NTPC LTD

2X660MW KHURJA STPP

(TG & ASSOCIATED PKG)

TECHNICAL SPECIFICATION

FOR

MISC. TANKS – SITE FABRICATED AND AIR RECEIVERS

SPECIFICATION NO.: PE-TS-475-167-A001

BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

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INTENT OF SPECIFICATION

1.0 **SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION**

1.1 This specification includes, but not limited to Supply part, Services part comprising of design (i.e. Preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles(as applicable) along with spares for erection, start up and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in-site transportation, assembly, erection & commissioning, final painting at site, minor civil work and carrying out Performance guarantee / Functional / Demonstration tests at site (as applicable) and handover in flawless condition of **Miscellaneous Tanks-Site Fabricated and Air Receivers** turnkey package specified above for **Khurja Project** complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.

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

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

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded and notwithstanding that they may have been omitted in drawings / specifications or schedules.

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

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

1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on

specification requirement in the format enclosed under specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule, otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

1.12 BHEL's Customer's representative shall be given full access to the shop in which the equipment's are being manufactured or tested and all test records shall be made available to him.

1.13 Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.

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

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

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION-B	
		REV. 00	DATE: MAR 2021
		SHEET : 1 OF 1	

PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA

CLAUSE NO.	PROJECT INFORMATION

KHURJA STPP (2X660 MW)

1.00.00 BACKGROUND

THDC India Limited (Formerly Tehri Hydro Development Corporation), is a joint venture of Govt. of India & Govt. of Uttar Pradesh. THDC India Limited has been entrusted to execute a Thermal Power Project in Khurja at district Bulandshahar, Uttar Pradesh (UP) along with various other hydro projects.

THDC has placed a Consultancy order to NTPC Ltd for Pre-award to Commissioning activities (consultancy) of Khurja Coal based power project (2x660 MW).

The present proposal is to establish 2X660 MW coal based Khurja Super Thermal Power Project for the benefit of Uttar Pradesh, Rajasthan, Uttarakhand, Himachal Pradesh & Delhi.

2.00.00 CAPACITY

PRESENT PROPOSAL **:** 2 x 660 MW

3.00.00 MODE OF OPERATION

Base Load

4.00.00 LOCATION AND APPROACH

Khurja Super Thermal Power Project is located in Bulandshahar district of Uttar Pradesh, between 28°08'35" to 28°10'25" Northern latitude and 77°53'47" to 77°55'22" Eastern longitude. The site is situated near villages Dushhara-kherli, Jahanpur, Naiphal (Unchagaon) and Rukunpur. The district Headquarters Buland Shahar is about 32 kms. The nearest railway station Danwar on Delhi-Kolkata Section (via Aligarh) is approximately 5 km away from the project site. The nearest major railway station is Khurja at a distance of about 11 kms.

Vicinity Plan of the proposed project is placed at **Annexure-I**.

Distance of the project site from nearest cities

Khurja	11 kms
Aligarh	36 kms
Delhi	90 kms
Bulandshaher	32 kms

For further information, bidders are also advised to visit the project site and collect data regarding local site conditions.

4.03.00 **AIRPORT**

The nearest commercial airport at Delhi is located at a distance of approximately 120 kms from the project site.

CLAUSE NO.	PROJECT INFORMATION
5.00.00	**LAND** The land requirement for the project has been estimated as 1400 Acres for Main Plant, Balance of Plant including Coal Handling Plant, Ash Disposal Area, Ash Disposal Pipeline Corridors, Construction Stores & Offices, Laydown & Fabrication Yard, and Labor Colony etc. Land has already been acquired through UPSIDC. Additional patches of required land shall be acquired.
6.00.00	**WATER** The Upper Ganga Canal passes near by the Khurja STPP. The makeup water for the project is proposed to be drawn from Upper Ganga Canal at a distance of about 13 kms. Quantity of make-up water required for 2X660MW would be about 3265 Cum/hr with ash water recirculation system and 4415 Cum/hr with once through ash water system. Make-up water is proposed to be used for condenser cooling, ash sluicing, coal dust suppression and other plant processes. Make up water shall be drawn from the canal by constructing suitable intake structures. A Raw Water Reservoir is envisaged. Govt. of UP has conveyed commitment for supply of required quantity of water for the project.
7.00.00	**COAL**
7.01.00	**Coal Requirement, Availability and Linkage** The daily coal requirement for 2x660 MW units shall be about 15261 tonnes based on Gross Calorific Value of 4200 Kcal/kg and 2248 Kcal/KWh unit heat rate, considering 90% plant load factor. Annual coal requirement for the plant shall be about 5.57 MTPA considering PLF of 90% and the same is proposed to be met from Amelia Coal Mine in District Singrauli, Madhya Pradesh, allotted to THDCIL by Ministry of Coal, Govt. of India. THDCIL has entered into an agreement with Nominated Authority, Ministry of Coal for the development of Amelia Coal Mine in Synchronization with the implementation of Khurja STPP. The distance between Khurja STPP plant site and Allotted Amelia Mine at Singrauli, Madhya Pradesh is around 900 Kms.
7.02.00	**Coal Transportation** The envisaged mode of coal transportation from the coal mines to the power plant is through Indian Railways**.**
7.03.00	**Coal Quality** The primary fuel for the main steam generator shall be coal. The coal quality parameters indicated in **Annexure-II** are to be considered for steam generator design.
8.00.00	**Fuel Oil** The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel Oils having the characteristics & and High Speed Diesel Oil having the characteristics given at **Annexure-III & Annexure-IV** respectively.

