

1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT

KARNATAKA POWER CORPORATION LIMITED

TECHNICAL SPECIFICATION

FOR

MISCELLANEOUS TANKS

SPECIFICATION NO. : PE-TS-409-167-A001



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



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CCPP YELAHANKA, BANGALORE
INDEX**

SPECIFICATION NO. PE-TS-409-167-A001

VOLUME: II B & III

REVISION 00

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VOLUME – IIB

SECTIONS	TITLE	Page No
SECTION-A	INTENT OF SPECIFICATION	4
SECTION-B	PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA	7
SECTION-C	TECHNICAL SPECIFICATIONS	
	SECTION-C1 SPECIFIC TECHNICAL REQUIREMENT	10
	C1-A SCOPE OF SUPPLY	11
	C1-B DATASHEET AND SKETCH OF CST & DM WATER TANK	20
	C1-C DATASHEET OF BOUGHT OUT ITEMS	27
SECTION-D	STANDARD TECHNICAL SPECIFICATIONS	32

SECTION-E	ANNEXURE-I	LIST OF MAKES OF SUB-VENDOR ITEMS	47
	ANNEXURE-II	MANDATORY SPARE LIST	50
	ANNEXURE-III	PAINTING & COLOUR SCHEME	52
	ANNEXURE-IV	LIST OF COMMISSIONING SPARES	54
	ANNEXURE-V	DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE	56
	ANNEXURE-VI	MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	58
	ANNEXURE-VII	FORMAT FOR OPERATION AND MAINTENANCE MANUAL	60
	ANNEXURE-VIII	SITE STORAGE AND PRESERVATION	65

VOLUME-III

SECTIONS	TITLE	Page No
1	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	79
2	COMPLIANCE CUM CONFIRMATION CERTIFICATE	81
3	PRE BID CLARIFICATION SCHEDULE	84
4	NO DEVIATION CERTIFICATE	86
5	SUGGESTIVE PRICE FORMAT	88
6	LAYOUT DRAWING	92
7	INDICATIVE BILLING BREAKUP	94

VOLUME II B

SECTION-A

INTENT OF SPECIFICATION



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CCPP YELAHANKA**

SPECIFICATION NO. PE-TS-409-167-A001

VOLUME II-B

SECTION 'A'

REVISION 00

DATE: 11/01/2016

1.0 INTENT OF SPECIFICATION

1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, chemicals, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, minor civil works, preparation and submission of "As Built" drawings, site testing, carrying out Hydro tests at site and handover of **MISCELLANEOUS TANKS** as per the details in different sections / volumes of this specification for **370 MW (109 FB) CCPP YELAHANKA**.

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of **Miscellaneous Tanks** within quoted price.

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.

1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.

1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CAPP YELAHANKA**

SPECIFICATION NO. PE-TS-409-167-A001

VOLUME II-B

SECTION 'A'

REVISION 00

DATE: 11/01/2016

prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (**KPCL-Karnataka power corporation limited**) as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.
- 1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 1.12 BHEL's Customer's representative shall be given full access to the shop in which the equipment's are being manufactured or tested and all test records shall be made available to him.
- 1.13 Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.
- 1.14 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.
- 1.15 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

SECTION: B

**PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN
CRITERIA**

Yelahanka 1x350 MW CCPP Plant details

1	Topographical Details of site		
	a Latitude	:13 Deg 7 Min	
	b longitude	:77 Deg 35Min	
	c Elevation	: 900 Mtr (Please Refer the Contour Map)	
2	Highest Flood level	: Not applicable and can be finalized by studying the Plant Topography	
3	Elevation	: 900 Mtr (Please Refer the Contour Map)	
4	Annual Mean of Daily Max Temp	37.Deg.cent	
5	Annual Mean of Daily Min Temp	11.5 Deg cent	
6	Highest Temp Recorded	39.Deg Cent	
7	LowestTemp Recorded	9.9 Deg Cent	
8	Desigen Temperature	28.0 Deg Cent.	
9	Relative Humidity	at 830hrs	79%
		at 1730 hrs	52%
10	Annula total Rain Fall (Max rain fall during July to Oct)	970 mm	
11	Design Wind Speed	33M/sec (As per IS: 875)	
12	Earthquake Zone	Seismic Zone II As per IS 1893	

SECTION: C

TECHNICAL SPECIFICATIONS

SECTION: C 1

SPECIFIC TECHNICAL REQUIREMENT

SECTION: C 1-A

SCOPE OF SUPPLY



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CAPP YELAHANKA**

SPECIFICATION NO. PE-TS-409-167-A001

VOLUME II-B

SECTION 'C1'

REVISION 00

DATE: 11/01/2016

1.0 SCOPE OF SUPPLY

1.1 Steel tanks fabricated and supplied at site under this specification shall be as per enclosed DATA SHEET and sketch for Condensate Storage Tank & DM water storage tank. Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.

1.2

a) The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in the enclosed DATA SHEET and sketch for Condensate Storage Tank & DM water storage tank.

b) The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).

c) The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

d) Weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.

e) Pad plates on the tanks for supporting outside piping shall be provided by the bidder. Details of the pad plates (sizes, quantity etc.) shall be informed to bidder during detail engineering.

f) Fabrication and supply of all flanges and counter flanges for all nozzles and valves of tank connections shall be included in the scope of work of the bidder. Necessary bolts, nuts and gaskets for these connections shall also be supplied by the bidder.

g) The manhole shall be of hinged and bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 600 mm.


1.3 The scope of works shall also include supply and installation of special accessories as indicated in DATA SHEET and sketch for Condensate Storage Tank & DM water storage tank. The necessary fixtures and other accessories for mounting these special fittings shall be included in the scope of work of the bidder.

1.4 Level gauge / indicator for each tank shall be provided by the bidder along with all fittings & accessories as required for mounting the level gauge / indicator on the tanks. Float and board type level gauge / indicator shall be provided unless otherwise specified in Datasheet and sketch for Condensate Storage Tank & DM water storage tank for storage tanks.


1.5 Required number of tapings with 25NB instrument root valves shall be provided by the bidder for mounting instruments like level switches, level transmitters etc. The number of tapings shall be as indicated in the Datasheet and sketch for Condensate Storage Tank & DM water storage tank.

1.6

a) Sampling Connection with isolation valve of size 25 NB for each tank (if indicated in Data sheet for Condensate Storage Tank & DM water tank).

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 370 MW (109 FB) CAPP YELAHANKA	SPECIFICATION NO. PE-TS-409-167-A001	
		VOLUME II-B	SECTION 'C1'
		REVISION 00	DATE: 11/01/2016

