TECHNICAL SPECIFICATION FOR STORAGE TANKS(WATER)

(CT MAKE-UP WATER, DM WATER, & INTERMEDIATE DM WATER)

PROJECT :	**1X51 MW ONGC HAZIRA COMBINED CYCLE POWER PLANT**
CUSTOMER :	**M/S OIL & NATURAL GAS CORPORATION.**
CONSULTANT :	**M/S FICHTNER CONSULTING ENGINEERS PVT. LTD.**

Ref. Doc

Table of Contents

S. No.	*DESCRIPTION*	*PAGE NO.*
1.0	Intent of Specification	3
	Project information	4
2.0	Special Instructions to Bidders	4
3.0	Scope of supply, Scope of services, Exclusions & Terminal Point Details	6
4.0	Detailed Design & Technical Requirements	10
5.0	Testing & Inspection	12
6.0	Painting	13
7.0	Drawings and Documents to be submitted with the bid	13
8.0	Drawings/Documents required during detailed Engineering	13
9.0	Pre-Bid Clarifications & Deviations	20
10.0	Bid Evaluation Criteria	22
11.0	Other Requirements	22
12.0	Billing Breakup Methodology	22
13.0	List of Annexures	24
	Annexure I – Datasheet for Water Storage Tanks	--
	Annexure II –Piping Material Specification	--
	Annexure III – Sub-Vendor List	--
	Annexure IVA- Datasheet for Level Indicator Annexure IVB- Datasheet for Plates & Structural Steel	--
	Annexure V-Pre-Bid Clarifications	--
	Annexure VI- Recommended Spares for 3 Years of Normal Operation	--
	Annexure VII- Checklist(To be submitted by the bidder along with offer)	--
	Annexure VIII- Price Bid Format	--
	Annexure IX-Reference P&IDs	--
	Annexure X- Sketch for Water Levels of Storage Tanks	--
	Annexure XI- Inspection, Testing, Erection & Commissioning Reuirements	--

Ref. Doc

DOCUMENTS TO BE SUBMITTED ALONG WITH BID:

The bidder must submit the following documents along with their bid so as to enable BHEL to evaluate their offer.

Bidder to note that in case following documents are not submitted along with offer, the offer may be liable for Technical Rejection.

- Signed and Stamped copy of Annexure-I(Datasheet for Water Storage Tanks)
- Checklist for the offer (Annexure-VII) – Completely filled and stamped copy along with all the necessary documents and drawings.
- Unpriced "Price-Bid Format" (Annexure-VIII) - Completely filled and stamped copy
- Any deviations/clarifications required on the technical specification/annexures, bidder has to raise the pre-bid queries vide Annexure-V and bidder has to submit zero deviation offer.

Ref. Doc

1.0 INTENT OF SPECIFICATION

1.1 The specification is intended to cover design, engineering, supply of material (including commissioning spares), inspection and testing at vendor's / sub-vendor's works, proper packing and forwarding, shipment & delivery at site, fabrication, erection, inspection and testing at site, commissioning for the following tanks as per the specifications and requirements indicated in different sections of this specification.

1. **1 No. of CW Make-Up Water Tank of Capacity 1000Cu.m**
2. **1 no. of DM Water Storage Tank of Capacity 1000Cu.m**
3. **1 No. of Intermediate DM Water Storage tank of Capacity 50Cu.m**

1.2 The contractor shall be responsible for providing all material, equipment & services required to ensure operability, maintainability, reliability and safety of the tanks as covered under this specification, irrespective of whether they have been specifically indicated in this specification or not.

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 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 their specification are subject to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.

1.5 All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.

1.6 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 ONGC/Fitchner as interpreted by BHEL in the relevant context.

PROJECT INFORMATION

1.	Owner	M/S OIL & NATURAL GAS CORPORATION.
2.	Project	1X51 MW ONGC HAZIRA COMBINED CYCLE POWER PLANT
3.	Owner's consultant	M/S FICHTNER CONSULTING ENGINEERS PVT. LTD.
4.	Location	ONGC Limited, Hazira
5.	Nearest Airport	Surat, 10 KM
6.	Nearest Railway Station	Surat, 20 KM
7.	Access to site	NH-8 (30 KM)
8.	Maximum Average DBT	45.6^0C
9.	Minimum Average DBT	4.4^0C
10.	Relative Humidity	
	Design AMB Humidity	Minimum- 18% Maximum- 70% Average-64%
11.	Wind data	
	Max. wind speed (as per IS:875) 20-61 kmph for 20 days in a year < 20 kmph for remaining period	44 m/s(Design Wind Speed)
12.	Prevailing Wind Direction	South - West
13.	Seismic coefficient	III (IS 1893)

2.0 SPECIAL INSTRUCTIONS TO BIDDERS

2.1 This specification shall be read in conjunction with all its enclosures. In case of any discrepancy arising between this job specification & its enclosures, the most stringent of all (as determined by purchaser) shall be followed. Further, if a requirement in this specification or any of the enclosures, calls for a decision from the Purchaser, it shall be bidder's sole responsibility to clearly bring out/highlight the same distinctively in his pre-bid queries, so as to enable purchaser to furnish their decision/clarification. If such issues/requirements are not duly addressed by bidder during the pre-bid stage and if such issues/requirements are observed later during order execution stage, it shall be

binding on the bidder to comply with the final decision made by the purchaser subsequently, without any cost, delivery, or any other commercial implications.

2.2 Any additional equipment, material, services etc., which are not specifically mentioned in this specification, but required to make the Tanks complete in all respects, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.3 Any specific hardware/software/item/ etc. required as indicated in 2.2. above but not listed elsewhere in this specification or its enclosures, shall be deemed to be included in the basic price quoted by the bidder. Also, all mounting hardware/ accessories/fittings/conduits/etc. required for the Erection & Commissioning of the Tanks shall be deemed to be included in the basic price quoted by the bidder. Bidder, at no point of time, shall be eligible to raise any extra claim in this regard.

2.4 The Bidder shall accept full responsibility for the completeness and for the reliable operation of Tanks as a whole. These shall be executed on the basis of proven design principle. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of Erection & Commissioning of the Tanks. Even though, the requirements are specified in detail to the extent possible, bidder to apply good engineering practices in the design, selection of equipment, manufacturing, procurement, transportation, fabrication, painting, inspection & testing, supervision of erection & commissioning of system etc., wherever same is not clearly spelt out.

2.5 By accepting the contract, the bidder shall be deemed to have accepted the obligation of supplying everything that is necessary for the purpose mentioned above, regardless of any omission in the specification or on the drawings for the fulfillment of complete main plant package.

2.6 Bidder to note that the Purchase Order for the Water Storage Tanks for the 1 x 51 MW ONGC Hazira CCPP shall be placed on lump sum fixed prices based as per tender specification requirements.
Bidder to further note that they shall not be permitted for any claim for additional commercial implication on any account during the detail engineering stage

2.7 Bidder shall quote strictly as per the scope of supply and requirements of this specification. Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.

2.8 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their

prior approval before submission of their bid. All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of enquiry by bidder and clarifications on the same shall be obtained by the bidder from the purchaser. In case no such clarifications are sought during pre-bid stage, it will be assumed that bidder has no comments or observations on BHEL's specification and no deviations to the specifications will be taken by the bidder.

2.9 Bidder to quote strictly as per BHEL's Price Bid format(Annexure-VIII). Failure to do shall make their offer liable for rejection. Any tampering/modification/change of the BHEL's price format is not allowed and is liable for rejection of bidders offer.

2.10 Incase Bidder is unable to offer due to any specific requirement of specification, Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.

2.11 Compliance with this specification shall not relieve the bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

2.12 The design information, specifications and drawings indicate the "Minimum" requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the information included in this specification as required and submit a comprehensive bid.

2.13 The intending tenderers shall be deemed to have visited the site and have studied the conditions before submitting the Bids. Non-familiarity with the site conditions will not be considered a reason either for extra claims or for not carrying out the work in strict conformity with the drawings and specifications.

2.14 Civil works will be done by BHEL based on civil inputs furnished by the bidder during detail engineering. In case of any changes in the civil input drawing after civil work is completed, necessary prices on account of modification of the civil work shall be deducted from bidder's account.

3.0 SCOPE OF SUPPLY, SCOPE OF SERVICES, EXCLUSIONS AND TERMINAL POINT DETAILS:

Designs, supply of material to site, fabrication, erection, inspection & testing, commissioning and handing over of following tanks are covered under this specification.

1. **1 No. of CW Make-Up Water Tank of Capacity 1000Cu.m**
2. **1 no. of DM Water Storage Tank of Capacity 1000Cu.m**
3. **1 No. of Intermediate DM Water Storage tank of Capacity 50Cu.m**

Technical Details of above tanks are indicated in Datasheet for Water Storage Tank(Annexure-I).

3.1 **SCOPE OF SUPPLY**

3.1.1 The Scope of Supply shall include the following major items:

a) All the plate materials required for Tank Bottom, Shell, and Roof etc. for the Water Tanks.

b) All the required connections, nozzles and accessories required for each tank as per enclosed Data Sheet for Water Storage Tanks(Annexure-I).

c) All the required piping material inside the tank.

d) All the required pad plates on the tanks for supporting outside piping.

e) All flanges and counter flanges/blind flanges for all nozzles of tank connections including the fasteners (bolts, studs, nuts) and gaskets for these connections.

f) All the required manhole covers/flanges including the fasteners (bolts, studs, nuts) and gaskets. Manholes shall be provided with davit arrangement for ease of maintenance.

g) All the structural material required for roofs, ladders, wind girders, rails, platforms, stairs, supports, stiffeners, curb angles etc.

h) 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers.

i) Seal Pot and Breather tanks shall be provided for DM & Intermittent DM Water Storage tanks as per Annexure-IX & Annexure-XIII.

j) Piping from Vent and Overflow of DM & Intermittent DM Water Storage tanks upto Breather tank and Seal pot are in bidder's scope of supply.

k) All inlet lines shall be provided with diffusers to limit the velocity.

l) The following instrumentation along with their fittings, accessories, mountings etc. (As per the enclosed Data Sheets provided elsewhere in this specification) :

~~1) 3 nos of Level Switches(Level High, level Low, Level Low Low) for each tank~~

2) 1no Level Indicator(Mechanical Level Indicator of Float and Board Type) for each tank as per Datasheet for Water Storage Tank(Annexure-I)

m) All anchor bolts, nuts, washers including pad plates (as required for anchoring of tank as per approved design calculations).

n) All the required material for draining and goose neck venting arrangements for the tanks including necessary piping, fittings, nozzles, valves, flanges, fasteners etc.

o) ~~1 no. of 300 NB size Drain valve for each tank~~.

~~p) All the required material for routing the drain and over-flow of the tanks to the nearest storm water drain system located at 20 mtrs away from the tank area. These shall include necessary piping (approximately 75 mtrs of 12" pipe(6.35 mm thick), 10 nos. of 12" elbows, 3 nos. of 12" Tees), fittings, nozzles, valves, flanges, fasteners etc. These material is requirement of two no of water tanks.~~

q) Required material for Earthing of the tanks up to the nearest risers of earthing mats including earthing pads, strips etc.

r) All the required quantity of paint material indicated in Datasheet for water Storage tank(Annexure-I)

s) Start-up Spares ~~and Commissioning Spares~~ (Details to be provided by vendor).

t) O&M Manuals in both soft and hard form(6 sets).

u) Required hard copies of approved drawings/documents indicated elsewhere in this specification.

v) Any other material required to complete the Tanks as per the intent and requirements of this specification.

3.2 **SCOPE OF SERVICES**

The major scope of services shall include:

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

3.2.2 **Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over of all the three tanks are in Bidder's scope.** ~~Bidder to furnish recommended fabrication, erection & commissioning, testing and inspection procedure along with drawing / documents to facilitate fabrication, Erection & Commissioning, testing and inspection of Tank.~~

~~3.2.3 Supervision of (a) Fabrication, Erection & Commissioning, (b) Inspection & testing, (c) handing over of the tank for 80 man days. For the purpose of tender (L1 bidder evaluation) total no of 80 man days to be covered in 5 visits have been considered. However, either or both of the number of man days or no of visits may change on either side based on the actual site requirement.~~

3.2.4 Preparation and submission of all drawings as per Cl. No. 8.1 of this specification.

3.2.5 Any other service required for making the installation complete in all respect within bidder's scope and for satisfactory erection & commissioning of the system, unless specifically EXCLUDED from scope of services.

3.2.6 Surface preparation, Painting of Tanks(Required coats) as indicated in Datasheet for Water Storage Tanks(Annexure-I) at Site/sub vendor works.

~~3.2.7 Material re-conciliation will be done jointly by Purchaser's erection office (BHEL-PSER) & Sub-vendor. Bidder to note that the payment towards the supply for any item will be made only after the completion of the material reconciliation activity at site. Bidder to further note that no separate payment shall be made by Purchaser for material reconciliation activity & any price of this service will be deemed to be included in the basic price of supply of the package quoted by the bidder.~~

3.2.8 Storage, preservation of Materials/Equipment at site.

3.2.9 Site facilities refer Annexure –XII: Site Facilities in Bidder and BHEL's Scope

3.3 **EXCLUSIONS**

3.3.1 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.

3.3.2 Earthing of tank is not in bidders scope. However, supply of required material for Earthing of the tanks up to the risers of earthing mats including earthing boss, strips are in the scope of bidder. Connecting these earth strips to the tank and above ground earth riser shall be done by bidder.

~~3.3.3 Supply of painting material, surface preparation and painting of tanks are excluded from bidders scope.~~

3.3.4 All the instrumentation associated with the tank except Mechanical Level Gauge are excluded from bidder scope of supply. However mechanical Level Gauge with required guide pipe level gauge(Float and Board type mechanical level gauge) to be provided by the bidder.

3.4 **TERMINAL POINT DETAILS**

3.4.1 For all nozzles(except drain, overflow, vent, level instruments) matching counter flanges/blind flanges shall be the terminal point.

3.4.2 CW Make-Up Water Storage Tank: The terminal point for Overflow and drain of tank shall be nozzle provided on the tank. For vents, goose neck shall be terminal point. For details bidder may refer P&ID for Cooling Water System, Drg No. 2-38101-04546(Sh 02 of 02)) enclosed as Annexure-IX

3.4.3 DM Water/Intermediate DM Water Storage Tank: The terminal point for Overflow and Vent shall be Seal Pot and Breather tanks located on the ground level. Drain line shall be terminated with a nozzle and counter flanges. For details bidder may refer P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496 enclosed as Annexure-IX

3.4.4 For nozzles for Level Instruments(LG/LS/LT), the terminal point shall be nozzle with counter flanges on tank(Instrumentation is excluded from bidder scope of supply).

3.4.5 For earthing purpose, terminal point is nearest risers in the mat.

4.0 DETAILED DESIGN & TECHNICAL REQUIREMENTS

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

a) The tanks shall be designed as per IS: 803/API-650 latest edition.

b) Material of construction of Water Storage tanks shall be mild steel conforms to IS – 2062 Grade – B.

c) Plate thickness calculation (different courses of shell plate, bottom plate and roof plate thickness), roof curb angle, top wind girder, intermediate wind girder, tank internal pressure vis–a-vis. allowable value.

(i) Shell, Bottom and Roof plate thicknesses shall be provided as specified in datasheet for water storage tanks enclosed as Annexure-I. Plate thickness calculation shall be 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 comes out more than the specified value then the nearest available (higher side) plate thickness in the market shall be provided for bottom, shell and roof plates without any commercial implication.

(ii) 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.

d) All inlet piping shall be taken from bottom of the tank(Shell Side). The clearance between the bottom of the tank and the edge of the inlet piping shall be kept as per code and good engineering practices.

e) All the manhole covers/flanges shall be of hinged & bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 600 mm.

f) Wind and seismic load calculations required for foundation bolt design. If required, widn girders shall be provided based on the code design calculations.

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

h) Maximum Height of unstiffened shell shall be calculated based on the corroded thickness of shell courses. Section modulus of wind girders shall also based on corroded thickness of shell course.

4.2 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803/API650 as per the design code indicated in DATA SHEET for Water Storage Tanks(Annexure-I).

4.3 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.

4.4 In calculating the minimum plate thickness, the specific gravity of the liquid shall not be taken less than 1.

4.5 Tank seams shall be so positioned that they do not pass though tank connections. Longitudinal seams of various shell courses shall be offset.

4.6 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.

4.7 Due consideration shall be given by the supplier for wind load and earthquake effect in the design of tanks.

4.8 For the tanks being of diameter larger than 3.75 m added structural supports in the form of rafter shall be provided.

4.9 Reinforcement in tanks shall be provided as per design code as indicated in **DATA SHEET for Water Storage Tanks**(Annexure-I). The reinforced connection shall be completely pre - assembled into shell plate.

4.10 The joint efficiency factor of 0.7 to be adopted for design calculation. All the design calculations shall be in accordance with the specified design code.

4.11 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.

4.12 Staircase / access ladder and hand railing shall be provided as per the relevant codes and standards.

4.13 Water draw off sump shall be provided as per the relevant design code, latest editions.

4.14 Code conformance for flanges / counter flanges shall be as per IS2062 Gr B (Dimensional standard- ANSI B16.5 clause 150/IS 1538).

4.15 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 minor change during detail engineering stage for which no commercial implication shall be entertained by BHEL.

4.16 Bidder shall furnish the Standard calculation along with the roof structure calculation during detail engineering for checking the stability of roof.

4.17 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 Water Storage Tanks**(Annexure-I)**.**

4.18 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.

5.0 TESTING & INSPECTION

5.1 Bidder shall maintain an effective Quality Assurance System, to ensure that all equipment and material supplied as a part of the Fire water tanks meet required Quality standards and specifications.

5.2 After award of contract, bidder shall submit Quality Plan for approval. The quality plan shall be submitted in BHEL quality plan format, Bidder to note that all the cost involved in any of the inspection & testing requirements as per the approved quality plan shall be deemed to be included in the price quoted by the bidder. Bidder shall not be eligible to raise any extra claim on account of any inspection & testing as per the approved quality plan.

5.3 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 recommended FQP (field quality plan) and suggestive PG test procedure for BHEL review during detail engineering stage.

6.0 PAINTING

All the necessary surface preparation required for painting and painting of tanks to be carried out by bidder at site/sub vendor works for the material and equipment supplied by the bidder. Painting specification shall be in-line with the painting details indicated in Annexure-I(Datasheet for Water Storage Tanks)

7.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

The bidder must submit the following drawings and documents along with their bid in **2 Sets** so as to enable BHEL to evaluate their offer. In absence of any of these documents, BHEL reserves right not to evaluate the offer of the concerned bidder.

a) Checklist for Tanks as per Annexure-VII

b) List of recommended spares for 3 years normal operation indicating quantities in terms of numbers as per(Annexure-VI).

c) Un-priced copy of price format(Annexure-VIII) indicating quoted/ not quoted against each row & column.

d) Start up & Commissioning Spares(List and quantity as per bidders recommendation)

e) Tentative GA for BHEL' reference only. Bidder to furnish the weight of each tank (in empty condition and water filled condition). Bidder to note that the weight in water filled condition shall be considered from bottom of tank up to top of curb angle.

In the absence of any documents mentioned above, bidder's offer is liable to be rejected. Further any documents submitted by bidder other than above shall not be taken cognizance of and these shall not form part of contract.

8.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

8.1 The successful bidder shall submit the following drawings / documents during detail engineering stage(after award of contract) for approval / information / reference (as the case may be):-

S.no.	Document no.	Category	Title	
A.	**DESIGN CALCULATION**			**Time Period for Submission from PO Date.**
1		Approval	Design Calculation for Fire Water Storage Tank, seismic design calculation along with roof structure	1 Week
2			Vent sizing calculation.	1 Week
B.	**DRAWINGS**			
1		Approval	GA - Storage Tank including nozzle details, bill of material, weld details etc.	2 Weeks
2		Information	GA of stairway indicating platforms, landings and handrails with bill of materials	2 Weeks
3		Information	Roof structural detail of Storage Tank including nozzle details, bill of material, weld details etc.	2 Weeks
4		Information	Plate cutting layout of storage tank (shell, roof and bottom plate)	2 Weeks
5		Information	Fabrication Drawing for	2 Weeks

			Storage Tank	
6		Approval	Nozzle orientation drawing of Storage Tank	3 Weeks
7		Approval	Load Data of Tank Foundations and Details of Anchor Chair for Tank Foundations	2 Weeks
8		Approval	~~GA / cross sectional drawing of CS valve.~~	
9		Approval	GAD of Level Indicator	3 Weeks
10		Approval	~~GAD of Level Switch~~	
B.	**DATA SHEETS**			
1		Approval	Data sheet for Plates & Structure	3 Weeks
2		Approval	Data sheet for Pipe, Fittings, and Flanges & Accessories.	3 Weeks
3		Approval	Datasheet for Paint for Water Storage Tanks.	3 Weeks
4		Approval	~~Datasheet for Valves.~~	
C.		**QUALITY PLANS**		
1		Approval	Recommended Field Quality Plan	3 Weeks
2		Approval	Inspection Check List of MS Plates & Structural Steel	3 Weeks
3		Approval	QAP of Valves.	3 Weeks
4		Approval	QAP for MS Plates & Structural Steel	3 Weeks
5		Approval	QAP for Pipe, Fittings, Flanges & Accessories.	3 Weeks
6		Approval	QAP for Level indicator	3 Weeks
7		Approval	~~QAP for Level Switch~~	
D		**GENERAL / OTHER DOCUMENTS**		
1		Information	Bar Chart	1 Week
2		Approval	Billing Break-Up for Supply	8 Weeks
3		Approval	Makes of Bought-out Items	2 Weeks
4		Approval	As Built	After Approval of all drawings(Before PO Delivery Date)
		Approval	O&M Manual	After Approval of all drawings(Before PO Delivery Date)
5		Approval	Packing procedure before	12 Weeks

			FOB delivery	
6		Approval	Packing list	12 Weeks
7		Approval	Suggestive PG test procedure	12 Weeks
8		Approval	Erection procedure	12 Weeks
9		Approval	Commissioning procedure	12 Weeks
10		Approval	Painting Procedure	12 Weeks
11		Approval	~~Valve schedule~~	

8.2 All drawings shall be prepared as per BHEL's title block and bear BHEL's drawing No. and customer /consultant's drawing no; which will be forwarded to the successful bidder during detail engineering stage.