9.00.00 **STEAM GENERATOR TECHNOLOGY**

The steam generators shall be based on super critical technology, once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.

10.00.00 **FLUE GAS DESULPHURIZATION SYSTEM (FGD) & SCR:**

The project is envisaged with Flue Gas Desulfurization (FGD) system and Selective Catalytic Reduction (SCR) in compliance to the notification dated 07.12.2015 by Ministry of Environment, Forest & Climate Change. The Tentative Limestone characteristic to be used for design of FGD system shall be as per the characteristic given at **Annexure-V.**

11.00.0 **POWER EVACUATION SYSTEM**

Power Generated from each 660 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer and will be evacuated through 400kV transmission systems. Associated Transmission System (ATS) of the project has already taken-up with PGCIL/CEA/UPPTCL and will be finalized soon.

12.00.00 **METEOROLOGICAL DATA**

The meteorological data from nearest observatory (Aligarh) is placed at **Annexure - VI.**

13.00.00 **PLANT WATER SCHEME**

The Plant water scheme is described below.

13.01.00 **Condenser Cooling (CW) Water System**

It is proposed to adopt a recirculating type cooling water system with cooling towers for the project. For the re-circulating type CW system it is proposed to supply clarified water as make up. Circulating water from CW pumps to TG area and from TG area to cooling tower will be carried through pipes/ducts. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.

13.02.00 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject system, FGD & SCR system etc. shall also be cooled by Demineralized (DM) water in a closed circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.

13.03.00 **Other Miscellaneous Water Systems**

CW system blow down water shall be used for the plant service water requirement, dust suppression system of coal handling plant, ash slurry pumps sealing, sealing of Vacuum

pumps (if applicable) of Ash Handling plant, FGD system, make-up to fire water system. The service (wash water) water collected from various areas and coal handling plant shall be treated as per requirement and reused.

FGD waste water shall be diverted to ash system after neutralization.

The quality of clarified water & DM water is given in this sub-section at **Annexure-VII-1 & VII-2.**

The Salient data for design and sizing of equipment at BMCR Condition is given in this sub-section at **Annexure-VII-3.**

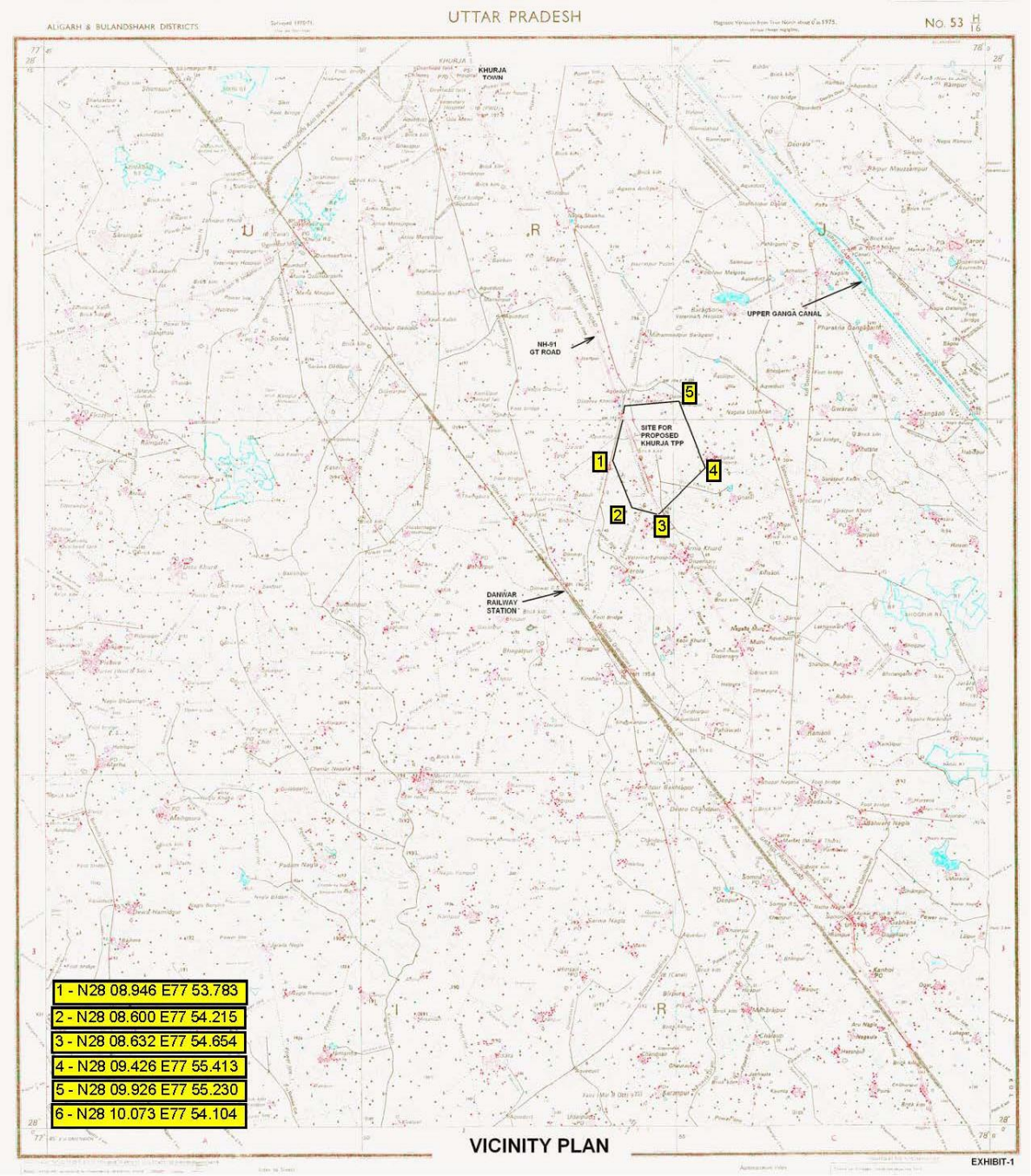
Salient data for design and sizing of equipment at Pure Sliding Pressure Condition is given in this sub-section at **Annexure-VII-4.**