- b) Drain valve of size 100 NB for CST tank and 100 NB for DM water storage tank shall be provided by the bidder unless otherwise indicated in the Datasheet and sketch for Condensate Storage Tank & DM water storage tank.
- c) Quantity and size of spare nozzles and valves shall be supplied by the bidder as per Datasheet and sketch for Condensate Storage Tank & DM water storage tank.
- 1.7 NaOH / KOH breather and seal pot shall be provided with necessary drain valve of size 25 NB with stainless steel construction unless otherwise specified in the Datasheet and sketch for Condensate Storage Tank & DM water storage tank. Two (2) nos. NaOH / KOH breather shall be provided by the bidder for each tank out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.
- 1.8 Pipes, fittings, nozzles, flanges and counter flanges shall be supplied by the bidder. The minimum requirement like quantity, size, type etc. are indicated in the Datasheet and sketch for Condensate Storage Tank & DM water storage tank and may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL. Material of construction of all pipes, fittings, nozzles, flanges and counter flanges shall be as per Datasheet and sketch for Condensate Storage Tank & DM water storage tank.
- 1.9
- a) Material of construction of all tanks shall be mild steel conforms to IS-2062 Grade – B.
- b) All valves shall be of stainless steel construction as per section C1-B for Condensate Storage Tank & DM water storage tank.
- 1.10 NaOH / KOH breather and seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH / KOH breather shall be provided through 200 NB SS pipe.
- Vent size calculation shall be furnished by the bidder during detail engineering stage based on the tank filling / emptying rate for approval and increase in vent size from the minimum size requirement, if any, shall be provided by the bidder without any commercial implication.
- The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.
- 1.11 The minimum number of anchor bolts along with the minimum size has been specified in clause no. 3.23 of this section. However, any additional anchor bolts of higher size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication.
- 1.12 Bidder shall provide adequate numbers of earthing / grounding pads for each tank. Each pad shall be made of mild steel of required size, which will be informed to the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL. Further, grounding of tank with the earth mat shall be in BHEL scope.
- 1.13 Painting of the tanks is included in bidder's scope of work. Painting specifications of storage tanks / seal pot / NaOH / KOH breather are enclosed in **Annexure – III**.
- 1.14 Commissioning spares as specified in Annexure-IV shall be in bidder's scope.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 370 MW (109 FB) CAPP YELAHANKA	SPECIFICATION NO. PE-TS-409-167-A001	
		VOLUME II-B	SECTION 'C1'
		REVISION 00	DATE: 11/01/2016

1.15 Platforms, monkey ladder inside tank, staircase (hand railing, knee guard and toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice (as indicated in the Datasheet for Condensate Storage Tank & DM water storage tank) shall be included in bidder's scope of work. All stair tread and platforms shall be made from 8 thk. chequered plate. Roof level interconnection between DM storage tanks or CST both shall be done.

1.15 Suitable structural items like channels and saddle supports shall be provided for fixing the tank with foundation for each of rectangular tank and horizontal cylindrical tank respectively.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

2.1 Design, engineering, preparation of detailed fabrication drawings, bill of material, tag and piece numbers, welding procedures etc. Stiffeners and other structural framing for supporting the tank shall be designed by the fabricator and properly shown in the fabrication drawings.

2.2 Erection & Commissioning of Tanks.

2.3 Erection of all foundation bolts / anchor bolts etc. as required for any equipment/ foundation /concrete.

2.4 Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of pockets, excavation & filling of earth for buried MS pipes if and as required.

2.5 Inspection & testing and carrying out demonstration test.

2.6 Painting of tank and other equipment within the battery limit.

2.7 Any other equipment / material / services as required to make the installation complete in all respects shall be deemed to be included in bidder's scope of work whether mentioned above or not.


3.0 DESIGN CONSIDERATIONS

3.1 The successful bidder shall furnish design calculations to BHEL during detailed engineering stage for approval along with the Xerox copies of relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. Calculation shall be necessarily done in **SI UNITS** only for the followings: -


a) Tanks shall be designed as per IS – 803 / API – 650 Good engineering practice as applicable and referred code shall be of latest edition. However, requirement of codes and standards shall be as indicated in the Datasheet for Condensate Storage Tank & DM water storage tank

b) Weight calculation of plates, appurtenances & structures separately shall be included in the Design calculation.


c) Design of roof and roof structures for vertical storage tanks shall be designed based on guidelines given in the book titled "Process equipment design" by Brownell and Young.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 370 MW (109 FB) CAPP YELAHANKA	SPECIFICATION NO. PE-TS-409-167-A001	
		VOLUME II-B	SECTION 'C1'
		REVISION 00	DATE: 11/01/2016

- d) Tank stability calculation (wind load / seismic / overturning stability) shall be done as per API – 650, latest edition. However, factors / coefficients as required for the design of tank shall be obtained from BHEL by the bidder after placement of order.
- d) Vent sizing calculation shall be done as per API – 2000, latest edition
- e) Sizing calculation for vent, NaOH / KOH breather, seal pot and breather valve.
- 3.2 The successful bidder shall indicate references of all the clauses indicating their page number from respective standard in the design calculation during detail engineering stage. All calculations shall necessarily be done in SI units only. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation.
- 3.3
- a) Bottom plate shall be 8.0 mm thick (minimum). Minimum 6 mm (excluding tolerance on plate as per relevant IS) thick plates including corrosion allowance shall be provided for shell plates and minimum 6 mm for roof plates for all tanks. Calculation for the plate thickness shall be got approved from BHEL /Customer during detailed engineering stage. However, if the addition / summation of calculated value of plate thickness (excluding tolerance on plate as per relevant IS) / nominal minimum thickness specified in the relevant design code / standard and corrosion allowance of 3 mm comes out more than 8 mm then the nearest available (higher side) plate thickness in the market shall be provided for bottom, shell and roof plates without any commercial implication. For calculating shell plate thickness. IS 803 to be used.
- b) Negative tolerance on plate thickness shall not be considered in the plate thickness calculation and also shall not be provided in the tank. Only positive tolerance shall be considered.
- 3.4 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650 and as per the design code indicated in DATA SHEET for Condensate Storage Tank & DM Tank.
- 3.5 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties.
- 3.6 In calculating the minimum plate thickness, the specific gravity of the liquid shall not be taken less than 1.
- 3.7 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.
- 3.8 Vessels seams shall be so positioned that they do not pass through vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.
- 3.9 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.
- 3.10 Due consideration shall be given by the supplier for wind load and earthquake effect in the design of tanks.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 370 MW (109 FB) CAPP YELAHANKA	SPECIFICATION NO. PE-TS-409-167-A001	
		VOLUME II-B	SECTION 'C1'
		REVISION 00	DATE: 11/01/2016

- 3.11 For the tanks being of diameter larger than 3.75 m added structural supports in the form of rafter shall be provided.
- 3.12 Reinforcement in tanks shall be provided as per design code as indicated in DATA SHEET for Condensate Storage Tank and DM water storage tank. The reinforced connection shall be completely pre - assembled into shell plate.
- 3.13 The joint efficiency factor to be adopted for design calculation shall be in accordance with the specified design code.
- 3.14 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m² of projected area.
- 3.15 Staircase / access ladder and hand railing shall be provided as per the relevant codes and standards.
- 3.16 Water draw off sump shall be provided as per the relevant design code, latest editions.
- 3.17 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for bolts and nuts shall be SA 193 & 194 respectively.
- 3.18 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the sketches attached with the data sheets are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.
- 3.19 Bidder shall furnish the STAAD calculation along with the roof structure calculation during detail engineering for checking the stability of roof.
- 3.20 Provision shall be made by the bidder to minimise the air ingress in the tank through float with arrow type level gauge and details of the same shall be furnished during detail engineering stage for BHEL's approval and approved arrangement shall be provided by the bidder without any commercial implication.
- 3.21 The tank shall be designed for filled water head / atmospheric pressure and design temperature for the tank shall be as specified in the DATA SHEET for Condensate Storage Tank and DM water storage tank.
- 3.22 Bidder to note that surface cleaning shall be of Blast clean type. However Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL.
- 3.23 Bidder to note that foundation drawing along with loading data & anchor bolt details shall be provided by bidder within two weeks' time from the LOI. **Bidder to provide minimum 12 nos., M27 anchor bolts for Condensate Storage Tank and minimum 12 nos., M30 anchor bolts for DM water Storage Tank irrespective of calculation for tank stability.**
- 4.0 WELDING**
- 4.1 Welding shall be in accordance with the requirement of IS: 803, 816, 817 and 823 or equivalent.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS 370 MW (109 FB) CAPP YELAHANKA	SPECIFICATION NO. PE-TS-409-167-A001	
		VOLUME II-B	SECTION 'C1'
		REVISION 00	DATE: 11/01/2016

4.2 Welding sequence shall be adopted in such a way so as to minimize the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.