8.3 Data sheets of various items shall be prepared by the bidder for storage tanks and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

8.4 GA drawing, nozzle schedule, design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.

8.5 O & M manual shall be furnished to BHEL for approval during detailed engineering stage.

8.6 All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

8.7 Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

8.8 Any other drawings and documents in addition to the list of drawings and documents indicated in the NIT specification as required by BHEL for the execution of the project shall be furnished by them during detailed engineering stage and no commercial implication shall be entertained by BHEL for the same.

8.9 Bidder to confirm that all the drawings shall be prepared in Auto Cad - 2010 version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage.
Following may be noted wrt the drawing submission schedule.

SL NO.	DESCRIPTION	NUMBER OF COPIES TO BE SUBMITTED	WHEN TO SUBMIT
1.	Initial drawings/documents under approval and information category.	4	As per approved Master document list
2.	Revised drawings/documents incorporating BHEL's comments.	4	Within 1 week of receipt of commented Drawings from BHEL
3.	Final Drawings/documents	10	Within 2 months of placement of order.
4.	Erection Documentation	8	1 Month before dispatch of equipment, The list of documents identified under master document list for erection to be furnished in 5 nos. of folders.
5.	Draft O & M Manuals with out test certificates	2	2 months before the delivery date of equipment
6.	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	10	Within one month after dispatch of equipment
7.	Final O&M Manuals and Approved Documents/Drawings in a CD	3	Within one month after dispatch of equipment

8.10 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.

8.11 The engineering drawings submitted by successful bidder for approval during detailed engineering stage showing / indicating the followings:-

- Scope of work by BHEL and bidder shall be indicated with different legend or in the form of note.
- Recommended locations of earthing bosses.
- Civil loads and the detailed calculation showing weights of roof, bottom, and shell plates, all accessories and nozzles etc.
- Details of pockets as required for anchor bolts.

8.12 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. However, minimum 7 days notice shall be served for the same.

8.13 All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

8.14 All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-

a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.

b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.

8.15 **ENGINEERING COMPLETION:**

8.15.1 The Engineering shall be considered as completed after the following activities are finished:

- Final approval of all the Drawings / Documents which are in 'Approval' Category as per Document List in clause 8.1 above.
- After successful review of drawings/documents which are in 'Information' Category as per Document List in clause 8.1 above.

- Final approval of detailed Bill of Quantity (BOQ).

8.16 **ERECTION & COMMISSIONING DOCUMENTATION:**

8.16.1 **ERECTION DOCUMENTATION:**

8.16.1.1 Erection document List shall be prepared during Engineering review meeting (after award of contract) identifying all the DOCUMENTS / DRAWINGS required for completion of Erection activities of the complete system, to be submitted by the bidder as part of documentation.

8.16.1.2 The Bidder shall submit for Purchaser's approval draft manual for Equipment Delivery and Erection (EDE Manual) covering detailed instructions, write up, technical data, drawings, check-lists, documentation formats for all activities after equipment manufacture upto installation of equipment. This manual shall cover general instructions for all equipment and specific instructions for individual equipment wherever required and shall include at least the following :

- Instructions for packing, shipping, receiving, handling, ware-housing and storage.
- Part number/Dispatch link-up of all the equipments/items supplied and also their co-relation with system/drawing/approved BOQ.
- Instructions for location and installation of equipment furnished by this specification.
- Installation drawings for field mounted equipment and other equipment covered under this specification.
- Instruction relating installation of piping, support and routing drawings of drain and overflow nozzles.
- Check lists and quality assurance hold points.
- Formats for all related documentation.
- The EDE Manual shall conform to the requirements of this specification, all applicable codes and standards, recommendations of equipment manufacturers and accepted good engineering practices and shall be subject to Employer approval during detailed engineering.
- The Bidder shall ensure that all work under this part shall be performed as per the requirements of this specification, Employer approved EDE Manual and drawing/documents approved by the Employer during detailed engg.

8.16.1.3 Erection Manuals

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

- Erection strategy.

- Sequence of erection.
- Erection instructions.
- Critical checks and permissible deviation/tolerances.
- List of tool, tackles, heavy equipments like cranes, dozers, etc.
- Bill of Materials
- Procedure for erection.
- General safety procedures to be followed during erection/installation.
- Procedure for initial checking after erection.
- Procedure for testing and acceptance norms.
- Procedure / Check list for pre-commissioning activities.
- Safety precautions to be followed in erection all equipments and electrical supply distribution during erection

8.16.2 **COMMISSIONING DOCUMENTATION:**

8.16.2.1 The contractor shall submit the commissioning documentation, comprising of Standard checklists, pre-commissioning procedures, testing schedules, commissioning schedules and commissioning networks for various Equipment / systems covered under the contract, for the approval of employer.

8.16.2.2 Standard checklist, as the name suggests, shall be a fairly general documents, containing the list of all checks required to be carried out for similar and repetitive type of equipment to ensure consistent and thorough checking.

8.16.2.3 The testing schedule is a document, designed for safe and systematic commissioning of individual equipment/sub-system. Commissioning schedule is a document envisaged for commissioning of a system. The testing/Commissioning schedule shall have a standard format in order to maintain consistency of presentation, content and reporting. A brief write up on the contents of the Testing Schedule/Commissioning Schedule is as per the following:

Testing Schedules should be designed to ensure that the plant area, equipment or apparatus are tested and commissioned and will operate as per the employer's specifications and good engineering practices.

Testing Schedule/Commissioning Schedule is required to be of a standard format in order to maintain consistency of presentation, content and reporting.

Testing Schedule/Commissioning Schedule should contain the following sections to make the document a self contained one:

a) Plant Details/Design data
b) Testing Objective/Proposals
c) State of the Plant required prior to commissioning

- Erection Status with respect to Mech. Elect and C&I
- Services required
- Safety requirements

d) Test method including completion/acceptance criteria
e) Results
f) Testing Programme
g) Mech/Elect/C&I –Plant item completing list
h) List of Drawing/documents required for carrying out the testing.

8.16.2.4 The contractor shall submit the list of commissioning documentation to be submitted by him, alongwith their submission schedule for various equipment/systems covered under the contract, with in 6(six) month from the date of award of contract, for the acceptance of employer.

8.16.2.5 The Contractor shall submit the commissioning documentation, for various equipment/covered under the contract, for the approval of employer, at least 12 months before the scheduled date of commissioning of the equipment/systems.

9.0 PRE-BID CLARIFICATIONS AND DEVIATIONS

9.1 Bidders are advised to quote strictly as per BHEL's specification requirements. In case bidder excludes some components of scope of supply or some features of specification requirements, the bidder will be required to include the same in the scope during offer evaluation stage /contract execution stage without any additional commercial and price implications on account of the same. Bidder to note that they won't be entitled for any price impact on account of withdrawal of deviation taken from BHEL spec during technical scrutiny/evaluation of the bidder's offer . Price impact will be allowed by BHEL only to the extent of change of specification during tender evaluation stage, if any, from BHEL end.

9.2 In case bidder feels that it is necessary to exclude some components of scope of supply & some features of specification requirements, due to genuine constraints if any, bidder has to clearly bring out the same to the notice of BHEL and take their prior approval before submission of bid. Bidders are requested to bring out only those issues and deviations which are impractical to meet (or) not technically advisable as per the experience of bidder, for BHEL's review before the submission of bid**.** All such clarifications required by the bidder shall be intimated to BHEL together as a single notice within a week of receipt of the Enquiry/NIT/RFQ in the enclosed format (Annexure -V).
All such applicable deviations /clarification shall have cross reference to page number /section / clause /para etc. of this specification or its annexure with proper reasons for the deviations for purchaser's consideration. Any such applicable deviations /clarification not listed under the above section, even if reflected in any other portion of the bidder's proposal shall not be considered applicable.

Purchaser shall review the above pre-bid queries & deviations submitted by the bidder and furnish the necessary clarifications /instructions to the bidder immediately.
Bidder shall submit their offer taking cognizance of these clarifications/instructions provided by Purchaser.

9.3 In absence of any such pre-bid clarifications sought by the bidder and in case of contradictory requirements of the specification (if any), the more stringent requirement as interpreted 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 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.

9.4 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

9.5 Bidders are advised to quote strictly as per BHEL's specification requirements. In case bidder excludes some components of scope of supply or some features of specification requirements, the bidder will be required to include the same in the scope during offer evaluation stage /contract execution stage without any additional commercial and price implications on account of the same. Bidder to note that they won't be entitled for any price impact on account of withdrawal of deviation taken from BHEL spec during technical scrutiny stage. Price impact will be allowed by BHEL only to the extent of change of specification during tender evaluation stage, if any, from BHEL end.

9.6 Information like Bill of materials (BOM), Instrument list, datasheets, and typical specifications enclosed by the bidder as a part of their bid, shall be retained for information only and shall not be referred by contractor in future as contractual agreement during contract execution stage. No implication shall be admissible on the basis of these documents during any stage of contract execution and the requirements of as specified/indicated this specification will be binding and final. System wise BOQ shall be finalized based on approved drawings during detail engineering stage.

10.0 BID EVALUATION CRITERIA

REFER PRICE BID FORMAT (ANNEXURE-VIII)

~~The bid shall be evaluated based on the price quoted for the tank and its accessories & commissioning spares, Supervision charges for E&C and any technical loading due to non-adherence to the technical specification.~~

~~However, the price for recommended spares shall not be considered for evaluation purpose.~~

11.0 OTHER REQUIREMENTS

11.1 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.

11.2 Items shall be procured from the subvendor list as per Annexure-III

11.3 Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structurals, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.

11.4 While supplying the material bidder shall consider suitable margin (at least 5%) for the materials i.e. pipes, plates, flanges and fittings, traps, insulation and cladding etc. over and above the requirement as per approved drawing / documents so as to take care of material shortage at site during erection.

11.5 Commissioning spares are deemed to be included in bidder's scope and same shall be supplied during erection and commissioning stage. In case of any shortfall of these spares, same shall be procured by BHEL and the prices of the same shall be deducted from bidder's account.

12.0 Billing Breakup Methodology

12.1. Billing break-up (BBU) shall be submitted to BHEL in following methodology:

12.1.1 The BBU shall be prepared only for the pro-rata billing purpose.

12.1.2 BBU will contain complete list of items required for the completion of the project as per specification and shall be dispatched by bidder irrespective of the items/quantities are indicated in the document or not.

12.1.3 Any additional requirement of the item already indicated in the document will be updated in the subsequent revision of this document. All such item will be dispatched as "free item" term to BHEL.

12.1.4 Inspection & Testing of all items shall be as per approved quality plan. The entire item shall be dispatched to site only after the completion of Inspection and testing requirement as per approved quality plan. Non-inclusion of any item does not absolve the vendor from meeting the requirement.

12.1.5 Vendor shall obtain prior permission from BHEL after submitting all the documents before ensuring dispatch of all main items applicable for project.

12.1.6 Inspection & quality: All the items applicable for this project shall be inspected as per approved quality plan. It may be noted that any item shall be dispatched to site only after complying with the Inspection requirements as per approved quality plan.

12.1.7 As separate document indicating the details of all the items having SHELF LIFE shall be furnished. Prior permission from BHEL shall be taken before dispatch of any of the item having shelf life.

12.1.8 Applicable taxes & duties shall be extra.

12.2. BBU shall be a comprehensive document having details of all the items applicable for this project .**There should not be any Non-Billable item to be supplied at site**.

12.3. BBU shall be submitted as per "Payment Terms of Annexure-BB"

12.4. Wherever Lot items are indicated, same shall be quantified in details in a separate annexure. Similarly all Accessories/ Instruments/ items are to be defined with comprehensive details
It is to be ensured that all fittings, accessories (including Bolts, fittings etc.), Instrument and other items, if any, shall be listed in separate line items or in a separate annexure.

12.5. In case requirement of any such item / additional item is detected at any stage of the contract execution, BBU will be revised to reflect the same. However all the additional items will be supplied as a 'Zero Value Item', without any commercial implication to BHEL. All the contractual requirements shall be valid for these additional items also.

13.0 LIST OF ANNEXURES

The following are the List of Annexures

1. Annexure I – Datasheet for Water Storage Tanks
2. Annexure II –Piping Material Specification
3. Annexure III – Sub-Vendor List
4. Annexure IVA- Datasheet for Level Indicator
5. Annexure IVB- Datasheet for Plates & Structural Steel
6. Annexure V-Pre-Bid Clarifications
7. Annexure VI- Recommended Spares for 3 Years of Normal Operation
8. Annexure VII- Checklist(To be submitted by the bidder along with offer)
9. Annexure VIII- Price Bid Format
10. Annexure IX-Reference P&IDs
11. Annexure X- Sketch for Water Levels of Storage Tanks
12. Annexure-XI- Inspection, Testing, Erection And Commissioning Requirements
13. Annexure-XII - Site Facilities in Bidder and BHEL's Scope
14. Annexure-XIII - Typical Seal Pot and Breather Tanks for DM & Intermittent DM water Storage Tanks

Ref. Doc

Variant Table

Variant No.	Description	Material Code
01	Design, Supply of Material to Site, for 1 No. of CW Make-Up Water Tank of Capacity 1000 Cu.m	9751186013
02	Design, Supply of Material to Site, for 1 No. of DM Water Storage Tank of Capacity 1000 Cu.m	9751186021
03	Design, Supply of Material to Site, for 1 No. of Intermediate DM Water Storage tank of Capacity 50 Cu.m	9751186030
04	Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over of 1 No. of CW Make-Up Water Tank of Capacity 1000 Cu.m	9751186040
05	Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over of 1 No. of DM Water Storage Tank of Capacity 1000 Cu.m	9751186058
06	Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over 1 No. of Intermediate DM Water Storage tank of Capacity 50 Cu.m	9751186066

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	26.06.15	FIRST ISSUE		

Ref. Doc

Annexure-I

Datasheet for Water Storage Tanks

S.No.	Description	Unit	Value/Specification		
			CW make-Up Water Storage Tank	**DM Water Storage Tank**	**Intermediate Water Storage Tank**
1	**General**				
1.1	Type of Tank		Conical roof type, Vertical atmospheric steel tank. **(MSEP)**	Conical roof type, Vertical atmospheric steel tank. Tank shall have 3 layers of PP balls of 50 mm dia. Also it shall be provided with CO2 absorbers. **(MSEP)** **<u>Notes</u>:** **1) Seal Pot and Breather Tanks including piping from DM Water Storage Tank to these tanks are in bidders scope of supply. For Details refer Annexure-XIII** **2) 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers.**	Conical roof type, Vertical atmospheric steel tank. Tank shall have 3 layers of PP balls of 50 mm dia. Also it shall be provided with CO2 absorbers. **(MSEP)** **<u>Notes</u>:** **1) Seal Pot and Breather Tanks including piping from DM Water Storage Tank to these tanks are in bidders scope of supply. For Details refer Annexure-XIII** **2) 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers.**
1.2	Quantity of Tanks	Nos	1	1	1
1.3	Fluid stored		Filtered Water	DM Water	DM Water
2	**Design Features**				
2.1	Tank Design Code		IS803, API 650	IS803, API 650	IS803, API 650
2.2	Wind Load		Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**	Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**	Calculation for wind effect shall be in accordance with IS: 875-1987(part-3) **<u>Note</u>: As per design calculation, if required, vendor shall provide required no. of wind girders**

2.3	Earthquake Consideration		Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III	Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III	Seismic Load Design Criteria (1) Design Code/Zone IS: 1893, Parts 1 & 4 / Zone III (2) Soil Type Type III
2.4	Design Liquid		Water	Water	Water
2.5	Net Capacity of Tank	cu.m.	1000	1000	50
2.6	Dimension of tank (DiaxHeight)	m x m	12.5 x 9.3 (Refer Annexure-X)	12.5 x 9.3 (Refer Annexure-X)	4 x 5.5 (Refer Annexure-X)
2.7	Design Metal Temperature	°C	80	80	80
2.8	Design Pressure		Full of Water + Atmospheric Pressure	Full of Water + Atmospheric Pressure	Full of Water + Atmospheric Pressure
2.9	Density of Design liquid	kg/cu.m	1000	1000	1000
2.10	Thickness provided for				
a	Shell mm	mm	Total 7 Courses 6.0 (1st course) & 5.0 (remaining courses)	Total 7 Courses 6.0 (1st course) & 5.0 (remaining courses)	Total 4 Courses 5.0 (All courses)
b	Roof Plate	mm	5.0 (Including Corrosion Allowance)	5.0 (Including Corrosion Allowance)	5.0 (Including Corrosion Allowance)
c	Bottom Plate	mm	6.0 (Including Corrosion Allowance)	6.0 (Including Corrosion Allowance)	6.0 (Including Corrosion Allowance)
2.11	Corrosion Allowance	mm	0.0 mm (Since coating is provided)	0.0 mm (Since coating is provided)	0.0 mm (Since coating is provided)
2.12	Joint Efficiency of weld joints		0.7	0.7	0.7
2.13	Design wind speed	m/s	44	44	44
3	**Material of construction**				
3.1	Shell, Roof & Bottom plate		IS2062 Gr.E250 B	IS2062 Gr.E250 B	IS2062 Gr.E250 B
3.2	**Shell & Roof appurtenances**				
a	**For Manholes**				
	Size and location		600NB & One each on shell and roof	600NB & One each on shell and roof	600NB & One each on shell and roof
	Necks, flanges and coveraplates		IS2062 Gr.E250 B, conform to IS803	IS2062 Gr.E250 B, conform to IS803	IS2062 Gr.E250 B, conform to IS803

	Bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
b	**For Nozzles**				
	No. and size of Shell, Roof, Vent and Drain Nozzles		As per P&ID for Cooling Water System, Drg No. 2-38101-04546(Sh 02 of 02)) enclosed as Annexure-IX	P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496 enclosed as Annexure-IX	P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496 enclosed as Annexure-IX
	No. and size of spare nozzles		One spare inlet(8" 150#) and one spare outlet nozzle(10", 150#) shall be provided.	One spare inlet(6" 150#) and one spare outlet nozzle(8", 150#) shall be provided.	One spare inlet(6" 150#) and one spare outlet nozzle(8", 150#) shall be provided.
	Inlet Nozzles		All inlet nozzles shall be routed from bottom of tank	All inlet nozzles shall be routed from bottom of tank	All inlet nozzles shall be routed from bottom of tank
	Nozzle necks		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	Flanges and counter-flanges		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	Bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
Note: All Nozzles(Inlet/outlet/Recirculation/Instrumentation/Drain/Overflow/Make-Up) on the shell(except manhole) shall be provided with SS Wire Mesh to prevent blocking of PP Balls.					
c	**Fittings**				
	Dimensional standard		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
	End connection		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
3.4	**Gaskets**		As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)	As per applicable Piping Material Specification. (Refer Annexure-II)
3.5	Structurals, stairways and platforms		IS2062 Gr.E250 A	IS2062 Gr.E250 A	IS2062 Gr.E250 A

3.6	Foundation bolts & Nuts		IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.	IS1367 Cl 4.6/4, Galvanized.
3.7	Hand rail		32NB, IS:1239 MEDIUM CLASS (GI)	32NB, IS:1239 MEDIUM CLASS (GI)	32NB, IS:1239 MEDIUM CLASS (GI)
3.8	Earthing lugs & Nameplate		Austenitic Stainless Steel (SS304)	Austenitic Stainless Steel (SS304)	Austenitic Stainless Steel (SS304)
4	**Accessories**				
4.1	Spiral stair case		Yes	Yes	Outside Cage ladder shall be provided
4.2	Hand railing		Yes	Yes	Yes
4.3	Anchor chairs & foundation bolts		Yes	Yes	Yes
4.4	Mechanical Level Gauge		Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**	Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**	Yes, Float and Board type Mechanical Level gauge **(Bidder's Scope of Supply)**
4.5	Level Transmitter		Yes, 2 No's, Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**	Yes, 1 No., Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**	Yes, 1 No., Side Mounted, Diaphragm Remote Seal Type. **(Excluded from Bidder Scope of Supply. Only Nozzle along with Counter Flanges, Gaskets, Studnuts to be provided by bidder)**
4.6	Gauge Hatch Nozzle with hinged cover		Yes	Yes	Yes
4.7	Earthing lugs		Yes, 2 No's	Yes, 2 No's	Yes, 2 No's
4.8	Cathodic Protection		Not Required.	Not Required.	Not Required.
5	**Painting**				
i.	**Internal Painting of the Tank(Reference: As per Industrial Practice)**				
	Surface Preparation		Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.	Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.	Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.
	Primer		One Coat of Unmodified epoxy resin	One Coat of Unmodified epoxy resin along with	One Coat of Unmodified epoxy

			along with Polyamide hardener **DFT: Minimum** 40 micron per coat	Polyamide hardener **DFT: Minimum** 40 micron per coat	resin along with Polyamide hardener **DFT: Minimum** 40 micron per coat
	Paint		Three(3) coats of unmodified epoxy resin along with Aromatic Adduct Hardener **DFT: Minimum** 40 micron per coat	Three(3) coats of unmodified epoxy resin along with Aromatic Adduct Hardener **DFT: Minimum** 40 micron per coat	Three(3) coats of unmodified epoxy resin along with Aromatic Adduct Hardener **DFT: Minimum** 40 micron per coat
	Total Thickness		Total Thickness of primer and paint shall not be less than 400 micron.	Total Thickness of primer and paint shall not be less than 400 micron.	Total Thickness of primer and paint shall not be less than 400 micron.
	Colour Shade		White	White	White
ii.	**External Painting of the Tank(Reference: Sub-Section 2.15, Surface Preparation and Painting, Vol-III, Doc. No. 5111168-ME-SPC-100-001)**				
	Surface Preparation		Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.	Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.	Manual Wire Brushing conforming to SA 2-1/2 Standard. **Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.
	Primer Coat		2 No. Coats of P-2 with each Coat of 50 Micron DFT **Primer (P-2) :** High build chlorinated rubber zinc phosphate primer	2 No. Coats of P-2 with each Coat of 50 Micron DFT **Primer (P-2) :** High build chlorinated rubber zinc phosphate primer	2 No. Coats of P-2 with each Coat of 50 Micron DFT **Primer (P-2) :** High build chlorinated rubber zinc phosphate primer
	Intermediate Coat		NA	NA	NA
	Top Coat		2 No. Coats of F-3 with each Coat of 30 Micron DFT **Finish Coat (F-3):** Chlorinated Rubber paint	2 No. Coats of F-3 with each Coat of 30 Micron DFT **Finish Coat (F-3):** Chlorinated Rubber paint	2 No. Coats of F-3 with each Coat of 30 Micron DFT **Finish Coat (F-3):** Chlorinated Rubber paint
	Colour Code Identification		**Base/Ground Colour:** SEA GREEN	**Base/Ground Colour:** SEA GREEN	**Base/Ground Colour:** SEA GREEN
iii.	**Bottom Plate Underside Painting(Reference: As per Industrial Practice)**				
	Surface Preparation		Manual Wire Brushing conforming to SA 2-1/2 Standard.	Manual Wire Brushing conforming to SA 2-1/2 Standard.	Manual Wire Brushing conforming to SA 2-1/2 Standard.