CLAUSE NO.

PROJECT INFORMATION

ANNEXURE-I

VICINITY PLAN



METEOROLOGICAL DATA

ANNEXURE-VI

BACK

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : अलीगढ
STATION : Aligarh

अक्षांश LAT. 27°53' देशांतर LONG. 78°04' समुद्री तल माध्य से ऊंचाई HEIGHT ABOVE M.S.L. 187 मीटर METRES

प्रेक्षणों पर आधारित BASED ON OBSERVATIONS 1971-2000

माह / MONTH		स्टेशन का सतह दाब / STATION LEVEL PRESSURE (एच.पी.ए / hPa)	वायु तापमान माध्य: शुष्क बल्ब / DRY BULB (डि. से / °C)	नम बल्ब / WET BULB (डि. से / °C)	दैनिक अधिक तम / DAILY MAX (डि. से / °C)	दैनिक न्यून तम / DAILY MIN (डि. से / °C)	माह में उच्चतम / HIGHEST IN THE MONTH (डि. से / °C)	माह में निम्नतम / LOWEST IN THE MONTH (डि. से / °C)	चरम: उच्चतम / HIGHEST (डि. से / °C)	दिनांक और वर्ष / DATE AND YEAR	निम्नतम / LOWEST (डि. से / °C)	दिनांक और वर्ष / DATE AND YEAR	आर्द्रता: सापेक्ष आर्द्रता / RELATIVE HUMIDITY (प्रतिशत / %)	वाष्प दाब / VAPOUR PRESSURE (एच.पी.ए / hPa)	मेघ की मात्रा: समस्त मेघ / ALL CLOUDS (आकाश के अष्टमाश / Oktas of sky)	निम्न मेघ / LOW CLOUDS (आकाश के अष्टमाश / Oktas of sky)	मासिक योग / MONTHLY TOTAL (मि.मि. / mm)	वर्षा के दिनों की संख्या / NO. OF RAINY DAYS	वर्षा: वर्षसहित सबसे नम महीने का योग / TOTAL IN WETTEST MONTH WITH YEAR (मि.मि. / mm)	वर्षसहित शुष्कतम महीने का योग / TOTAL IN DRIEST MONTH WITH YEAR (मि.मि. / mm)	24 घंटों की सबसे भारी वर्षा / HEAVIEST FALL IN 24 HOURS (मि.मि. / mm)	दिनांक और वर्ष / DATE AND YEAR	माध्य पवन गति / MEAN WIND SPEED (कि.मी. प्र. घं. / Kmph)
जनवरी / JAN	I	996.0	10.8	9.2	20.6	7.4	25.1	3.8	30.7	28	0.6	16	80	10.5	2.5	2.3	15.2	1.5	71.9	0.0	53.8	12	3.1
	II	993.3	18.2	13.8						1991		1935	60	12.4	2.3	2.0			1883			1994	
फरवरी / FEB	I	993.7	13.3	11.1	23.6	9.5	28.8	5.0	33.3	26	1.7	11	75	11.6	2.5	2.2	13.9	1.4	141.0	0.0	71.1	2	3.5
	II	991.0	21.2	15.4						1989		1950	52	13.0	2.3	2.1			1928			1928	
मार्च / MAR	I	990.9	19.3	15.2	30.0	14.1	35.5	8.9	41.7	31	3.9	6	63	14.1	2.3	1.9	8.5	1.0	106.7	0.0	63.5	18	4.2
	II	988.1	27.2	18.7						1945		1945	41	14.8	2.6	2.1			1870			1870	
अप्रैल / APR	I	986.6	26.8	18.9	36.8	20.1	41.5	14.3	44.5	29	10.9	9	45	15.5	1.5	1.2	8.8	0.9	68.1	0.0	30.6	29	4.8
	II	982.9	34.3	21.3						1999		1957	28	14.7	2.0	1.6			1909			1997	
मई / MAY	I	982.5	30.6	21.9	40.1	24.5	43.9	19.9	47.2	28	15.5	3	45	19.2	1.5	1.3	21.0	2.2	75.7	0.0	41.1	20	4.9
	II	979.1	37.6	24.0						1988		1987	30	18.8	1.6	1.4			1913			1913	
जून / JUN	I	978.7	31.2	24.8	39.3	26.6	44.4	22.3	46.7	7	18.6	2	59	26.1	2.8	2.6	68.5	4.1	544.8	0.0	327.2	30	5.6
	II	975.3	36.5	26.0						1995		1957	44	25.1	3.0	2.8			1933			1981	
जुलाई / JUL	I	978.4	29.2	26.3	34.6	26.0	39.4	23.0	44.5	2	19.9	12	79	31.9	6.1	5.9	217.7	10.2	576.1	1.5	164.6	3	4.7
	II	975.4	32.2	27.3						1987		1988	69	32.0	6.1	5.8			1958	1941		1942	
अगस्त / AUG	I	980.0	28.3	26.1	33.2	25.4	36.9	22.9	42.1	11	20.1	13	84	32.1	6.1	5.7	247.4	11.6	529.8	0.0	183.6	15	4.3
	II	977.3	30.7	27.0						1987		1957	75	32.7	6.1	5.9			1940			1964	
सितम्बर / SEP	I	984.6	27.4	24.5	33.8	23.8	36.9	20.7	40.2	1	14.8	16	78	28.6	3.2	2.9	104.1	5.2	590.5	0.0	220.6	26	3.7
	II	981.5	31.0	25.6						1979		1994	65	28.6	3.2	3.0			1884			1964	
अक्तूबर / OCT	I	990.4	23.5	19.8	33.0	18.8	36.2	14.4	41.7	4	11.0	9	69	20.2	1.0	0.9	31.4	1.4	231.1	0.0	138.7	13	2.2
	II	987.2	29.1	21.8						1952		1983	51	20.4	1.0	0.8			1955			1955	
नवम्बर / NOV	I	994.5	17.5	14.4	28.3	12.9	32.1	9.4	36.1	3	5.0	30	69	14.0	0.8	0.7	4.2	0.5	34.8	0.0	26.2	14	2.1
	II	991.5	24.0	18.2						1944		1937	55	16.4	0.9	0.8			1904			1966	
दिसम्बर / DEC	I	996.7	12.3	10.4	22.5	8.5	26.7	5.3	32.8	2	1.2	30	77	11.2	1.7	1.4	11.0	0.8	87.6	0.0	56.2	28	2.7
	II	993.6	19.5	15.0						1948		1973	59	13.5	1.8	1.5			1909			1977	
वार्षिक योग या माध्य / ANNUAL TOTAL OR MEAN	I	987.7	22.5	18.6	31.3	18.1	44.1	3.4	47.2	28	0.6	16	69	19.6	2.6	2.4	751.8	40.7	1342.9	204.5	327.2	30	3.8
	II	984.7	28.5	21.2					5	1988	1	1935	52	20.2	2.7	2.4			1933	1918	6	1981	
वर्षों की सं / NUMBER OF YEARS	I																						
	II	29	29	29	29	29	29	29	68		68		29	29	29	29	28	28	64	64	66		15