4.3 All welders shall be BHEL / customer / consultant qualified as per the approved quality plan / field quality plan which will be submitted by the successful bidder during detail engineering stage. WPS and PQR shall be submitted by the successful bidder to BHEL / customer / consultant for review and approval.

5.0 TEST AND INSPECTION

5.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant's approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial implication.

5.2 DPT / MPI on all welds (100%).

5.3 All cross / Tee joints and butt welds to be 10% Radio graphed.

5.4 For the offered tanks, fill test shall be carried out for at least 24 hours. Atmospheric storage tanks on inside surface shall be leak tested before painting.

5.5 All quality plans / checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.

6.0 PAINTING

Annexure-III to be referred for painting.

7.0 LIST OF COMMISSIONING SPARES

Annexure-IV to be referred for Commissioning Spares.

8.0 TERMINAL POINTS

Matching counter flanges for all nozzles mounted on the tank and its accessories. However, counter flanges for all nozzles and valves of tank shall be provided by the bidder.

9.0 EXCLUSIONS

Tank foundation & associated civil works are excluded from bidder's scope of work. However, foundation drawing along with loading data, anchor bolt details etc. shall be furnished by the successful bidder during detailed engineering stage.



**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CAPP YELAHANKA**

SPECIFICATION NO. PE-TS-409-167-A001

VOLUME II-B

SECTION 'C1'

REVISION 00

DATE: 11/01/2016

10. DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The bidder must submit the drawings / documents as mentioned under "CHECK LIST FOR DOCUMENT TO BE SUBMITTED" (In Volume-III) along with their bid in 4 sets. In absence of any of these documents, BHEL reserves right not to evaluate the offer of the concerned bidder.

11.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under Annexure-VI during detail engineering for approval / information / reference (as the case may be):-

12.0 OTHER TECHNICAL REQUIREMENTS

- 1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.
- 4) Commercial implication includes price implication as well as delivery implication.
- 5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).
- 6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code.
- 7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.
- 8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.
- 9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.
- 10) All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.

**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS TANKS
370 MW (109 FB) CCPP YELAHANKA**



SPECIFICATION NO. PE-TS-409-167-A001

VOLUME II-B

SECTION 'C1'

REVISION 00

DATE: 11/01/2016

- 11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.
- 12) Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.

SECTION: C 1-B

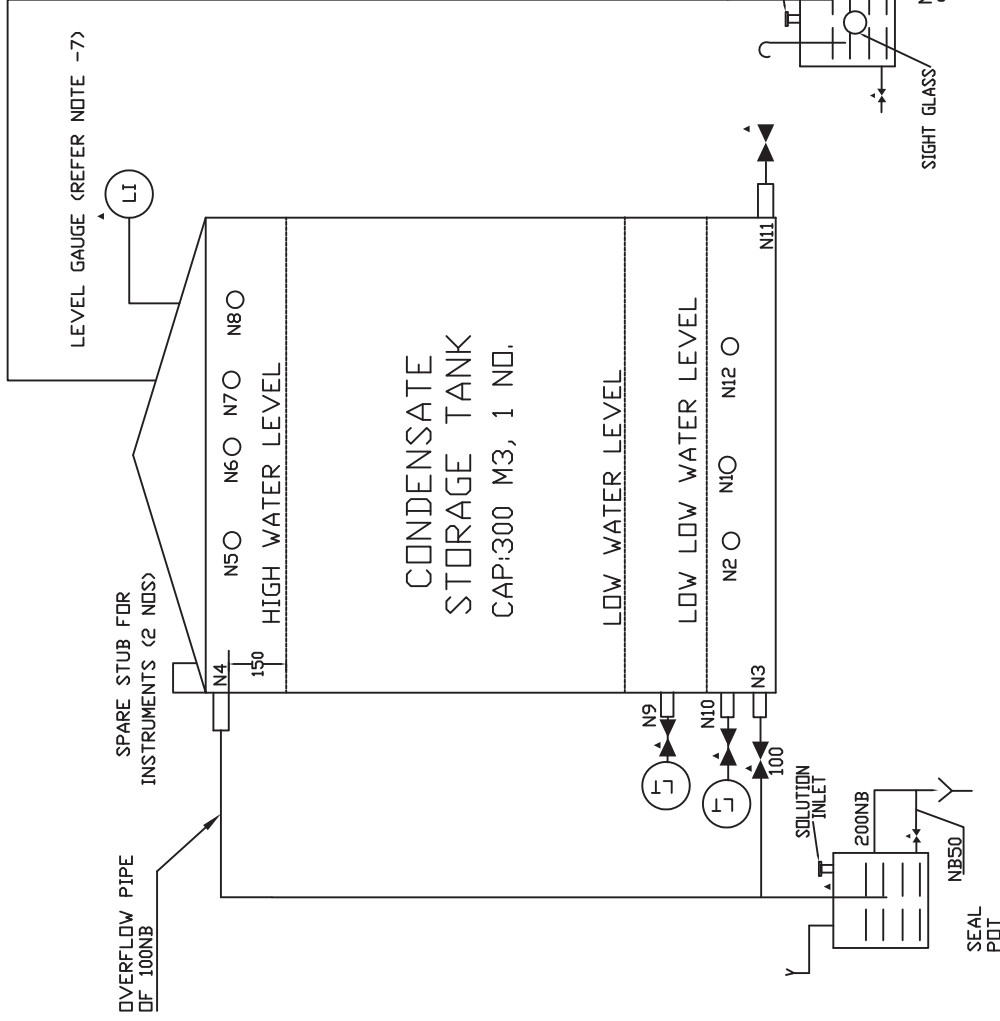
DATASHEET AND SKETCH OF CST & DM WATER TANK

BHEL PEM	DATA SHEET FOR CONDENSATE STORAGE TANK		DOC NO: PE-DC-409-167-A001
	PROJECT TITLE: 370 MW (109 FB) CAPP YELAHANKA,BANGALORE		REV NO: 00
1	SERVICE IDENTIFICATION	CONDENSATE STORAGE TANK	
2	P&ID NO.	PE-DG-409-100-N110 (BEING SUBMITTED SEPARATELY)	
3	SYSTEM	DM WATER SYSTEM	
4	APPLICABLE CODES/STATUTORY REGULATIONS	IS-803/API650	
5	CAPACITY	300 M ³	
6	NUMBER REQUIRED	ONE (01) NO	
7	STORAGE MEDIUM	DM WATER / CONDENSATE	
7a	OPERATING PRESSURE	ATMOSPHERIC PRESSURE	
7b	DESIGN PARAMETER	FILLED WATER HEAD+ATMOSPHERIC	
7c	HYDROSTATIC PRESSURE	FILLED WATER HEAD	
8	TYPE	VERTICAL, CYLINDRICAL	
9	SIZE	8.0 M (DIA) X 7.5 M (HEIGHT)	
10	PRESSURE CLASS	DESIGN FOR FILLED WATER HEAD / ATOMSPHERIC	
11	MATERIAL OF CONSTRUCTION	STRUCTURAL STEEL TO IS:2062 CORROSION ALLOWANCE= 3.2 mm INCLUDING MILL TOLERANCE	
12	MINIMUM PLATE THICKNESS INCLUDING CORROSION ALLOWANCE	BOTTOM – 8 MM, SHELL - 6 MM , ROOF- 6 MM	
13	COURSE WIDTH OF PLATES	1.25M*/1.5M/1.8M/2.0M AS PER IS:803. (*)1.25 M WIDTH PLATES SHALL BE USED ONLY WHEN THE OTHER SIZES AS SPECIFIED (I.E 1.5/1.8/2.0M) ARE NOT AVAILABLE DURING THE EXECUTION OF THE TANKS)	
14	JOINT EFFICIENCY	0.85	
15	DESIGN TEMPERATURE	60 °C	
16	LOCATION OF INSTALLATION	OUTDOOR	
17	DRAIN VALVE FOR TANK	100 NB	
18	DRAIN VALVE FOR NAOH BREATHER	25 NB	
19	DRAIN VALVE FOR SEAL POT	50 NB	
20	NOZZLE CONNECTIONS REQD / END CONNECTION	AS PER ENCLOSED SKETCH SW FOR SIZE <= NB50 & BW FOR SIZE > NB50	
21	PIPE / NOZZLE MATERIAL	STAINLESS STEEL TO SA312 TP 304, SCH 10S FOR > NB50 & 40S FOR <=NB50 (REFER ANNEXURE-III)	
22	PIPE MATERIAL FOR HAND RAILING	CARBON STEEL, GALVANIZED, MEDIUM GRADE (REFER ANNEXURE-II)	
23	VALVES MATERIAL	STAINLESS STEEL (REFER ANNEXURE-IV)	
24	VALVES END CONNECTION	SOCKET WELDED FOR SIZE <= NB50 BUTT WELDED FOR SIZE > NB50	

