMER shall provide statutory approvals/ clearances to the successful bidder during contract stage. However, the responsibility to generate all the documents related to statutory approval shall be on the Bidder.

7. In case of any deviation from this Technical Specification and Technical Requirements, Bidder shall indicate the same in the Schedule of Deviations. In the absence of duly filled schedules, it will be assumed that the bid strictly conforms to the specification.

8. The bids shall be in English language and SI Units.

PROJECT INFORMATION

INTRODUCTION

A Project Information & Location

Project Title	:	Ennore SEZ project of 2 x 660 MW Coal Based Super Critical Thermal Power Project at ash dyke of NCTPS
Plant capacity	:	1320 MW (2 units of 660 MW each)
Type of project	:	Green field
Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
Plant site location	:	Ash dyke of North Chennai Thermal Power Station (NCTPS)
Location co-ordinates	:	80° 18' E to 80° 19' E Longitude 13° 17' N to 13° 18' N Latitude
Nearest Village	:	Vayalur
Nearest Town & City	:	Chennai (35 Km)
State Capital	:	Chennai (35 Km)
Nearest Railway Station	:	Athipattu Pudunagar (~5 Km)
Nearest Airport	:	Chennai (~60 Km)
Nearest Seaport	:	Ennore (~5 Km)
Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway

B Meteorological Condition

Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
Ambient Temperature		
a) Annual Maximum Mean Temperature	:	32° C

b) Annual Minimum Mean Temperature	:	24° C
c) Design ambient temperature	:	35° C

Relative Humidity

a) Maximum	:	100%
b) Minimum	:	36%
c) Design	:	75%

Annual Rainfall

Maximum	:	2540 mm
Average	:	1600 mm
Minimum	:	1175 mm

Prevailing Wind Direction	:	November to January – From NW & NE February to March – From East & SE April to May – From South & SE June – From SW July to August – From NW September to October – From SE & SW
Wind Speed	:	11.8 kmph (Avg), 50m/s max)
Seismic zone	:	Zone: III as defined in IS:1893-2002

TECHNICAL REQUIREMENTS

1. TECHNICAL REQUIREMENTS

Technical specification document are minimum requirements, which the bidder should follow. However, the bidder shall also include & provide any additional requirements, if so warranted to meet tender requirements including guarantees as well as those required for smooth & trouble free operation of the system/ plant.

2. CODES & STANDARDS

The latest revision/ version of the following or equivalent standards shall be complied as a minimum requirement. It shall be responsibility of the Bidder to comply all the applicable Indian/International codes, best practices for complete Design, Engineering, Manufacturing, Delivery, Erection and Hydro-testing.

1	IS 14402	GRP pipes, joints, and fittings for use for sewerage, industrial waste and water.
2	IS 5382	Rubber sealing rings for gas mains, water mains and sewers
3	IS 13916	Installation of GRP Piping system – code of practice
4	IS 6746	Unsaturated polyester resin systems - specification
5	IS 11273	Woven roving fabrics of 'E' glass fiber
6	IS 11320	Glass Fiber roving for the reinforcement of Polyester and of epoxide resin system
7	IS 11551	Glass fiber chopped strand mat for the reinforcement of epoxy, phenolic and polyester resin system
8	IS 1367 (Part 1 to 20)	Technical supply conditions for threaded steel fasteners
9	AWWA C950	Standard for fiberglass pressure pipe
10	AWWA M45	Fiberglass pipe design
11	ASTM D 3517	Standard Specification for "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin) Pressure Pipe
12	ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
13	ASTM D2583	Standard Test method for Indentation hardness of rigid plastics by means of a Barcol Impressor.

2.0 DESIGN REQUIREMENTS

a) Nominal Diameter

The nominal diameter of the pipe shall be as specified in the specification. The inside diameters and tolerances on diameters for the specified nominal diameter shall conform to the requirements stated in IS: 14402 / AWWA C 950 / ASTM D3517.

b) Length

Pipes shall be supplied in nominal lengths of 12m as per requirements. The tolerances on nominal lengths shall be as per relevant IS / AWWA / ASTM standards to which they are supplied.

c) Wall Thickness

The average Wall thickness of the pipe shall not be less than the minimum wall thickness published in the latest manufacturer's catalogue. However, minimum wall thickness in these published wall thicknesses of manufacturer shall conform to the tolerance limit as given in relevant IS / AWWA / ASTM standards to which GRP pipes are supplied.
Contractor shall submit design calculations as per AWWA M 45 & AWWA C 950 to establish the adequacy of pipe size, pressure class and stiffness class selected for the GRP pipes.

d) Pressure Class

Design Pressure of piping system is mentioned in the Annexure-A1. GRP pipes shall have adequate pressure class based on the given design pressure of pipes.

e) Stiffness Class

GRP pipes specified should have a minimum Stiffness Class of 5000 N/m2 to take care of the uncertainties of various loading conditions in different terrains. However, the actual stiffness class calculations as per AWWA-M-45/ relevant code shall be submitted to BHEL for approval.

f) Hoop and Longitudinal tensile strength

GRP pipe system shall meet the minimum hoop tensile strength and minimum longitudinal tensile strength requirements specified in IS 14402 / AWWA C 950 / ASTM D3517 for the considered pressure class based on the design pressure requirements mentioned in Annexure-1.