27

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : अलीगढ
STAION : Aligarh

		मौसम परिघटना						पवन													मेघ												दृश्यता				
		के साथ दिनों की संख्या						पवन की गती के साथ दिनों की संख्या (कि. मी. प्र. घं.)				पवन की दिशा के दिनों की संख्या का प्रतिशत									मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश					निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश						दृश्यता सहित दिनों की संख्या				
माह		वर्षण 0.3 मि.मि.या अधिक	ओले	गर्जन	कुहरा	धूल भरी आंधी	चंड वात	62 या अधिक	20-61	1-19	0	उ	उपू	पू	दपू	द	दप	प	उप	शांत	0	ले-2	3-5	6-7	8	0	ले-2	3-5	6-7	8	कुहरा 8	1 कि.मी. तक	1-4 कि.मी.	4-10 कि.मी.	10-20 कि.मी.	20 कि.मी. से अधिक
		WEATHER PHENOMENA						WIND													CLOUD										VISIBILITY				
		No. OF DAYS WITH						No. OF DAYS WITH WIND SPEED (Km. p. h.)				PERCENTAGE No. OF DAYS WIND FROM									No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS					No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS						No. OF DAYS WITH VISIBILITY				
MONTH		PPT 0.3 mm Or more	HAIL	THUN DER	FOG	DUST STORM	SQU ALL	62 Or more	20-61	1-19	0	N	NE	E	SE	S	SW	W	NW	CALM	0	T-2	3-5	6-7	8	0	T-2	3-5	6-7	8	FOG 8	UP TO 1 Km	1-4 Kms	4-10 Kms	10-20 Kms	OVER 20 Kms
जनवरी	I	2.1	0.1	0.2	3.0	0.0	0.0	0	0	25	6	2	14	10	16	2	11	15	9	21	20	1	2	3	5	20	1	2	3	5	0	3.3	6.2	16.9	4.6	0.0
JAN	II							0	0	23	8	4	9	6	13	4	5	19	13	27	19	2	2	4	4	20	2	2	3	4	0	1.1	11.5	6.3	12.1	0.0
फरवरी	I	2.4	0.1	0.5	1.2	0.0	0.0	0	0	23	5	3	14	8	14	2	12	15	14	18	16	2	3	3	4	18	1	2	3	4	0	1.9	4.8	14.5	6.8	0.0
FEB	II							0	0	23	5	5	8	5	13	1	9	24	15	20	17	2	3	3	3	18	2	2	3	3	0	0.0	8.4	4.8	14.8	0.0
मार्च	I	2.2	0.3	0.7	0.0	0.1	0.0	0	0	27	4	2	13	8	19	2	12	16	14	14	20	1	3	4	3	22	0	3	3	3	0	0.4	4.7	13.4	12.5	0.0
MAR	II							0	0	26	5	6	8	6	11	2	10	20	22	15	17	2	4	5	3	19	2	3	4	3	0	0.1	6.3	6.6	18.1	0.0
अप्रैल	I	1.9	0.1	0.9	0.0	0.8	0.0	0	0	26	4	3	15	9	18	2	12	13	15	13	21	1	3	3	2	24	0	2	2	2	0	0.0	3.6	14.0	12.4	0.0
APR	II							0	0	27	3	8	7	6	12	4	9	13	30	11	19	2	3	4	2	20	2	3	3	2	0	0.0	5.5	7.0	17.4	0.0
मई	I	3.2	0.1	0.9	0.0	2.3	0.0	0	0	27	4	3	12	11	13	3	12	15	16	15	23	1	2	2	3	25	0	2	1	3	0	0.0	5.6	15.4	9.9	0.0
