	GSPC PIPAVAV POWER COMPANY LIMITED		SECTION: D4.1
	TITLE		SHEET 1 OF 4
	700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV CIVIL WORKS - SCOPE OF WORK		SPEC. NO. TCE.4916A-H-500-001

**GENERAL**

1. This specification is to cover the design, preparation of general arrangement, construction as well as Fabrication drawings, supply of all labour as well as materials and construction of all civil, structural as well as architectural work on EPC basis for the proposed 700 MW (2X350 MW) Combined Cycle Power Project promoted by M/s GSPC Pipavav Power Company Ltd in the state of Gujarat.

2. Description of various items of work under this specification and nature of work in detail are given hereinafter. The complete work under this scope is referred to as CIVIL WORKS. Lists of various civil works are covered under the scope of work given in SECTION – D4.2.

3. The work to be performed under this specification consists of design, engineering, execution, supervision as well as providing all labour, materials, consumables, equipment, temporary works, temporary labour and staff colony, constructional plant, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of the plant, all in strict accordance with the specifications, including revisions and amendments thereto as may be required during the execution of the work.


4. All materials including cement, reinforcement steel, structural steel shall be arranged by the BIDDER.

5. The scope shall also include setting up by the BIDDER a complete testing laboratory in the field to carry out all relevant tests required for the civil works for the project.

6. The work shall be carried out according to the design/drawings to be developed by the BIDDER and approved by the OWNER. For all building and structures, foundations, etc., necessary layout and details are to be developed by the BIDDER keeping in view the statutory & functional requirements of the plant and facilities and providing enough space and access for operation, use and maintenance. Certain minimum requirements are indicated in this specification for guidance purpose only. However, the BIDDER's offer shall cover the complete requirements as per the best prevailing practices and to the complete satisfaction of the OWNER.

7. BIDDER shall inspect the site, examine and obtain all information required and satisfy himself regarding matters and things such as

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access to site, communications, transport, right of way, the type and number of equipment and facilities required for the work, availability of local labour, materials and their rates, local working conditions, weather, tidal / flood levels, subsoil conditions, natural drainage, etc. Ignorance of the site conditions shall not be accepted by the Owner as basis for any claim for compensation or extension of time. The submission of a bid by the BIDDER will be construed as evidence that such an examination was made and any later claims / disputes in regard to price quoted shall not be entertained or considered by the OWNER on account of ignorance of prevailing site conditions.

8. In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the Owner.

9.0 **GEOTECHNICAL INVESTIGATION**

OWNER has carried out a brief Geotechnical Investigation in the proposed power plant area and the Report is available with Owner. However this report along with the recommendation given here in shall be considered by the bidder for reference only.


9.1 Based on the above investigation, it is observed that the proposed site contains topographically flat area in which top layer of cohesive soils namely clayey silt up to 0.2m to 2.75m depth followed by highly weathered rock. BH6 and BH-16 contains soil stratum up to deeper level i.e. 5.75m and 9.50m which shows comparatively the worst condition in the whole area.


9.2 The rock is classified as Milolitic lime stone overlying Gaj Lime Stone. The ground water table is encountered at shallowest depth of 1.55m below G.L necessitating dewatering for deeper foundation. It is proposed to place the shallow foundation on weathered rock with at least 1.0m embedment in it. The recommended S.B.C at 1.5mts below G.L shall be considered as 20t/m<sup>2</sup>.

9.3 The top soil being plastic silty clay/ clayey silt followed by weathered disintegrated rock will permit the vertical excavation without side support upto 4.0m to 5.0m depth below ground level in dry condition as ground water has to be lowered by proper dewatering measures.

9.4 Chemical analysis of ground water shows high amount of chlorides and sulphates rendering it useless for concrete mixing and curing purpose.

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	GSPC PIPAVAV POWER COMPANY LIMITED		SECTION: D4.1
	TITLE	700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV CIVIL WORKS - SCOPE OF WORK	SHEET 3 OF 4
			SPEC. NO. TCE.4916A-H-500-001
<p>Sulphate contents of water should be reduced below 500mg/l and chloride content in water should be reduced below 1000mg/l for use in RCC and 200mg/l for use in plain concrete work as per IS: 3205.</p>			
9.5	Field permeability tests show that average co-efficient of permeability varies from $2.71 \times 10^{-3}$ cm/sec to $7.24 \times 10^{-4}$ . Soil permeability seems to be higher side due to presence of SP/SC/GC type of soil and disintegrated weather rock.		
9.6	The foundation for all major structures will be of pile or open type with ground improvement method. All minor structures will be of open type. As vast difference is observed in the strength of sub soil and ground water table level, the actual type of foundation shall be decided by the Owner during detailed Engineering after complete study of final geotechnical report.		
9.7	Alternatively BIDDER may make his own assessment for the type of foundations envisaged based on the report available with owner at his own risk. In any case, the Bidder has to carryout detailed geo technical investigation after the award of contract, through some approved/reputed agency and submit geotechnical investigation report with recommendations for Owner's review and approval. The recommendation given in approved final report becomes binding on the contractor. The Bidder is not eligible to increase his cost or demand any extension of time because the final report is in variance from preliminary report furnished by Owner.		
10.	<b><u>SURVEY DATA</u></b>  The OWNER is presently carried out a topographical survey of the proposed power plant area and the data is available with the Owner. The bidder shall be required to make the plant layout considering the contour and minimum cutting and filling. Bidder is required to do the grading for entire area by filling or cutting. Excess/surplus excavated material shall be disposed off by the Bidder as per the instructions of, the Employer upto a lead of about 5 km.		
11.	<b><u>STATUTORY REQUIREMENT</u></b>  BIDDER shall comply with all the applicable statutory rules pertaining to Factory act, Fire safety rule of Tariff Advisory Committee, Water act		
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	<b>GSPC PIPAVAV POWER COMPANY LIMITED</b>		SECTION: D4.1	
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT          NEAR PIPAVAV          CIVIL WORKS - SCOPE OF WORK</b>		SHEET 4 OF 4	
			SPEC. NO. TCE.4916A-H-500-001	
<p>of Pollution control board, Explosives act, local civil authority including building use permission etc. Provisions of Safety, health and welfare according to Factories act shall also be complied with. Statutory clearances and norms of State Pollution Control Board shall be followed. BIDDER shall obtain approval of Civil / Architectural drawings from concerned authorities before taking up the construction work.</p>				
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**GSPC PIPAVAV POWER COMPANY LIMITED**

TITLE

**700 MW (2X350 MW) COMBINED CYCLE POWER PLANT  
NEAR PIPAVAV  
CIVIL WORKS - SCOPE OF WORK**

SECTION: D4.2

SHEET 1 OF 2

SPEC. NO.  
TCE.4916A-H-500-001**1.0 SCOPE OF WORK**

1.1 The works covered in this section consists of collection of all site related data, conducting site investigations, design, preparation of all construction drawings, supply of all materials, construction, fabrication, erection and testing where necessary, of all structures required for housing all equipment and civil works for all services required for the Power Plant defined in the specification document. The Civil works shall include those required for Installation, Commissioning, testing, operation and maintenance of the Power Plant. The Scope will cover but not limited to the following buildings / structures / systems / facilities.