3.0 MATERIAL REQUIREMENTS

a) Resin

A thermosetting polyester resin (isopthalic resin) to be used and quality parameters shall be as per relevant IS / AWWA / ASTM standards.

b) Glass Fiber Reinforcement

Glass fiber reinforcement shall be of 'E-CR' type and shall conform to IS 11273, IS11320 or IS11551 as appropriate or relevant ASTM standards.

c) Wall Composition

GRP pipes must be provided with UV (ultraviolet) stabilizers in the resin system so that there should not be any degeneration during storage in the pipe surface due to ultraviolet light. Structure of pipe shall have chemical resistant liner, reinforced structural layer and outer surface layer.

d) Other Materials

Other materials used in the manufacturing of pipe like aggregates, fillers and additives shall be in accordance with the relevant IS / AWWA / ASTM standards.

4.0 MANUFACTURING REQUIREMENTS

The pipes shall be manufactured through Filament winding process (Continuous Filament Winding process using advancing mandrel method or Helical Filament Winding process with full automation)

5.0 GRP FITTINGS & SPECIALS

All GRP fittings, such as bends/ elbows, ends, tees, spools, flanges and reducers etc. shall be equal to or superior in performance to pipe of the same classifications and shall be smoothly finished internally.

All GRP fittings are to be manufactured in factory. Dimensions of the fittings shall be as per relevant standards, and drawings shall be submitted by Bidder to BHEL for approval.

Complete pipes to be installed by Bidder must be new & unused.

(a) Fittings made from straight pipe

Fittings shall be fabricated from complete pipes or portions of straight pipe complying with IS 14402 / ASTM standards, as applicable for the pipe classifications. The fitting shall comply with the declared design requirement and be suitably mitred. The mitre 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 are to be used. All fittings shall have sufficient end length of pipe to accommodate over wrapped length of fitting and pipe.

(b) 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.

6.0 JOINTING & INSTALLATION

GRP pipeline shall have a jointing & installation system that shall provide for fluid tightness for the intended service condition in line with relevant AWWA/ ASTM/ IS code mentioned above.
As per scope, Bidder has to provide Civil Design/ Technical inputs to BHEL for GRP piping. Bidder shall submit detailed installation procedure for BHEL's approval. It is Bidder's responsibility to ensure correct installation & proper quality of complete GRP system with also ensuring coordination with the BHEL's civil execution agency. Bidder shall be deemed responsible for any possible defect (like leakage through joints, excessive ovality or dislocation of joints & pipe spools) found in GRP piping during hydro testing of the system after complete installation.

(a) Below ground Piping

Based on Bidder's civil inputs, Civil Works i.e. excavation and concrete encasing for the below ground GRP pipes shall be done by BHEL during project execution.
GRP pipes and fittings shall be joined with unrestrained sleeve couplings (Double REKA joint) or un-restrained double 'O' ring Bell-Spigot joints. Below ground GRP piping shall be concrete encased (BHEL's scope).
Manholes of 600Nb size with MOC as GRP shall be provided by the Bidder as per location shown in the piping layout drawing. Cover for the same along with fasteners etc. shall be of steel and are in BHEL's scope.
For GRP piping layout, Bidder is requested to refer Annexure-3.

Further, please note that piping shall be laid as per details given in Figure-1. Bidder shall be provided with trench for pipe laying with concrete stage-1 casted for pipe jointing/ installation. Pipe transportation from storage yard to site, lowering & jointing and installation of fittings/ manholes are in bidder's scope. Completion of concrete encasement and backfilling shall be done by BHEL.

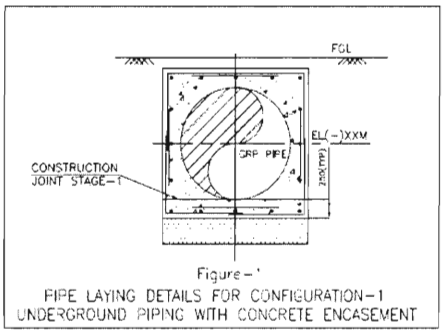


Figure-1
PIPE LAYING DETAILS FOR CONFIGURATION-1
UNDERGROUND PIPING WITH CONCRETE ENCASEMENT

(b) Flanged Joint

Flanged joints shall be used for connecting GRP pipes with Valves and Terminal ends (Flange details shall be as per AWWA). Flanged joints shall be used with EPDM gasket and hot dip galvanized bolts. The flanged joint is made from the same material as the pipe.