MAY	II							0	0	27	4	7	9	8	12	3	9	16	25	11	22	3	2	2	2	23	2	2	2	2	0	0.0	5.9	9.2	15.9	0.0
जून	I	5.2	0.0	0.5	0.0	1.0	0.0	0	0	26	4	2	12	13	15	4	14	11	15	14	17	1	3	4	5	17	1	3	4	5	0	0.0	5.4	13.0	11.6	0.0
JUN	II							0	0	27	3	5	14	11	15	4	13	11	18	9	15	3	3	4	5	16	3	3	3	5	0	0.0	5.8	8.9	15.3	0.0
जुलाई	I	13.2	0.0	0.6	0.0	0.1	0.0	0	0	26	5	2	13	11	11	3	18	12	15	15	4	1	2	6	18	5	1	2	6	17	0	0.0	4.6	12.2	14.2	0.0
JUL	II							0	0	26	5	5	14	14	12	4	14	10	12	15	2	2	3	8	16	3	2	3	7	16	0	0.0	5.3	7.7	18.0	0.0
अगस्त	I	14.4	0.0	0.8	0.0	0.0	0.0	0	0	25	6	2	11	12	12	3	15	13	14	18	4	0	3	5	19	5	1	2	4	19	0	0.0	3.3	11.4	16.2	0.0
AUG	II							0	0	26	5	5	14	13	10	5	14	13	9	17	2	3	3	6	17	2	3	3	6	17	0	0.0	5.4	7.6	18.0	0.0
सितम्बर	I	7.4	0.0	0.4	0.0	0.0	0.0	0	0	24	6	2	11	13	15	3	14	13	11	18	16	1	4	3	6	17	1	3	3	6	0	0.0	1.4	10.2	18.4	0.0
SEP	II							0	0	23	7	7	12	10	11	2	11	13	12	22	13	5	3	4	5	15	4	3	3	5	0	0.0	4.6	6.7	18.7	0.0
अक्तूबर	I	1.9	0.0	0.5	0.1	0.1	0.0	0	0	20	11	4	8	10	11	3	5	11	10	38	26	1	1	1	2	27	0	1	1	2	0	0.1	1.6	11.7	17.7	0.0
OCT	II							0	0	17	14	8	6	8	9	2	5	8	10	44	25	2	1	1	2	26	1	1	1	2	0	0.0	7.5	6.1	17.4	0.0
नवम्बर	I	0.7	0.0	0.1	0.1	0.0	0.0	0	0	18	12	3	7	7	11	2	8	14	6	42	25	1	2	1	1	27	0	1	1	1	0	0.1	3.6	16.3	10.0	0.0
NOV	II							0	0	12	18	6	2	4	5	1	4	11	7	60	25	1	2	1	1	26	1	1	1	1	0	0.0	12.2	6.6	11.2	0.0
दिसम्बर	I	1.2	0.0	0.1	2.2	0.0	0.0	0	0	21	10	1	9	7	15	1	9	14	10	34	22	1	2	3	3	25	0	1	2	3	0	1.5	7.7	16.0	5.7	0.0
DEC	II							0	0	17	14	3	4	3	8	1	4	20	10	47	21	2	2	3	3	23	1	2	3	2	0	0.1	14.6	5.9	10.4	0.0
वार्षिक योग या माध्य	I	55.8	0.8	6.1	6.7	4.3	0.0	0	0	287	78	2	12	10	14	2	12	13	12	23	224	11	29	38	63	240	7	24	32	62	0	7.3	52.6	166.8	138.4	0.0
ANNUAL TOTAL OR MEAN	II							0	0	276	89	6	9	8	11	3	9	15	15	24	202	28	33	46	56	220	24	27	39	55	0	1.2	91.3	83.3	189.1	0.0
वर्षों की सं NUMBER OF YEARS	I II	29						30				30									30					30						30				

ANNEXURE- (D)

CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Annexure – B for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a) Welded steel structures : 1.0%

b) Bolted steel structures : 2.0%

c) Reinforced concrete structures :1.6%

d) Steel stacks : As per IS: 6533 & CICIND Model Code whichever is more critical.