1.2 Site related investigations, consisting of

- a) Topography Survey
- b) Geotechnical Investigation

1.3 Site development works, consisting of

- a) Fencing.
- b) Roads, drains and culverts
- c) Storm water drainage
- d) Sewage / waste water drainage

1.4 Construction enabling works

- b) Construction water
- e) Construction power

1.5 Temporary buildings

1.6 GTG & STG Building

1.7 Control & switchgear building

1.8 Heat Recovery Steam Generator

1.9 Foundation inclusive of GTG, STG, BFP etc,


1.10 Steel stack for HRSG

1.11 Transformer yard structures & foundations

1.12 Switch yard structures & trenches

1.13 D M plant building, DM water storage tank & Condensate storage tank

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	GSPC PIPAVAV POWER COMPANY LIMITED		SECTION: D4.2
	TITLE		SHEET 2 OF 2
	700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV CIVIL WORKS - SCOPE OF WORK		SPEC. NO. TCE.4916A-H-500-001

1.14

Condenser cooling water system

1.15

Cooling water pump house, fore bay & C W pipe line

1.16

C W inlet & outlet conduits

1.17

Clarifiers, Chlorination room, clarified seawater storage tank, Filter water storage tank and pump houses

1.18

Make up water pipe line

1.19

Cooling tower

1.20

Sea water intake and allied works

1.21

Service water over head tank

1.22

Pipe, cable rack and pipe sleepers

1.23

Guard pond

1.24

Fuel gas receiving and metering station

1.25

Deaerator , BFP building, MCC room

1.26

DG and Air compressor room

1.27

Fuel gas control room

1.28

Gas conditioning skid

1.29

Permeate water storage tank

1.30


Permeate water pump house.


1.31

Workshop and stores


It is not the intent to specify herein all the works in the scope of this contract. The scope also includes all other buildings, structures and works necessary which are not specifically mentioned here but required for construction, operation and maintenance of the power plant are deemed to be included in the scope of the Contractor. All works shall conform to the specification. The works shall conform to high standards of design, engineering and workmanship. Design and construction shall conform in every respect to all local and state regulations governing such works and to stipulations of Indian Standards unless stipulated otherwise in detail specification.


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	<b>GSPC PIPAVAV POWER COMPANY LIMITED</b>	<b>SECTION: D4.3</b>
	<b>TITLE 700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV</b>	<b>SHEET 1 OF 2</b>
	<b>DOCUMENTS TO BE SUBMITTED BY BIDDER WITH EPC BID PERTAINING TO CIVIL WORKS</b>	<b>SPEC. NO. TCE.4916A-H-500-001</b>
<p>The following documents are to be submitted by bidder with EPC bid</p> <ol style="list-style-type: none"> <li>1. Suggested plot plan locating all buildings, structures, facilities, roads, temporary site office, etc. with their plan dimensions.</li> <li>2. Write up on proposed storm water drainage system furnishing layout of the drains, types of drains and suggested disposal system.</li> <li>3. Write up on proposed sewage disposal system for the toilet in various buildings and scheme for usage / disposal of the clear water.</li> <li>4. Write up on proposed treatment and disposal of effluent / waste water generated in the plant and scheme for usage / disposal of clear water.</li> <li>5. A detailed write up on Sea water intake system, Condenser cooling water system along with schematic drawing showing preliminary sizing and details of Cooling towers, channels, forebay and pump house, cold and hot water conduits and the method of construction.</li> <li>6. A detailed write up on make up water system for the cooling tower blowdown, covering, source of water, Intake / withdrawal arrangement, pump houses, conduits along with method of construction.</li> <li>7. A report on foundation proposed for various structures, buildings and facilities based on the data furnished by OWNER and further data collected by the BIDDER. Allowable safe bearing capacity for open foundation, depth of foundation, need for pile foundations, soil improvement if any required, special precaution against aggressive soil etc shall also be covered in the report.</li> <li>8. A write up on dewatering system proposed at the time of construction where deep construction such as for C.W. forebay and pump house etc. are to be executed where water table is higher.</li> <li>9. General arrangements / architectural drawings for all buildings and structures showing dimensions, levels, plans, sections, elevations, materials proposed, types of framing, wall / cladding, floors, roofs, types of finishes etc.</li> <li>10. Detail design criteria proposed to be adopted for each building, structures, foundations, facilities etc.</li> <li>11. A write up on the sizing and constructional details of steel stack with sketch showing detail of foundation along with list of appurtenances.</li> <li>12. List of software proposed to be used in various areas for analysis, design, drafting as well as project monitoring along with their sources and validation report for software.</li> </ol> <div> <b>ISSUE R0</b> </div>		