(c) Rubber Gaskets

Rubber gasket used with push-on flexible joints shall conform to the requirements of IS: 5382/ ASTM F 477. Rubber gaskets for use with flanged joints shall conform to IS 5382 or equivalent.

(d) Dewatering

Flooded trench condition shall be avoided as far as possible during erection of GRP Pipes. Suitable mitigation measures to prevent floatation of pipes shall be taken by Bidder, by considering suitable dewatering process.

7.0 TESTING

All piping & fittings shall be tested at shop as per Quality Plan (approved by BHEL/ Customer).

(A) TYPE TESTS

a. The Long term type tests (HDB & strain corrosion) should have been conducted by the manufacturer or its technology provider on GRP pipes at an independent laboratory or duly approved by accredited third party agency. Bidder shall submit these type test reports to BHEL during contract. In case the Type Test Certificate is more than Three (03) years old, Type Test shall be performed as per applicable standard.

b. The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days' notice shall be given to obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

(B) Field Hydrostatic Tests

The pipeline shall be hydro tested in stretches of suitable length at 1.5 times the maximum working pressure or 1.1 times the design pressure, whichever is higher.

8.0 MARKING FOR PIPE & FITTING

The marking on pipe shall include the following:

a. Standard mark for the pipes conforming to IS / AWWA / ASTM standards to which they are supplied.
b. The manufacturer's name or trademark.
c. The nominal pipe diameter
d. Class of pipe (Pressure & Stiffness)
e. Batch no. or date of manufacture

9.0 TRANSPORTATION, DELIVERY & SITE STORAGE

a. As per scope, complete GRP pipe transportation, delivery and site storage and handling at site is in bidder's scope. Bidder shall have to submit a write up for safe transportation and site storage in the contract stage. In case of transport by ship, packing shall be sea worthy so as to ensure safe delivery till site.
b. Inside plant boundary, open space shall be provided for material storage requirement. However, construction of any covered storage on the material handling area for the protection of material shall be in Bidder's scope.
c. As the complete installation of GRP pipe is in Bidder's scope, it shall be his responsibility to arrange all type of material handling requirements and storage for safe transportation and erection of GRP pipes inside & outside plant boundary area.
d. The material being delivered at site shall be jointly inspected by the BHEL's/ Bidder's representatives. Defective or damaged pipe shall be rejected or in case of minor damage, repair of the pipe may be allowed to the satisfaction of BHEL.

10.0 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 End Customer (If required). All inspection and testing shall be carried out by BHEL and CUSTOMER (if required). In case inspection is by both BHEL and CUSTOMER, then the inspection can be carried out jointly or separately.

11.0 DRAWINGS AND DOCUMENTS

A. The bidder shall furnish the following documents (2 sets) along with the bid:

i. Compliance certificate (as enclosed).
ii. Schedule of deviations, if any (as per compliance certificate).

iii. Pipe thickness, stiffness and other calculations as per relevant code.
iv. Quality Plan - duly signed & stamped.
v. Bidder's Field Quality Plan - duly signed & stamped.
vi. Relevant Catalogs with detailed technical information.
vii. Un-price schedule of prices.

B. The successful bidder shall furnish the following documents (2sets) to BHEL during the contract stage viz. after the award of contract:

i. Pipe thickness, stiffness and other calculations as per relevant code.
ii. GA drawings of Pipes, fittings, end caps (for Hydro-testing) with marking details and dimensions.
iii. GA drawings of Coupling with marking details and dimensions.
iv. GA drawings of Rubber gasket & center register dimensions.
v. Detailed installation drawing based on piping layout drawing (Annexure-3) indicating all details of piping coupling, fittings, etc.
vi. GA drawing of Pipe trench for various sections.
vii. Detailed supply, storage, piping erection & Hydro-test methodology indicating various stages of activities.
viii. Civil Design/Technical inputs for thrust blocks.
ix. Quality Plan - duly signed & stamped.
x. Bidder's Field Quality Plan - duly signed & stamped.
xi. Procedure for butt wrap joining of GRP pipe & fittings.
xii. Type test Reports of Hydrostatic design basis & Chemical resistance test.
xiii. Field hydro test procedure.
xiv. Procedure for HDB & strain corrosion test procedure.