			Note: In ONGC Hazira complex no sand blasting or shot blasting shall be done.	**Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.	**Note:** In ONGC Hazira complex no sand blasting or shot blasting shall be done.
	Primer Coat		One Coat of Primer (DFT: 30-40 Micron per Coat)	One Coat of Primer (DFT: 30-40 Micron per Coat)	One Coat of Primer (DFT: 30-40 Micron per Coat)
	Finish Coat		Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)	Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)	Three(3) Coats of Coaltar Epoxy (DFT: 60-80 Micron per Coat)

Notes for Surface Preparation and Painting

a) Surface Preparation by Manual Wire Brush: SA 2 ½

Very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight imperfections in the form of spots or stripes. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It must then correspond in appearance to the prints designated Sa 2 1/2. Mechanical cleaning should only be used when procedures (a) and (b) are not practicable.

b) External Painting

Primer (P-2) : High build chlorinated rubber zinc phosphate primer

Type and composition : Single pack Chlorinated rubber medium plasticized with unsaponifiable plasticiser pigmented with zinc phosphate

Volume solids : 35-40%

Finish Coat (F-3): Chlorinated Rubber paint

Type and Composition: Single pack Plasticised chlorinated rubber medium with chemical & weather resistant pigments.

Volume Solids: 30 % (min)
DFT : 30 microns/coat (min)
Covering Capacity: 10 sq.m./lit/coat

c)Following activities to be ensured while performing surface preparation and painting

1) All primers and finish coats should be cold cured and air dried unless otherwise specified.

2) Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine/saline environment.
3) All paints shall conform to relevant Indian Standard and shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship should be ensured.
4) In case of use of epoxy tie coat, manufacturer should demonstrate satisfactory test for inter coat adhesion.
5) All primers should be top coated immediately as per manufacturer's recommendations.
~~6)~~ **In ONGC Hazira complex no sand blasting or shot blasting shall be done.** ~~All equipment shall be protected with anti-corrosive coat and after final painting only shifted to project site for further erection. Touch – up painting for the damage area during transportation can be done at project site.~~

Annexure-II

Piping Material Specification

PED-MECHANICAL

PIPING MATERIAL SPECIFICATION

11D

Customer:	**:STD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

TEMP	0	38	50	100													
PRESS.	7.00	7.00	7.00	7.00													

SERVICE: A/G ,U/G COOLING WATER

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	1½" AND BELOW	SW COUPLING
	2" AND ABOVE	BUTT WELDED AS PER ANSI B16.25
DRAINS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-D1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO. 4-38101-02488, TYPE-D2**
VENTS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-V1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO4-38101-02488, TYPE-V2**
TEMP. CONN.	1½"	**FLANGED INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488**
PRESS. CONN.	¾"	**SW NIPPLE (VI) WITH VALVE AS PER BHEL. STD. DWG. 4-38101-02488.**

NOTES

1. NDT REQUIREMENTS AS PER BHEL STD DOC NO GT 57124

2. ALL FLANGED VALVES ABOVE 24" SIZE SHALL HAVE FLANGED END AS PER AWWA C207 CL D.

3.VENT & DRAIN ISOLATION VALVES SHALL BE GATE VALVES .

4. FOR GENERAL NOTES ON PMS,PIPING & VALVES REFER STD. NO GT 6 9959.

5.BLANK

6. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.

7.MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE OR THICKNESS.

8.USE BUTTERFLY VALVES INSTEAD OF GATE VALVE FROM 10" ON WARDS IN WATER SERVICE UP TO 70 DEG CEN.

BUTTER FLY VALVE SHALL BE OF PN 10 RATED WITH DESIGN PRESSURE OF 10.55 KG/CM2.

8. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.

9 ALL WELDS SHALL BE 10% RADIOGRAPHED.

10. FOR SIZE 30" TEMPERATURE & PRESSURE RATING TO BE LIMITED TO 7.0KG/CM2 AND 70 DEG. CEN.

11. FORGINGS ARE ACCEPTABLE IN LIEU OF PLATE MATERIAL FOR BLIND FLANGES AND SPACER & BLINDS.

12. MITRE BENDS 90 DEG SHALL BE 5-PIECE FOR SIZE FROM 26" TO 64", MITRE BENDS 45 DEG. SHALL BE 3-PIECE FOR SIZE FROM 26" TO 64"

BHEL	**Customer:**	**:STANDARD**	
	ANSI CLASS:	150 #	
	CORR.ALL.	1.0 mm	Rev.02
PED-MECHANICAL	Special requirement	NON IBR	03.03.09

BRANCH CONNECTION CHART
LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW
W	WELDOLETS

BRANCH PIPE SIZE (IN INCHES)	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64
64																																										E
62																																									E	R
60																																							E	R	R
58																																						E	R	R	R
56																																					E	R	R	R	R
54																																				E	R	R	R	R	R
52																																			E	R	R	R	R	R	R
50																																		E	R	R	R	R	R	R	R
48																																	E	R	R	R	R	R	R	R	R
46																																E	R	R	R	R	R	R	R	R	R
44																															E	R	R	R	R	R	R	R	R	R	R
42																														E	R	R	R	R	R	R	R	R	R	R	R
40																													E	R	R	R	R	R	R	R	R	R	R	R	R
38																												E	R	R	R	R	R	R	R	R	R	R	R	R	R
36																											E	R	R	R	R	R	R	R	R	R	R	R	R	R	R
34																										E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
32																									E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
30																								E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
28																							E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
26																						E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
24																						E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
22																																										
20																				E		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
18																			E	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
16																		E	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
14																	E	P	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
12																E	P	P	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
10															E	R	P	P	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
8														E	P	R	P	P	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
6													E	P	P	R	P	P	R	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
5																																										
4											E		P	P	P	P	P	P	P	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
3½																																									
3									E		P		P	P	P	P	R	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
2½																																									
2							E		P		P		P	P	P	P	P	P	P	P		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1½						T	E		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
1¼																																									
1				T		T	H		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
¾			T	T		T	H		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
½		T	T	T		T	H		H		H		H	H	H	H	H	H	H	H		H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
¼																																									

RUN PIPE SIZE (INCHES)

Customer:	**:STD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL **CARBON STEEL** DESCRIPTION	BHEL SPEC	NOTE	Revision
PIPES	SEAMLESS	BE	½	¾	S160		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	1	2	S80		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	3	6	S 40		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	8	14	S 20		B 36.10	A106 GRB	AA10455		
	EFSW (WELDED)	BE	16	24	S 20		B 36.10	A672 GRB60 CL 22	AA10457	6,9	
	EFSW (WELDED)	BE	26	48	12		IS3589	IS 3589 GR FE 410	AA10147	6,9	
	EFSW (WELDED)	BE	50	60	14		IS3589	IS 3589 GR FE 410	AA10147	6,9	
	EFSW (WELDED)	BE	62	64	16		IS3589	IS 3589 GR FE 410	AA10147	6,9	
FLANGES	SLIP ON	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	AA7246106		
	SLIP ON	RF	2	24	150	125AARH	B 16.5	ASTM A 105	AA7246101		
	SLIP ON (HUB TYPE)	FF	26	64	150	125AARH	AWWA-C207 CL.D	ASTM A 105	GT57318-0		
	BLIND	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	HY7246772		
	BLIND	RF	2	24	150	125AARH	B 16.5	ASTM A 105	HY7246166		
	BLIND	FF	26	64	150	125AARH	AWWA-C207 CL.D	ASTM A 285 GRC		11	
	FIGURE8 BLANK	FF	½	1½	300	125AARH	B 16.48	ASTM A 105	GT57083		
	FIGURE8 BLANK	FF	2	8	150	125AARH	B 16.48	ASTM A 105	GT57083		
	SPACER & BLIND	FF	10	24	150	125AARH	B 16.48	ASTM A 105	GT57083		
	SPACER & BLIND	FF	26	64	150	125AARH	MNF. STD.AS PER 31.3	ASTM A 285 GRC		11	
FITTINGS	ELBOWS 90 DEG	SW	½	1½	3000		B 16.11	ASTM A 105	AA724501		
	ELBOWS 90 DEG	BW	2	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242695	7	
	ELBOWS 90 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY7242695	7	
	MITRE 90	BW	26	64	M	R=1.5D	BHEL STD	IS 3589 GR FE 410	GT57220-0	7,9,12	
	ELBOWS 45 DEG	BW	2	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY42566	7	
	ELBOWS 45 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY42566	7	
	MITRE 45	BW	26	64	M	R=1.5D	BHEL STD	IS 3589 GR FE 410	GT57220-0	7,9,12	
	EQ. TEE	SW	½	1½	3000		B 16.11	ASTM A 105	AA7242510		
	EQ. TEE	BW	2	14	M		B 16.9	ASTM A 234 GR WPB	AA7242511	7	
	EQ. TEE	BW	16	24	M		B 16.9	ASTM A 234 GR WPB-W	AA7242511	7,9	
	EQ. TEE	BW	26	48	M		B 16.9	ASTM A 234 GR WPB-W	GT57220-0	7,9	
	CON. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB	HY7242692	7	
	CON. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W	HY7242692	7,9	
	CON. RDCR	BW	26	64	M,M		BHEL STD	IS 3589 GR FE 410	GT57220-0	7,9	
	ECC. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB	GT57220-0	7	
	ECC. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W	GT57220-0	7,9	
	ECC. RDCR	BW	26	64	M,M		BHEL STD	IS 3589 GR FE 410	GT57220-0	7,9	
	CAP	NPT(F)	¾	¾	3000		B 16.11	ASTM A 105			
	CAP	BW	2	48	M		B 16.9	ASTM A 234 GR WPB	HY7242570		
	CAP(DISHED ENDS)	BW	50	64	M		ASME SEC VIII	ASTM A 285 GRC			
	FULL COUPLING	NPT/NPT	½	1½	3000		B 16.11	ASTM A 105	HY7242595	5	
	FULL COUPLING	SW	½	1½	3000		B 16.11	ASTM A 105	AA7242520		
	VI (HALF CPLG)	SW	½	1½	3000		B 16.11	ASTM A 105	TC56213		
	NIPPLE	BW /NPT	½	¾	S 160		B 16.11	A106 GRB	HY7242578	5	
	NIPPLE	BW /NPT	1	1½	S 80		B 16.11	A106 GRB	HY7242578	5	
	NIPPLE	NPT/NPT	½	¾	S 160		B 16.11	A106 GRB	HY7242580	5	
	NIPPLE	NPT/NPT	1	1½	S 80		B 16.11	A106 GRB	HY7242580	5	
VALVES	GATE	SW	½	1½	800		API 602 / BS 5352	B:A 105; T:13% Cr;St	AA7521468		
	GATE	FL	2	8	150	B16.5	API 600	B:A 216 GR. WCB; T:13% Cr	AA7521408		
	GLOBE	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	AA7501468		
	GLOBE	FL	2	16	150	B16.5	BS 1873	B:A 216 GR. WCB; T:13% Cr	AA7521408		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	AA7531468		
	DUEL PLATE CHECK	FF	2	24	150			B:A 216 GR. WCB; T:13% Cr	GT57377-00		
	DUEL PLATE CHECK	FF	26	48	150			B:A 216 GR. WCB	GT57377-00		
	BUTTER FLY	WAFER WITH LUGS	10	24	150	B16.5	BS 5155	B:A 216 GR. WCB; T:13% Cr	GT57213-04		
	BUTTER FLY	FL	26	48	**150**	AWWA-C 207	BS 5155	B:A 126 CLB; T:13% Cr	GT57213-04	2	

B:BODY, T:TRIM, BB:BOLTED BONNET, St:STELLITED

Customer:	**:STD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL **CARBON STEEL** DESCRIPTION	BASIC MATERIAL **CARBON STEEL** BHEL SPEC	NOTE	Revision
BOLT & GASKET	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	HY7142198		
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	HY7142299		
	GASKET		½	1½	600		B 16.20	SS JACKTED CAF IS 2712 GR W/3	AA7240358		
	GASKET		2	24	150		B 16.20	SS JACKTED CAF IS 2712 GR W/3	AA7240345		
	GASKET		26	62	3		AWWA-C207 CLD	CAF SHEET	AA21502		
MIS	Y-TYPE STRAINER	SW	½	1½	800		B 16.11	B: A 105; INT: SS 304	HY577468		
	Y-TYPE STRAINER	BW	2	62	150		MNF. STD	B: A 234 WPB, INT. SS304	GT57308-0		
	RE JOINT	FL	2	48	150		MNF. STD	is 2062, NEOPRENE RUBBER	GT57214-0		
	AIR RELEASE VALVE	FL	1½	8	150		is14845	IS 216 wcb	GT57317-0		

Customer:	**:STANDARD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

TEMP	-29	38	50	100	150	200	250	300	325	350					
PRESS.	19.99	19.99	19.58	18.05	16.12	14.08	12.34	10.40	9.49	8.57					

SERVICE

HSD, NAPHTHA, NATURAL GAS, REFINERY GAS, FLUSHING OIL ,LUBE OIL, BLOW DOWN, VENTS,OWS, CHEMICAL DRAINS,FLARE LINES, BOILER FEED PUMP SUCTION, CEP SUCTION, WATER WASH, UTILITY LINES,**INSTRUNET AIR**, CBD VENT TO DEAERATOR.

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	1½" AND BELOW	SW COUPLING (REF NOTE-5)
	2" AND ABOVE	BUTT WELDED AS PER ANSI B16.25
DRAINS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-D1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO. 4-38101-02488, TYPE-D2**
VENTS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-V1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO4-38101-02488, TYPE-V2**
TEMP. CONN.	1½"	**FLANGED INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488**
PRESS. CONN.	¾"	**SW NIPPLE (VI) WITH VALVE AS PER BHEL. STD. DWG. 4-38101-02488.**

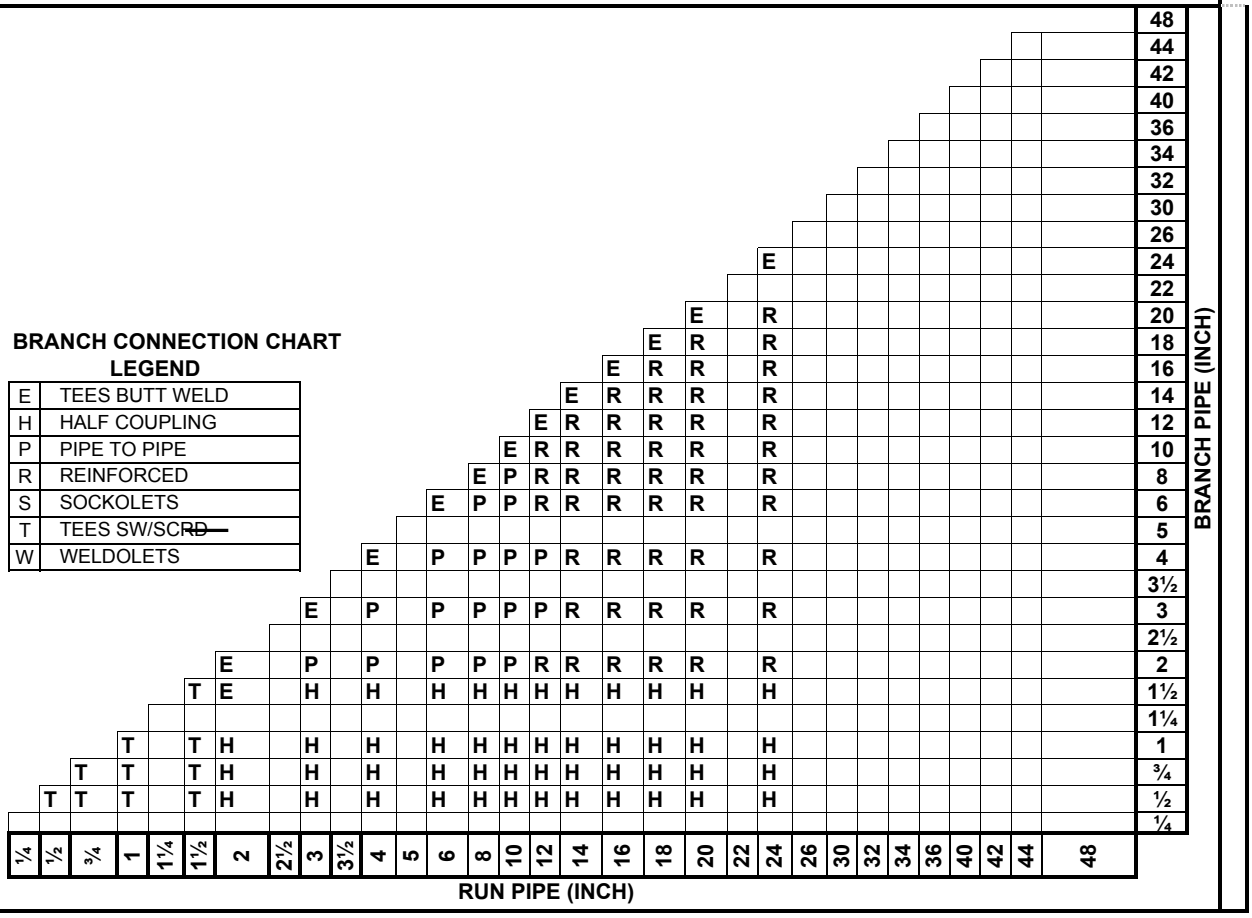
NOTES

1. **NDT REQUIREMENTS AS PER BHEL STD DOC NO GT 57124**
2. BALL VALVES SHALL NOT BE USED BEYOND 200 DEG CEN & PR. 7.03 KG/CM2(G)
3. VENT & DRAIN ISOLATION VALVES SHALL BE GATE VALVES . USE OF BALL VALVES SHALL BE LIMITED TO PROCESS LINES ONLY.
4. **FOR GENERAL NOTES ON PMS,PIPING & VALVES REFER STD. NO GT 6 9959.**
5. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY.
6. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.
7. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE OR THICKNESS.
8. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.
9. NOT A PREFFERED SCHEDUEL IN BHEL. AVOID SELECTION OF THIS SIZE IF POSSIBLE.