25	INSTRUMENTS / ACCESSORIES REQUIRED	(a) CONSERVATION VENT VALVE / BREATHER (b) OVERFLOW & DRAIN PIPING WITH DRAIN VALVE (c) SEAL POT WITH DRAIN VALVE ETC FOR OVERFLOW (d) LEVEL GAUGE (FLOATING TYPE) WITH FITTINGS (e) 2 NOS TAPPINGS WITH NB 25 ROOT VALVES ON TANK (FOR MOUNTING TWO (02) LEVEL TRANSMITTERS) (f) STEEL STAIRS AND PLATFORMS FOR EXTERNAL APPROACH AND LADDERS FOR ACCESS INSIDE. (g) SAMPLING CONNECTION WITH 25 NB VALVE ON TANK. (h) 3 NOS INSTRUMENT CONNECTIONS ON TANK ROOF FOR FLOAT AND ARROW TYPE LEVEL GAUGE. (i) FOLLOWING SPARE CONNECTION SHALL BE PROVIDED : 1.2000 NB-ONE NO., 2. 100 NB-ONE NO. SPARE VALVE SHALL BE PROVIDED FOR OUTLET SPARE CONNECTIONS AND BLIND FLANGE SHALL BE PROVIDED FOR INLET SPARE CONNECTION. (j) DIP HATCH WITH SCREWED END FITTED WITH BRASS CAP AND CHAIN.
26.0	SURFACE PREPARATION	SAND BLASTED TO SA 2 1/2 AND DRY AIR BLASTED BEFORE PAINTING. SHADE AS PER OWNERS REQUIREMENT.
27.0	INSIDE PROTECTION & EXTERNAL PAINTING	REFER ANNEXUER- I REGARDING PAINTING SPECIFICATION
28.0	MANHOLE	TWO (2) NOS. ONE ON SHELL & THE OTHER ON ROOF
29.0	FUNCTIONAL DEMONSTRATION	FOR FUNCTION DEMONSTRATION OF CST TANKS, WATER RETENTION TEST SHALL BE CARRIED OUT AT SITE DURING COMMISSIONING OF THE TANKS.
30.0	DRAWING ATTACHED	SKETCH FOR CONDENSATE WATER STORAGE TANK : PE-DC-409-167-S001. REV-00
31.0	LIST OF ANNEXURE ATTACHED	ANNEXURE I-PAINTING SPECIFICATION. ANNEXURE II- DATASHEET FOR PLATE AND STRUCTURAL STEEL. ANNEXUREIII- DATASHEET FOR PIPES, FITTINGS, FLANGES & ANNEXURE IV-SPECIFICATION FOR VALVES ANNEXURE V- SPECIFICATION FOR FLOAT AND ARROW TYPE LEVEL

NOTE-1 : Additional height over and above required to meet effective tank capacity to be provided by bidder without cost implication to BHEL.

SKETCH FOR CONDENSATE STORAGE TANK



NOTES:

- 1.0 - HIGH WATER LEVEL SHALL BE MIN.150MM BELOW BOTTOM OF OVERFLOW NOZZLE.
- 2.0 - ALL NOZZLES (ALONG WITH FLANGES & COUNTER FLANGES), OVERFLOW PIPE, ROOT VALVES FOR LT, NOZZLE FOR MOUNTING LEVEL INDICATOR, ISOLATION VALVES AND SPARE VALVES SHALL BE SUPPLIED BY TANK VENDOR.
- 3.0 - TRANSMITTER SHOWN ARE EXCLUDED FROM TANK VENDOR SCOPE. THESE SHALL BE SUPPLIED SEPARATELY UNDER INSTRUMENTATION PACKAGE.
- 4.0 - MARKED ITEMS ARE TO BE SUPPLIED ALONG WITH TANK.
- 5.0 - LOCATION OF THE TANK IS OUTDOOR.
- 6.0 - THE NET CAPACITY OF TANK I.E 300 CUM IS CAPACITY BETWEEN LOW LOW LEVEL AND HIGH LEVEL SHOWN IN THIS SKETCH.
- 7.0 - FLOAT & ARROW TYPE LEVEL INDICATOR SHALL BE PROVIDED.
- 8.0 - A CIRCUMFERENTIAL DRAIN SHALL BE PROVIDED AROUND THE CONDENSATE STORAGE TANK FOR TERMINATING THE TANK, SEAL POT & NADH BREATHHER DRAINS. THE CIRCUMFERENTIAL DRAIN SHALL THEN BE CONNECTED TO NEARBY PLANT DRAIN BY CIVIL AGENCY.
- 9.0 - INLET SPARE CONNECTIONS SHALL BE PROVIDED WITH BLIND FLANGE. SPARE VALVES SHALL BE PROVIDED AT SPARE OUTLET CONNECTIONS.
- 10.0 - NOZZLE ORIENTATION SHALL BE AS PER FINAL LAYOUT.
- 11.0 - LEVEL TRANSMITTER SHALL BE OF DIFFERENTIAL TYPE.
- 12.0- ALL VALVES SHALL BE PROVIDED AT APPROACHABLE DISTANCE.