BHEL	**QUALITY PLAN**	CUSTOMER: TANGEDCO	PROJECT: 2X660 MW Ennore SEZ STPP	PO No.:	-
		BIDDER/VENDOR: -	SPEC. NO : PE-TS-412-100-M042	QP No.:	PE-QP-412-100-M053 Rev-0A
		SYSTEM: GRP PIPING SYSTEM	ITEM: GRP PIPES & FITTINGS	Issue Date :	23.08.2017

S.No	Component/ Operation	Characteristics Checked	Category	Type/ Method of Check	Extent of Check	Reference Document/ Standard	Acceptance Norms	Format of Records	Agency P	Agency W	Agency V	Remarks
1.0	2	3	4	5	6	7	8	9	10			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.
		2.Viscosity	MA				600 cps + / - 20 %		2	1	1	
		3.Acid 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	Test certificates of Vender tested samples to be verified and Two samples from Lot of 100MT to be Witnessed by BHEL/BHEL Authorised Representative/
		6. Reactivity	MA				<40 min@ 25-exotherm peak		2	1	1	
		7. Exotherm peak	MA				140 - 180 deg cen		2	1	1	
		8. appearance	MA				clear no hage		2	1	1	
1.2	Fiber Glass	1.Roving Weight (Tex)	MA	Physical & Chemical	One sample from every Lot of 10MT per Type	IS 11320 & vendor spec	600 gm/ km+ / -10% 1200/2400/4400/4800 gm/km + / - 8%	MANUFACTURERS TEST REPORT	2	1	1	Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative.
		2.Moisture Content	MA				Max 0.3 %		2	1	1	
		3.Loss on Ignition	MA				+ / -20% OR 0.2% FROM THE NOMINAL VALUE STATED BY SUPPLIER (WHICHEVER IS GREATER TOLERANCE)		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.
		4.Conductivity	MA				Max 12.5 mS/m		2	1	1	
1.3	Silica Sand	1.Sieve Analysis (Particle Size)	MA	Physical , Chemical & Visual	One Composite Sample from every lot of 20MT	IS 14402 & vendor spec	0.05 - 0.8 mm	MANUFACTURERS TEST REPORT	2	1	1	Test certificates of the Raw material supplier to be reviewed by BHEL/BHEL Authorised Representative.
		2.Moisture Content	MA				Max 0.1%		2	1	1	
		3.Loss on Ignition	MA				Max 0.5%		2	1	1	
		4.Wettability	MA				Max 200 Seconds		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	
1.4	Rubber Gasket	1.Shore "A"Hardness	MA	Physical & Visual	5 % for dimensional & 25 % for Physical Appearance in every Lot	IS 5382 & vendor spec	50 + 5 / - 4	TEST CERTIFICATES REPORT	2	1	1	
		2.Dimension Check	MA				As per IS 5382:1985 Cl 3.6 & Approved Drawings		2	1	1	
		3.Material of Construction	MA	Compliance certificate	100%		EPDM (Type 2)	Compliance certificate of Sub-vender	-	-	1, 2	

BHEL	PARTICULARS	BIDDER/VENDOR	
Saurabh Duggal	NAME		
Saurabh	SIGNATURES		
25/08/17	DATE		BIDDER/VENDERS COMPANY SEAL

	QUALITY PLAN	CUSTOMER: TANGEDCO	PROJECT: 2X660 MW Ennore SEZ STPP	PO No.:	-
		BIDDER/VENDOR: -	SPEC. NO : PE-TS-412-100-M042	QP No.:	PE-QP-412-100-M053 Rev-0A
		SYSTEM: GRP PIPING SYSTEM	ITEM: GRP PIPES & FITTINGS	Issue Date :	23.08.2017