Appendix-I

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

a) The basic wind speed “Vb” at ten metre above the mean ground level : 47 metre/second

b) The risk coefficient “K1” : 1.07

c) Category of terrain : Category-2

Annexure-(E)

CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS: 1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS: 1893, provisions of part 1 shall be read along with the relevant clauses of IS: 1893:1984, for embankments.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS: 1893 (Part 1) and Annex B of IS: 1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS: 1893 (Part 1 to Part 4).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
b)	Reinforced Concrete structures	:	5%
c)	Reinforced Concrete Stacks	:	3%
d)	Steel stacks	:	2%

Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS: 1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS: 1893 (Part 1).

In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS: 1893 (Part 1).

The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve.

For buildings, if the design base shear (VB) obtained from modal combination is less than the base shear ($\overline{V}$B) computed using the approximate fundamental period (Ta) given in IS: 1893: Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\overline{V}$B/ VB. However, no reduction is permitted if $\overline{V}$B is less than VB.

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Design/Detailing for Ductility for Structures

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.

APPENDIX-I

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT FOR KHURJA STPP

The various site specific seismic parameters for the project site shall be as follows:

1) Peak ground horizontal acceleration (MCE) : 0.32 g

2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra

   a) for special moment resisting steel frames designed and detailed as per IS:800 : 0.08

   b) for special concentrically braced steel frames designed and detailed as per IS:800 : 0.06

   c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.048

   d) for RCC chimney, RCC Natural Draft Cooling Tower : 0.16

   e) for Liquid retaining tanks : 0.096

   f) for Steel chimney, Absorber Tower, Vessels : 0.12

   g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below, in general(excluding special structure/ configuration/ materials) : 0.08

3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.16

Note:

g = Acceleration due to gravity

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

APPENDIX – II

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
(In units of 'g')

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
0.000	1.000	1.000	1.000
0.030	1.000	1.000	1.000
0.040	2.240	2.032	1.600
0.050	2.450	2.222	1.750
0.060	2.660	2.413	1.900
0.070	2.870	2.604	2.050
0.080	3.080	2.794	2.200
0.090	3.290	2.985	2.350
0.100	3.500	3.175	2.500
0.105	3.500	3.175	2.500
0.110	3.500	3.175	2.500
0.115	3.500	3.175	2.500
0.120	3.500	3.175	2.500
0.125	3.500	3.175	2.500
0.130	3.500	3.175	2.500
0.135	3.500	3.175	2.500
0.140	3.500	3.175	2.500
0.145	3.500	3.175	2.500
0.150	3.500	3.175	2.500
0.200	3.500	3.175	2.500
0.220	3.500	3.175	2.500
0.230	3.500	3.175	2.500
0.240	3.500	3.175	2.500
0.300	3.500	3.175	2.500
0.350	3.500	3.175	2.500
0.400	3.500	3.175	2.500
0.450	3.500	3.175	2.500
0.500	3.500	3.175	2.500
0.550	3.500	3.175	2.500
0.600	3.173	2.879	2.267
0.650	2.929	2.657	2.092
0.700	2.720	2.467	1.943
0.750	2.539	2.303	1.813
0.800	2.380	2.159	1.700
0.850	2.240	2.032	1.600

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
0.900	2.116	1.919	1.511
0.950	2.004	1.818	1.432
1.000	1.904	1.727	1.360
1.050	1.813	1.645	1.295
1.100	1.731	1.570	1.236
1.150	1.656	1.502	1.183
1.200	1.587	1.439	1.133
1.250	1.523	1.382	1.088
1.300	1.465	1.329	1.046
1.350	1.410	1.279	1.007
1.400	1.360	1.234	0.971
1.450	1.313	1.191	0.938
1.500	1.269	1.151	0.907
1.550	1.228	1.114	0.877
1.600	1.190	1.080	0.850
1.650	1.154	1.047	0.824
1.700	1.120	1.016	0.800
1.750	1.088	0.987	0.777
1.800	1.058	0.960	0.756
1.850	1.029	0.934	0.735
1.900	1.002	0.909	0.716
1.950	0.976	0.886	0.697
2.000	0.952	0.864	0.680
2.050	0.929	0.843	0.663
2.100	0.907	0.822	0.648
2.150	0.886	0.803	0.633
2.200	0.865	0.785	0.618
2.250	0.846	0.768	0.604
2.300	0.828	0.751	0.591
2.350	0.810	0.735	0.579
2.400	0.793	0.720	0.567
2.450	0.777	0.705	0.555
2.500	0.762	0.691	0.544
2.550	0.747	0.677	0.533
2.600	0.732	0.664	0.523
2.650	0.718	0.652	0.513
2.700	0.705	0.640	0.504
2.800	0.680	0.617	0.486
2.850	0.668	0.606	0.477
2.900	0.657	0.596	0.469