BRANCH CONNECTION CHART

LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW/SCRD
W	WELDOLETS



Customer:	**:STANDARD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL **CARBON STEEL** DESCRIPTION	BASIC MATERIAL **CARBON STEEL** BHEL SPEC	NOTE	Revision
PIPES	SEAMLESS	BE	½	¾	S160		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	1	1½	S80		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	2	2	S80		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	3	12	S 40		B 36.10	A106 GRB	AA10455		
	SEAMLESS	BE	14	16	STD (S30)		B 36.10	A106 GRB	AA10455		
	EFSW	BE	18	18	STD		B 36.10	ASTM A 672 GR B 60 CL 22	AA10457	6	
	EFSW	BE	20	20	STD (S20)		B 36.10	ASTM A 672 GR B 60 CL 22	AA10457	6	
	EFSW	BE	24	24	STD (S20)		B 36.10	ASTM A 672 GR B 60 CL 22	AA10457	6,9	
FLANGES	WELD NECK	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	AA7246306		
	WELD NECK	RF	2	24	150	125AARH	B 16.5	ASTM A 105	HY7246361		
	BLIND	RF	½	1½	300	125AARH	B 16.5	ASTM A 105	HY7246772		
	BLIND	RF	2	24	150	125AARH	B 16.5	ASTM A 105	HY7246166		
	FIGURE8 BLANK	RF	½	1½	300	125AARH	B 16.48	ASTM A 105	GT57083		
	FIGURE8 BLANK	RF	2	8	150	125AARH	B 16.48	ASTM A 105	GT57083		
	SPACER & BLIND	RF	10	24	150	125AARH	B 16.48	ASTM A 105	GT57083		
FITTINGS	ELBOWS 90 DEG	SW	½	¾	6000		B 16.11	ASTM A 105	AA7242501		
	ELBOWS 90 DEG	SW	1	1½	3000		B 16.11	ASTM A 105	AA7242501		
	ELBOWS 90 DEG	BW	2	2	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242695	7	
	ELBOWS 90 DEG	BW	3	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242695	7	
	ELBOWS 90 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY7242695	7	
	ELBOWS 45 DEG	BW	2	2	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242566	7	
	ELBOWS 45 DEG	BW	3	14	M	R=1.5D	B 16.9	ASTM A 234 GR WPB	HY7242566	7	
	ELBOWS 45 DEG	BW	16	24	M	R=1.5D	B 16.9	ASTM A 234 GR WPB-W	HY7242566	7	
	EQ. TEE	SW	½	¾	6000		B 16.11	ASTM A 105	AA7242510		
	EQ. TEE	SW	1	1½	3000		B 16.11	ASTM A 105	AA7242510		
	EQ. TEE	BW	2	2	M		B 16.9	ASTM A 234 GR WPB	AA7242511	7	
	EQ. TEE	BW	3	14	M		B 16.9	ASTM A 234 GR WPB	AA7242511	7	
	EQ. TEE	BW	16	24	M		B 16.9	ASTM A 234 GR WPB-W	AA7242511	7	
	CON. RDCR	BW	2	14	M,M		B 16.9	ASTM A 234 GR WPB	HY7242692	7	
	CON. RDCR	BW	16	24	M,M		B 16.9	ASTM A 234 GR WPB-W	HY7242692	7	
	CAP	BW	2	2	M		B 16.9	ASTM A 234 GR WPB	HY7242570		
	CAP	BW	3	24	M		B 16.9	ASTM A 234 GR WPB	HY7242570		
	FULL COUPLING	NPT/NPT	½	¾	6000		B 16.11	ASTM A 105	HY7242595	5	
	FULL COUPLING	NPT/NPT	1	1½	3000		B 16.11	ASTM A 105	HY7242595	5	
	FULL COUPLING	SW	½	¾	6000		B 16.11	ASTM A 105	AA7242520		
	FULL COUPLING	SW	1	1½	3000		B 16.11	ASTM A 105	AA7242520		
	VI (HALF CPLG)	SW	½	¾	6000		B 16.11	ASTM A 105	TC56213		
	VI (HALF CPLG)	SW	1	1½	3000		B 16.11	ASTM A 105	TC56213		
	NIPPLE	BW /NPT	½	¾	S 160		B 16.11	A106 GRB	HY7242578	5	
	NIPPLE	BW /NPT	1	1½	S 80		B 16.11	A106 GRB	HY7242578	5	
	NIPPLE	NPT/NPT	½	¾	S 160		B 16.11	A106 GRB	HY7242580	5	
	NIPPLE	NPT/NPT	1	1½	S 80		B 16.11	A106 GRB	HY7242580	5	
VALVES	GATE	SW	½	1½	800		API 602 / BS 5352	B:A 105; T:13% Cr;St	AA7521468		
	GATE	FL	2	24	150		API 600	B:A 216 GR. WCB; T:13% Cr	AA7521408		
	GLOBE	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	AA7501468		
	GLOBE	FL	2	16	150		BS 1873	B:A 216 GR. WCB; T:13% Cr	AA7501408		
	Reg GLOBE VLV	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	HY7511943		
	Reg GLOBE VLV	FL	2	12	150		BS 1873	B:A 216 GR. WCB; T:13% Cr	AA7511408		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS 5352	B:A 105; T:13% Cr;St	AA7531468		
	CHECK	FL	2	24	150		BS 1868	B:A 216 GR. WCB; T:13% Cr	AA7541408		
	BALL	FL	½	1½	**150**		BS 5351	B:A 105; T:13% Cr;St	GT57066	2,3	
	BALL	FL	2	16	150		BS 5351	B:A 105; T:13% Cr;St	GT57066	2,3	

B:BODY, T:TRIM, BB:BOLTED BONNET, St:STELLITED

Customer:	**:STANDARD**
ANSI CLASS:	150 #
CORR.ALL.	1.5 mm
Special requirement	NON IBR

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL **CARBON STEEL** DESCRIPTION	BASIC MATERIAL **CARBON STEEL** BHEL SPEC	NOTE	Revision
BOLT & GASKET	STUD + 2NUTS		M12	M27			B 18.2	A 193 GR B7/ A194 2H	HY7142198		
	STUD + 2NUTS		M30	M70			B 18.2	A 193 GR B7/ A194 2H	HY7142299		
	GASKET		½	1½	600		B 16.20	SS 316 SPIRAL WOUND + CAF		8	
	GASKET		2	24	150		B 16.20	SS 316 SPIRAL WOUND + CAF		8	
MISC	STEAM TRAP	RF	½	1½	**300**	THERMODY NAMIC	MNF. STD.	B:A 105; INT: SS 304	**GT57278**		
	Y-TYPE STRAINER	SW	½	1½	800		B 16.11	B: A 105; INT: SS 304	HY7577468		
	Y-TYPE STRAINER	FL	2	24	150		B 16.5	B: A 216 WCB; INT: SS 304	HY7577408		

Customer:	**: STANDARD**
ANSI CLASS:	150 #
CORR.ALL.	0.0 mm
Special requirement	NON IBR

TEMPERATURE (Deg.C) & PRESSURE (kg/cm2 g) RATINGS

TEMP	-29	38	50	100	150	200	250	300	325	350					
PRESS.	19.41	19.41	19.00	17.37	16.04	14.10	12.36	10.42	9.50	8.58					

SERVICE: HSD, NAPHTHA, NG, REFINERY GAS, COLD DM WATER,POLISHED WATER, POLISH CONDENSATE, LP DOSING, LUBE OIL AFTER FILTER.

ITEM	SIZE	DESCRIPTION
MAINT. JOINTS	ALL	FLANGED (TO BE KEPT MINIMUM)
PIPE JOINTS	1½" AND BELOW	SW COUPLING (REF NOTE-5)
	2" AND ABOVE	BUTT WELDED AS PER ANSI B16.25
DRAINS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-D1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO. 4-38101-02488, TYPE-D2**
VENTS	ON LINES ≤ 1½"	**AS PER BHEL STD DRG NO.4-38101-02488, TYPE-V1**
	ON LINES ≥ 2"	**¾" OR AS PER BHEL DRG NO4-38101-02488, TYPE-V2**
TEMP. CONN.	1½"	**FLANGED INSTALLATION AS PER BHEL STD. DWG.NO 4-38101-02488**
PRESS. CONN.	¾"	**SW NIPPLE (VI) WITH VALVE AS PER BHEL. STD. DWG. 4-38101-02488.**

NOTES

1. **NDT REQUIREMENTS AS PER BHEL STD DOC NO GT 57124**
2. BALL VALVES SHALL NOT BE USED BEYOND 200 DEG CEN & PR. 7.03 KG/CM2(G)
3. VENT & DRAIN ISOLATION VALVES SHALL BE GATE VALVES . USE OF BALL VALVES SHALL BE LIMITED TO PROCESS LINES ONLY.
4. **FOR GENERAL NOTES ON PMS,PIPING & VALVES REFER STD. NO GT 6 9959.**
5. NPT CONNECTIONS ARE PERMITTED IN THERMAL RELIEF VALVES ONLY.
6. WELDED PIPE SHALL HAVE ONLY LONGITUDINAL WELD MADE BY EMPLOYING AUTOMATIC WELDING.
7. MINIMUM THICKNESS OF FITTING SHALL BE IN LINE WITH THE PIPE SCHEDULE OR THICKNESS.
8. BLABK
9. NOT A PREFFERED SCHEDUEL IN BHEL. AVOID SELECTION OF THIS SIZE IF POSSIBLE.
10. ALL ITEMS SHALL BE SUPPLIED IN SOLUTION ANNEALED CONDITION.
11. MSW GASKET SHALL BE SELF ALIGNING TYPE WITH INNER RING OF SPIRAL STRIP MATERIAL.

BRANCH CONNECTION CHART

LEGEND

E	TEES BUTT WELD
H	HALF COUPLING
P	PIPE TO PIPE
R	REINFORCED
S	SOCKOLETS
T	TEES SW/SCRD
W	WELDOLETS

BRANCH PIPE (INCH)	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	22	24	26	30	32	34	36	40	42	44	48
48																						E								
44																														
42																														
40																														
36																														
34																														
32																														
30																														
26																														
24																						E								
22																														
20																				E		R								
18																			E	R		R								
16																		E	R	R		R								
14																	E	R	R	R		R								
12																E	R	R	R	R		R								
10															E	R	R	R	R	R		R								
8														E	P	R	R	R	R	R		R								
6													E	P	P	R	R	R	R	R		R								
5																														
4												E		P	P	P	P	R	R	R		R								
3½																														
3									E		P		P	P	P	P	R	R	R	R		R								
2½																														
2							E		P		P		P	P	P	P	R	R	R	R		R								
1½						T	E		H		H		H	H	H	H	H	H	H	H		H								
1¼																														
1					T		T	H		H		H		H	H	H	H	H	H	H		H								
¾				T		T	T	H		H		H		H	H	H	H	H	H	H		H								
½			T		T	T		T	H		H		H		H	H	H	H	H	H		H								
¼																														

RUN PIPE NB

Customer:	**: STANDARD**
ANSI CLASS:	150 #
CORR.ALL.	0.0 mm
Special requirement	NON IBR

ITEMS	TYPE	ENDS	DIA. RANGE (INCH) LOW	DIA. RANGE (INCH) HIGH	SCH/ THK/ RATING	FACE FINISH / RADIUS	DIM / DESG. STD.	BASIC MATERIAL **STAINLESS STEEL** DESCRIPTION	BASIC MATERIAL **STAINLESS STEEL** BHEL SPEC	NOTE	Revision
PIPES	SEAMLESS	BE	½	¾	S 80S		B 36.19	A312 TP321	AA10755		
	SEAMLESS	BE	1	1½	S 40S		B 36.19	A312 TP321	AA10755		
	SEAMLESS	BE	2	6	S 40S		B 36.19	A312 TP321	AA10755		
	SEAMLESS	BE	8	8	S 10S		B 36.19	A312 TP321	AA10755		
	SEAMLESS	BE	10	12	S 10S		B 36.19	A312 TP321	AA10755	9	
FLANGES	WELD NECK	RF	½	1½	300	125AARH	B 16.5	A182 F321	HY7246375		
	WELD NECK	RF	2	12	150	125AARH	B16.5	A182 F321	HY7246374		
	BLIND	RF	½	1½	300	125AARH	B 16.5	A182 F321	HY7246774		
	BLIND	RF	2	12	150	125AARH	B 16.5	A182 F321	HY7246775		
	FIGURE8 BLANK	FF	½	1½	300	125AARH	B 16.48	A182 F321	GT57083-06		
	FIGURE8 BLANK	FF	2	8	150	125AARH	B 16.48	A182 F321	GT57083-06		
	SPACER & BLIND	FF	10	12	150	125AARH	B 16.48	A182 F321	GT57083-06		
FITTINGS	ELBOWS 90 DEG	SW	½	1½	3000		B 16.11	ASTM A182 F321	AA7242501		
	ELBOWS 90 DEG	BW	2	8	M	R=1.5D	B 16.9	ASTM A 403 GR WP321-S	**HY7242696**	7	
	ELBOWS 90 DEG	BW	10	12	M	R=1.5D	B 16.9	ASTM A 403 GR WP321-WX	**HY7242696**	7	
	ELBOWS 45 DEG	BW	2	8	M	R=1.5D	B 16.9	ASTM A 403 GR WP321-S	HY7242558	7	
	ELBOWS 45 DEG	BW	10	12	M	R=1.5D	B 16.9	ASTM A 403 GR WP321-WX	HY7242558	7	
	EQ. TEE	SW	½	1½	3000		B 16.11	ASTM A182 F321	AA7242510		
	EQ. TEE	BW	2	8	M		B 16.9	ASTM A 403 GR WP321-S	**HY7242693**	7	
	EQ. TEE	BW	10	12	M		B 16.9	ASTM A 403 GR WP321-WX	**HY7242693**	7	
	CON. RDCR	BW	2	8	M		B 16.9	ASTM A 403 GR WP321-S	**HY7242694**	7	
	CON. RDCR	BW	10	12	M		B 16.9	ASTM A 403 GR WP321-WX	**HY7242694**	7	
	FULL COUPLING	NPT/NPT	½	1½	3000		B 16.11	ASTM A182 F321	HY7242595	5	
	FULL COUPLING	SW	½	1½	3000		B 16.11	ASTM A182 F321	AA7242520		
	VI (HALF CPLG)	SW	½	1½	3000		B 16.11	ASTM A182 F321	TC56213		
	NIPPLE	BW /NPT	½	1½	S 80S		B 16.11	ASTM A182 F321	HY7242578	5	
	NIPPLE	NPT/NPT	½	1½	S 80S		B 16.11	ASTM A182 F321	HY7242580	5	
VALVES	GATE	SW	½	1½	800		API 602	B:A 182 GR. F304 ; T:St	GT57078-02		
	GATE	FL	2	12	150		API 600	B:A 351 GR CF8; T:SS304	AA7521418		
	GLOBE	SW	½	1½	800		BS 5352	B:A 182 GR. F304 ; T:St	AA7501478		
	GLOBE	FL	2	12	150		BS 1873	B:A 351 GR. CF8; T:SS304	AA7501418		
	Reg. Globe valve	SW	½	1½	800		BS 5352	B:A 182 GR. F304 ; T:St			
	Reg. Globe valve	FL	2	14	150		BS 1873	B:A 351 GR. CF8; T:SS304	HY7511516		
	CHECK (PISTON LIFT)	SW	½	1½	800		BS 5352	B:A 182 GR. F304 ; T:St	GT57070-02		
	CHECK	FL	2	12	150		BS 1868	B:A351 GR. CF8; T:SS304	GT57071-03		
	BALL	FL	½	1½	150		BS 5351	B:A 182 GR. F304 ;SEAT-RPTFE	GT57066-06	2,3	
	BALL	FL	2	12	150		BS 5351	B:A 351 GR. CF8; SEAT-RPTFE	GT57066-06	2,3	
	B:BODY, T:TRIM, BB:BOLTED BONNET, St:STELLITED										
BOLT & GAS	STUD + 2NUTS	NPT	M12	M27			B 18.2	A 193 GR B7/ A194 2H	HY7142198		
	STUD + 2NUTS	NPT	M30	M70			B 18.2	A 193 GR B7/ A194 2H	HY7142299		
	GASKET	RF	½	1½	300		B 16.20	NAB MSW (SS304)+ PTFE FILL	HY7240363	11	
	GASKET	RF	2	12	150		B 16.20	NAB MSW (SS304)+ PTFE FILL	HY7240362	11	
MISC	Y-STRAINERS	FL	½	1½	800		MFG STD	B:A 182 GR. F321 ;INT-SS304	GT57309-00		
	Y-STRAINERS	FL	2	12	150		MFG STD	B:A 403 GR. WP321 ;INT-SS304	GT57310-00		

Annexure-III

Sub-Vendor List

S.No	Item	Sub vendor
1	MS Plate	STEEL AUTHORITY OF INDIA LTD
		KIRTANLAL INTERNATIONAL DMCC
		INDUSTEEL BELGIUM
		DILLINGER-GTS VENTES
		ESSAR STEELS LIMITED
		UNION STAHL GMBH
		SALZGITTER MANNESMANN INTL GMB
		HANGZHOU COGENERATION
		JSW STEEL LIMITED
		DAEWOO INTERNATIONAL CORP. LTD
		WELSPUN CORP LIMITED
		DUFERCO S.A.,
		ACRONI d.o.o.
		JINDAL STEEL & POWER LIMITED
		CORUS UK LTD.,
2(a)	CARBON SEEL (SEAMLESS) TUBES / PIPES OD UPTO AND INCLUDING 114.3 MM	Sumitomo
		Koba steel
		Maharashtra Steel Tubes
		Jindal
		SAIL (WTP -Duplex imported)
		HUBEI XINYEGANG STEEL CO. LTD
		JR SEAMLESS PRIVATE LIMITED
		WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		YANCHENG STEEL TUBE CO. LTD.
		PATELS AIRFLOW LIMITED
		RMG ALLOY STEEL LIMITED
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.

		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,
		BHEL-SSTP-TRICHY
		LAL BABA SEAMLESS TUBES PVT. LTD.
2(b)	CARBON STEEL (SEAMLESS) TUBES / PIPES OD ABOVE 114.3 MM AND BELOW 219.1 MM	HUBEI XINYEGANG STEEL CO. LTD
		WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		YANCHENG STEEL TUBE CO. LTD.
		RMG ALLOY STEEL LIMITED
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,
3	STAINLESS STEEL TUBES &PIPES OD UPTO AND INCLUDING 168.3	LINK WELL SEAMLESS TUBES (P) LTD.
		ZHEJIJANG HI-TECH METALS CO. LTD.
		WUXI SPECIAL STEEL MATERIAL CO LTD
		ZHEJIANG PENGYE STAINLESS STEEL
		RATNAMANI METALS & TUBES LTD.,
		TPS TECHNITUBE ROHRENWERKE
		MODERN TUBE INDUSTRIES
		KRYSTAL STEEL MANUFACTURING
		CHANDAN STEEL LIMITED
		SHUBHLAXMI METALS & TUBES
		MAXIM TUBES COMPANY PVT. LTD.
		PRAKASH STEELAGE LTD.,
		HEAVY METAL & TUBES LIMITED,
		REMI EDELSTAHL TUBULARS LIMITED
		SANDVIK ASIA LIMITED
		SHEKASA ENGINEERING CO. PVT LTD
		HINDUSTAN INOX LTD
		SCORODITE STAINLESS

		IGAWARA INDL SERVICE & TRADING
		TUBACEX TUBOS INOXIDABLES S.A.
4(a)	CARBON STEEL & ALLOYSTEEL - HEAVY STRUCTURAL STEEL (WF BEAMS,ANGLES & CHANNELS)	STEEL AUTHORITY OF INDIA LTD
		BEEKAY STRUCTURAL STEELS
		UNION STAHL GMBH
		SALZGITTER MANNESMANN INTL GMBH
		IGAWARA INDL SERVICE & TRADING
		JINDAL STEEL & POWER LIMITED
		CORUS UK LTD.,
4(b)	STRUCTURAL STEEL (BEAMS, ANGLES & CHANNELS)	
		SUJANA METAL PRODUCTS LTD.
		STEEL AUTHORITY OF INDIA LTD
		RASHTRIYA ISPAT NIGAM LIMITED,
		BEEKAY STRUCTURAL STEELS
		NANDAN STEELS & POWER LTD.
		MAHAMAYA STEEL INDUSTRIES LIMITED
		TOPWORTH STEELS & POWER
		AGRAWAL STRUCTURE MILLS PVT. LTD.
		PRIME ISPAT LIMITED
		SKS ISPAT POWER LTD.
		MONNET ISPAT & ENERGY LTD.
		RELIABLE SPONGE PVT. LTD.
		JINDAL STEEL & POWER LIMITED
		KANISHK STEEL INDUSTRIEL LTD.
		NOBLE TECH INDUSTRIES PVT. LTD.
4(c)	MS FLATS, NON CRITICAL & SMALL QUANTITY STRUCTURALS	SUJANA METAL PRODUCTS LTD.
		STEEL AUTHORITY OF INDIA LTD
		PUSHPA ISPAT PVT. LTD.
		RASHTRIYA ISPAT NIGAM LTD,
		STEEL AUTHORITY OF INDIA LTD
		THE STAR WIRE (I) LTD.,
		PADMINI STEELS
		SARADA STEELS&BEARING COMPANY
		FERROMET STEELS PRIVATE LIMITED
5	PIPE FITTINGS	U I PIPE FITTINGS PVT. LTD.
		TUBE PRODUCTS INCORPORATE
		GUJARAT INFRAPIPES PVT.LTD.,
		TRUE FORGE PVT.LTD.,

		DEE DEVELOPMENT ENGINEERS LTD.,
		TRUE FAB ENGINEER (P) LTD.
		P.K. TUBES & FITTINGS PVT. LTD.
6	FLANGES	PRESHZINGER ENGINEERING
		THE PUNJAB STEEL WORKS,
		METAL FORGINGS P. LTD.
		TUBE PRODUCTS INCORPORATE
		C.D. INDUSTRIES,
		CHW FORGE PRIVATE LIMITED
		KISAAN STEELS (PVT) LTD.,
7	GASKETS	JYOTHI INDUSTRIES,
		STARFLEX SEALING INDIA
		JAMES WALKER INMARCO INDS PVT LTD
		UNIQUE INDUSTRIAL PACKINGS PVT. LTD
		UNI KLINGER LTD.
		I G P ENGINEERS LIMITED,
		MADRAS INDUSTRIAL PRODUCTS,
		PACKINGS & JOINTINGS GASKETS
		PRESHZINGER ENGINEERING
		THE PUNJAB STEEL WORKS,
		METAL FORGINGS P. LTD.
		TUBE PRODUCTS INCORPORATE
		C.D. INDUSTRIES,
		CHW FORGE PRIVATE LIMITED
		KISAAN STEELS (PVT) LTD.,

Annexure-IV(A)

Datasheet for Level Indicator

Annexure-IV(B)

Datasheet for Plates and Structural Steel

ANNEXURE-IV(A): DATA SHEET FOR LEVEL INDICATOR

S.NO.	COMPONENT	DESCRIPTION
1	Type	Float and Dial Type Level Gauge
2	Float Material	CS
3	Guide Cable	CS
4	Float Cable	CS
5	Spring	CS
6	Cover	CS
7	Roller / Pulley and Pulley Housing	CS
8	Scale Board	Aluminium, P.U. Painted
9	Pointer and Graduations	Aluminium and S.S.
10	Accuracy	± 5 mm
11	Range	To suit tank size
12	Quantity	One (1) number each for the following tanks 1 No. of CW Make-Up Water Tank of Capacity 1000Cu.m 1 No. of Intermediate DM Water Storage tank of Capacity 50Cu.m 1 no. of DM Water Storage Tank of Capacity 1000Cu.m
NOTE: For other components, the material shall be intimated to successful bidder by BHEL during detail engineering for which no commercial implication shall be entertained by BHEL. Suitable mechanism shall be provided by the bidder to minimize air ingress into the tank.		

ANNEXURE-IV(B): DATA SHEET FOR PLATES & STRUCTRUAL STEEL

1.0	Make	:	As indicated in the vendor list
2.0	Quantity of Structural Steel	:	As per approved BOQ
A.0	**MS Plate**		
1.0	Material	:	IS:2062, Gr. B
2.0	Width	:	To be informed to successful bidder during detail engineering stage
3.0	Length	:	To be informed to successful bidder during detail engineering stage
4.0	Thickness (minimum)	:	As specified in Datasheet for Water Storage Tanks(Refer Annexure-I)
5.0	Chemical Composition	:	As per IS:2062
6.0	Mechanical Composition	:	As per IS:2062
7.0	Inspection & Testing	:	As per approved ICP/QAP
B.0	**Angle, Channel, Beam, Bar and Flat**		
1.0	Material	:	As per IS:2062, Grade-A
2.0	Size	:	As per IS Structural Hand Book

Annexure-V

Pre-Bid Clarification Format

ANNEXURE-V: PRE-BID CLARIFICATION FORMAT

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification Doc. No. PY-51186(along with all Annexures) and the Enclosed Check List(Refer Annexure-VII) shall also be referred.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

Annexure-VI

Recommended Spares for 3 Years of Normal Operation

<u>ANNEXURE-VI</u>: RECOMMENDED SPARES FOR 3 YEARS OF NORMAL OPERATION

S.No.	Item Description	Quantity
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

Annexure-VII

CHECK LIST

(TO BE SUMITTED ALONG WITH OFFER)

ANNEXURE-VII: CHECK LIST TO BE SUBMITTED BY THE BIDDER ALONG WITH THE OFFER

Note: Bidder to note that Check List shall be completely filled and the data required in-line with Check List shall be submitted along with their Offer will all the necessary data/drawings/documents to enable Purchaser to evaluate the offer submitted.