S.No	Component/ Operation	Characteristics Checked	Category	Type/ Method of Check	Extent of Check	Reference Document/ Standard	Acceptance Norms	Format of Records	Agency			Remarks
									P	W	V	
1.0	2	3	4	5	6	7	8	9	10			11
2.0	GRP PIPES											
2.1	Acceptance Tests	Dimensions (OD)	MA	Measurement	100%	IS 14402 :1996 & BS - EN 14364 : 2006 & also Technical data sheet of vendor	$	INSPECTION REPORT	2	1	-	Two Sample from every 100 Pipes to be witnessed by BHEL +Test certificates of 100% pipes tested by Vender to be verified by BHEL/BHEL Authorised Representative.
2.2		Wall Thickness	MA	Measurement			$	INSPECTION REPORT	2	1	-	
2.3		Workmanship	MA	Visual			IS 14402:1996;Cl.9	INSPECTION REPORT	2	1	-	
2.4		Soundness of Pipe (Hydrotest)	CR	Annex C,IS 14402			IS 14402:1996;Cl.12.2 (Two times Pressure Class)	INSPECTION REPORT	2	1, 4	-	
2.5		Nominal Length	MA	Measurement			As per Customer requirements	INSPECTION REPORT	2	1	-	
2.6		Marking	MA	Visual			As per Customer requirements	INSPECTION REPORT	2	1	-	
2.7		Barcol Hardness	MA	ASTM D - 2583			Min 40	INSPECTION REPORT	2	1	-	
2.8	Destructive Tests	Pipe Stiffness & Deflection	CR	Annex B,IS 14402	One sample from every 100 Pipes. (Min Two samples per Lot)		IS 14402:1996;Cl.10	INSPECTION REPORT	2	1, 4	-	One sample from every 100 Pipes. (Min Two samples per Lot)
2.9		Longitudinal Tensile Strength	CR	Annex D,IS 14402			IS 14402:1996; Cl.13 Table-06	INSPECTION REPORT	2	1, 4	-	
2.10		Hoop Tensile Strength	CR	Annex E,IS 14402			IS 14402:1996; Cl.14 Table-07	INSPECTION REPORT	2	1, 4	-	
2.11		Composition	CR	ISO 1172, ASTM D-2584			% Resin, Glass & Sand	INSPECTION REPORT	2	1	-	
2.12	Type Tests / Long term Tests	Hydrostatic Design Basis (HDB)	MA	Annex F,IS 12709	6 Samples (3Samples for 100Hrs and 3Samples for 1000Hrs)		IS 14402:1996;Cl.15	INSPECTION REPORT	2	1	4	Vendor to submit valid TEST Certificate 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 vendor to site at his risk and cost till successful conductance of test.
2.13		Chemical Resistance of Pipe (Strain Corrosion test)	MA	Annex F,IS 14402			IS 14402:1996;Cl.16	INSPECTION REPORT	2	1	4	

BHEL	PARTICULARS	BIDDER/VENDOR	
Sourabh Duggal	NAME		
	SIGNATURES		
25/08/17	DATE		BIDDER/VENDERS COMPANY SEAL

	QUALITY PLAN	CUSTOMER: TANGEDCO	PROJECT: 2X660 MW Ennore SEZ STPP	PO No.:	-
		BIDDER/VENDOR: -	SPEC. NO : PE-TS-412-100-M042	QP No.:	PE-QP-412-100-M053 Rev-0A
		SYSTEM: GRP PIPING SYSTEM	ITEM: GRP PIPES & FITTINGS	Issue Date :	23.08.2017

S.No	Component/ Operation	Characteristics Checked	Category	Type/ Method of Check	Extent of Check	Reference Document/ Standard	Acceptance Norms	Format of Records	Agency			Remarks
									P	W	V	
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 Vender to be verified by BHEL/BHEL Authorised Representative.
4.0	**GRP FITTINGS**											
4.1	Acceptance Tests	Workmanship	MA	Visual	100%	IS:14402 :1996	As per Vendor SPEC/STD/APPD DWGS	INSPECTION REPORT	2	1	-	One Sample per Type & Lot to be witnessed by BHEL +Test certificates of 100% fittings by Vender to be verified by BHEL/BHEL Authorised Representative.
4.2		Dimensions	MA	Measurement			As per Approved Drawings	INSPECTION REPORT	2	1	-	
4.3		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.		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%**	IS 14402 :1996	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 :

1. In case of Long Term tests are requried to be carried out as per IS14402, the dispatches to be made pending the test results to meet delivery requirement.
2. 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.
3. 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
4. BHEL /Customer or Authorised Representative may witness at any stage as deemed necessary during the contract execution.
5. Samples selected by BHEL for HYDRO test will only be identified by marking.
6. Lot size is the quantity offered in one inspection call/one inspection visit.

BHEL	PARTICULARS	BIDDER/VENDOR	
Saurabh Duggal	NAME		
Saurabh	SIGNATURES		
25/08/17	DATE		BIDDER/VENDERS COMPANY SEAL

	COMPLAINCE SHEET	SPECIFICATION NO. PE-TS-412-100-M042	
		REV. NO.: 0	DATE: 23.08.2017
		Sheet 1 of 1	

I hereby comply/not comply (*) to all the requirements of this technical specification in totality.

- **In case the bidder does not comply with the technical specification, the deviations shall be explicitly listed in the technical deviation sheet of GCC. Deviations listed in technical deviation sheet shall only be considered.**

Name of Bidder / Authorized Representative: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Designation: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Signature: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