NOZZLE NO.	DESCRIPTION	SIZE (NB)
N1	HRSG FILL PUMP SUCTION / HOTWELL MAKEUP PUMP SUCTION	200
N2	SPARE WITH NOZZLE	100
N3	DRAIN WITH VALVE	100
N4	OVERFLOW	100
N5	DM WATER INLET	50
N6	HOTWELL MU PUMP RECIRCULATION	25
N7	HRSG FILL PUMP RE-CIRCULATION	80
N8	CONDENSATE EXCESS RETURN	100
N9&N10	LEVEL TRANSMITTER	25
N11	SAMPLING CONNEC. WITH VALVE	25
N12	SPARE WITH NOZZLE	23

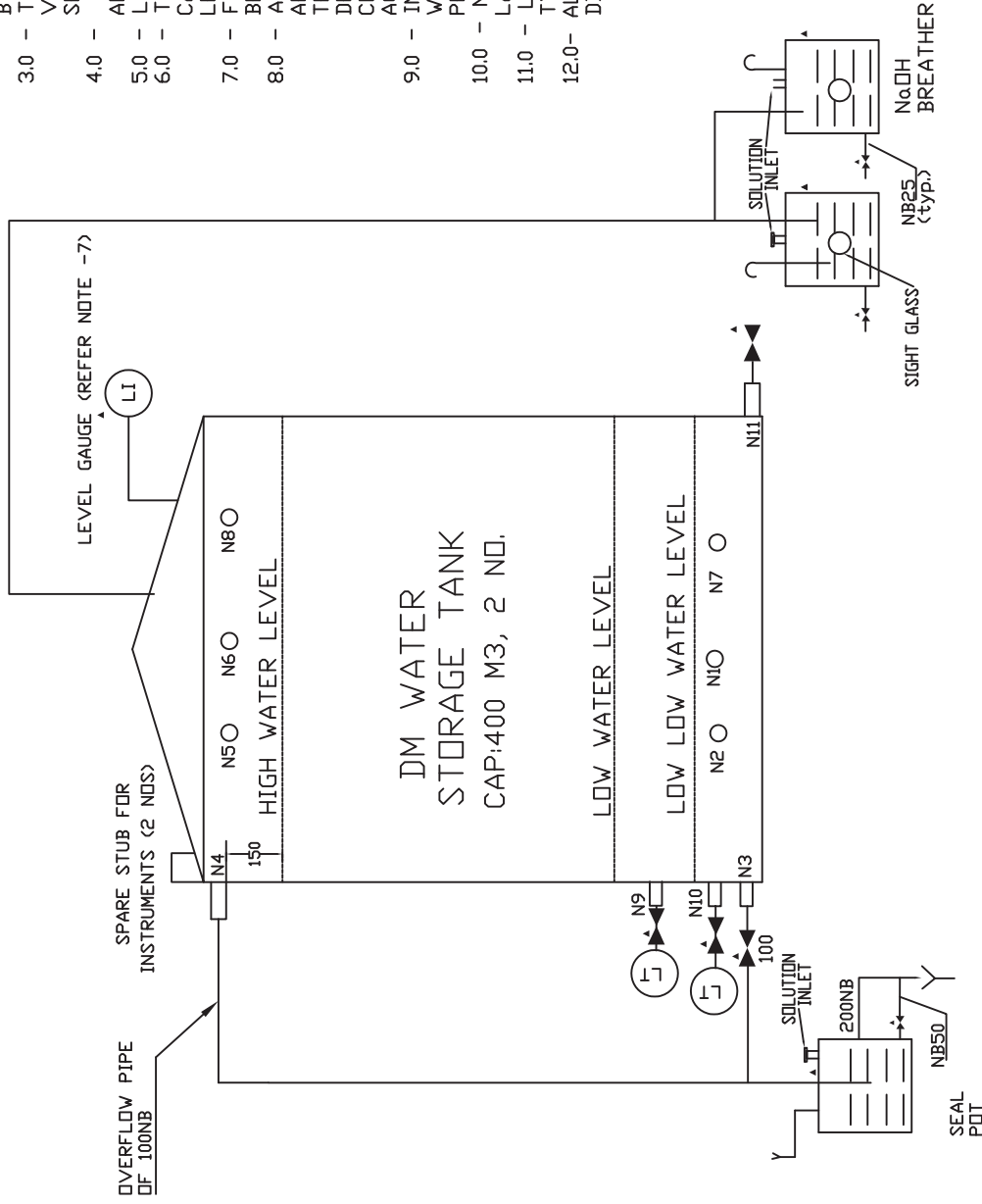
DIM. OF TANK - 8.0M DIA x 7.5M HT.

BHEL PEM	DATA SHEET FOR DM WATER STORAGE TANK		DOC NO: PE-DC-409-167-A001
'PROJECT TITLE: 370 MW (109 FB) CAPP YELAHANKA,BANGALORE		REV NO: 00	
1	SERVICE IDENTIFICATION	DM WATER STORAGE TANK	
2	P&ID NO.	PE-DG-409-100-N110 (BEING SUBMITTED SEPARATELY)	
3	SYSTEM	DM WATER SYSTEM	
4	APPLICABLE CODES/STATUTORY REGULATIONS	IS-803/API650	
5	CAPACITY	400 M ³	
6	NUMBER REQUIRED	TWO (02) NO	
7	STORAGE MEDIUM	DM WATER	
7a	OPERATING PRESSURE	ATMOSPHERIC PRESSURE	
7b	DESIGN PARAMETER	FILLED WATER HEAD+ATMOSPHERIC	
7c	HYDROSTATIC PRESSURE	FILLED WATER HEAD	
8	TYPE	VERTICAL, CYLINDRICAL	
9	SIZE	9.0 M (DIA) X8 M (HEIGHT)	
10	PRESSURE CLASS	DESIGN FOR FILLED WATER HEAD / ATOMSPHERIC	
11	MATERIAL OF CONSTRUCTION	STRUCTURAL STEEL TO IS:2062 GRADE-A	
		CORROSION ALLOWANCE= 3.2 MM INCLUDING MILL TOLERANCE	
12	MINIMUM PLATE THICKNESS INCLUDING CORROSION ALLOWANCE	BOTTOM – 8 MM, SHELLI - 6 MM , ROOF- 6 MM	
13	COURSE WIDTH OF PLATES	1.25M*/1.5M/1.8M/2.0M AS PER IS:803. (*)1.25 M WIDTH PLATES SHALL BE USED ONLY WHEN THE OTHER SIZES AS SPECIFIED (I.E 1.5/1.8/2.0M) ARE NOT AVAILABLE DURING THE EXECUTION OF THE TANKS)	
14	JOINT EFFICIENCY	0.85	
15	DESIGN TEMPERATURE	60 ⁰ C	
16	LOCATION OF INSTALLATION	OUTDOOR	
17	DRAIN VALVE FOR TANK	100 NB	
18	DRAIN VALVE FOR NAOH BREATHER	25 NB	
19	DRAIN VALVE FOR SEAL POT	50 NB	
20	NOZZLE CONNECTIONS REQD / END CONNECTION	AS PER ENCLOSED SKETCH SW FOR SIZE <= NB50 & BW FOR SIZE > NB50	
21	PIPE / NOZZLE MATERIAL	STAINLESS STEEL TO SA312 TP 304, SCH 10S FOR > NB50 & 40S FOR <=NB50 (REFER ANNEXURE-III)	
22	PIPE MATERIAL FOR HAND RAILING	CARBON STEEL, GALVANIZED, MEDIUM GRADE (REFER ANNEXURE-II)	
23	VALVES MATERIAL	STAINLESS STEEL (REFER ANNEXURE-IV)	
24	VALVES END CONNECTION	SOCKET WELDED FOR SIZE <= NB50 BUTT WELDED FOR SIZE > NB50	