	<b>GSPC PIPAVAV POWER COMPANY LIMITED</b>		SECTION: D4.5
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV</b>		SHEET 16 OF 29
	<b>DESCRIPTION OF BUILDING, STRUCTURES AND FACILITIES</b>		SPEC. NO. TCE.4916A-H-500-001
14.1	Extent of the Switchyard will depend on the layout of the switchyard, which has been outlined in the Electrical section of this document.		
14.2	All steel structure for the Switch yard shall be hot double dip galvanised structure with welded / bolted connections at shop and bolted connection at site. All bolts and nuts shall also be galvanised. Minimum zinc consumption shall be 900 gms per square meters of exposed surface. Design criteria of Switchyard structure are furnished else where in the specification.		
14.3	Major steel structures are towers, beams, lighting masts etc. They are all of latticed construction using angle sections. In addition supporting structure for equipment, such as isolator, lightning arrestors, etc shall also be provided. These structures may be of tubular section or latticed as the case may be. Towers, beams etc shall be trial assembled at shop, keeping in view the actual site condition, prior to dispatch to erection site so that they can be conveniently pre-assembled before erection or conveniently assembled during erection.		
14.4	Lighting masts shall be provided with cage ladder. Where platforms are provided on lighting masts for mounting of lighting fixtures, they shall have protection handrails formed of galvanised section. Grating used for platforms shall be galvanised.		
14.5	Foundations may be open foundation or on piles based on soil / conditions.		
14.5	Trenches shall all be of RCC construction. Trench walls shall be designed to withstand a surcharge load of 1500 kg / sq.m. Trench wall shall project 150 mm above the paved / graded level to prevent ingress of storm / rain water. All trench, floors shall be given a slope of minimum 1 in 750 and the slope shall lead to a sump, where pump can be installed for drainage. Cover for cable trenches shall be as per specification.		
14.6	The complete area within the fencing for switch yard/transformer yard shall be provided with a mild slope towards peripheral RCC drains, which in turn will be connected to the plant drainage system. Entire switchyard area shall be provided with 75 mm thick paving using 20 to 40 mm size stone aggregate on top and 75 mm paving of 20 mm stone aggregate below. Before laying the paving, the ground surface shall be treated with anti weed chemicals as per manufacturer recommendations.		
14.7	Fencing around switch yard area shall comprise of PVC coated G-1 chain link fencing of minimum 8G (including PVC coating) of mesh size 75 mm and of height 2400 mm above toe wall with 600 mm high galvanised anti-climbing device with barbed wire (8 rows) such that total fence height of 3 m above toe wall is achieved. Other details of fencing such as anti-climbing device, fencing, toe wall etc shall be as explained earlier.		
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	GSPC PIPAVAV POWER COMPANY LIMITED	SECTION: D4.5
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV</b> <b>DESCRIPTION OF BUILDING, STRUCTURES AND FACILITIES</b>	SHEET 17 OF 29  SPEC. NO. TCE.4916A-H-500-001
	<p>15.0 <b><u>D.M PLANT BUILDING INCLUDING NEUTRALISING PIT AND LABORATORY</u></b></p> <p>DM Plant Equipment area shall be of structural steel construction with colour coated metal sheeting as roof. Side cladding shall be colour coated galvanised sheeting over 3000mm high Brick wall. Dimension and height of the building / structures shall be decided based on equipment layout and height of the vessels accommodated inside.</p> <p>15.1 Control room and laboratory shall be provided in an RCC framed building with brick cladding. Cable vault shall be provided below the Control room and switchgear room. Control room and laboratory shall be air-conditioned. False ceiling with colour coated aluminium-ceiling system shall be provided in this area. Under deck insulation shall be provided in the A/C area. Staircase in the control room complex shall be extended to the roof also. Flooring in control room shall have 2 mm thick PVC topping. Toilet along with the washrooms shall be provided in the ground floor. In case a transformer yard is provided the wall in front shall be designed to satisfy fire rating as per TAC. Roof shall be given elastomeric water proofing treatment as per specification. The external wall surfaces shall be provided with 20 mm thick plaster in two layers, the second layer of 6 mm shall be mixed with W.P compound. Internal plastering shall of 12 mm thick. Ceiling in areas where false ceiling is not provided shall be given ceiling plaster 6 mm thick. External finish shall be Granular finish (Vineratex) of 2mm thick over plain-faced cement plaster.</p> <p>15.2 Floor where acid / alkali spillage are expected shall be isolated with RCC kerb and the flooring inside shall be of acid / alkali resistant brick. The drains carrying acid / alkali mixed discharge shall be provided with AR brick lining. Acid / alkali unloading and storage area outside the building shall also be provided with kerb with a sump inside. This area shall also be provided with AR brick lining.</p> <p>15.3 Neutralising pit shall be in 2 compartments and designed as a water retaining structure with external damp proofing. Floor and walls of the pit shall be given A.R brick lining. Ceiling as well as floor supporting pumps, pumping the clear water from neutralising pit shall be given epoxy lining. Capacity of the pit shall be as specified in Mechanical Section of the document.</p> <p>15.4 DM water storage tank outside the DM plant, condensate storage tank near HRSG shall be supported on sand pad with ring wall.</p> <p>15.5 Walls inside the DM plant area shall be provided with chlorinated rubber based painting.</p> <p>15.6 The chemical laboratory shall be located on top of MCC room of WT Building. Filtered water storage tanks shall be located on top of Chemical laboratory.</p> <div>         ISSUE R0       </div>	

	GSPC PIPAVAV POWER COMPANY LIMITED	SECTION: D4.6a
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV</b>	SHEET 1 OF 14
	<b>PART A – GENERAL REQUIREMENTS</b>	SPEC. NO. TCE.4916A-H-500-001
<p>1.0      <b><u>General Requirement of building / Structures</u></b></p> <p>1.1      Design and construction of buildings, structures etc. shall take into account requirements for operation and maintenance of all equipment and its users. The buildings shall have good architectural features. The surrounding areas shall be properly micro levelled and graded.</p> <p>1.2      <b><u>Architectural Concept for Buildings</u></b></p> <p>            The architectural design concept of buildings shall be evolved considering the functional, technical and other requirements for efficient operation, ensuring comfortable working environment for personnel, satisfying the aesthetic requirements. Special care shall be taken to provide elegance and aesthetics, with effective use of appropriate treatment, materials, fittings and finishes. To achieve above objective CONTRACTOR shall employ a qualified architect/architectural firm to carry out all designs and hold all other architectural responsibilities for the project.</p> <p>1.3      The CONTRACTOR shall obtain and be conversant with all laws, by-laws and regulations of local and Statutory Bodies as applicable to the project. The architectural concept evolved should also take care of these requirements. The CONTRACTOR shall provide the drawings and documents for such statutory approvals.</p> <p>1.4      Parapet, Chajjas over window and door heads, architectural facias, projections, etc., shall be provided with drip course in cement sand mortar 1:3.</p> <p>1.5      Architectural Concepts</p> <p>            a) Layout of the plant area shall have definite hierarchy of road network depending upon its usage, aesthetic, visual sensibilities for creating road vistas, focal points, building back drops, building frames. General layout shall be evolved taking over the basis of landform and local climate and due consideration shall be given to orientation and wind direction. The resulting built mass shall present a definite image with in distinct vocabulary in the form of landmarks, nodes and skyline.</p> <p>            b) Main Plant building shall be architecturally treated in such a way hat it retains a monumental scale, yet presents a pleasing composition of mass and void with suitable and functionally designed projections and recesses. The overall impact of the building shall be</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">             ISSUE R0           </div>		

	<b>GSPC PIPAVAV POWER COMPANY LIMITED</b>	<b>SECTION: D4.6a</b>
	<b>TITLE</b> <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT</b> <b>NEAR PIPAVAV</b>	<b>SHEET 2 OF 14</b>
	<b>PART A – GENERAL REQUIREMENTS</b>	<b>SPEC. NO.</b> <b>TCE.4916A-H-500-001</b>
<p>one of aesthetically unified architectural composition having a comprehensible scale, blending tonal values with the surroundings and taking full consideration of the climatic conditions, the building orientation and the existing structures nearby.</p> <p>c) All other buildings and structures shall be architecturally treated in such a way so as to be in complete harmony with the main plant, surrounding structures and environment. Local architectural characters and materials may be judiciously imbibed. The building shall be designed initiating an architectural control common to all buildings. The architectural control shall be clearly spelt out in terms of scale, man and form.</p> <p>d) Overall colour scheme of the plant and other buildings shall be designed judiciously and in a comprehensive manner taking into account the mass and void of buildings, its facade, equipment, exposed structural elements, piping, trestles, bus ducts and other service elements.</p> <p>e) Overall emphasis shall be on developing an eco-friendly architecture, merging with the nature with its own sustainable energy management systems.</p> <p>The scheme shall be conceptually finalised in totality including that of equipment so that the proper coordination with other agencies can be taken up at appropriate time.</p> <p><b>B) Architectural Design</b></p> <p>a) Natural light shall be used to the maximum extent, especially in the form of north light/sky light. For adequate light and ventilation, National Building code recommendations shall be followed.</p> <p>b) Entrance canopies chajjas (projections, recesses) over openable windows and door openings on exterior facades shall be provided.</p> <p>c) All the buildings shall be architecturally designed to meet the National Building Code (SP: 7) norms and local building bye laws, wherever applicable.</p> <p>d) Architectural design and detailing aspects of all the buildings shall be rendered through professional services of an Architect. Statutory requirements may be required to be met with, wherever essential. The Architect Consultant shall be of</p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <b>ISSUE</b>  <b>R0</b> </div>		