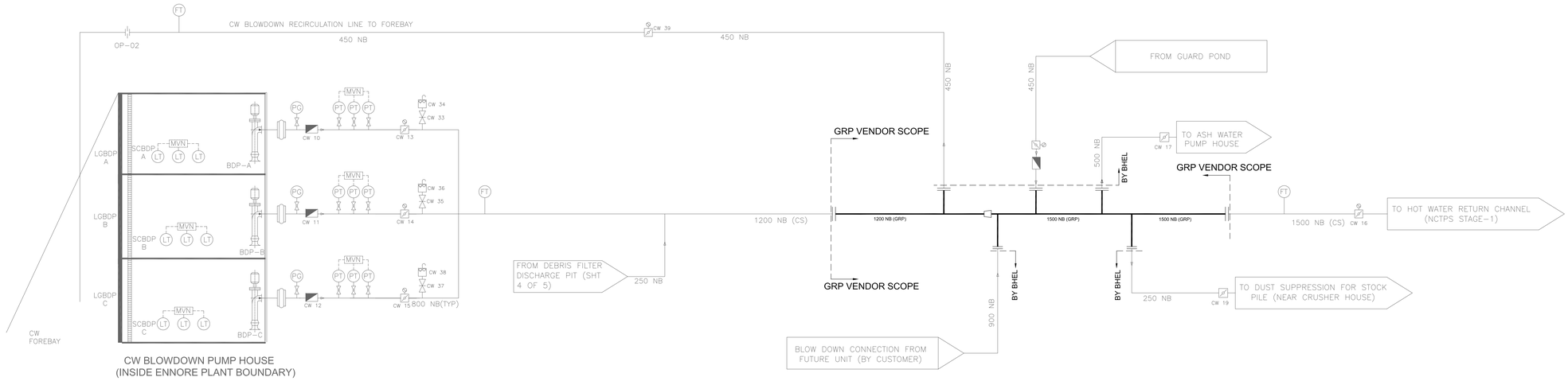
Company Seal: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Date: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

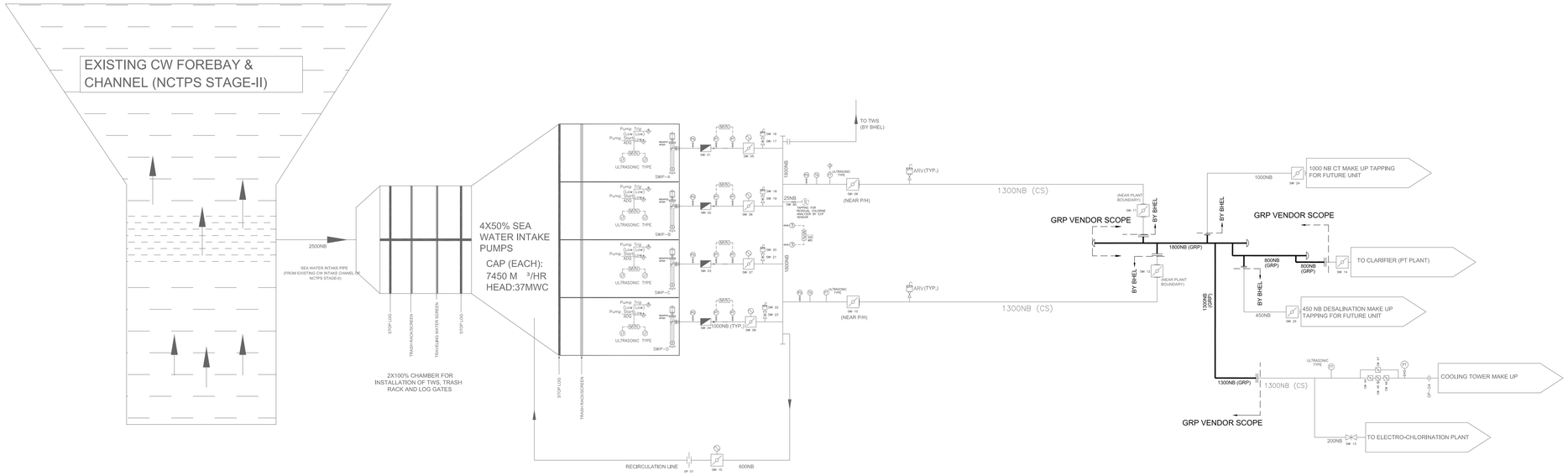
	BHEL			ANNEXURE-1: ESTIMATED BILL OF MATERIAL (GRP-UNDERGROUND)#														DOCUMENT NO:						REV NO: 00
																		PE-TS-412-100-M042						23.08.2017
				PROJECT TITLE: 2x660 MW ENNORE SEZ STPP											PREPARED BY		CHECKED BY:		APPROVED BY:					
				CUSTOMER: TANZEDCO											LG		SD		SK					