25	INSTRUMENTS / ACCESSORIES REQUIRED	(a) CONSERVATION VENT VALVE / BREATHER (b) OVERFLOW & DRAIN PIPING WITH DRAIN VALVE (c) SEAL POT WITH DRAIN VALVE ETC FOR OVERFLOW (d) LEVEL GAUGE (FLOATING TYPE) WITH FITTINGS (e) 2 NOS TAPPINGS WITH NB 25 ROOT VALVES ON TANK ' (FOR MOUNTING TWO (02) LEVEL TRANSMITTERS) (f) STEEL STAIRS AND PLATFORMS FOR EXTERNAL APPROACH AND LADDERS FOR ACCESS INSIDE. (g) SAMPLING CONNECTION WITH 25 NB VALVE ON TANK. (h) 3 NOS INSTRUMENT CONNECTIONS ON TANK ROOF FOR FLOAT AND ARROW TYPE LEVEL GAUGE. (i) FOLLOWING SPARE CONNECTION SHALL BE PROVIDED : 1.100 NB- ONE NO., 2. 80 NB- ONE NO. SPARE VALVE SHALL BE PROVIDED FOR OUTLET SPARE CONNECTIONS AND BLIND FLANGE SHALL BE PROVIDED FOR INLET SPARE CONNECTION. (j) DIP HATCH WITH SCREWED END FITTED WITH BRASS CAP AND CHAIN.
26.0	SURFACE PREPARATION	SAND BLASTED TO SA 2 1/2 AND DRY AIR BLASTED BEFORE PAINTING. SHADE AS PER OWNERS REQUIREMENT.
27.0	INSIDE PROTECTION & EXTERNAL PAINTING	REFER ANNEXUER- I REGARDING PAINTING SPECIFICATION
28.0	MANHOLE	TWO (2) NOS. ONE ON SHELL & THE OTHER ON ROOF
29.0	FUNCTIONAL DEMONSTRATION	FOR FUNCTION DEMONSTRATION OF DM TANKS, WATER RETENTION TEST SHALL BE CARRIED OUT AT SITE DURING COMMISSIONING OF THE TANKS.
30.0	DRAWING ATTACHED	SKETCH FOR CONDENSATE WATER STORAGE TANK : PE-DC-409-167-S002. REV-00
31.0	LIST OF ANNEXURE ATTACHED	ANNEXURE I-PAINTING SPECIFICATION. ANNEXURE II- DATASHEET FOR PLATE AND STRUCTURAL STEEL. ANNEXUREIII- DATASHEET FOR PIPES,FITTINGS, FLANGES & ACCESSORIES ANNEXURE IV-SPECIFICATION FOR VALVES ANNEXURE V- SPECIFICATION FOR FLOAT AND ARROW TYPE LEVEL INDICATOR

NOTE-1 : Additional height over and above required to meet effective tank capacity to be provided by bidder without cost implication to BHEL

SKETCH FOR DM WATER STORAGE TANK



NOTES:

- 1.0 - HIGH WATER LEVEL SHALL BE MIN.150MM BELOW BOTTOM OF OVERFLOW NOZZLE.
- 2.0 - ALL NOZZLES (ALONG WITH FLANGES & COUNTER FLANGES), OVERFLOW PIPE, ROOT VALVES FOR LT, NOZZLE FOR MOUNTING LEVEL INDICATOR, ISOLATION VALVES AND SPARE VALVES SHALL BE SUPPLIED BY TANK VENDOR.
- 3.0 - TRANSMITTER SHOWN ARE EXCLUDED FROM TANK VENDOR SCOPE. THESE SHALL BE SUPPLIED SEPARATELY UNDER INSTRUMENTATION PACKAGE.
- 4.0 - ▲ MARKED ITEMS ARE TO BE SUPPLIED ALONG WITH TANK.
- 5.0 - LOCATION OF THE TANK IS OUTDOOR.
- 6.0 - THE NET CAPACITY OF TANK I.E 400 CUM IS CAPACITY BETWEEN LOW LOW LEVEL AND HIGH LEVEL SHOWN IN THIS SKETCH.
- 7.0 - FLOAT & ARROW TYPE LEVEL INDICATOR SHALL BE PROVIDED.
- 8.0 - A CIRCUMFERENTIAL DRAIN SHALL BE PROVIDED AROUND THE CONDENSATE STORAGE TANK FOR TERMINATING THE TANK, SEAL POT & NADH BREATHING DRAINS. THE CIRCUMFERENTIAL DRAIN SHALL THEN BE CONNECTED TO NEARBY PLANT DRAIN BY CIVIL AGENCY.
- 9.0 - INLET SPARE CONNECTIONS SHALL BE PROVIDED WITH BLIND FLANGE. SPARE VALVES SHALL BE PROVIDED AT SPARE OUTLET CONNECTIONS.
- 10.0 - NOZZLE ORIENTATION SHALL BE AS PER FINAL LAYOUT.
- 11.0 - LEVEL TRANSMITTER SHALL BE OF DIFFERENTIAL TYPE.
- 12.0- ALL VALVES SHALL BE PROVIDED AT APPROACHABLE DISTANCE.

NOZZLE NO.	DESCRIPTION	SIZE (NB)
N1	DM TRANSFER PUMP SUCTION	80
N2	DM PLANT REGENERATION	80
N3	DRAIN WITH VALVE	100
N4	OVERFLOW	100
N5	DM WATER INLET	80
N6	DM TRANSFER PUMP RECIRCULATION	25
N7	SPARE WITH NOZZLE	100
N8	SPARE WITH NOZZLE	80
N9&N10	LEVEL TRANSMITTER	25
N11	SAMPLING CONNec. WITH VALVE	25

DIM. OF TANK - 9.0M DIA x 8M HT.

SECTION: C 1-C

DATASHEET OF BOUGHT OUT ITEMS



**370 MW (109 FB) CCPP
YELAHANKA, BANGALORE
SITE FABRICATED**

BHEL Doc. No: **PE-DC-409-167-A001**

REV	00
DATE	28.12.2015
SHEET	

ANNEXURE-II

DATASHEET FOR PLATES & STRUCTURAL STEEL

A.0	MS Plate		
1.0	Material		IS:2062, Gr. B
B.0	Angle, Channel, Beam, Bar and Flat		
1.0	Material		IS: 2062, Gr. A/B
C.0	Handrail		
1.0	Size of pipe		32 NB
2.0	Material		ERW pipe as per IS:1239,Part-I
3.0	Dimension standard		ANSI 36.10, plain ends



**370 MW (109 FB) CAPP
YELAHANKA, BANGALORE
SITE FABRICATED**

BHEL Doc. No: PE-DC-409-167-A001

REV	00
DATE	28.12.2015
SHEET	

ANNEXURE-III

PIPES, FITTINGS, FLANGES & ACCESSORIES

1.0	SS Pipes	Material Standard	Dimensional Standard
1.1	50 NB and below	Stainless steel pipe as per ASTM A-312, Gr. 304 , Seamless, Sch. 40S	As per ANSI B-36.19, socket welded
1.2	65 NB and above	Stainless steel pipe as per ASTM A-312, Gr. TP-304, Seamless, Sch.10S	As per ANSI B-36.19, BW ends as per ANSI B16.25
2.0	SS Fittings(Elbow, Tees & Reducers)		
2.1	50 NB and below	Forged Stainless steel as per ASTM A-182, F-304	ANSI B 16.11, S/W ends
2.2	65 NB and above	Stainless Steel as per ASTM A-351, CF8	ANSI B 16.9, B/W ends
3.0	SS Flanges		
3.1	For SS Pipes up to 50 NB	ASTM A182 F304	ANSI B16.5, RF
3.2	For SS Pipes above 50 NB	ASTM A403 Gr. 304	ANSI B16.5, FF
4.0	Gasket for SS fittings		
4.1	Up to 50NB	SS jacketed CAF with superior oil/resistance	ANSI B 16.21
4.2	Above 50NB	PTFE (TEFLON)	ANSI B 16.21
5.0	Bolts & Nuts		
5.1	Wherever applicable in all the tanks.	ASTM A-193, Gr. B7 for Bolts ASTM A-194, Gr. 2H for Nuts	ASTM A-193 / A-194