S.No.	Description	Enclosed or [Yes/No]	Remarks/Comments By Bidder
1	**Bidder to confirm compliance with PY-51186** and its annexures without any deviations and price implications.		
2	**Bidder to Confirm** Compliance with Annexure-XI: Site facilities in Bidder's and BHEL's Scope.		
3	**Bidder** has already raised pre-bid queries (if any) on Technical specification for Storage tanks through Annexure-V(Pre-Bid Clarifications). **Pre-Bid Clarifications Received from purchaser and the same are Agreed/Accepted without any price implication (If any).** The offer is submitted without any deviations and price implication.		
4	**Bidder to Confirm Compliance** with Datasheet for Water Storage Tanks (Annexure-I). Signed and stamped copy of Annexure-I is enclosed with Bidder's offer.		
5	**Bidder to Confirm Compliance with** Scope of supply, Scope of Serviecs, Exclusions(Civil Engg & Civil Works, Instrumentation is in Purchaser's Scope) and other Sub-Sections of Purchase Specification PY-51186 along with enclosed Annexures.		
6	Bidder to note that loading data & anchor bolt details shall be provided by bidder within two weeks' time from the LOI. **Bidder to confirm.**		
7	Refer Note of Pg. 4 of 8 of Annexure-I, wherein SS Wire Mesh shall be provided		

	fro all nozzles except shell/roof manhole to prevent blocking of PP Balls. **Bidder to Confirm.**		
8	**Refer S. no. 1.1 of Pg. 1 of 8 of Annexure-I, wherein** 3 layers of Polypropylene Balls of diameter 50mm each to be provided for DM Water & Intermittent DM Water Storage tanks in addition to CO2 Absorbers. **Bidder to Confirm.**		
9	**Refer S. no. 1.1 of Pg. 1 of 8 of Annexure-I,** wherein seal pot and breather tank for each DM & Intermittent DM Water Storage Tank are in Bidder's Scope of Supply. **Bidder to Confirm.**		
10	Refer 3.1.1(j) of **PY 51186, wherein** Piping from Vent and Overflow of DM & Intermittent DM Water Storage tanks upto Breather tank and Seal pot are in bidder's scope of supply. **Bidder to Confirm.**		
11	Refer 3.1.1(k) of **PY 51186, wherein** all inlet lines shall be provided with diffusers. **Bidder to Confirm.**		
12	Refer 4.1(d) of **PY 51186, wherein all inlet** Piping to CW, DM & Intermittent DM Water Storage tanks shall be routed from bottom of tank(Shell Side). **Bidder to Confirm.**		
13	All the documents indicated in Cl. No. 8.1 of PY 51186 shall be submitted within the time period indicated. **Bidder to confirm.**		
14	**Bidder to confirm compliance** with Painting Specification indicated in Datasheet for Water Storage Tank as Annexure-I with PY-51186.		
15	All the Three Storage Tanks are designed, manufactured, testing & inspection at manufacturer's works/Site in accordance with IS-803/API-650. **Bidder to Confirm.**		
16	Bidders to note that minimum inspection check requirement are indicated in the Technical Specification for the following		

	items. 1) Plates 2) Valves 3) Pre-fabricated plates, Pipes and Fittings and Structural Steel 4) Level Switches and Level Gauges / Indicators. Any changes made by customer on the same during detail engineering will not have any commercial implication. Further, QAP/CL required for balance items (if any) shall be submitted by bidder during detail engineering for customer approval. **Bidder to confirm.**		
17	**Bidder to note that the offer is submitted without** any Deviation and price implications.		
18	Filled and stamped copy of Recommended Spares for 3 Years of Normal Operation is enclosed with bidder's offer. **Bidder to confirm.**		
19	Bidder to indicate the deviations which are impractical. These deviations shall be raised(By Bidder) in pre-bid clarification format(Refer Annexure-V) only.		
20	Bidder to Confirm Compliance with Annexure-XI(including guidelines for preparation of QAP, QAP format, Inspection, Testing and E&C requirements) with purchase specification PEMC-51186		
21	~~**100 % Additional Gaskets(Quantity Equivalent to Installed Gaskets)** for each Condensate Forwarding Tank shall be supplied in loose. **Bidder to Confirm.**~~		
22	**Bidder to Confirm** the following i) Provision of Float cum Dial Type Mechanical Level Guage. **ii) <u>Provision of Manholes:</u>** One. No(600 mm) on Shell Plate and One No(600 mm) on Roof Plate. **iii) <u>Provision of Ladder:</u>** One No. of cage ladder for 50 cu.m and One No. of Spiral		

	Staircase for each Tank(1000 cu.m) and suitable access platform.		
23	**Surface Preparation:** In ONGC Hazira complex no sand blasting or shot blasting shall be done. Only wire mesh of SA 2 ½ to be performed. **Bidder to confirm.**		
24	Size and No. of Foundation Bolts for all the three tanks are indicated in Bidder's offer. **Bidder to Confirm.**		
25	Filled and stamped copy of un-priced bid format(Annexure-VIII) is enclosed with the offer.		

SIGNATURE:_____

NAME: _____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

Annexure-VIII

PRICE BID FORMAT FOR WATER STORAGE TANKS

ANNEXURE-VIII: PRICE BID FORMAT FOR WATER STORAGE TANKS

PROJECT - 1X51 MW ONGC HAZIRA COMBINED CYCLE POWER PLANT

Sl. No.	Description	Qty.	Unit	PRICE (Refer Notes)	
				Unit Price (Rs.)	Total Price (Rs.)
A	**MAIN BID**				
I	**Supply of Materials for Storage Tanks**				
1	Price for Design, Supply of Material to Site, for 1 No. of CW Make-Up Water Tank of Capacity 1000 Cu.m	1	SET		
2	Price for Design, Supply of Material to Site, for 1 No. of DM Water Storage Tank of Capacity 1000 Cu.m	1	SET		
3	Price for Design, Supply of Material to Site, for 1 No. of Intermediate DM Water Storage tank of Capacity 50 Cu.m	1	SET		
II	**Erection & Commissioning of Storage Tanks**				
1	Price for Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over of 1 No. of CW Make-Up Water Tank of Capacity 1000 Cu.m	1	SET		
2	Price for Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over of 1 No. of DM Water Storage Tank of Capacity 1000 Cu.m	1	SET		
3	Price for Storage, Preservation, Site Transportation, fabrication, Erection, inspection and testing, painting and commissioning, handing over 1 No. of Intermediate DM Water Storage tank of Capacity 50 Cu.m	1	SET		
B	**OPTIONAL BID**				
4	3 Years operational spares(Detailed list with individual prices to be furnished as per Annexure-VI-Recommended Spares for 3 Years of Normal Operation)	1	set		

Notes:

1. Bidder to quote strictly as per BHEL's NIT requirements.
2. Bidder to note that this is a LUMP SUM Turn-Key Order. Any additional claim after placement of order will not be entertained under any circumstances.

3. Offer will be evaluated based on total price for Supply and Erection & Commissioning (i.e. Sl. Nos. **A.I.1 + A.I.2 + A.I.3 + A.II.1 + A.II.2 + A.II.3** of price format). Prices of Optional Item shall not be considered for Price bid evaluation.
4. For purpose of ordering of complete Water Storage Tank Package by BHEL, the prices of all Supply and E&C portions shall be considered as follows:
    i) <u>For Supply of Materials for Complete Water Storage Tanks</u>:
    Shall be **65 % of the Total Prices** (i.e. Sl. Nos. **A.I.1 + A.I.2 + A.I.3 + A.II.1 + A.II.2 + A.II.3)** of price bid format quoted by the bidder for supply of materials and Erection & Commissioning of complete water storage tanks.
    i.e. Total Price for the Supply shall be considered as **0.65x (A.I.1 + A.I.2 + A.I.3 + A.II.1 + A.II.2 + A.II.3)**
    ii) <u>For Erection & Commissioning Services of Water Storage Tanks</u> :
    Shall be **35% of the Total Prices** (i.e. Sl. Nos. **A.I.1 + A.I.2 + A.I.3 + A.II.1 + A.II.2 + A.II.3)** of price bid format quoted by the bidder for supply of materials and Erection & Commissioning of complete water storage tanks.
    i.e. Total Price for the Erection & Commissioning shall be considered as **0.35x (A.I.1 + A.I.2 + A.I.3 + A.II.1 + A.II.2 + A.II.3).**
5. Separate Purchase Orders will be issued for Supply portion and for Erection & Commissioning works of this project. The Purchase Order for Supply portion will be issued by BHEL-PE&SD whereas the Purchase Order for E&C portion will be issued by BHEL-PSWR (BHEL's Construction Management Division)
6. Bidder to quote the base rates only. All Applicable taxes and duties to be indicated shall be indicated separately for the Supply Portion and Erection & Commissioning Portion as follows:
    i) All Applicable Taxes and duties for Supply of Main Items shall be computed for the value of 0.65 x (A.I.1 + A.I.2 + A.I.3).
    ii) All Applicable Taxes and duties for Erection & commissioning Part shall be computed for the value of 0.35 x (A.II.1 + A.II.2 + A.II.3).

BIDDER'S SIGNATURE
NAME:
DATE
COMPANY SEAL

Annexure-IX
REFERENCE P&IDs

Refer P&ID for Cooling Water System.	Drg No. 2-38101-04546(Sh 02 of 02)	CW Make-Up Water Storage Tank(Capacity 1000 cu.m)
P&ID for Mixed Bed Unit and Associated Unit .	Drg No. 1-38101-06496	DM Water Storage Tank(Capacity 1000 cu.m) & Intermediate DM Water Storage Tank(Capacity 50 cu.m)

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-38101-04546

SH. 02 OF 02

AIR SCOURING BLOWERS (1W + 1S)

	Pr. Kg/Cm²(g)	Temp °C	Flow m3/hr
NOR.	2.65	34	200
MIN.	--	--	--
MAX.	3.0	--	--
DES	4.0	65	--

FROM CW PUMP DISCH. HEADER
REF DRG NO 2-38101-04546 SH. 1 OF 2

BW ← SSF VENDOR

PE&SD PIPING

GTV-4883, GTV-4885A, GTV-4886A, GTV-4887A, 04-ABM-4832, 04-AB-4831
GTV-4885B, GTV-4886B, GTV-4887B, 04-ABM-4834, 04-AB-4833

PI 4857, PI 4856

BV-4884A, BV-4884B

PE&SD PIPING → TO SSF BACKWASH & CT DRAIN PIT REF P&ID: 1-38101-6547

BW ← SSF VENDOR

PI 4852, PI 4855

GTV-4881A, BV-4882A, BV-4883A, GTV-4879A, GTV-4880A
GTV-4881B, BV-4882B, BV-4883B, GTV-4879B, GTV-4880B

DPI 4851, DPT 4851, DPI 4854, DPT 4854

BV-4872A, GTV-4878A, BV-4873A, PI 4850, GTV-4874A, BV-4875A, BV-4876A, GTV-4877A
BV-4872B, GTV-4878B, BV-4873B, PI 4853, GTV-4874B, BV-4875B, BV-4876B, GTV-4877B

04-SSF-4829

04-SSF-4830

TO CW SUMP
REF P&ID: 2-38101-4546 SH. 1/2

2X50% SIDE STREAM FILTERS
CAP: 100 M3/HR. EACH
(SSF Vendor Scope)

PI 4849, GTV-4871A, GTV-4870A, NRV-4869A, 04-PM-4826, 04-P-4825, GTV-4868A
PI 4848, GTV-4871B, GTV-4870B, NRV-4869B, 04-PM-4828, 04-P-4827, GTV-4868B

SSF BACK WASH WATER PUMP (1W + 1S)

SSF VENDOR → BW

	Pr. Kg/Cm²(g)	Temp °C	Flow m3/hr
NOR.	--	--	5
MIN.	--	--	--
MAX.	--	--	--
DES	--	--	--

P

PE&SD C&I

FLOAT & BOARD TYPE LEVEL INDICATOR

SW, DAIL TYPE LI 4860

PE&SD PIPING OVER FLOW

3"-CWM-04-4825-11D

PE&SD

I 4815, LSH 4858, LSL 4859, I 4816

04-TK-4819

SERVICE WATER TANK (HDPE/FRP) CAP:5M³

TANK VENDOR

P&ID FOR SW & FILTERED WATER DIST. REF P&ID: 1-38101-6222

GTV-MOV-4861

GTV-4888

GTV-4891

P&ID FOR SW & FILTERED WATER DIST. REF P&ID: 1-38101-6222

FLOAT & BOARD TYPE LEVEL INDICATOR

SW, DAIL TYPE LI 4842

12", 1"

PE&SD PIPING
12"-OF-04-4833-11D OVER FLOW

04-TK-4820

CW MAKEUP WATER STORAGE TANK (MSEP TANK)

CAP:1000m³

TANK VENDOR

OPEN ON LAL 4814

LAH 4845, LAL 4845

CLOSE ON LAH 4817

LI 4845

10" SPARE

LT 4845A, GTV-4889A, 3" 300# RF
LT 4845B, GTV-4889B, 3" 300# RF

1oo2

8" SPARE

24" MANHOLE

10"-CWM-04-4827-11D

GTV-4863

10"-CWM-04-4828-11D

8"-CWM-04-4826-11D

GTV-4859, GTV-4858, GTV-4856, GTV-4855

S, SOV 4841, UV 4841, ZSO 4841, ZAO 4841, ZSC 4841, ZAC 4841

FC

GLV-4857

REFER NOTE 12

BHEL CUSTOMER

FILTERED WATER HEADER

	Pr. Kg/Cm²(g)	Temp °C	Flow m3/hr
NOR.	3.0	--	133.2
MIN.	--	--	--
MAX.	--	--	--
DES	--	--	--

CW Water Storage Tank
Instrumentation on tank is excluded from vendor Scope. **Only Nozzle along with Counter Flanges, Gaskets, Studnuts for Instrument nozzles to be provided by bidder. However Level Indicator is in Bidder Scope of Supply.**

I 4818, PAL 4843, PS 4843, GTV-4890

CT SUMP MAKE UP LINE
2-38101-04546 SH. 1 OF 2

	Kg/Cm (g)	Temp °C	Flow m3/hr
NOR.	1.5	--	113
MIN.	--	--	--
MAX.	--	--	--
DES	--	--	--

6"-CWM-04-4832-11D

PI 4847, GTV-4867A, GTV-4866A, 6"-CWM-04-4830-11D, NRV-4865A, 04-PM-4822, 04-P-4821, GTV-4864A
PI 4846, GTV-4867B, GTV-4866B, 6"-CWM-04-4831-11D, NRV-4865B, 04-PM-4824, 04-P-4823, GTV-4864B

I 4805, I 4807, I 4818

8"-CWM-04-4829-11D

CT SUMP MAKEUP WATER PUMP (1W + 1S)

CUSTOMER: ONGC — OIL AND NATURAL GAS CORPORATION LIMITED

CONSULTANAT: FICHTNER CONSULTING ENGINEERS (INDIA) PVT. LTD.

PROJECT: 1x51MW COMBINED CYCLE CAPTIVE POWER PLANT,AT HAZIRA PLANT, GUJARAT.

BHARAT HEAVY ELECTRICALS LTD HYDERABAD

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	AJIT SINGH	SD/-	16.06.15	-N.A.-
CHD.	PRADEEPA	SD/-	16.06.15	
APPD.	AMIT SINHA	SD/-	16.06.15	

DEPT.	UNTOL. DIMS.		SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
PE&SD	GR. C/M/F				-N.A.-	-N.A.-	-N.A.-
CODE 450							

TITLE: P&ID FOR COOLING WATER SYSTEM

CARD CODE N.A.

BHEL DRG NO. 2-38101-04546 REV. 01

CUST. DRG NO. 4546-04-1248

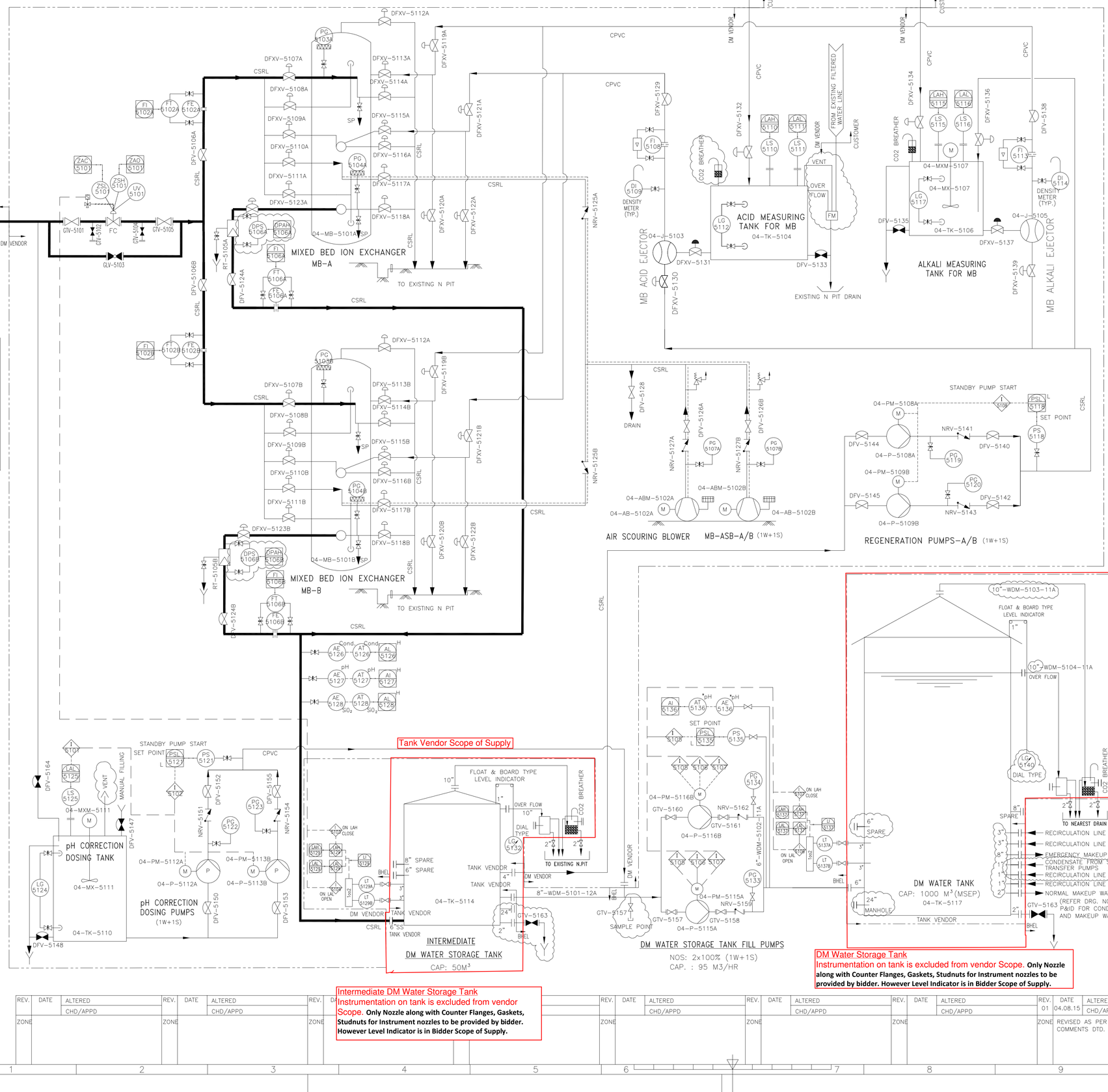
SHT. No 02 NO. OF SHT. 02

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 1-38101-06496

SH. OF



TAG NOS. ALLOCATION SUMMARY

DESCRIPTION	USED TAG NO.	RANGE	NOT USED
VALVE TAG.	5101-5164	5101-5199	5156,5149,5146
INTERLOCKS	5101-5108	5101-5199	–
INSTRUMENTATION TAG.	5101-5140	5101-5199	5130,5131, 5138,5139
LINE NUMBERS	5101-5104	5101-5199	–
EQUIPMENT TAG.	5101-5117	5101-5199	–

INTERLOCK SUMMARY:-

TITLE OF LOGIC	LOGIC NO.	TAGS INVOLVED	CONDITIONS FOR LOGIC EXECUTION	REMARKS
DM WATER INLET TO MB UNIT	I 5103	LAH -5130	INTERMEDIATE DM WATER STORAGE TANK FULL	TO CLOSE UV-5101
	I 5104	LAL-5131	INTERMEDIATE DM WATER STORAGE TANK LEVEL LOW	TO OPEN UV-5101
DM WATER STORAGE FILL PUMP	I 5107	LAH -5139	DM WATER STORAGE TANK FULL	TRIP THE DM WATER STORAGE FILL PUMP.
	I 5106	LAL-5138	DM WATER STORAGE TANK LEVEL LOW	START THE DM WATER STORAGE FILL PUMP.
	I 5105	PSL-5135	DISCHARGE HEADER PRESSURE LOW	START STANDBY DM WATER STORAGE FILL PUMP.
REGENERATION PUMP	I 5108	PSL-5118	DISCHARGE HEADER PRESSURE LOW	START STANDBY REGENERATION PUMP.
PH CORRECTION PUMP	I 5101	LAH -5125	PH CORRECTION TANK LEVEL LOW.	TRIP THE PH CORRECTION DOSING PUMP.
	I 5102	PSL-5121	DISCHARGE HEADER PRESSURE LOW	START STANDBY PH CORRECTION DOSING PUMP.