Time Period (Sec)	Damping Factor (as a percentage of critical damping)		
	2%	3%	5%
2.950	0.645	0.585	0.461
3.000	0.635	0.576	0.453
3.050	0.624	0.566	0.446
3.100	0.614	0.557	0.439
3.150	0.604	0.548	0.432
3.200	0.595	0.540	0.425
3.250	0.586	0.531	0.418
3.300	0.577	0.523	0.412
3.350	0.568	0.516	0.406
3.400	0.560	0.508	0.400
3.450	0.552	0.501	0.394
3.500	0.544	0.493	0.389
3.550	0.536	0.487	0.383
3.600	0.529	0.480	0.378
3.650	0.522	0.473	0.373
3.700	0.515	0.467	0.368
3.750	0.508	0.461	0.363
3.800	0.501	0.455	0.358
3.850	0.495	0.449	0.353
3.900	0.488	0.443	0.349
3.950	0.482	0.437	0.344
4.000	0.476	0.432	0.340

SUB SECTION-C1

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF SUPPLY

1.1 Misc. tanks -site fabricated (**2 Nos Condensate storage tanks**) under this specification shall be as per enclosed General Arrangement drawings (Sub Section-D, Section-I, Annexure-III). Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.

1.2 **2 nos, Air Receivers (shop fabricated)** of 10 m3 capacity. with instruments, relief valve, drain connection with automatic trap stations and other accessories as specified. Air receivers shall be procured from approved makes only as given under this specification.

1.3

a) The connections and accessories which are required to be supplied with each tank(CST) and by the bidder shall be as indicated in the enclosed General Arrangement drawings (Sub Section-D, Section-I, Annexure-III).

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

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

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

e) Pad plates along with 1.0m suitable ISA on the tanks for supporting outside piping shall be provided by the bidder.

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

g) The manhole shall be of hinged and bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 800 mm for tank, if not specified in the specification.

1.4 Level gauge / indicator for each tank shall be provided by the bidder along with all fittings & accessories as required for mounting the level gauge / indicator on the tanks. Level gauge with Mechanical Float type & dial type indicator shall be provided unless otherwise specified in GA drawing for Miscellaneous tanks.

1.5 Pressure gauge (with isolation valve), Temperature gauge, Safety valve, drain connection with electronic timer controlled solenoid operated automatic trap stations etc. along with all fittings & accessories shall be provided by bidder.

1.6 Sampling Connection with isolation valve of size 50 NB and drain connection with isolation valve of size 100 NB for each condensate storage tank(CST).

1.7 Quantity and size of spare nozzles and valves shall be supplied by the bidder as per GA drawing for Miscellaneous tanks (Condensate storage tanks)

1.8 NaOH / KOH breather pots and seal pot shall be provided with necessary drain valve of size 25NB and 50 NB respectively with stainless steel construction unless otherwise specified in the GA drawing for Miscellaneous tank (CST). Two (2) nos. NaOH / KOH breather shall be provided by the bidder for each CST out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.

1.9 Pipes, fittings, nozzles, flanges and counter flanges shall be supplied by the bidder. The minimum requirement like quantity, size, type, MOC etc. are indicated in General Arrangement drawing of CST and may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL. Material of construction of all pipes, fittings, nozzles, flanges and counter flanges shall be as per General Arrangement drawing (Sub Section-D, Section-I, Annexure-III).

1.10 All valves shall be of stainless steel construction for Condensate Storage Tank.

1.11 NaOH / KOH breather Pots and Seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH / KOH breather Pots shall be provided through SS pipe for condensate storage tank. The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.

1.12 The minimum number of anchor bolts along with the minimum size has been specified in GA drawing of CST (Sub Section-D, Section-I, Annexure-III). However, any additional anchor bolts of required size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication. The material of construction for anchor bolts shall be IS 1367 Part-3.

1.13 Painting of the tanks is included in bidder's scope of work. Painting specifications of storage tanks / seal pot / NaOH / KOH breather are given under GA drawings of Misc. tanks. Painting requirement specified under GA drawing are minimum requirement. Any modification in painting requirement found applicable during detained engineering, shall be under bidder's scope without any commercial implication.

1.14 Commissioning spares as required for commissioning of the tanks are in bidder's scope.

1.15 First fill of NaOH/KOH solution in Breather pots is under bidder's scope of supply.

1.16 Platforms, monkey ladder inside tank, staircase (hand railing, knee guard and toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice (as indicated in the GA drawing for Miscellaneous tanks) shall be included in bidder's scope of work.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

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

2.2 Erection & Commissioning of Misc. tanks and Air Receivers.

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

2.4 Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of pockets. Supply of grouting material is under bidder's scope.

2.5 Inspection & testing and carrying out demonstration test of tanks/ air receiver.

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

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

3.0 DESIGN CONSIDERATIONS FOR MISC TANKS (CST)

3.1 Bidder to furnish Sizing calculation of NaOH / KOH breather and seal pot.

3.2 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650.

3.3 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.

3.4 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.

3.5 Vessels seams shall be so positioned that they do not pass though vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.

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

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

3.8 Reinforcement in tanks shall be provided as per design code for tanks.

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

3.10 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for bolts and nuts shall be SA 193 & 194 respectively.

3.11 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the GA drawing are tentative and for bidder guidance purpose only. Same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.