**370 MW (109 FB) CCPP
YELAHANKA, BANGALORE
SITE FABRICATED**

BHEL Doc. No: **PE-DC-409-167-A001**

REV 00

DATE 28.12.2015

SHEET

**ANNEXURE-IV
SPECIFICATION FOR VALVES**

S.N	COMPONENT	DESCRIPTION
1.	Body & Bonnet	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
2.	Wedge & Seat ring	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
3.	Trim	ASTM A182 Gr F304
4.	Rating	Class 800 (50NB & below) Class 150 (50NB above)
5.	Ends	SW to B16.11 (50NB & below) Flanged to B16.5 (50NB above)
6.	Design Standards	B16.34 / API600 for Gate valve B16.34 / BS1873 for Globe valve
7.	Testing standards	API 598 for all valve (All sizes)
8.	Bolts & Nuts	A193 Grb7 & A194 Gr.2H



**370 MW (109 FB) CCPP
YELAHANKA, BANGALORE
SITE FABRICATED**


BHEL Doc. No: PE-DC-409-167-A001

REV	00
DATE	28.12.2015
SHEET	

**ANNEXURE-V
LEVEL INDICATOR**

S.NO.	COMPONENT	DESCRIPTION
1	Type	Float and Board
2	Float Material	SS 316
3	Float Cable	SS-316
4	Indicator Assembly	Epoxy Painted Aluminium
5	Guide wire Spring assembly	SS-316 (2 nos.)
16	Guide wire Anchor	SS-316 Anodized Aluminium with engraved marking (minium graduation 10mm)
7	Scale Board	Mounting brackets and suitable hardware required as per tank height
8	Elbow Assembly	Anodized Aluminium
9	Flanges	RF, ANSI 150, SS (3 nos.)
10	Accuracy	± 10 mm or better
11	Accessories	All the mounting accessories including counter flange, nuts & bolts, suitable gasket as applicable.
12	Quantity	one(1) number per tank

SECTION: D
STANDARD TECHNICAL SPECIFICATIONS

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 1 of 9	


1.0 SCOPE

This specification covers design, engineering, supply of material, fabrication, assembly, inspection and testing at shop as well as at site, erection and commissioning, painting and functional demonstration testing at site.

2.0 CODES & STANDARDS

The design, fabrication & assembly, erection & performance of steel tanks shall comply with all latest statutory regulations and safety codes applicable in the locality where the tanks are to be installed. Tanks shall conform to the latest applicable Indian / British / USA standards. The vendor shall not be construed to be relieved of his responsibility by virtue of this specification. The tank in general shall conform to the latest editions, as applicable, out of the following standards.


1. IS-800 Code of practice for use of steel in general building construction
2. IS-803 Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.
3. IS-804 Specification for rectangular pressed steel tanks
4. IS-805 Code of practice for use of steel in gravity water tank.
5. IS-816 Code of practice for metal arc welding for general construction in MS.
6. IS-817 Code of practice for training and testing for metal arc welder
7. IS-2825 Code of practice for unfired pressure vessel
8. BS-2594 Specification for carbon steel welded horizontal cylindrical storage tank
9. BS-2654 Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry
12. Indian Factories Act
13. American code for oil tanks API 650
14. Material Specification
15. American water works association standards (AWWA D100)

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 2 of 9	

3.0 **DESIGN REQUIREMENT**

3.1 **General Requirement**

- 3.1.1 All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid which these tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain. The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.
- 3.1.2 Tank thickness shall be calculated as per IS803 latest edition. Intermediary wind girder design, Wind Design, Seismic design, anchor bolt design / selection etc. shall be done as per API 650 latest edition, latest addendum available at the time of detail engineering.
- 3.1.3 All tanks will be designed for the capacities, dimensions and working conditions as specified in **DATA SHEET for DM & Condensate Storage Tank**. These tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. A 2.0 mm corrosion allowance for shells, bottom and roofs above and beyond the required thickness / calculated thickness / nominal thickness as specified in the design code shall be provided.
- 3.1.4 Vessel seams shall be so positioned that they do not pass through nozzle connections on vessel. For vessels consisting of more than two sections, longitudinal seams shall be offset.
- 3.1.5 The inside seam should be ground smooth, suitable for application of corrosion resistant primer. If the stiffening of shell, bottom and / or roof is necessary, tanks will be stiffened from outside.
- 3.1.6 Flange faces of all nozzles shall be machined and squared with the vessel center line.
- 3.1.7 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m² of projected area.
- 3.1.8 The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.
- 3.1.9 When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface. The plate shall not be gouged or torn in process of removing lugs.
- 3.1.10 In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.
- 3.1.11 Material of construction of all tanks shall be mild steel conforms to IS – 2062 grade – B unless otherwise specified in the **DATA SHEET for DM & Condensate Storage Tank**.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 3 of 9	

3.1.10 **Alignment**

3.1.10.1 Plates to be joined by butt-welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whichever is larger.

3.1.10.2 In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate thickness exceeding 8 mm except that for plate thickness 8 mm and under, the maximum shall be 1.5 mm.

3.1.10.3 Each tank shall be properly constructed ensuring perfect vertical alignment with 5 mm or as specified in the relevant code / standard and tank circularity within 5 mm on diameter or as specified in the relevant code / standard. Local bulging and / or depressions at any location of tank particularly shell shall not be permitted.

3.1.11 **WELDING**

3.1.11.1 Tanks and other attachments shall be welded as per IS-816.

3.1.11.2 Welding sequence shall be so adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be submitted for approval of BHEL giving details of material, welding position, sequence, type of electrode used, pre-heat & post weld requirement etc as per the code of construction. Brand name of electrodes to be used with proper classification (e.g. E 6013) shall be as per BHEL's approval.

3.1.11.3 Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.


3.1.11.4 Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets, bolts, nuts etc shall be conforming to relevant standards of repute and approved by the purchaser prior to use.

3.1.12 Each tank shall be complete with access staircase, ladder and safety cage and fittings like drain connection, overflow connection, tank inlet and outlet covers, level gauge glass, fittings with isolation cocks and protection covers, tank vent connection etc all complete with needed accessories for the completeness of the tanks and as specified in **DATA SHEET for DM & Condensate Storage Tank**.

3.1.13 All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.

3.1.14 **STAIRCASE / ACCESS LADDER AND HAND RAILING**

3.1.14.1 All cylindrical vertical tanks shall be provided with spiral staircase and shall conform to the requirements specified in design codes / standards unless specified otherwise. All stair treads shall be 32 mm steel fabricated gratings or 8mm thk. chequered plate which will be decided during detail engineering stage. Each tread, if needed, shall be housed in individual

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 4 of 9	

steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall have minimum 800 mm clear width.

3.1.14.2 Access ladder, one (1) for each horizontal cylindrical / rectangular tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm diameter rods spaced at not more than 30 mm center to center. All ladders shall have steel fabricated safety cage to the approved construction. Safety cage shall be provided about 2.5 m clear height of the ladder. Access ladder's stringers shall be widely spaced at top for free access to the tank roof.

3.1.14.3 All staircase and roofs of vertical cylindrical tanks shall be provided with pipe hand railings of effective height as indicated in the relevant code / standard throughout. Handrails shall be constructed out of 32 mm medium class galvanized steel pipe conforming to IS- 1239: 1968. Handrail posts shall be arranged at spacing not greater than 1850 mm. Two (2) sets of pipes horizontal runners all along the length shall be provided. All welds joints in the handrails shall be ground flush to protect any person getting injured. Steel toe plates of 100 mm flats shall be used. Hand railing shall be fabricated and installed in an approved manner as directed by purchaser in accordance with approved drawings.