NOTES:-

1. ADDITIONAL VENTS AT HIGH POINTS AND DRAINS AT LOW POINT SHALL BE PROVIDED AS PER FINAL LAYOUT.
2. DM PLANT WILL BE OPERATED ON SEMI-AUTOMATIC MODE WITH ADEQUATE INSTRUMENTS FOR MONITORING AND ANNUNCIATIONS IN DCS
3. THE ACTUAL SIZE OF VALVES & PIPES ALONG WITH TAG NUMBERS SHALL BE INDICATED AFTER FINALIZATION OF DM PLANT VENDOR.

* TO BE SUPPLIED LOOSE BY VENDOR.

1-38101-06323	STANDARD LEGEND FOR P&ID	
PEMC-05061	NUMBERING PHILOSOPHY	
DRAWING NO.	TITLE	REMARKS

REFERENCE DRAWINGS

CUSTOMER:
OIL AND NATURAL GAS CORPORATION LIMITED

CONSULTANAT:
FICHTNER CONSULTING ENGINEERS (INDIA) PVT. LTD.

PROJECT: 1x51MW COMBINED CYCLE CAPTIVE POWER PLANT,AT HAZIRA PLANT, GUJARAT.

BHARAT HEAVY ELECTRICALS LTD
HYDERABAD

	NAME	SIGN.	DATE	NO. OF VAR.
DRN.	AJIT SINGH	SD/-	16.05.15	-N.A.-
CHD.	PRADEEPA	SD/-	16.05.15	
APPD.	AMIT SINHA	SD/-	16.05.15	

REV.	DATE	ALTERED	CHD/APPD
01	04.08.15	REVISED AS PER CUSTOMER/CONSULTANT COMMENTS DTD. 01.06.15.	CH.P AKS

DEPT. PE&SD	UNTOL. DIMS. GR. G/M/F	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEMS
CODE 450				-N.A.-	-N.A.-	-N.A.-

TITLE: P&ID OF MIXED BED UNIT & ASSOCIATED SYSTEM

CARD CODE N.A.

BHEL DRG NO. 1-38101-06496 REV. 01

CUST. DRG NO. 6496-04-1151

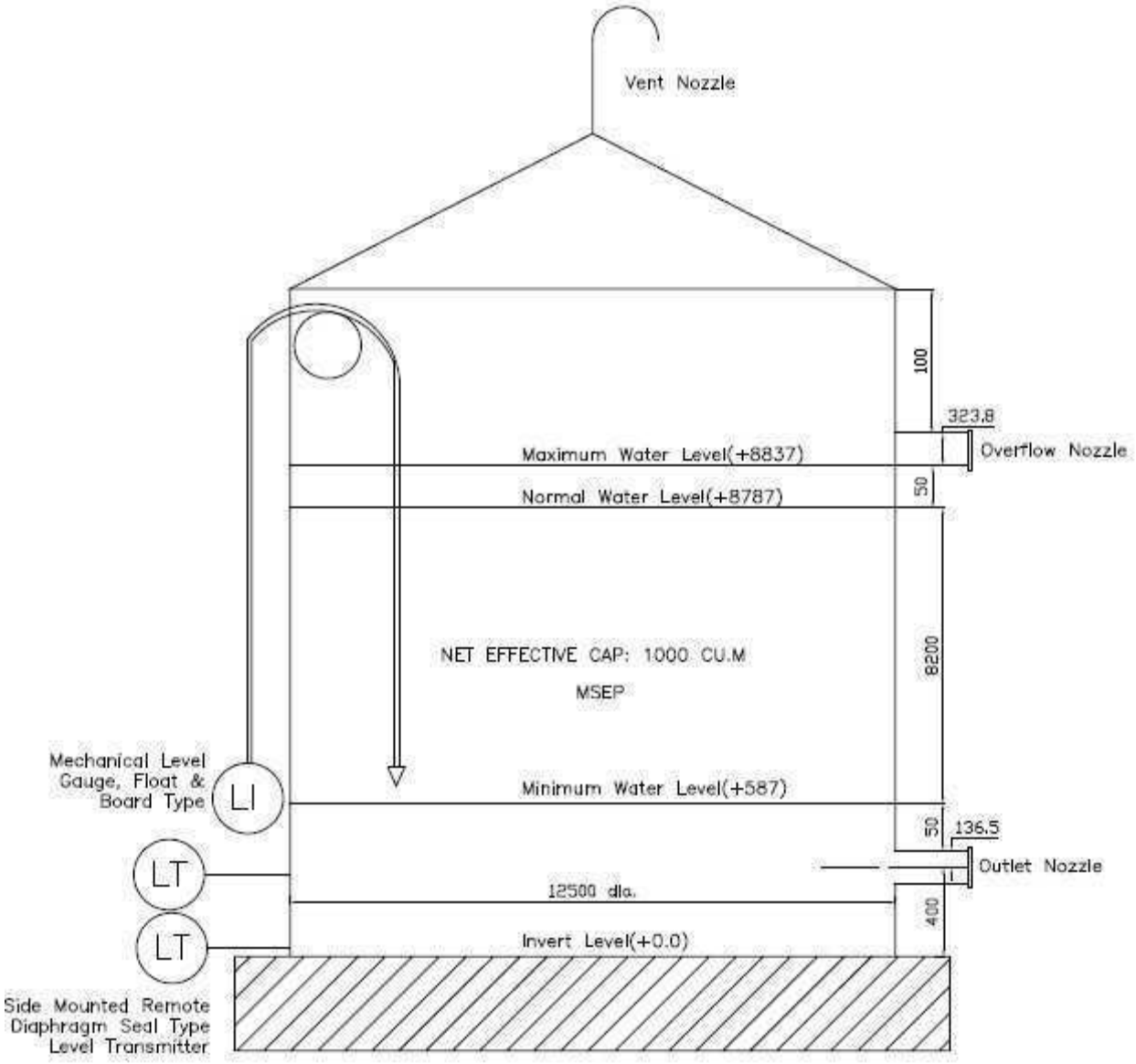
SHT. No 01 NO. OF SHT. 01

JCS

Annexure-X

Sketch for Water Levels of Storage Tanks

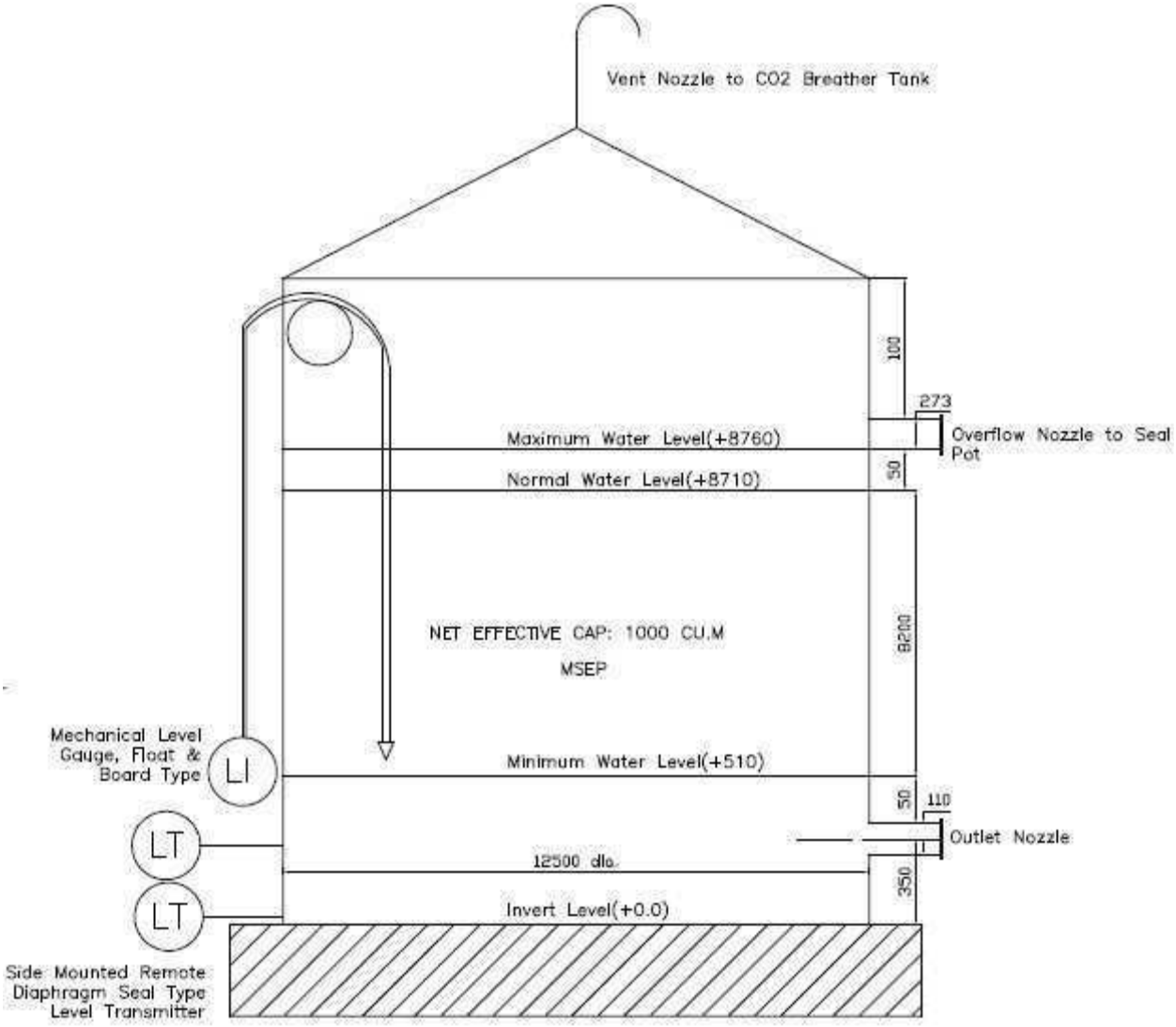
(A) CROSS-SECTIONAL VIEW OF CW MAKE-UP WATER STORAGE TANK (of Capacity 1000 cu.m)



Notes

1. All the dimensions are in mm.
2. Dimensions of height of tank are indicative only.
3. For Details, Refer P&ID for Cooling Water System, Drg No. 2-38101-04546(Sh 02 of 02)

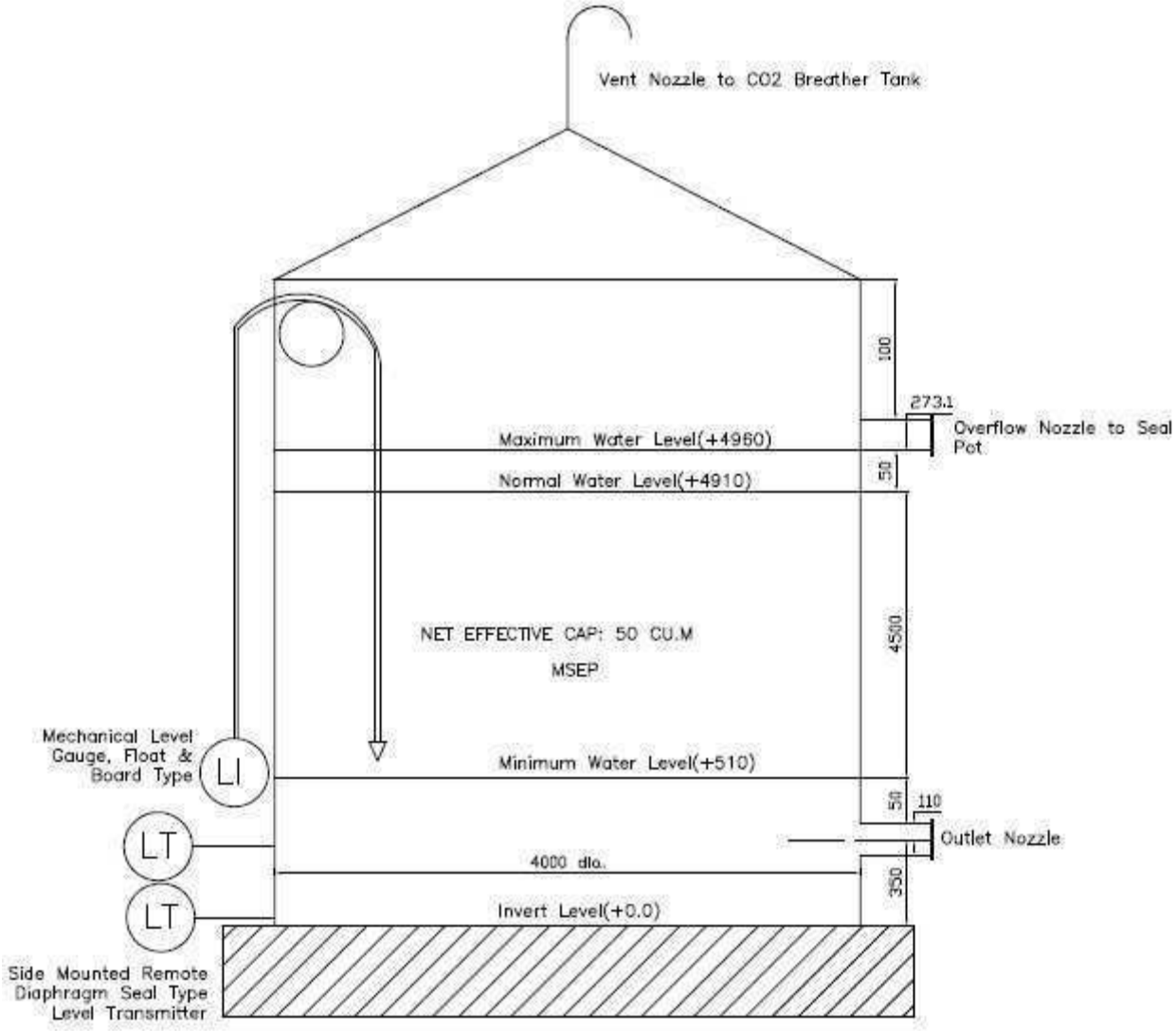
(B) CROSS-SECTIONAL VIEW OF DM WATER STORAGE TANK (of Capacity 1000 cu.m)



Notes

1. All the dimensions are in mm.
2. Dimensions of height of tank are indicative only.
3. For details, refer P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496

(C) CROSS-SECTIONAL VIEW OF INTERMEDIATE DM WATER STORAGE TANK(of Capacity 50 cu.m)



Notes

4. All the dimensions are in mm.
5. Dimensions of height of tank are indicative only.
6. For details, refer P&ID for Mixed Bed Unit and Associated Unit , Drg No. 1-38101-06496

Annexure-XI

INSPECTION, TESTING, ERECTION AND COMMISSIONING REQUIREMENTS

QAP GUIDELINES & FORMAT

(ANNEXURE XI TO SPECIFICATION PY51186)

The QAP format and Guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.

2. Each page of QAP shall contain the following information.
   a) Vendor's name & address.
   b) Customer: BHEL, Hyderabad.
   c) Project.
   d) BHEL Product Standard Number/revision number as referred in P.O.
   e) BHEL Purchase Order Number & Date.
   f) Product as per P.O. description.
   g) QAP Number (unique and shall not repeat)/revision number/date.
   h) Page number and number of pages

3. QAP shall contain four parts / stages as follows.
   a) Raw materials and bought out items.
   b) In process Control / Inspection.
   c) Final assembly, Inspection & Testing.
   d) Painting, preservation & packing.

4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).

5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)

6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.

7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)

8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)

9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.

10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.

11. Please refer 'Agency' in QAP format.
    Under P: Perform, W: Witness, V: Verify
    Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR
    2: (Vendor / Sub vendor)
    Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code1.

12. Under 'D' please put (□ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.

13. Vendor's signature & stamp should be available on each page of QAP.

14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.

15. The following operations/characteristics/check points may be included (AS APPROPRIATE)
    a) Visual check
    b) Dimensional check
    c) Mechanical and Chemical properties.
    d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)
    e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.
    f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.
    g) Verification of test certificate for protection class for the enclosures.
    h) Mechanical functioning of switches.
    i) Continuity of earthing and provision of earth points.
    j) Colour coding of wiring, size, tightness & dressing of wiring.
    k) Review of test certificates of assembled items, raw materials, internal test reports etc.
    l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.
    m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.
    n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)
    o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.
    p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)
    q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole.
    r) Packing and Preservation.

16. **QAP Format enclosed.**

8.0.0 QUALITY ASSURANCE, SHOP INSPECTION AND TESTING

8.1.0 General

This section contains general requirements for inspection of material, parts, equipment and workmanship of the plant during manufacture, assembling to demonstrate compliance with specification, codes and standards to ensure overall reliability of plant operation and performance.

The Owner/Owner's representative and/or authorised Representatives shall, at any time, be allowed free and ready access to the Contractor's premises and those of his suppliers as well as to the site installation and the Contractor has to make the plant items available for the purpose of inspecting the specified equipment components and obtaining information as to the progress of the work. Failure on the part of the Owner/Owner's representative, at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed an acceptance thereof nor a waiver of defects therein.

The approval of the Owner/Owner's representative shall not prejudice the right to reject equipment if it does not give complete satisfaction in service.

8.2.0 Scope

All materials, components and equipments covered under this specification shall be tested at all stages of procurement, manufacturing, erection, commissioning as per a comprehensive quality assurance programme. The requirements of minimum quality plans to be followed by the Bidder in respect of various equipment are specified in detailed technical specification. The Bidder shall draw his own quality plans in line with these requirements and his standard practices and implement such programme after approval by the Owner/Owner's representative.The Owner/Owner's representative shall appoint a Third party inspection (TPI) agency for bought out items/outside inspection.The Owner/Owner's representative will carry out on-site supervision and inspection.

Manufacturing quality plan shall detail out, for all the components and equipments, various tests/inspection to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by contractor's quality control organization, the relevant reference document and standards, acceptance norms and inspection documents raised. during all stages of material procurement, manufacture, assembly and final testing/performance testing.

The Contractor has primary responsibility for ensuring the quality of items of equipment supplied under the contract and remains accountable when manufacture or erection is subcontracted. It is therefore a requirement of the specification that work is only subcontracted to companies with effective quality control organization and that the Contractor monitors the performance of these by the attendance at tests of experienced inspectors employed by the Contractor. The Contractor shall, at the appropriate time, prove that his

material and / or equipment comply with all the requirements of this Section, such proof being the successful completion of tests and inspections. Routine test and type test certificates shall be submitted for each item of equipment, wherever applicable.

All materials, components and equipment supplied under the contract shall be subject to inspection by the Owner/Owner's representative, his representative, Inspectors of Boilers (India) or his authorized Agency or any other Inspector of the Government, should they so require during manufacture, erection and after completion. The necessary inspection charges of the authorized agency of Inspection of Boilers (India) shall be borne by the contractor. The inspection and tests shall include but shall not be limited to the requirements of this section of the specification. Further requirements to be applied are specified in the detailed specification.

The Bidder along with quality plan, shall also furnish copies of the reference documents/plant standards/acceptance norms/test and inspection procedure referred by him in quality plans. These quality plans and reference documents/standards will be subject to Owner/ Owner's representative's approval and will form a part of the contract. In these approved quality plans, Owner/Owner's representative shall identify customer hold points (CHP), indicating tests/checks which shall be carried out in presence of the Owner/Owner's representative's or authorized representative and beyond which work will not proceed without consent of Owner/Owner's representative's in writing.

No materials/equipment shall be dispatched from the manufacturer's works before the same is either accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Owner/Owner's representative or such pre-dispatch final inspection is waived by the Owner/Owner's representative and dispatch is authorized after review of test reports.

All materials used or supplied shall be accompanied by valid and approved material certificates and test and inspection reports duly approved by the Owner/Owner's representative. These certificates and reports shall indicate the acceptable identification number of the material they proposed to certify. The material certified shall also have the identification details stamped on it.

All material used for equipment construction including castings and forgings shall be of tested quality as per relevant codes/standards. Details of results of the test conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedures recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or as specified in detailed specification.

All welding shall be carried out as per welding procedure drawn and qualified in accordance with requirements of ASME Section IX. Welding procedures shall be submitted to the Owner/Owner's representative for approval prior to carrying out qualification test in the presence of I/Owner/Owner's representative

All welders/welding operators employed on any part of the contract either in the Supplier's works or at site or elsewhere shall be qualified as per ASME Section-IX.

Test results of qualification tests and specimen testing shall be furnished to the Owner /Owner's representative for approval. However, wherever required by the Owner/ Owner's representative, tests shall be conducted in presence of Owner/Owner's representative

All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

All the sub-vendors proposed by the Bidder for procurement of major bought out items including castings, forgings, pumps, heat exchangers, semi finished and finished components/equipment-(list of which shall be drawn up by the Bidder along with his offer and finalized with the Owner/Owner's representative) shall be subject to Owner/ Owner's representative's approval.

The type and extent of inspection of items shall be in accordance with the relevant International/Indian Standards/Indian Boiler Regulations and other standards approved by the Owner/Owner's representative, supplemented or amended by the requirements of this section of the specification or as specified elsewhere in the Specification.

8.3.0 Inspection Program and Test Notifications

Before manufacturing commences and not later than 45 days after award of contract, the Contractor shall submit an outline of his proposed inspection program, which shall include all major stages during manufacturing. The inspection and test program shall include for the various items the designation No., name of equipment, part of equipment, the kind of test, test standard, company which carries out the test, place, date and witnesses by the Contractor, third party or Owner/Owner's representative's .

The Owner/Owner's representative will return a copy of the Contractor's proposed inspection program indicating those inspection stages for which notification is required. Notification shall be by Fax or email in a format to be agreed and shall be sent at least 20 days prior to the intended test in accordance with 'Conditions of Contract'. If the Owner/Owner's representative intends to be represented at the test he will provide at least 24 hours' notice and if his representative does not attend on the notified date, the test may proceed unless an alternative date has been requested by the Owner/Owner's representative.

8.4.0 Test Certificate Documentation

The results of all tests shall be certified by the manufacturer, Contractor or independent agency as appropriate.