	GSPC PIPAVAV POWER COMPANY LIMITED	SECTION: D4.6a
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV</b>	SHEET 3 OF 14
	<b>PART A – GENERAL REQUIREMENTS</b>	SPEC. NO. TCE.4916A-H-500-001
<p>National/International reputed having experience in similar kind of works. The consultant shall evolve the design philosophy based on Employer's guidelines and shall present it in the form of presentation drawings, Prospective views, 3-D Models and detail drawings.</p> <p>1.6 Service utility ducts shall be planned to take care of all piping such that no pipelines are visible from outside. However proper access to the ducts shall be provided at each floor along with platform in the duct for the purpose of maintenance.</p> <p>2.0 <b><u>ROOF ACCESS</u></b></p> <p>All roofs shall be provided with access through a staircase/ cage ladder. Minimum 1000 mm wide access path shall be provided with tiles to approach equipment on roof.</p> <p>3.0 <b><u>PLATFORMS AND WALKWAYS</u></b></p> <p>3.1 Platforms shall be provided to all major equipment, which are not directly accessible from the floors, for maintenance. Platforms and connecting walkways shall have a minimum width of 750 mm. Platforms in front of the entry shall be at least 900 mm wide. Platforms located close to each other shall be connected with walkways.</p> <p>3.2 All steel platforms above grade level shall be constructed with kick plates at edge of the platform to prevent tools or materials from falling off. It shall consist of 8 mm thick steel plate projecting 100 mm above the platform surface. Kick plate shall be painted with the same type of coating as the material to which it is attached.</p> <p>3.3 Continuous walkway, at least 500 mm wide shall be provided along the crane girder level with handrails on both sides of the building. Approach to EOT crane shall be ensured by Cage ladder or staircase</p> <p>4.0 <b><u>STAIRS AND LADDERS</u></b></p> <p>4.1 <b><u>Steel Stairs</u></b></p> <p>All steel staircases shall normally have minimum clear width (back to back of stringer) of 1000 mm and maximum inclination with horizontal of 35.75°. However, in case of space restriction, minimum clear width upto 750 mm and slope upto 45° may be provided. The vertical height between successive landings shall not exceed 5 m.</p> <div>           ISSUE R0         </div>		

	GSPC PIPAVAV POWER COMPANY LIMITED	SECTION: D4.6a
	TITLE <b>700 MW (2X350 MW) COMBINED CYCLE POWER PLANT            NEAR PIPAVAV</b>	SHEET 4 OF 14
	PART A – GENERAL REQUIREMENTS	SPEC. NO. TCE.4916A-H-500-001
<p>Channels (minimum MC200) shall be provided as stair stringers. Treads shall be minimum 275 mm wide of chequered plate/grating, with suitable nosing, and spaced equally so as to restrict the rise to maximum 180 mm.</p> <p><b>4.2      <u>Steel Ladders</u></b></p> <p>Ladders shall be provided to platforms, walkways, instruments and equipments which do not require frequent access. Ladders shall preferably be vertical and its angle with vertical shall not exceed 5°. Ladders shall be of minimum 450 mm clear width with 20 mm diameter MS rungs spaced at 300 mm (maximum). Ladders shall be provided with a safety cage of minimum 750 diameter clear when the top of ladder is more than 4.5 m above the landing level. However safety cages shall start at 2.5 m above the lower landing level.</p> <p><b>4.3      <u>RCC Stairs</u></b></p> <p>All stairs shall have maximum riser of 180 mm and a minimum tread of 250 mm. However, for administration buildings riser shall be limited to 150 mm and tread width of 300 mm. Minimum width of stairs shall be 1200 mm generally. All stairs normally shall have not more than 15 risers in one flight. Aluminium angle nosing with minimum 50X25X3 angle or PVC nosing shall be provided for edge protection of RCC stairs.</p> <p><b>5.0      <u>HANDRAILS</u></b></p> <p><b>5.1</b>      Handrails shall be provided at appropriate places to ensure safety e.g. around all floors/roof openings, projections / balconies, walkways, platforms, steel stairs etc.</p> <p><b>5.2</b>      All handrails shall be of 50 mm nominal bore MS pipes (medium class) as per IS :1161 galvanised using 750 gm/sq. m of zinc. Handrails for platforms, walkways and projections shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the protected horizontal opening. In such a case spacing shall not exceed 1850 mm center to center of posts. Handrails shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. For platforms at elevation more than 30 m, three rail system with top rail at 1500 mm shall be adopted.</p> <div style="border: 1px solid black; padding: 2px; text-align: center;">             ISSUE R0           </div>		

	GSPC PIPAVAV POWER COMPANY LIMITED		SECTION: D4.6a
	TITLE 700 MW (2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV		SHEET 5 OF 14
	PART A – GENERAL REQUIREMENTS		SPEC. NO. TCE.4916A-H-500-001

5.3

For RCC stairs, handrails with 20 mm square MS bar balustrade with suitable MS flat & aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.

6.0

**EDGE PROTECTION**

Wherever possible around floor openings an RCC kerb of 100 mm wide 150 mm high shall be provided. All concrete edges, where breakage of concrete corner is expected, shall be provided with angles at least L 50x50x6 with lugs for edge protection e.g. all round the cut-outs/openings in floor slab, edges of drains supporting grating covers, edges of RCC cable/pipe trenches supporting covers, edges of manholes supporting covers and supporting edges of precast covers etc.

7.0

**ANCHOR BOLTS AND INSERT PLATES**

7.1

Anchor bolts shall be designed for working stress, in tension and shear, for embedded length of the anchor bolts and pipe sleeves. Shear and crushing strength of concrete shall also be checked.

7.2

Insert plates shall be designed/checked for shear and bending moment. All lugs shall be checked for tension. Bond strength of concrete shall also be checked. Lugs using steel bars shall preferably be fillet welded to the plate to transfer full strength of the lug.


8.0

**VERTICAL HEADROOM**

8.1

All accessible areas shall be provided with a minimum clear headroom as follows, unless otherwise specified:

Finished floors to ceiling (buildings)	:	3000 mm
Doors, Walkways, Platforms, Stairs etc.	:	2100 mm
False ceiling of office areas	:	2400 mm
Walkway above false ceiling	:	1000 mm
Safety cage for ladders	:	2500 mm
Access for forklift trucks	:	2800 mm
Main roads/Railway crossings & crane access:		9000 mm
Other plant roads and truck access	:	6000 mm

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Cable & Pipe rack : 3000 mm  
(except Road/Rail crossings)

9.0 **EXPANSION/CONSTRUCTION JOINTS**

9.1 Expansion and construction joints shall be provided wherever required. All expansion and construction joints of water retaining structures in RCC shall be made watertight using PVC ribbed water stops with central bulb. However, kicker type (externally placed) PVC water stops may be used for the base slabs and in other areas where it is required to facilitate concreting. The minimum thickness of PVC water stops shall be 6 mm and minimum width 225 mm. At other joints these shall be 150 mm wide.