Sl. No.	LINE DESCRIPTION	OPERATING		DESIGN		PIPE MATERIAL	PIPE			BENDS / ELBOWS				TEES		REDUCERS		FLANGES		END CAPS		REMARKS
		PRESS. Kg/cm2 (g)	TEMP (°C)	PRESS. Kg/cm2 (g)	TEMP (°C)		OD (mm)	THK (mm)	LEN (M)	SIZE (NB)	R	θ dg	No	SIZE (NB)	No	SIZE (NB)	No	SIZE	No	SIZE (NB)	No	
Sea Water Intake System																						
1	Sea Water Intake Header	4	24 TO 41.5	7.5	50	GRP	1800	To be selected by Bidder	45	1800		90	1	1800*1300 1800*1000 1800*800	3 1 1			1300 1000 150	2 1 1	1800	2	Buried Piping
2	Cooling Tower Make up piping	4	24 TO 41.5	7.5	50	GRP	1300		730	1300		90 45	3 1	1300*600 1300*200	2 1	--		1300 600 200 150	1 2 1 1	--	--	Buried Piping
3	Make up piping to Clarifier	4	24 TO 41.5	7.5	50	GRP	800		1150	800		90	6	800*450 800*1800 800*800 800*200	1 1 1 4	--		800 450 200 150	1 1 4 1	800	1	Buried Piping
Cooling Water Blow Down System																						
4	CT Blowdown Piping	2.5	24 TO 41.5	5	60	GRP	1200	To be selected by Bidder	250	1200		90 45	1 1	1200*450 1200*600 1200*200	1 1 1	--	--	1200 600 450 200 150	1 1 1 1 1	--	--	Buried Piping
5	CT Blowdown Piping Header to Channel	2.5	24 TO 41.5	5	60	GRP	1500		550	1500		90	3	1500*900 1500*500 1500*450 1500*250 1500*600 1500*200	1 1 1 1 1 1	1500*1200	1	1500 900 450 500 250 600 200 150	1 1 1 1 1 1 1 1	--	--	Buried Piping

#Note: BOM provided is estimated BOM based on the drawing attached with the specification. Bidder to note that his scope includes supply of all items required for complete installation till Hydro-test of piping (other than those mentioned as free supply by BHEL) as per drawing including tools /tackles.



CW BLOW DOWN SCHEME



SEA WATER INTAKE PUMP HOUSE
(AT NCTPS STAGE-II, NEAR CW FOREBAY)

SEA WATER INTAKE SCHEME

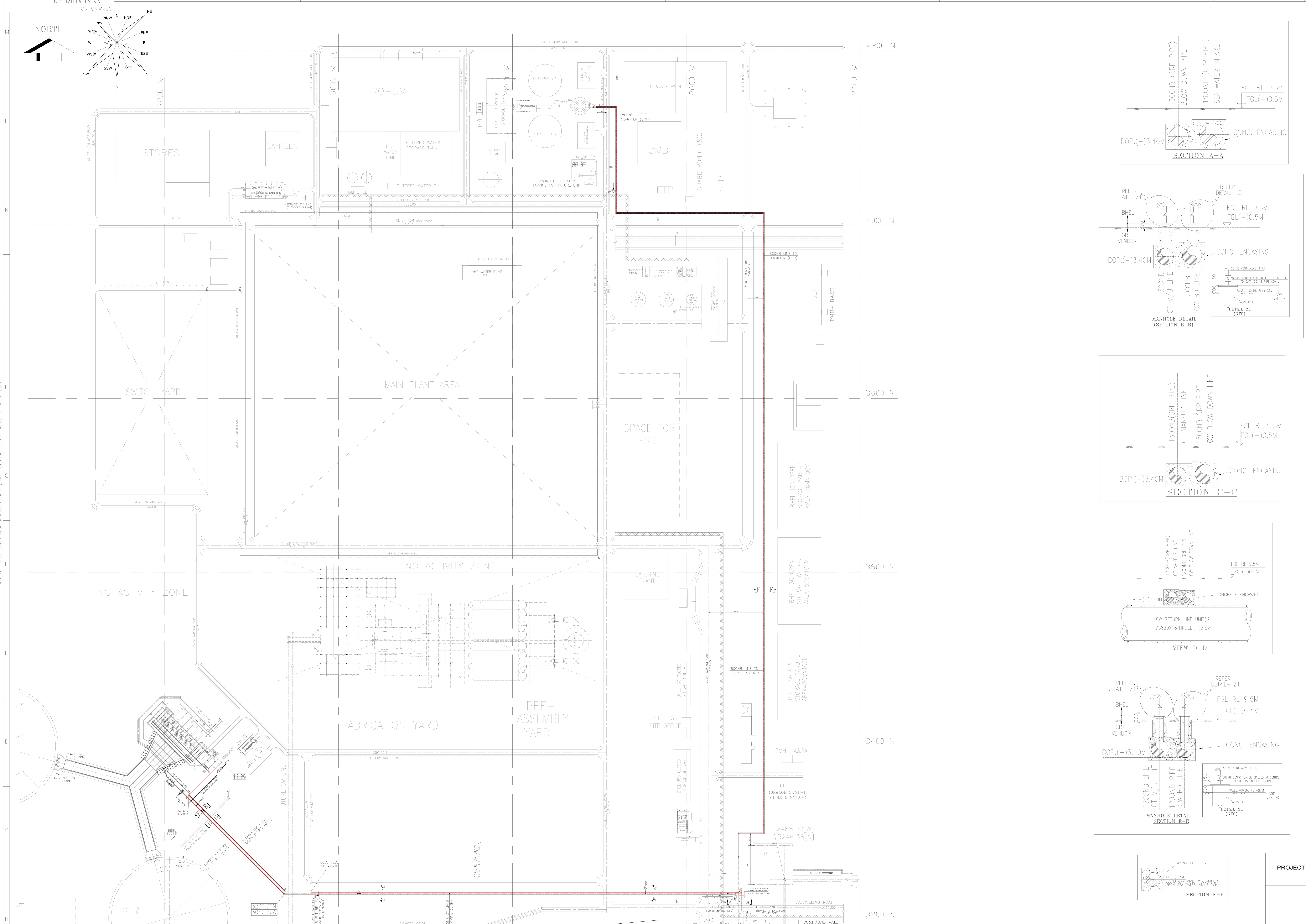
NOTES:

1. CW BLOWDOWN SYSTEM:
   DESIGN PRESS : 5.0 Kg/sq.cm (g), OPER. PRESS : 2.5 Kg/sq.cm (g)
   SEA WATER INTAKE SYSTEM:
   DESIGN PRESS : 7.5 Kg/sq.cm (g), OPER. PRESS : 4.0 Kg/sq.cm (g)
   DESIGN MECHANICAL TEMPERATURE: 60 °C
   OPERATING TEMPERATURE: AMBIENT TEMPERATURE (24 to 41.5 °C)
2. THE LOCATION OF TERMINAL POINTS SHALL BE REFERRED FROM THE LAYOUT DRAWING ATTACHED AS ANNEXURE–2.
3. ARVs SHALL BE INSTALLED IN THE SEA WATER INTAKE PIPING AND COOLING WATER BLOW DOWN PIPING AT SUITABLE LOCATIONS, WHICH SHALL BE CALCULATED BASED ON TRANSIENT ANALYSIS.
4. COMPLETE PIPING SYSTEM WITH FITTINGS (TEES, ELBOWS, EXPANDER/REDUCER, MANHOLES ETC.), FLANGED TAPPING FOR BRANCH PIPE CONNECTIONS, DRAINS, VENTS AND INSTRUMENTS, SHALL BE IN BIDDER'S SCOPE.
5. ISOLATION VALVES, ARVs, FLOW MEASURING DEVICE, INSTRUMENTATION SHALL BE SUPPLIED BY BHEL WITH FLANGED ENDS, AS FREE SUPPLY ITEMS.

ANNEXURE–2
(PIPING FLOW DIAGRAM)

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



NOTES:

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METER UNLESS OTHERWISE STATED.
2. PLANT FINISHED GRADED LEVEL (FGL) SHALL BE RL (+)9.50M.
   POWER HOUSE (TG BUILDING) FINISHED FLOOR LEVEL IS EL(+)0.00M, WHICH CORR. TO RL(+)10.0M.
3. CW BLOW DOWN DESIGN PRESSURE : 5.0 Kg/sq.cm (g)
   SEA WATER INTAKE DESIGN PRESSURE : 7.5 Kg/sq.cm (g)
   DESIGN MECHANICAL TEMPERATURE : 60 °C

JOB NO.	412
STATUS	CONTRACT
DISTRIBUTION	
TO	
No. OF	

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:-	BHARAT HEAVY ELECTRICALS LTD.

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN			
	DESN			
	CHD			
	APPD			

TITLE

PIPING LAYOUT FOR GRP PIPING INSIDE PLANT BOUNDARY

DEPT.	SCALE: 1:1500	DRAWING NO. ANNEXURE-3
SIGN		
DATE		SHEET 1 OF 1 — REV. 00

FORMAT SIZE A0

ANNEXURE-4

FOR BELOW GROUND GRP PIPE

	DATA TO BE FILLED BY THE BIDDER FOR EACH SIZE & PRESSURE CLASS		
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	-	
2.0	Stiffness Class 5000 N/m2 (min)	N/m2	
2.1	Design Pressure rating	Kg/sq.cm (g)	
2.2	Pressure Class considered	PN	
3.0	Standard permitted deflection	%	
3.1	Max. allowable long term vertical deflection (rel)	%	
	Calculations at Minimum Soil cover of 1.5 m or equal to pipe diameter, whichever is maximum (for design purpose)		
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	
	Calculations at Maximum soil cover of 4.0 m (for design purpose)		
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	