Document files containing material certificates, welding procedures, test report shall be compiled for each item of plant and shall be suitably identified (including equipment classification reference) and bound.

Three copies of each document file containing inspection reports and certificates of site erection testing activities of a particular item of plant or system shall be supplied to the Owner/Owner's representative prior to commissioning.

Copies of the performance and acceptance test reports shall be prepared and distributed as specified in Clause 'Performance and acceptance test data and reports' of this Section. All documentation as required by IBR shall also be prepared and submitted.

8.5.0 Certification of Equipment by Owner/Owner's representative's

The Personal and travelling costs in connection with the Owner/Owner's representative's inspection and witnessing of tests of equipment, components and material manufactured in India and abroad will be borne by the Owner/Owner's representative.

8.6.0 Codes and Standards

8.6.1 General

The type and extent of inspection shall generally be in accordance with that specified in the standard used for design and construction of the item of equipment supplemented or amended by the requirements of this section of the specification. The Contractor should provide the relevant codes and standard to the Owner/Owner's representative.

8.6.2 Reference to Codes and Standards

Reference to special codes and standards, where designated either directly or as "relevant", is intended to provide a measure of performance, safety, in-shop and on-site testing, and methods of construction and/or installation which must be equalled or exceeded in order to be considered acceptable for use under this specification. If more than a single degree of quality or accuracy is permitted within the scope of particular code or standard, the highest quality shall be applicable and the degree of accuracy commensurate with the intended function shall be selected, but with the understanding that the final decision will be made by the Owner/Owner's representative.

In all instances, the finally accepted applicable code or standard shall be the version last published.

8.6.3 Alternative Standards

Where no appropriate standard is available, tests shall be conducted in accordance with the manufacturer's standard practice, subject to the approval of the Owner/Owner's representative.

In such cases the Contractor shall submit to the Owner/Owner's representative, complete data and a suggested procedure for the testing to be performed. Commencement of manufacture before receipt of the Owner/Owner's representative's approval shall be at the Contractor's risk.

If the proposed procedures are accepted, the Contractor shall provide the Owner/Owner's representative with four additional copies in English before any test is performed.

8.6.4 Derating Standards

The Contractor's attention is drawn to the climatic conditions in the site area. Derating factors shall apply in accordance with the relevant and approved standards if not specified in the contract documents.

8.7.0 Services prior to and During Inspection and Testing

In accordance with and in addition to specified standards the Contractor shall submit procedures for material testing, manufacture, quality control and performance testing as they apply from the procurement phase of raw materials to the finished product. Manufacture commenced before receipt of the Owner/Owner's representative's approval of material specifications and testing procedures shall be at the Contractor's risk.

No inspection shall be valid unless the Contractor and manufacturer are in possession of relevant approved drawings and procedures for the item to be tested. The Contractor on

request shall supply the Owner/Owner's representative's with a copy of drawings and procedures at the time of the test.

All instruments and apparatus required for the inspection or used for the performance of tests shall be subject to the approval of the Owner/Owner's representative at his discretion and shall be calibrated to an agreed standard in approved laboratories. The cost of making such calibrations shall be borne by the Contractor in all cases.

If the Contractor wishes to apply for a concession in respect of a departure from an approved procedure or standard, this shall be made in writing with full information substantiating the technical acceptability of the proposed change. The Owner/Owner's representative's decision shall be final. Concessions granted shall not absolve the Contractor from any of his responsibilities under the Contract.

8.8.0 Testing During Manufacturing

The minimum testing requirements for mechanical, electrical and C&I equipment testing to be conducted at manufacturer's works are specified in the detailed specifications.

9.0.0 EQUIPMENT ERECTION, SITE TESTING, COMMISSIONING AND PERFORMANCE TEST

This Specification generally covers the standards, scope of works, documentation, scope of installation, testing and commissioning of various mechanical, electrical, control and instrumentation equipment & system and various requirements to be adhered to during the execution of the works.

Works shall be performed in accordance with this technical specification and various other drawings and schedules submitted and approved by the Owner/Owner's representative during the execution and the instructions from Engineer-in-charge or his authorized representatives during the progress of the work. Consumables required for the job shall be ensured by the Contractor. All necessary equipments and instruments required to carry out the works, recalibration of the instruments required during loop checking and commissioning shall be done by the contractor.

Field quality plans shall be submitted and shall detail out for all the equipments, the quality practices and procedure to be followed by the Contractor's site quality control organization during various stages of site activities including receipt of materials/equipments at site, preservation and storage, pre-assembly, erection, pre-commissioning and commissioning. The Contractor shall provide all necessary means for execution of inspection and testing, according to the requirements.

9.1.0 Erection

9.1.1 General

Erection work shall be carried out in the manner and sequence as may be directed by Contractors supervisory Engineers and the Owner/Owner's representative.

All existing structures, piping, conduits, equipment and facilities shall be protected by the Contractor against damage/degrade during erection. Any damage/degradation caused by Contractor shall be rectified at his cost to the satisfaction of the Owner/Owner's representative within short timelines.

As erection proceeds each assembled part before being boxed up with a view to erecting it finally, shall be inspected and approved by the concerned supervisor. Should any defect be found out during such inspection, the Contractor shall make it good as per directives from Owner/Owner's representative.

All materials such as electrodes, gaskets, bolts, nuts shall be of reputed make and conforming to relevant Indian Standards. Prior approval of Owner/Owner's representative will have to be obtained before commencement of work. Manufacturer's test certificate shall have to be provided when called for.

Contractor shall furnish all instruments, isotopes, films for conducting radiography and equip himself fully. Necessary operators of all testing equipment shall be provided by the Contractor. Dark room facilities with air conditioners for storing and processing radiography films and equipment, as necessary, shall have to be arranged by the Contractor. The radiography shall be done on any weld (including welds for repair) only after final heat treatment.

The equipment shall be placed on respective support, levelled and aligned with precision measuring instruments, checked for proper clearance between moving and stationary parts wherever applicable.

The installation of motors shall be carried out along with driven equipment in accordance with manufacturer's instructions and/or as directed by the Owner/Owner's representative.

Wherever the scope includes control panels, all connections in control panels shall be completed, checked and adjusted to ensure safety and satisfactory operation of the equipment.

Particular attention shall be given towards removal of buckles and other forms of distortion.

Holes in plate work to assist in erection should be avoided.

Misalignment in vertical joints shall not exceed 10% of plate thickness or 1.0 mm, whichever is larger.

Misalignment in horizontal joints shall not exceed 15% of upper plate thickness with a maximum of 2 mm for plate thickness above 8 mm and a maximum of 1.0 mm for plate thickness less than 8 mm.

Welding sequence shall be adopted in such a way so as to minimise distortion due to weld shrinkage and shall be got approved from the Owner/Owner's representative prior to commencement of work.

Welding shall not be carried out on wet surfaces and shall be protected from high winds.

9.1.2 Erection Program and notification

The Contractor shall furnish a detailed erection programme taking into consideration the constraints likely to be encountered during various phases of work including interfacing with the existing plant. This erection programme shall be strictly adhered. The Contractor shall take appropriate steps as directed by the Owner/Owner's representative to make up for any slippage from this erection programme and no additional compensation shall be allowed on this account.

Before erection commences and not later than three months before start of erection, the Contractor shall submit the proposed erection test program and the commissioning test program with all proposed erection and commissioning tests and checks. Together with the test programs the proposed test procedures have to be submitted.

The test programs should consider:

- that the sequence and duration of the proposed activities are logical, realistic and in accordance with safety and permit regulations in force
- that the commissioning of any item of plant would not interrupt the normal operation of the existing plant.
- that allowance for training the Owner/Owner's representative's operation personnel during this period has been made.

The Contractor has to take care that the test programs are maintained by the erection organization during erection and commissioning.

The Contractor has to mark all stages, which are subject to the Owner/Owner's representative's acceptance and has to notify at least two week's in advance when such inspection for acceptance becomes due.

9.1.3 Supervision during Erection

The Contractor shall provide at proper time the necessary supervisory Engineers, Supervisors and other supervisory personnel duly qualified and in sufficient number for transportation, handling, unloading, storage, erection, pre-commissioning and post commissioning, startup, testing and test operation of plants and equipment.

The Contractor shall keep a competent representative who will be resident Engineer-in-charge and shall remain as In-charge of Contractor's work site and also remain answerable to the Owner/Owner's representative for all activities of the Contractor at site. Before his placement at site, the Contractor shall submit his bio-data to the Owner/Owner's representative for his approval.

The Resident Engineer-in-charge shall supervise the work of all men of the Contractor working at site. He shall work in complete harmony and co-operation with Owner/Owner's representative. All statutory rules and labour laws prevailing in the area must be observed by the Contractor. All safety measures against occurrence of accidents must be taken effectively. Resident Engineer-in-charge shall not be withdrawn without written permission of the Owner/Owner's representative. If any of the Contractor's personnel was found unsuitable for the job, the Contractor shall remove him forthwith and a suitable replacement shall be posted to site within a reasonable time. No compensation for withdrawing of unsuitable or unqualified person(s) from site or for posting suitable person(s) to site at any stage of the project shall be allowed by the Owner/Owner's representative.

9.1.4 Sequence of Erection Work

All packing cases and packages shall be opened in presence of the Owner/Owner's representative or his authorised representative.

Nails and packing strips should be pulled out with suitable appliances and kept separately in container and not thrown away at random. All timber of packing cases shall have to be sorted out and stored properly at a suitable place as directed by the Owner/Owner's representative.

From time to time packing materials, timber, nails and strips shall be delivered back to the Owner/Owner's representative or otherwise disposed of as directed by the Owner/Owner's representative. All timber and packing materials shall remain the property of the Owner/Owner's representative.

Each material after stripping from boxes or received loose, shall be carefully inspected, checked with shipping list and identified with erection drawing if necessary. Any short supply and/or damaged part shall be reported forthwith to the Owner/Owner's representative in writing. The Contractor shall be completely responsible to make all necessary arrangements, application and follow procedure to process claim on underwriters, obtain replacement repair/rectify and modify as required on all such damaged/defective/lost equipment and material at no extra cost to the Owner/Owner's representative in order to execute the work to satisfaction of the Owner/Owner's representative within the stipulated contract time. Once the materials are inspected, the same shall be preserved properly and adequately protected from theft and deterioration or damage by rain, storm, dust, water, tampering by casual visitors or workers. The Contractor shall prepare and maintain stores, ledgers and bin cards for all materials in his custody.

Carrying out all repairs to damages/degradation that might have occurred during transit and in subsequent storage. Also modifications and rectification work as necessary and replacement of all lost parts, are under the Contractor's scope.

9.1.5 Safety Regulations

Contractor should follow all the safety regulations / norms as imposed by the Law/Authority/factory inspectorate /Owner/Owner's representative. When going to or from place of work in the plant only the prescribed walkways, paths or cross-overs shall be used and required protections, barricades shall be established for the plant area.

Crawling on, over or under movable equipment shall generally be prohibited.

For overhead work, proper signs shall be placed below and, when conditions justify, a watchman shall be stationed to warn employees in the vicinity.

Work on or about crane runways shall not be undertaken without the Owner/Owner's representative's permission. Whenever it is necessary to do any work on or above the crane runways, the Contractor shall furnish a flag man stationed on the floor.

Only scaffolds which meet the requirements of governing laws shall be used in the project.

Work in area of electric wires and cables shall generally be avoided.

All burning and welding equipment shall confirm to, and be used in accordance with, regulations governing such equipment. No burning or welding shall be done at any place on the site until location where such work is to be done is approved.

Adequate fire protection shall be available before work preceding the work.

All warning signs shall be observed.

Contractor shall require his employees to wear hard hats at all times when they are inside the plant area.

Goggles shall be worn whenever there is a possibility of flying particles or splashing of corrosive fluid.

While working at site all workmen shall wear necessary safety protective equipment.

When ladders are the means of access to a platform, they shall be firmly secured top and bottom and the ladder rails shall extend at least one meter above the top landing. When a ladder cannot be secured, a man shall be stationed at the base.

Safety belts shall be used by men working in high places when no hand rails or other guards are in place.

All accidents resulting in injury shall be reported to the Owner/Owner's representative promptly. Owner/Owner's representative's safety rules, regulations and directives shall be followed and reports thereon shall be submitted as and when required.

9.1.6 Proper Treatment of Injured

Contractor shall ensure that proper treatment of injuries is immediately available either as such or in the form of constantly available transportation to a source of such treatment.

Contractor shall ensure that stretchers are available near all areas in which their men are working and that the location of stretchers are well marked.

Contractor shall be solely responsible for the dissemination of all safety regulations including those written here, those promulgated by Owner/Owner's representative and those dictated by good practice, and shall ensure that all his employees and those of his Sub-Contractors are conversant with same

9.2.0 Inspection

After completion of erection and/or installations and before start-up the equipment and all its appurtenances shall be thoroughly cleaned and then, inspected in the presence of the Owner/Owner's representative for correctness, soundness and completeness of installation and acceptability for start-up.

All works to be carried out by the Contractor shall be subject to inspection by the / Owner/Owner's representative as applicable. The work shall be carried out as per applicable specifications, codes of practice, drawings and instructions of Owner/Owner's representative . The Contractor shall provide necessary facilities, instruments and personnel for carrying out the inspection as above and shall comply with the instructions given.

A check list in triplicate will be furnished for the approval of Owner/Owner's representative wherein all items to be checked and necessary instructions will be listed. Inspection and checking shall strictly follow this check list. On completion of the joint inspection and checking two (2) copies of the check list will have to be handed over to the Owner/Owner's representative. The check lists after checking will have to be jointly signed by the Contractor's supervisor and the Owner/Owner's representative to ensure that all inspection and checking have been properly carried out. However, such endorsement shall not relieve the Contractor from the responsibility in ensuring proper erection and cleaning.

During inspection all clearance, alignment and important measurements and adjustments as may be directed shall be noted by the Contractor for future reference and guidance. Two (2) copies of such notes shall be delivered to the Owner/Owner's representative.

All reports of radiographic examination in a format approved by the Owner/Owner's representative shall be submitted to the Owner/Owner's representative for his approval and records.

9.2.1 Cleaning

The Contractor shall observe strict cleanliness during execution of the work and shall be in possession of vacuum cleaner for cleaning the internals of machinery under installation. They shall check that all the finished surfaces are greased and covered.

Before boxing up, the Contractor shall examine carefully to ensure that no foreign material, such as welding rod ends, welding beads, metal chips, rope, working tools has been left inside any equipment.

In the case of motors, the following procedure shall be observed

a. Checking and cleaning of bearings and charging / filling of lubricants, wherever necessary.

b. Cleaning of core and winding, drying out and cornicing the winding and measurement of air gap for motor assembled at site.

Wherever the scope includes control panels, all withdrawable components shall be taken out and internals shall be cleaned with vacuum cleaner, if required.

9.3.0 Testing and Commissioning

9.3.1 Erection Test

Following the satisfactory completion of inspection, checking and cleaning of a unit, the plant will be placed in test run. During this period, all adjustments and repairs as required shall be made by the Contractor. Protocol shall be made and signature has to be obtained from Owner/Owner's representative. On completion of satisfactory test run, the plant will be placed under trial operation.

Prior to trial operation of any equipment the following shall be checked:

During erection all required erection tests as well as final erection checks of the mechanical completion of the systems and part thereof have to be performed.

After successful mechanical completion Mechanical Completion Certificates will be issued.

The activities necessary for mechanical completion shall include but not be limited to following testing:

- Visual inspection after unloading at site
- Checking of completion of relevant systems
- Proper installation of the drive and equipment on the foundation
- Proper alignment of drive and the driven equipment
- Proper connection of supports, hangers, piping, valves, instruments and other fittings.
- Freeness of the rotors of drive and equipment
- Healthiness of lube oil system, changing and filling as necessary.
- Safety audit
- Testing of site welds (non-destructive examinations)

- Pressure/leak/tightness test
- Pipe line and equipment flushing and cleaning
- Chemical protection of piping systems
- Checking of coating
- Testing of cranes and hoists
- Safety signs and warning signs
- Completion of buildings and civil works
- Test of ventilating and air-conditioning units

Electrical/instrumentation equipment tests

The following checks and tests measurements shall be made:

- Screwed connections for correct assembly
- Terminals and terminal connections for correct assembly
- Checking of earthing connections and testing of earthing resistances
- Measurement of insulation values
- Verification of neutralization conditions
- Fire-proof partitioning
- Marking, inscription, provision of designation plates
- Voltage checks
- Polarity checks in the case of DC voltages
- Fuses, over current trips, short-circuit trips, time settings, relay settings
- Transformer oil levels
- Setting indicators, revertive (check-back) signals to the central control room.
- Checks on wiring and cabling for conformity with the constructional circuit-drawings and plans
- checking and functionality testing of electrical systems according to IEC standards
- checking and testing of instruments

9.3.2 Pre-Commissioning Testing

After alignment of all equipment, alignment tests shall be carried out by the Contractor to check levelling, clearance, eccentricity.Measurements will be witnessed and acceptance will be certified by the Owner/Owner's representative.

Hydro-test / eddy current test, as applicable will be carried out on equipment as identified in the QAP to be finalized during detailed engineering. . All necessary blanking arrangements for hydro testing shall be furnished by the Contractor. All necessary test pump/temporary piping shall be supplied by the Contractor.

Preconditions for the commissioning are the issue of the Mechanical Completion Certificate and the availability of the accepted commissioning program and the Contractor's commissioning procedures. The Pre-commissioning Checks cover the functional tests of the individual items and their alarm and tripping systems. Following tests shall be included:

Mechanical equipment

- Individual pre-commissioning runs of all rotating equipment such as pumps, compressors, dosing equipment.
- functional tests of the mechanical equipment
- Testing and adjustment of safety devices.

Chemical Cleaning of Piping Systems and Equipment

Necessary procedure for chemical cleaning of piping and equipment shall be submitted to Owner/Owner's representative for their approval along with pre-commissioning document during detail engineering stage.

Before introducing chemicals, all the piping systems and equipment shall be water flushed. Water flushing will be followed by alkaline cleaning, acid cleaning and passivation or by EDTA (Ethylene Diamene Tetra Acid) and passivation.

However, the Contractor shall submit along with the offer his usual procedures and practices for chemical cleaning of the piping and equipment specified. The Contractor shall submit all schematics, write up, details of chemicals to be used. and detailed procedures he intends to follow. These schematics and procedures shall be subject to the approval of the Owner/Owner's representative.

Pre- cleaning procedure:

Prior to starting any phase of cleaning operation the following procedures shall be ensured:

Installation of all temporary piping, valves, pumps and equipments as required for the flushing and chemical cleaning operations. Temporary piping shall be routed at floor level as far as possible and secured in place to prevent movement/ vibration beyond acceptable limits.

Installation of the instruments as required to ensure satisfactory monitoring and control of the cleaning process. The Contractor shall also determine and arrange locations for sampling of the cleaning solution during cleaning.

By passing all regulation/control valves coming in the cleaning circuit or installation of temporary spool pieces.

Installation of special end covers and temporary suction strainers, for boiler feed pumps and condensate pumps. Pump internals shall not be installed.

Installation of plastic seal in the condenser neck to protect the turbine from alkaline fumes.

Blocking and securing of all spring hangers in the steam lines which may be flooded during the cleaning operation.

Hand cleaning of the interiors of all vessels which are included in the cleaning operation.

General cleaning procedures:

a) Seal water lines to pump shall be flushed by the permanent arrangement provided for the same.

b) Where pipeline terminate in spray headers, these headers shall be inspected after each phase of the cleaning operation and cleaned if necessary.

c) All strainers shall be observed closely during the cleaning operation by reading differential pressure gauges, and shall be cleaned when the differential pressure exceeds a predetermined value.

d) All high points, vents shall be opened periodically to ensure full system flow.

e) Upon completion of each stage of cleaning, the waste products shall be drained and transferred to the waste treatment basins. The Contractor shall then supply and add the necessary chemicals to the basin to neutralise all waste solutions and rinses generated by the cleaning process, and arrange for its disposal to an area to be indicated by the Owner/Owner's representative.

f) Strict safety precautions shall be exercised at all times during the chemical cleaning and during storage and handling of the chemicals. The Contractor shall ensure provision of all protective clothing, apparatus and equipment along with necessary first aid kits as required for handling the chemical and for carrying out the cleaning operation.

g) All Hazardous waste material generated during construction, erection and commissioning shall be disposed by Contractor using authorised waste disposal agency.

Steam Blowing of Piping Systems

i) Steam blowing shall include engineering, supply and installation of all temporary piping, valves, fittings including quick actuating valves (for puffing purposes), supports, blanking plates, spools, target plates, instruments, controls and all other accessories and services required to complete the cleaning process as specified herein

ii) The detailed schemes and procedure for steam blowing operations shall be prepared and furnished by the contractor and discussed and finalized during the detailed engineering stage.

iii) Steam blowing shall also include reinstatement of cleaned piping systems; and dismantling/removal of all temporary piping, equipment and materials from site. All temporary piping, valves, equipment and materials shall be taken back by the contractor upon satisfactory completion of cleaning, and shall be removed from the Owner/Owner's representative's premises.

iv) Engineering involved regarding temporary piping shall include the following:

a. Selection of temporary piping including disturbance factor calculation.
b. Preparation of layout of temporary piping and performing stress analysis as per ANSI B 31.1.
c. Selection of temporary hangers and supports as required.

v) The following piping systems shall be cleaned through steam blowing operation.

a) Main steam, , LP, HP and LP bypass and process steam piping system.
b) Auxiliary steam piping system.

vi) Steam blowing shall be carried out for removal of particles (rust, scales, weld splatter) from various piping systems to avoid damage to turbine bladings. Cleanliness of system shall be checked by means of test plates made of steel, which will be installed in the centre line of the piping system.

vii) Cleaning shall be achieved by steam purging i.e. by blowing of steam through the piping such that the momentum of flow is greater than that of steam flow during normal operation of unit (at TMCR). The disturbance factor during steam blowing (ratio of momentum of flow during purge to that during TMCR) shall be more than 1.4.

viii) The blow off shall be done with steam, which is exhausted through adequately sized, open-ended temporary piping. Temporary piping and motor operated valves shall be installed for steam blowing operation. Pressure shall be built up in the boiler and the

piping warmed before release of steam by quick opening of motor operated valve located on temporary piping. The cycle shall be repeated until steam from the blow out pipe is determined to be clean.

ix) If the flow nozzles and control valves have already been erected these shall be removed and replaced by spool pieces before steam blowing. The removed flow nozzle and control valves shall be put back after steam blowing.

x) The motor operated valves used for steam blowing shall have special characteristics like minimum loss of pressure, resistance to wear during severe working conditions (high velocity and carryover of water and solid particles), quick opening time, minimum effort on electric actuator.

xi) The steam blowing termination criteria shall be as under:

a) Acceptable target plate condition
b) Measured disturbance factor (DF) more than 1.4 ((to be reviewed and decided during detailed engineering stage depending upon type of cleaning adopted by Contractor Acid/alkali boil-out).