9.2 Two part polysulphide sealant conforming to IS:12118 shall be used for sealing of joints in contact with water. For other cases, bitumen sealing compound conforming to IS:1834 shall be used. Preformed bitumen impregnated fibre board conforming to IS:1838 shall be used as joint filler.


10.0 **BRICK / STONE MASONRY AND PARAPET WALL**

10.1 All masonry works shall be designed in accordance with IS:1905, IS:2212, IS:4326, IS:2185 and other relevant IS codes as applicable. Structural design of load bearing and non-load bearing walls constructed with solid burnt clay bricks / fly ash bricks confirming to IS: 12984 or concrete blocks shall be in accordance with criteria specified by Section 4 of National Building Code of India Part VI.


10.2 All walls shall be non-load bearing infilled panels walls. External walls of all buildings shall be at least one brick thick. All internal wall shall be at least one brick thick except for internal partition walls for office area, canteen, change rooms, first aid rooms and toilets which may be half brick thick. RCC bands (transoms and mullions) shall be provided wherever necessary to curtail the unsupported length/width of the wall.


10.3 50 mm thick DPC (1:1.5:3) with water proofing admixture followed by two layers of bitumen coating 85/25 grade as per IS:702 @ 1.7 kg./sq.m shall be provided at plinth level before starting masonry work.


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10.4	Bricks having minimum 35 kg/sqcm compressive strength shall be used for non load bearing super structure brick work. Cement sand mortar 1:6 for one brick thick wall and 1:4 for half brick thick wall shall be used. For half brick walls, RCC transoms and mullions shall be provided. Transoms shall be provided at lintel/door height. The spacing of the mullions shall not exceed 2000 mm center to center. The size of transoms/mullions shall be minimum 115 mm square with 4nos., 8 mm dia. bars and 6mm stirrups at 150 mm centers.		
10.5	Type, thickness and height of external wall, facing the transformer yard to take care of fire accidents in transformer yard shall be according to the requirements of Tariff Advisory Committee.		
10.6	Even where metal cladding is specified, for initial 3 m height from the ground level, minimum one brick thick masonry wall shall be provided.		
10.7	All upstands and parapet walls on roof shall be of RCC construction, minimum height of parapet walls shall be 750 mm and thickness 125 mm.		
11.0	<b><u>DRAINAGE</u></b>		
11.1	<b><u>Floor drainage</u></b>		
11.1.1	For all buildings and areas, suitable arrangement for draining out water collected from equipment blowdowns, leakage, floor washing, fire fighting, etc. shall be provided on each floor. Gully traps, inspection pits, collecting pits etc. shall be located suitably and designed considering flow volume, easy access, maintenance and safety.		
11.1.2	All drains inside the building shall have minimum 40 mm thick galvanised grating covers. In areas where heavy equipment loads would be coming, precast RCC covers shall be provided in place of grating. These drains shall lead the water to drain sump.		
11.1.3	Garland drains shall be provided around all buildings to receive the drainage water from roof and floor and lead them to the plant storm water drainage system.		
11.2	<b><u>Roof drainage</u></b>		
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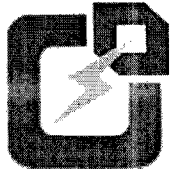
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<p>11.2.1 Roof drainage system shall be provided for quick and efficient draining of rainwater from roof to avoid seepage and damage to roof. The runoff gradient for the roof shall not be less than 1 in 100. Roof drainage system shall consist of roof drain heads, rainwater down take pipes and fixtures. System shall be designed to handle design requirements for the specific site and shall be in accordance to stipulations of IS:1742 and IS:2527. Roof drains shall conduct water to storm drains through down take pipes.</p> <p>11.2.2 Rain water down take pipes shall be of UPVC pipe of Class – 3 conforming to IS : 4985.</p> <p>11.3 <b><u>Sumps</u></b></p> <p>In case of underground structures, sumps with pumping arrangement shall be provided at suitable location to collect and pump out any incidental water collection to nearest storm water drains.</p> <p>12.0 <b><u>WATERPROOFING OF UNDERGROUND STRUCTURES</u></b></p> <p>12.1 All underground structures like water retaining structures shall have plasticiser cum waterproofing cement additives conforming to IS:9103. In addition, limits on permeability as given in IS:2545 shall also be met with. The concrete surface of these structures in contact with soil shall be provided with minimum two coats of bituminous painting of grade 85/25 conforming to IS:702 @ 1.7 kg/sq.m (minimum) for water / damp proofing. Also provision shall be made on the inner surface of walls and base slab, so that water proofing grouting can be injected after hydro testing case of leakage.</p> <p>12.2 In addition to above water proofing treatment, approved stone cladding with water proofing joints shall be constructed on outer faces including below base slab for all under ground structures to prevent of water being entering to the sump / tank etc. The stone cladding shall be follows.</p> <p>a) For base slab, a layer of PCC 1:4:8 shall be laid. Over PCC layer, two coats of acrylic polymer modified cement based flexible water proofing membrane of approved make laid as per manufacture's specification and instruction. Over water proofing membrane, 25mm thk CM 1:3 mixed with approved water proofing compound</p>		
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<p>at the rate specified by the manufacturer shall be applied. Over water proofing compound, protective layer of 15mm thk kota / cuddapa or equivalent stone with joints sealed with CM 1:3 shall be laid. Over this stone layer, RCC base slab shall be cast.</p> <p>b) For side walls, two coats of acrylic polymer modified cement based flexible water proofing membrane of approved make laid as per manufacture's specification and instruction shall be applied to the sides of RCC walls. 25mm thk CM 1:3 mixed with approved water proofing compound at the rate specified by the manufacturer shall be applied over it. Protective layer of 15mm thk kota / cuddapa or equivalent stone with joints sealed with CM 1:3 shall be laid. Water proofing compound. 25mm thk CM 1:3 mixed with approved water proofing compound at the rate specified by the manufacturer shall be applied.</p> <p><b>13.0     <u>ANTI TERMITE TREATMENT</u></b></p> <p>Pre-constructional anti termite treatment shall be given to all vulnerable areas susceptible to termite attack and shall include column pits, wall trenches, foundations, filling bellow the floors etc. as per IS: 6313 and other relevant Indian Standards.</p> <p><b>14.0     <u>PLINTH LEVEL</u></b></p> <p><b>14.1</b>     Finished ground floor level (plinth level) of all buildings and pump houses shall be minimum 300 mm above the formation level/grade level.</p> <p><b>14.2</b>     All cable vaults shall be located above ground level i.e. cable vaults shall not be provided as basements in the buildings.</p> <p><b>14.3</b>     Finished floor levels of HRSG area / transformer area yard paving shall be kept 150 mm lower than the finished floor level of turbine building.</p> <p><b>15.0     <u>STATUTORY REQUIREMENTS</u></b></p> <p><b>15.1</b>     All the applicable statutory rules pertaining to Indian Factories act, Factory rules of state government, Fire safety rules of Tariff Advisory Committee, Water act of Pollution Control Boards, Explosives act</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> ISSUE R0 </div>		