3.1.15 Unless otherwise specified, for all flanged connections, vendor shall furnish suitable counter flanges and necessary nuts, bolts and gaskets materials.

3.1.16 Unless otherwise specified, bolts and nuts shall be hexagonal head conforming to bolts and nuts shall be SA 193 & 194 respectively.

3.1.17 Gaskets shall be 3 mm thick full-face rubber or CAF. On completion of hydraulic test / water fill test, contractor shall replace the gaskets used during testing at his own cost.


3.1.18 Float level indicators other than float and arrow type level indicator, gauge glass shall be provided.

3.1.19 During erection of tank, shell plates shall be suitably supported both for outside and inside to avoid buckling / collapsing of tank due to high-speed wind, gust or severe storm, if any, occurring during erection.


3.2 VERTICAL CYLINDRICAL STORAGE TANKS

3.2.1 The vertical cylindrical storage (non- pressure) tanks shall be of mild steel welded construction and shall be designed in accordance with codes and standards as specified in the **DATA SHEET for Condensate Storage Tank**. The vertical cylindrical storage tanks shall have slightly sloping bottom towards an adequately sized sump inside the tank to enable complete draining of the tank. The tank shall be designed for a wind pressure and seismic coefficient as specified.


3.2.2 Conical roof shall be either self-supported or supporting. The roof shall have a slope as specified in the relevant design code to ensure drainage of rainwater. Needed roof rafters and purlins adequately designed shall be provided.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 5 of 9	

- 3.2.3 All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.
- 3.2.4 All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.
- 3.2.5 All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non-injurious methods.
- 3.2.6 Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all vertical joints be staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 8 mm.
- 3.2.7 The tank height shall be completed by the provision of top curb/ angle which shall be butt-welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.
- 3.2.8 Tank roof shall be either self-supported or supported over rafters / steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding bolted connections at one end and preferably on the tank periphery side. The roof-supporting frame shall have needed tie rods or bracing sets.
- 3.2.9 Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.
- 3.2.10 Openings needed for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall be bolted and hinged covers unless otherwise specified.
- 3.2.11 All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.
- 3.3.0 **RECTANGULAR TANKS**
- 3.3.1 Rectangular tanks shall be fabricated in steel material and shall be designed to withstand internal hydrostatic pressure. In addition these shall be checked for a wind pressure and seismic coefficient as specified wherever applicable. While worst of these two shall be considered, the permissible stress shall be increased as per good engineering practice when their effect considered with tank load.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 6 of 9	

- 3.3.2 Tank bottom and / or side plates shall be of minimum 8 mm thick plate. Corrosion margin of at least 2 mm shall be provided over the design thickness of bottom and / or side plates.
- 3.3.3 To support tank plates and to maintain required unsupported plate length, adequately sized and spaced steel structural closed frame shall be provided inside the tank. Longitudinal and / or vertical structural members to connect and adequately support these frames shall be provided at corners. Horizontal diagonal members / sway bracings at corner shall also be provided.
- 3.3.4 Tank plates cut to size shall be welded on these frames. Plate butt weld joints at other locations shall be eliminated to avoid warping of the plates at free joints. Adequate openings in the structural frames, particularly at the bottom shall be provided to ensure complete unrestricted drainage of tank at one point. Suitable sized drain valve of size minimum 25 NB unless otherwise specified in the **DATA SHEET for DM & Condensate Storage Tank** shall be provided below the tank bottom for proper draining of the tank.
- 3.3.5 Complete assembled tank shall have at its bottom longitudinal steel fabricated bearer beams welded to it. The tank with bearer will rest over number of concrete blocks to be provided by purchaser. The tank shall be adequately bolted / welded to the concrete blocks. Needed inserts / anchor bolts shall be furnished by the bidders. Grouting of tank over concrete blocks in approved manner shall be included in bidder's scope of work, if erection is also awarded to the bidder.
- 3.3.6 Where rectangular tanks are flushed in dual compartments the inside partition plate shall be well reinforced to withstand hydrostatic test pressure completely on one side throughout the full height.
- 3.3.7 The rectangular tank shall be designed as per good engineering practice and reference shall be taken from the book named "Theory of plates and shells" by Timoshenko. Design calculation shall be done in accordance with the above mentioned book.
- 3.3.8 Suitable steel structural e.g. channels shall be provided below the bottom plate so that tank can rest on the foundation / slabs through the structural supports.
- 3.4 **HORIZONTAL CYLINDRICAL TANK**
- 3.4.1 The horizontal cylindrical tank with dished ends shall be of mild steel welded construction and shall be designed in accordance with BS – 2594 / IS – 2825 / ASME as specified in the **DATA SHEET for DM & Condensate Storage Tank**. The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be considered, the permissible stress shall be increased as per relevant code / standard.
- 3.4.2 The shell and dished end plate thickness shall be chosen as per design requirement but in no case the dished end and shell plate thickness shall be less than 8 mm.
- 3.4.3 All seams, longitudinal as well as circumferential, shall be butt-welded. Longitudinal seams should not be situated in the lower third of a tank or on the top center line.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO. 1	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 7 of 9	

3.4.4 All tank shall be supplied with integral saddle support and shall be designed in accordance with BS- 2594 / IS – 2825 / ASME as specified in the **DATA SHEET for DM & Condensate Storage Tank.**

4.0 **TESTING AND INSPECTION AT MANUFACTURERER'S WORKS**

4.1 **General**

4.1.1 The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.

4.1.2 All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the final shop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out the necessary tests required by codes at his own cost.


4.1.3 Alloy cast iron and cast steel components shall be tested for both physical and chemical properties in absence of purchaser's representatives. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.

4.1.4 All materials including valves, instruments, pipings, flanges, counter flanges etc. shall be procured from BHEL approved manufacturer's only. Dealers are not acceptable.

4.2 **TESTING AND INSPECTION FOR TANKS**

4.2.1 The scope of testing and inspection for pressure vessel covered in this specification shall generally comprise of the following:

- i) Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.
- ii) Examination of materials of construction and identification with material test certificates.
- iii) All the plates of thickness 50 mm or more shall be ultrasonically tested to ensure freedom from laminations.
- iv) Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.
- v) Inspection of dished end flanges and alloy steel bolting where required.
- vi) Inspection during fabrication at appropriate stages including fit ups.

	TECHNICAL SPECIFICATION FOR MISCELLANEOUS TANKS (STANDARD TANK SPECIFICATION)	SPECIFICATION NO.	
		VOLUME II-B	SECTION 'D'
		REVISION 00	DATE:
		PAGE 8 of 9	

- vii) For all butt welds, the root run and final run shall be subjected to dye-penetrant or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye-penetrant / magnetic particle examination.
- viii) Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatment procedure as required by codes and specifications.
- ix) Examination of internal cleanliness before final closure.
- x) Dimensional examination of completed vessel including axis marking, proof marking, match marking etc.
- xi) Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification. In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.
- xii) Witnessing cleanliness, preservation, packing and marking.
- xiii) Stamping of vessel and issue of certificates.
- xiv) All tanks under this specification shall be tested as per the relevant design and testing code / standard. Supplier shall submit the detailed testing procedure for the tanks during detail engineering stage for BHEL / customer / consultant's approval and approved document shall be adhered by them and testing shall be done accordingly without any commercial implication.

4.2.2 **NON - PRESSURE TANKS**

The scope of testing and inspection for non-pressure tanks covered in this specification will comprise of the following:

- i) Identification of materials to manufacturer's test certificates.
- ii) Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling.
- iii) Checking of dimension and match marking.
- iv) Bottom testing
 - a. After the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.
 - b. Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of purchaser.