The required values to calculate actual DF will be measured at site. The criteria for acceptable target plate condition shall be finalised during detailed engineering.

Electrical equipment

As far as not already covered by the erection tests the pre-commissioning tests shall cover:

- High voltage tests
- trip tests
- Equipment Functional Test

Tests on Motors as per IS

- Insulation test of winding by megger, drying out and, if necessary, high potential test.
- Winding resistance measurement on all 3 phases for motors of bigger size.
- Testing the motor for proper direction of rotation and reconnection, if necessary.
- No load test run of the motor for a minimum of eight (8) hours to check out bearing or other associated parts.
- During test run, hourly record of currents on all the three phases shall be maintained and careful watch shall be maintained on the equipment for any abnormal sound, temperature of bearing, vibrations.
- After no load test run of the motor each rotary equipment shall be coupled and shall be subjected to a test run. The duration of this test run shall be mutually agreed.
- The objective of the test run shall be to ascertain that the following are within the permissible limits and the operation is satisfactory.
    - Vibration and noise level
    - Bearing vibration and temperature
    - Performance of the lube oil systems

- Motor winding temperature
- Performance of various control, interlocks and protective elements, wherever applicable.
- Performance of annunciation system and indication, wherever applicable.

.

Tests on transformers

During installation : Checking of complete delivery, checking of core earthing and insulation of active part from tank, H.V. sample tests of transformer Oil in accordance with IEC or equivalent Standards.

During commissioning : Checking of satisfactory operation.

Tests on earthing and lightning protection system

Acceptance tests and measurements of the earthing installations in accordance with IEC or IS standards.

Tests on lighting system

Proof of the minimum new value of lighting densities, checking of correct operation both electrically and mechanically.

Contractor shall provide the list of site tests to be performed on electrical equipment as part of pre-commissioning activities for Owner/Owner's representative's review.

Control Equipment

- Calibration tests of all analog measuring loops including all remote indications and recorders and the input signals used for closed loop control.
- Testing of all plant mounted transmitters.
- Wiring test of all control cabling in the field, control rooms combined with the function tests.
- Testing of all control modules in the control room

Functional testing of remote control of drives, circuit breakers, solenoid valves, actuators etc.

- Testing of open loop devices especially all sequence logic equipment using simulated inputs.

Testing of all interlocks to ensure safe operation.

- Testing of the alarm annunciation and event recorder system in connection with all field and control room devices using simulated inputs.
- Testing of all closed loop controls.
- Testing of insulation between cable screen and ground.

9.3.3 Commissioning

Preconditions of the commissioning are the successful completion of the pre-commissioning checks of all items of the whole system.

Commissioning tests shall be performed in accordance with the procedure contained in the commissioning program approved by the Owner/Owner's representative for individual equipment/system and as a plant. Commissioning test shall also include Redundancy and automatic fall back by simulation of fault conditions

On completion of each commissioning activity to the satisfaction of the Owner/Owner's representative,the commissioning schedule shall be signed and dated by the Contractor and countersigned by the Owner/Owner's representative.

Commissioning test shall prove that the plant is prepared and adjusted to ensure the correct functioning of the individual components and of the complete plant.

After successful completion of the commissioning tests "Authorization to Performance Test " shall be signed.

The Commissioning test shall cover at least following tests:

- Protection tests
- operation of protection devices including the following as a minimum
    - fire protection
    - HRSG protection
    - Gas turbine protection
    - steam turbine protection
    - generator protection
    - transformer protection
    - 66kV GIS protection
    - Balance of plant protection
- Method of alarm/trip condition reset for subsequent starting Isolation procedures method of isolation of plant equipment for safe shut-down and maintenance procedures including as a minimum
    - HV station and unit supplies
    - LV supplies
- Protection systems/settings, in accordance with agreed design and the requirements of the transmission system
- Start-up tests
    - Normal automatic start to preset load
    - Staged automatic including start to synchronous speed, manual synchronizing (including synchro-check), automatic synchronizing, manual and automatic loading
    - Starting with stand-by auxiliaries
    - Operation of all auxiliaries
    - Verification of start-up times and loading rates of power units and steam generators at various conditions
    - Power unit(s), test partial and full load rejection to demonstrate.

- Full load rejection tests to measure transient maximum speed and steady state speed at normal governor droop setting
- Method of resynchronism to be demonstrated.

- Turbine bypass operation capability
- Demonstaration of start up of the plant utilising start up power only from black start DG and demonstration of safe shut down utilising DG for emergency purposes.
- Operating stability when operated in the full range of load conditions with load variations by increasing or decreasing the electric load/steam delivery.
- Demonstration of the capabilities of the Power Units to operate at rated voltage and frequency, at power factors and reactive conditions between 0.85 (lag) and 0.95 (lead)
- Start-up tests of the Plant equipment, facilities and
- Verification of vibration and noise emission
- Environmental monitoring equipment, water quality monitoring equipment, functioning tests and verification of guarantees
- Verification of active power response and voltage control response according to the requirements specified in the network connection conditions
- Demonstration of proper controlling, monitoring and recording according to the requirements of the grid code shall be as per MPP recommendations.
- Verification of completeness of scope of supply. This shall be carried out along with the punch list.
- Verification of 24 hours uninterrupted MCR operation
- Establish the capability to deliver the specified process steam even at minimum Gas turbine load, without any fresh air for atleast 8 hours on a continous basis.

9.4.0 Trial Operations

After successful completion of commissioning test and after relevant test protocols have been accepted by the Owner /Owner's representative, the Contractor shall be allowed to prepare the Plant Units for trial operation. The plant will be started up and loaded. During this loading operation all the controls and protections shall be finally set.

After the plant is loaded to the maximum capability rating and the contractor is fully satisfied with its performance he shall offer the unit for Trial Operation by communicating the same to the Owner/Owner's representative in writing. After receipt of such communication the plant will be on trial operation. The trial operation will be for a minimum period of fifteen (15) days continuously at rated full load/part load as made available by the Owner/Owner's representative or as mutually agreed between the contractor & / Owner/Owner's representative to demonstrate the following :-

- Sustained capability of the plant
- Reliability of the equipment and auxiliaries
- Adequacy of the various auxiliaries, ancillaries & systems and controls.
- Capability of each equipment of the plant to correctly perform the functions for which it is specified.
- Safety requirements

This trial operation shall be undertaken jointly with the Owner/Owner's representative. As a part of the trial operation reliability run and guarantee tests of the plant shall be conducted.

9.5.0 Reliability Run

Reliability run shall be undertaken jointly with the Owner/Owner's representative as a part of the trial operation and within the trial operation period. Reliability run shall be conducted for seven (7) days uninterrupted at a load as available at prevailing ambient conditions.

In the event of interruptions to the reliability test run, for which the Contractor is responsible, the length of the reliability test run can be extended by a period equal to the total duration of the interruptions. If such an interruption lasts more than 24 hours, the reliability test run shall be restarted, after repairing the defect. The reliability test run may be interrupted on a maximum of three occasions, provided that no interruption exceeds 8 hours and that the Owner/Owner's representative is notified of the interruption in good time.

After the successful completion of reliability run test the Contractor shall offer the Owner/Owner's representative to conduct the gurantee test on prior intimation to the Owner/Owner's representative. The Contractor shall conduct gurantee test as per approved procedures for such test to the satisfaction of the Owner/Owner's representative. Perfromace and gurante tests shall be a part of the trial operation and shall be conducted to the requirements of testing stated under the clause Guarantee test.

Essentially the perfromace tests shall consist of a simultaneous test to establish the capability of the plant when delivering the base load. The gross heat rate of the unit shall be also tested while demonstrating to the Owner/Owner's representative the Gross Power Output and Auxilliary Power Consumption.in order to demonstrate that the plant is able to perform within the parameter limits specified in clause 20 below.

A joint log would be maintained to note various performance data, the malfunctions, output deficiency and short comings and would be compiled and furnished at the end of the trail operation along with the perfromace test results.

9.6.0 Guarantee Test

This consists of performance and guarantee tests as a part of the trial operation and within the trial operation period.

9.6.1 Objective of the test

The parameters which have an impact on commercial viability of the station are Gross Power Output &Gross Heat rate of the plant and the Auxiliary Power Consumption for the entire plant.

Performance Guarantee shall be provided for operation at contract specific site reference conditions as specified and the guaranteed performance parameters of the plant shall be proved by the Contractor during the test. Should the results of these tests show any deficiency from the guaranteed value, the Contractor shall modify the equipment as required at no extra cost to enable it to meet the guaranteed parameters.

All heat rates shall be based on Lower Heating value for the fuel.

9.6.2 Test Documents

The procedure for carrying out the above tests shall be submitted to the Owner/Owner's representative for approval six (6) months in advance. The procedure shall highlight the anticipated date for the test, arrangement and form of the tests.

The procedure shall include the following for each test or group of tests:

1. The sequence of the tests to be conducted.

2. The time duration of each test

3. The number of test runs

4. A list of instruments that will be used for each test. The list shall define which instruments are (a) special test instruments, (b) certified, (c) to be calibrated before and after each test, (d) check instruments, (e) station supply instruments (f) Schematic diagram showing all test points and cross referenced to the instrument list and (g) method of data logging. Data logging thro' satellite communication is not permitted.

5. All formulae, calculations, conversion factors, curves, correction curves etc., to be used in the conducting of the tests and the calculations of the test results. All such items shall be to a accuracy level of four decimals.

6. Sample test reports to data sheets and all specific result sheet forms that will be used for the test.

7. Written procedure and description of conducting the test.

9.6.3 Testing Method

The testing shall be carried out as per PTC – 46. The test boundary shall include the entire unit with heat sink.

9.6.3.1 **Measurements**

The following measurement has to be taken during performance and guarantee test

Output

- Gross power out put of the GTG and STG
  - Auxiliary Power Consumption
- Noise level

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrated sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/machine and at a height of 1.5 m above the floor level in elevation.

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on

the A-weighing scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed 85 dBA.

Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections in line with the applicable standards shall be collected during the tests.

- Emission level

Input

- Natural Gas consumption

Specific Site Conditions

- Ambient pressure
- Ambient temperature
- Relative humidity
- Grid frequency
- Power factor
- Fuel analysis (Natural Gas)
- Cycle blow down

Correction curves shall be applied only on the above measured specific site conditions to arrive at the Plant Performance Parameters at the contract specified specific site reference conditions.

9.6.3.2 **Contract Specific Site Reference Conditions**

- Ambient pressure - 1013 mbar
- Ambient temperature- 35°C
- Relative humidity - 70 %
- Grid frequency - 50 Hz
- Power factor – 0.80
- Design NOX – As per GPCB norms
- Design fuel analysis - LHV of the Natural gas fuel as per contract
- Cycle blow down equal to 0 %
- Deterioration due to aging - factors that are to be applied for Gross power output as agreed and stated in the contract.
- Tolerances that are to be applied on corrected Gross Heat Rate and Gross power output parameters as specifically stated in the contract.

9.6.3.3 **Specific Conditions of Testing Method**

The correction method stated under cl.5.5.2 in PTC 46 shall be applied to correct the performance parameters measured and corrected as per the above stated method Tolerances are applied over these corrected performance parameters in such case.

9.6.3.4 **Test Uncertainties**

The test uncertainty (not tolerence) shall be calculated based on the accuracy and number of test instruments utilized. The same shall be done as per PTC 46 and the maximum expected uncertainty shall not exceed 3 % for corrected gross heat rate and 1.2% for corrected Gross

power output to validate the test. Accordingly the Tenderer shall state in the proposal the permitted deviations/fluctuations of design parameters that are permitted during the test for each operating mode testing.

9.6.3.5 **Correction Curves & Tolerance**

The correction curves shall be provided as mathematical equations in addition to the curves to an accuracy of four decimals. The equations supplied shall be utilized to perform the test result calculations.

9.6.4 Measuring Equipment

All test instrumentation and test equipment shall be provided by the Contractor. All the instruments shall be calibrated by a certified body before and after the tests. The calibration certificates shall be submitted to the Owner/Owner's representative prior to the tests. The calibration certificates shall be considered valid for a period of not more than six (6) months from the date of its calibration.

The anticipated points of measurement together with necessary isolation during the tests shall be indicated by the Contractor.

VENDOR'S NAME & ADDRESS:	**MANUFACTURING QUALITY PLAN**		QP. NO.:	
	CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:	BHEL P.O.NO.: P.O.DATE: BHEL SPEC: REV:	REV NO:	DATE:
			PAGE 1 OF 1	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
2.0	**INPROCESS INSPECTION**												
3.0	**FINAL INSPECTION & TESTING**												
4.0	**PRESERVATION & PACKING**												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY VENDOR'S SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP

ANNEXURE-XII: Site Facilities in Bidder and BHEL's Scope

Sl.No.	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.1	**ESTABLISHMENT**		**YES**	
3.1.1	**FOR CONSTRUCTION PURPOSE**:			
a	OFFICE	**YES**		**Chargeable. Land for office construction shall be provided by BHEL/ONGC on chargeable basis @ Rs. 5.00 per Sq M.**
b	Open space for storage (as per availability)	**YES**		**Chargeable. Land for Storage yard shall be provided by BHEL/ONGC on chargeable basis @ Rs. 5.00 per Sq M.**
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipments, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Fire fighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			
a	Open space for labor colony (as per availability)		Yes	
b	Labor Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.0	**ELECTRICITY**			
3.2.1	**Electricity for construction purposes3 Phase** 415/440 V **(To be specified whether chargeable or free)**			**Chargeable @ Rs 5 per KWH.**
a	Single point source	**YES**		

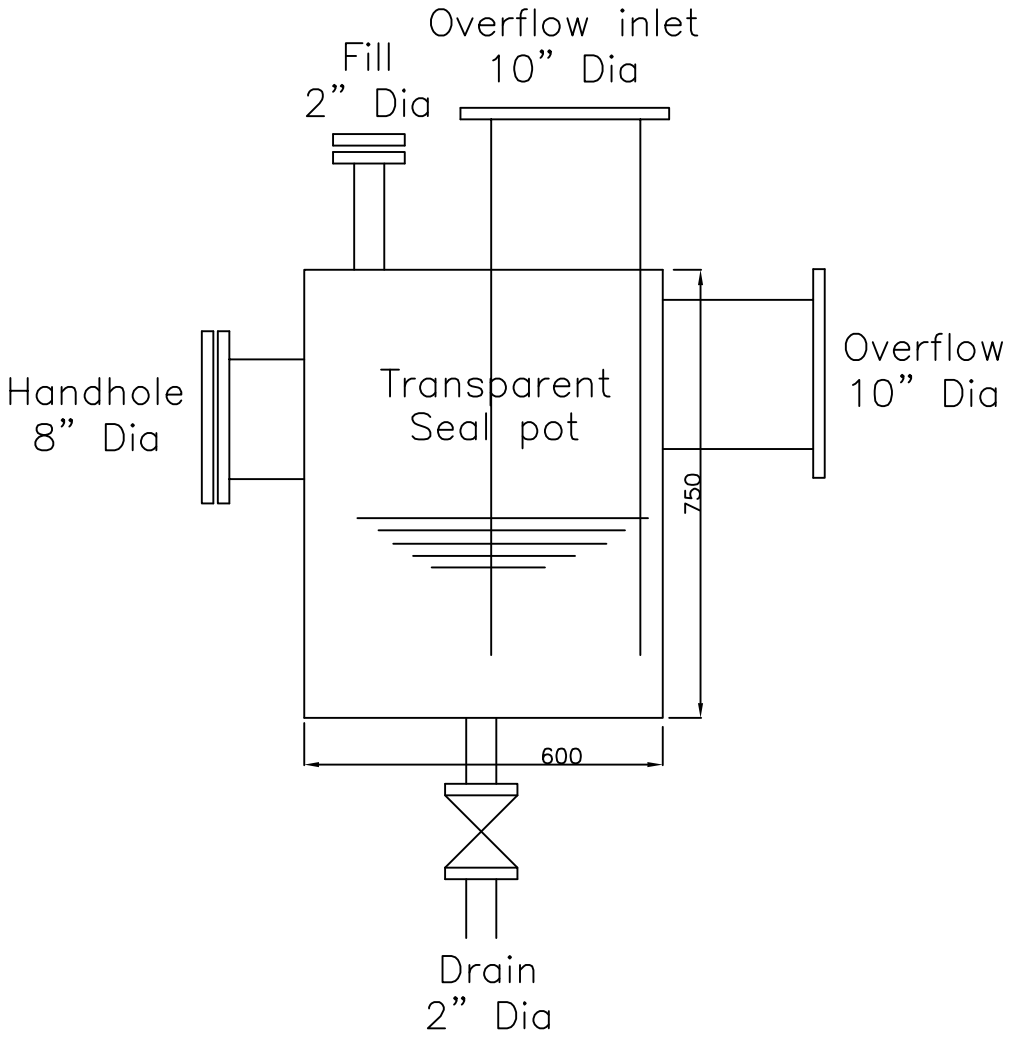
ANNEXURE-XII: Site Facilities in Bidder and BHEL's Scope

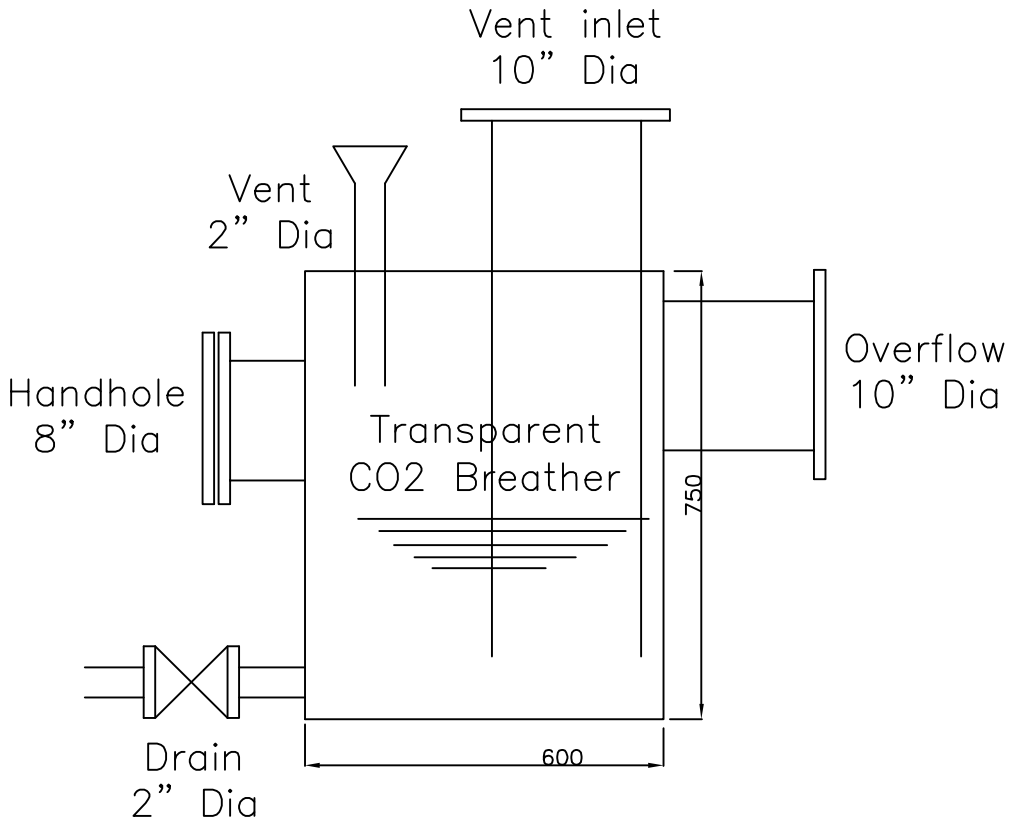
Sl.No.	Description **PART I**	Scope / to be taken care by **BHEL**	 **Bidder**	*Remarks*
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.2.2	**Electricity for the office, stores, canteen etc of the bidder(to be specified whether chargeable or free)**			**Chargeable @ Rs 5 per KWH.**
a	Single point source	**YES**		
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.2.3	**Electricity for living accommodation of the bidder's staff, engineers, supervisors etc**		Yes	
a	Single point source		Yes	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.3.0	**WATER SUPPLY**			
3.3.1	**For construction purposes:(to be specified whether chargeable or free)**			**Chargeable @ Rs 9 per CuM**
a	Making the water available at single point	**YES**		
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.2	**Water supply for bidder's office, stores, canteen etc**			
a	Making the water available at single point	**YES**		
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	

ANNEXURE-XII: Site Facilities in Bidder and BHEL's Scope

Sl.No.	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.3.3	**Water supply for Living Purpose**			
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.4.0	**LIGHTING**			
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5.0	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
a	Téléphone, fax, internet, intranet, e-mail etc.		Yes	
3.6.0	**COMPRESSED AIR wherever required for the work**		Yes	
3.7.0	**Demobilization of all the above facilities**		**YES**	
3.8.0	**TRANSPORTATION**			
a	For site personnel of the bidder		Yes	
b	For bidder's equipment and consumables (T&P, Consumables etc)		Yes	

Annexure-XIIII: Typical Seal Pot and Breather Tanks for DM & Intermittent DM water Storage Tanks





Reference: Annexure-I