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<p>etc. and stipulations of other relevant statutory authorities shall be taken into consideration at the time of design.</p> <p>15.2 Provisions of safety, health and welfare according to Factories act shall be complied with design stage. These shall include provision of continuous walkway (minimum 500 mm wide) along crane-girder at crane girder level on both sides of the building, comfortable approach to EOT crane cabin, railings, fire escape, locker room for workmen, pantry, toilets, rest room etc.</p> <p>15.3 Adequate number of fire escapes shall be provided in a building. Fire proof doors, number of staircases, fire separation walls, lath plastering on structural steel member (in fire prone areas) shall be made according to the recommendation of TAC. For fire safety requirements of buildings IS:1641 and IS:1642 shall be followed in addition to TAC requirements. All masonry firewalls shall be minimum 350 mm thick and RCC firewall shall be minimum 200 mm thick.</p> <p>16.0 <u>TOILETS</u></p> <p>Minimum one number main toilet block each (for male and female) with required facilities shall be provided on each floor of Main plant building, and Admin / Service/ office building. Attached toilets shall be provided for all senior executive rooms and conference rooms. All other buildings shall have minimum one toilet block each. The facilities provided in the toilet block shall depend on the number of users. However, minimum facilities to be provided shall be as stipulated in subsequent clause. IS:1172 shall be followed for working out the basic requirements for water supply, drainage and sanitation. In addition, IS:2064 and IS:2065 shall also be followed.</p> <p>i) Each toilet block shall have the following minimum facilities. Unless specified, all the fittings shall be of chromium plated brass (fancy type):</p> <p>a) WC (Indian type, Orissa pan (580 x 440mm) as per IS : 2556 with all fittings including photo-voltaic sensor operated flushing system of appropriate capacity and type.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;">           ISSUE R0         </div>		

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<p>b) Urinal with all fittings with photovoltaic control flushing system as per IS: 2556 .</p> <p>c) Wash basin (oval shape) with photo-voltaic control fittings as per IS : 2556 to be fixed on concrete platform finished and under fixed with 20mm thick polished granite stone and float glass mirror (600 x 450 x 5.5mm) with bevelled edges.</p> <p>d) 25mm dia Stainless steel towel rail (600 x 20mm)., liquid soap holder cum. dispenser with all fittings.</p> <p>e) Stainless steel liquid soap holder cum dispenser .-2 nos</p> <p>f) Janitor room</p> <p>g) Provision for installation of water cooler with recessed floor and stainless steel grating for draining of spillage water, including provision for potable water supply connection.</p> <p>h) Electric operated hand dryer with photo voltaic control</p> <p>j) Provision of ventilation shaft. Attached toilets provided for senior executive rooms shall and conference room have one no. European WC, wash basin (oval shape) with all fittings as per IS : 2556 to be fixed on concrete platform finished and under fixed with 20mm thick polished granite stone and float glass mirror (600 x 450 x 5.5mm) with bevelled edges, 1 towel rail, 1 liquid soap holder cum dipensor with all fittings. WC shall be of western type 390 mm high as per IS:2556 (Part-2) with toilet paper roll holder and all fittings including flushing valve of appropriate capacity and type. Unless specified all other fitting and fixtures in the toilet shall have same specifications as stipulated in above clause with photo-voltaic sensor/controls. Sunken floor shall be avoided as far as possible. The same shall be achieved by providing false ceiling for roof slab below toilets. So that the maintenance of pipe line will be easier.</p>			
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<div> <b>17.0     <u>SITE LEVELLING</u></b> </div> <div> <b>17.1</b>     Earth to be used for filling purpose shall be sand or other inorganic materials and they shall be clean and free from shingle, salts, organic, large roots and excessive amount of sod, lumps, concrete or any other foreign substances. All clods shall be suitably broken to small pieces. Sand used for filling shall be clean, medium grained and free from impurities. Fines less than 75 microns shall not be more than 20 %. In any case, the materials to be used for filling purpose shall have the prior written approval of the Engineer. </div> <div> <b>17.2</b>     Fill shall be placed in horizontal layers not exceeding 300 mm compacted thickness. Each layer shall be watered and compacted with proper moisture content and with such equipment as may be required to obtain a compaction / density of 95% of Standard Proctor Maximum Dry Density. </div> <div> <b>17.3</b>     Compaction shall be carried out with 12 tonne rollers smooth wheeled, sheep foot or wobbly wheeled as directed by the Engineer. Each layer shall be wetted or the material dried by aeration to a moisture content of 3-5% above the optimum. Each layer shall be watered, rammed and compacted and tested for ensuring the desired degree of compaction. </div> <div> <b>18.0     <u>CONSTRUCTION METHODOLOGY</u></b> </div> <div> <b>18.1</b>     Construction and erection activities shall be fully mechanised from the start of the work. </div> <div> <b>18.2</b>     All excavation and backfilling work shall be done using excavators, loaders, dumpers, dozers, poclains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated places with specific approval of engineer. </div> <div> <b>18.3</b>     For controlled rock blasting specialized agency, equipped with sensors to assess the impact of the blast on the adjoining existing structures, shall be employed. </div> <div> <b>18.4</b>     Dewatering shall be done using the combination of electrical and standby diesel pumps. </div> <div style="border: 1px solid black; padding: 2px; text-align: center;"> ISSUE R0 </div>		


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<p>18.5 Pile installation equipment suitable for flushing with air lift technique shall be used for construction of bored piles.</p> <p>18.6 For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used.</p> <p>18.7 All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machines, gantry cranes, crawler mounted heavy cranes and other equipment like heavy plate bending machines, shearing machines, lathe, milling machines, etc. Use of derricks shall not be permitted. Special enclosures, for blast cleaning of steel structure surface preparation, shall be used.</p> <p>18.8 All handling of materials shall be with cranes. Heavy trailers shall be used for transportation.</p> <p>18.9 Mechanized modular units of scaffolding and shuttering shall be used.</p> <p>18.9 Grouting shall be carried out using hydraulically controlled grouting equipment.</p> <p>18.10 Roadwork shall be done using pavers, rollers and premix plant.</p> <p>18.11 All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. shall not be permitted.</p> <p>18.12 Heavy duty hoists for lifting of construction materials shall be deployed. Compressors for cleaning of foundations and other surfaces shall be used.</p> <p>18.13 Field laboratory shall be provided with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc. For testing of steel works, ultrasonic testing machines, radiographic testing machines, dye penetration test equipment, destruction testing equipment, etc. shall be deployed.</p> <p>18.14 All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are</p>		
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<p>trained in the respective trade shall be employed for executing that particular work.</p>			
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	<b>DESCRIPTION OF BUILDING, STRUCTURES AND FACILITIES</b>		SPEC. NO. TCE.4916A-H-500-001
14.1	Extent of the Switchyard will depend on the layout of the switchyard, which has been outlined in the Electrical section of this document.		
14.2	All steel structure for the Switch yard shall be hot double dip galvanised structure with welded / bolted connections at shop and bolted connection at site. All bolts and nuts shall also be galvanised. Minimum zinc consumption shall be 900 gms per square meters of exposed surface. Design criteria of Switchyard structure are furnished else where in the specification.		
14.3	Major steel structures are towers, beams, lighting masts etc. They are all of latticed construction using angle sections. In addition supporting structure for equipment, such as isolator, lightning arrestors, etc shall also be provided. These structures may be of tubular section or latticed as the case may be. Towers, beams etc shall be trial assembled at shop, keeping in view the actual site condition, prior to dispatch to erection site so that they can be conveniently pre-assembled before erection or conveniently assembled during erection.		
14.4	Lighting masts shall be provided with cage ladder. Where platforms are provided on lighting masts for mounting of lighting fixtures, they shall have protection handrails formed of galvanised section. Grating used for platforms shall be galvanised.		
14.5	Foundations may be open foundation or on piles based on soil / conditions.		
14.5	Trenches shall all be of RCC construction. Trench walls shall be designed to withstand a surcharge load of 1500 kg / sq.m. Trench wall shall project 150 mm above the paved / graded level to prevent ingress of storm / rain water. All trench, floors shall be given a slope of minimum 1 in 750 and the slope shall lead to a sump, where pump can be installed for drainage. Cover for cable trenches shall be as per specification.		
14.6	The complete area within the fencing for switch yard/transformer yard shall be provided with a mild slope towards peripheral RCC drains, which in turn will be connected to the plant drainage system. Entire switchyard area shall be provided with 75 mm thick paving using 20 to 40 mm size stone aggregate on top and 75 mm paving of 20 mm stone aggregate below. Before laying the paving, the ground surface shall be treated with anti weed chemicals as per manufacturer recommendations.		
14.7	Fencing around switch yard area shall comprise of PVC coated G-1 chain link fencing of minimum 8G (including PVC coating) of mesh size 75 mm and of height 2400 mm above toe wall with 600 mm high galvanised anti-climbing device with barbed wire (8 rows) such that total fence height of 3 m above toe wall is achieved. Other details of fencing such as anti-climbing device, fencing, toe wall etc shall be as explained earlier.		
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15.0	<b><u>D.M PLANT BUILDING INCLUDING NEUTRALISING PIT AND LABORATORY</u></b>	
	DM Plant Equipment area shall be of structural steel construction with colour coated metal sheeting as roof. Side cladding shall be colour coated galvanised sheeting over 3000mm high Brick wall. Dimension and height of the building / structures shall be decided based on equipment layout and height of the vessels accommodated inside.	
15.1	Control room and laboratory shall be provided in an RCC framed building with brick cladding. Cable vault shall be provided below the Control room and switchgear room. Control room and laboratory shall be air-conditioned. False ceiling with colour coated aluminium-ceiling system shall be provided in this area. Under deck insulation shall be provided in the A/C area. Staircase in the control room complex shall be extended to the roof also. Flooring in control room shall have 2 mm thick PVC topping. Toilet along with the washrooms shall be provided in the ground floor. In case a transformer yard is provided the wall in front shall be designed to satisfy fire rating as per TAC. Roof shall be given elastomeric water proofing treatment as per specification. The external wall surfaces shall be provided with 20 mm thick plaster in two layers, the second layer of 6 mm shall be mixed with W.P compound. Internal plastering shall be 12 mm thick. Ceiling in areas where false ceiling is not provided shall be given ceiling plaster 6 mm thick. External finish shall be Granular finish (Vineratex) of 2mm thick over plain-faced cement plaster.	
15.2	Floor where acid / alkali spillage are expected shall be isolated with RCC kerb and the flooring inside shall be of acid / alkali resistant brick. The drains carrying acid / alkali mixed discharge shall be provided with AR brick lining. Acid / alkali unloading and storage area outside the building shall also be provided with kerb with a sump inside. This area shall also be provided with AR brick lining.	
15.3	Neutralising pit shall be in 2 compartments and designed as a water retaining structure with external damp proofing. Floor and walls of the pit shall be given A.R brick lining. Ceiling as well as floor supporting pumps, pumping the clear water from neutralising pit shall be given epoxy lining. Capacity of the pit shall be as specified in Mechanical Section of the document.	
15.4	DM water storage tank outside the DM plant, condensate storage tank near HRSG shall be supported on sand pad with ring wall.	
15.5	Walls inside the DM plant area shall be provided with chlorinated rubber based painting.	
15.6	The chemical laboratory shall be located on top of MCC room of WT Building. Filtered water storage tanks shall be located on top of Chemical laboratory.	
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Following loading conditions shall be considered in addition to the loading from super structure for the design of sub structure of pump house, channels, sumps, tanks, reservoirs, trenches and other under ground structures.

13.1 Only liquid pressure from inside and no earth pressure and ground water pressure and surcharge pressure from outside (applicable only to the structures which are liable to be filled with water or any other liquid).

13.2 Earth pressure, surcharge pressure and ground water pressure from outside and no water pressure from inside.

13.3 Base slab of the pump house shall be designed for the condition of different combinations of pump sumps being empty during maintenance stages with maximum ground water table. Intermediate dividing piers of pump sumps and partition walls in channel shall be designed considering water on one side only and the other side being empty for maintenance.

13.4 Design shall also be checked against buoyancy due to ground water during construction and operation stage. Minimum factor of safety as per IS:3370 against buoyancy shall be ensured considering empty condition ignoring superimposed loads.

14.0 **SPECIAL STRUCTURES**

For the following structures additional loading criteria as mentioned below in addition to the criteria discussed above:

14.1 **Switchyard Structures**

14.1.1 The loading for the design of switchyard structures shall be as per IS: 802 Part 1/Sec 1:1995 (latest edition). Following loads shall be considered:

a) Dead load due to equipment and structure.

b) Wind load on towers, conductors, ground wires and insulator strings calculated as per Clause 8 and 9 of IS: 802.

c) Temperature effects consisting of effect of temperature variation and sag tension as per clause 10 of IS:802.


d) Climatic loads as per clause 11.2 of IS:802.


e) Anti cascading loads as per clause 11.3.1 of IS:802.

f) Torsional and longitudinal loads caused by breakage of conductor as per clause 11.3.2 and 16 of IS:802.

g) Construction and maintenance loads

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<p>h) Seismic loads as per IS:1893.</p> <p>i) Short circuit forces including “snap effect” in the case of bundled conductors.</p> <p>14.1.2 Switchyard structure shall be designed for the worst combination of above loads. The factor of safety for design of members shall be considered 1.2 for normal &amp; broken wire conditions and 1.5 for combined short circuit and broken wire conditions. Short circuit forces and wind forces shall not be considered simultaneously.</p> <p>14.3.3 Foundation shall be designed for a factor of safety 2.2 for normal and broken wire condition and 1.65 for combined short circuit and broken wire conditions. Design of foundation shall be carried out as per IS: 4091.</p> <p>14.2 <b><u>HRSG Support Structures</u></b></p> <p>14.2.1 The supporting structure shall be designed for the following :</p> <p>(a) Live / imposed loads</p> <p>(b) Dead loads</p> <p>(c) Static and dynamic loads of piping, movable equipment and maintenance parts</p> <p>(d) Cantilever loads of not less than 500 kg/m at a distance of 1200 mm from the external face or the columns, on both sides of the HRSG, for cable trays and walkways.</p> <p>(e) Seismic or wind loads as specified elsewhere in the specification</p> <p>(f) Temperature variation of <math>\pm 25</math> deg. C for atmospheric temperature variations</p> <p>(g) Temperature variations under HRSG operating conditions</p> <p>(h) The loads listed above indicate the minimum requirements</p> <p>14.2.2 HRSG supporting structures shall be so configured that the temperature of steel does not exceed 60 deg.C unless specified otherwise. Brackets shall be provided on both sides of the outermost row of columns of the HRSG for supporting cable trays and walkways, at a height not exceeding 10 m. The exact levels shall however, be decided during detail engineering.</p> <p>14.2.3 The bracings in the HRSG structure shall be provided such that under no circumstances normal / convenient access to all points in the boiler is blocked or obstructed.</p>			
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10.4 Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with min. DFT of 100 microns.

10.5 Top coat shall consist of one coat of epoxy paint suitably pigmented of approved shade and color with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

10.6 The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.

10.7 Total DFT shall not be less than 300 microns.

10.8 Intermediate / top / finishing coat paints shall be form the same manufacture and the paints shall have compatibility with one another. Applications shall be as per manufactures recommendations.

10.8 All other steel members like doors, rolling shutters, pipe supports etc. shall be painted as per the details as above

10.9 Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

10.10 Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

**11.0 REQUIREMENTS FOR SPECIFIC STRUCTURES**

**11.1 Switchyard Structures**

11.1.1 All switchyard structures comprising of towers, gantries, lightning masts, lighting towers, equipment structures etc. shall be galvanised steel with bolted site connection.

11.1.2 Three dimensional analysis shall be of carried out for structures like towers and gantries whereas two dimensional approach may be followed for equipment support structures.

11.1.3 All structural steel shall be of tested quality and shall conform to IS:2062. Steel tubes where used for equipment support structures shall conform to IS:1161.

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## GSPC PIPAVAV POWER COMPANY LIMITED

TITLE

### 700 MW(2X350 MW) COMBINED CYCLE POWER PLANT NEAR PIPAVAV PART D – STEEL STRUCTURES

11.1.4 All bolts and nuts shall be galvanised. In addition to heavy washers conforming to IS: 6610, spring washers conforming to IS:3063 shall be provided at all bolted connections. Bolts shall conform to IS:12427.

11.1.5 Fabrication and erection shall generally be as per IS:802 and IS:800; wherever there is a contradiction between two codes the provision in IS:802 shall govern.

#### 11.1.6 **Galvanising**

11.1.6 Galvanising of the towers shall be as per IS:4759 and IS: 2633 and as given in the following paras.

11.1.6.1 Before galvanising, the steel shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such other foreign matters as are likely to interfere with the galvanising process.

11.1.6.2 The acceptable values of the coating of zinc on the steel materials shall be in accordance with Table below:

KIND OF MATERIAL	COATING	
	<u>Average value</u>	<u>Minimum value</u>
Structural steel members except bolts,nuts and washers	Over 750 gm/sq.m	610 gm/sq.m
For bolts, nuts and washers	Over 550 gm/sq.m	500 gm/sq.m


11.1.6.3 The galvanised surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth, and shall be free from defects like discoloured patches, bare spots, globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

11.1.6.4 There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanised steel member shall withstand minimum four number of one minute successive dips in copper sulphate solution as per IS:2633 unless specified otherwise.

11.1.6.5 All galvanised members shall be treated with sodium dichromate solution or an approved equivalent after galvanising, so as to prevent white storage stains.

11.1.6.6 Wherever galvanised bolts, nuts, washers, accessories, etc. are specified these shall be hot-dip galvanised. Spring washers shall be electro-galvanised. Readily available GI nuts, bolts and washers conforming to galvanising requirements may also be used.

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11.1.6.7 CONTRACTOR shall ensure that galvanising is not damaged in transit. In the event of occurrence of any damage, CONTRACTOR shall at his own cost adopt scrapping and regalanising the member to satisfy the specific requirements.

11.2 **STEEL CHIMNEY**

11.2.1 The design and construction of chimney shall generally conform to IS:6533 and IS:800. Design and construction shall conform in every respect to Boiler and Factory Inspector's regulations, as well as Civil aviation authorities requirements. The basic dimension of the chimney such as clear diameter, height etc. shall be decided based on the temperature, composition and quantity of flue gases, draft requirements, pollution control regulation etc.

11.2.2 The stack shall be designed to resist stresses due to the following loadings and load combinations as specified in clause 6.5 of IS:6533.

i) Self weight of the stack along with permanent fixture  
ii) Weight of lining  
iii) Wind loading – both static and dynamic as per IS:6533 and IS:875  
iv) Earthquake load as per IS:1893  
v) Effect of temperature.  
vi) A live load of 300 kg/sq.m on each platform.


11.2.3 Steel used shall be as per IS:2062 grade A for sections and plates less than 20 mm in thickness and IS:2062 grade B for thicker sections and plates. The stack shall be so designed that stresses do not exceed those maximum permissible stress as specified in IS:6533 modified to take into account temperature effect.

11.2.4 Minimum thickness of the stack shall be the calculated thickness obtained from stress and deflection consideration plus allowance for corrosion as per table 1 of IS:6533 considering design life as 20 years. Minimum thickness shall not be less than 6 mm. Maximum deflection of the stack due to static wind loading shall not exceed 1/200 of the unsupported height of the stack.

11.2.5 The base plates and holding down bolts shall be adequate to take the load, moments and reactions between the shell and foundations generally satisfying requirements of IS:800. Anchor bolt shall be made 3 mm larger in diameter than computed dimension to satisfy stress levels. Helical strakes shall be provided for the top 1/3 portion of the unsupported height as explained in clause A.2.2 of IS:6533.

11.2.6 Stability of the structure and foundations as a whole or any part of it shall be checked as per IS:6533.

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<p>4.1.2 The underbed shall consist of well compacted ground supporting dry rubble soling of compacted thickness 225 mm with interstices properly filled with grits, followed by a layer of PCC of M 7.5, 50 mm thick.</p> <p>4.1.3 Paving in crane corridor shall be designed for the maximum load due to movement of crane.</p> <p>4.2 <u>P C C Paving</u></p> <p>4.2.1 PCC paving of nominal mix of grade M15, 150 mm thick laid over 150 mm thick compacted rubble soling shall be provided around all building as plinth protection to a width of 750 mm or the distance between the brick wall to the garland drain.</p> <p>a) Complete Transformer Yard, covering area between turbines building up to the fencing of the Transformer yard.</p> <p>b) Plinth protection around all building to a width of 1000 mm or the distance between the brick wall to the garland drain whichever is higher.</p> <p>4.3 <u>Stone Aggregate Paving</u></p> <p>4.3.1 Entire switchyard area and main transformer yard area shall be provided with 75 mm thick paving of 40 mm size stone aggregate on top and 75 mm thick paving of 20 mm stone aggregate below. Before laying the paving, the ground surface shall be treated with antiweed chemicals as per manufacturer recommendations.</p> <p>4.3.2 For auxiliary transformer yard, paving of stone aggregate of 75 mm thick using 20 mm size aggregate shall be provided after compacting the under bed and treating with anti-weed chemicals.</p>		
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