3.12 Bidder shall furnish the STAAD calculations and/or other suitable calculation during detailed for the following:
a. Roof structure calculations for checking the stability of roof.
b. Shell buckling under Roof & structure loading.

3.13 Provision shall be made by the bidder to minimise the air ingress in the tank through float & board type level gauge and details of the same shall be furnished during detail engineering stage for BHEL's approval and approved arrangement shall be provided by the bidder without any commercial implication.

3.14 The tank shall be designed for filled water head / atmospheric pressure and design temperature for the tank shall be as specified in the GA drawing for Miscellaneous tanks (CST).

3.15 Bidder to note that surface cleaning shall be as per approved painting schedule.

4.0 DESIGN CONSIDERATIONS FOR AIR RECEIVER

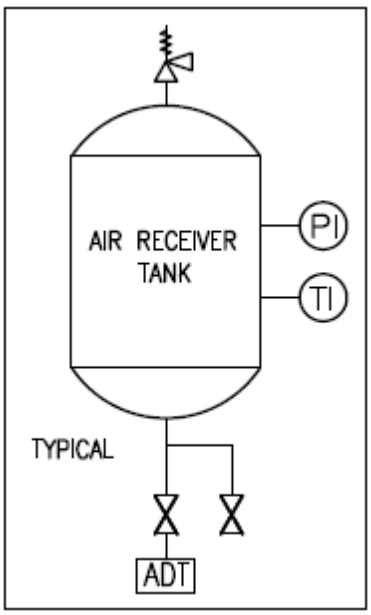
4.1 The air receivers shall be vertical self-supporting cylindrical vessels with supporting legs for resting on their foundation. The height of Air Receiver shall be limited to 4.0 m.

4.2 Design Pressure & Temperature for the Air receiver shall be minimum 10 kg/cm2 (g) & 80 degC respectively. Air receivers shall be designed as per ASME Section VIII Div.-I or equivalent.

4.3 The material of construction of shell, dished ends, flanges etc. of the air receivers shall be of carbon steel as per IS: 2062 / equivalent.

4.4 Air receiver shall be provided with nozzles, air release vents, safety valve, pressure gauge, temperature gauge, minimum 500 mm dia. manhole for inspection.

4.5 A typical sketch of Air receiver is given below:



5.0 WELDING OF MISC TANKS

5.1 Welding shall be in accordance with the requirement of IS: 803, 816, 817 and 823 or equivalent.

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

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

6.0 TEST AND INSPECTION

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

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

6.3 All cross / Tee joints and butt welds to be Radio graphed in line with the codal requirement.

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

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

7.0 MANDATORY SPARES:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY
1	Level gauges (Float & board) for Condensate Water Storage tank	2 nos.
2	Pressure Gauge for Air Receiver	2 nos.
3	Temperature gauge for Air receiver	2 nos

8.0 LIST OF COMMISSIONING SPARES:

SL. NO.	DESCRIPTION OF ITEMS	QUANTITY

1	Rubber Gasket of each size	2 nos.
2	Nuts, bolts & washers of each size (nos. of bolts, nuts & washers as required for each nozzle) as per approved Drg.	1 lot
3	Any other item required for successful commissioning of the tanks including rubber lining (to be specified clearly by bidder)	1 lot

9.0 TERMINAL POINTS

- Matching counter flanges for all nozzles and valves mounted on the condensate storage tanks. However, counter flanges for all nozzles of tank shall be provided by the bidder.
- Matching counter flanges for all nozzles and valves mounted on the Air receiver. However, counter flanges for all nozzles of air receiver shall be provided by the bidder.

10.0 EXCLUSIONS

1) Tanks foundation & associated civil works, Level Transmitters, etc. are excluded from bidder's scope of work.
2) Air receiver's foundation & associated civil works.

11.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID

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

12.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under SECTION-I, Sub-Section-D, Annexure-IV during detail engineering for approval / information / reference (as the case may be).

13.0 OTHER TECHNICAL REQUIREMENTS

1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.

2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.

3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

4) Commercial implication includes price implication as well as delivery implication.

5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).

6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self-supporting cone roof as per latest edition of relevant design code.

7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.

8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.

9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

10) All tools and plants including welding machines, crane, hydra, etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.

11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.

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

13) Bidder to prepare the model of tanks in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software and submit the same to BHEL along with 2D drawings.

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION-C2	
		REV. 00	DATE: MAR 2021
		SHEET :	

SUB SECTION-C2

CUSTOMER SPECIFICATION

LOW PRESSURE PIPING

1.00.00 **EQUIPMENT SIZING CRITERIA**

1.01.00 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.

1.02.00 For all Low Pressure piping systems covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.

1.03.00 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following:

a) **Water Application**

	Pipe Size	Water Velocity in m/sec Below 50 mm	50-150 mm	200 mm & above
(a)	Pump suction	------	1.2-1.5	1.2-1.8
(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
(c)	Header	------	1.5-2.4	2.1-2.4

Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value:

(i)	Carbon steel pipe	100
(ii)	Ductile Iron.	140
(iii)	Rubber lined steel pipe	120
(iv)	Stainless steel pipe	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water.

(b) **Compressed Air Application**

Compressed air 15.0 m/sec.(under Average Pressure & Temp. conditions)

1.04.00 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.

1.05.00 Based on the inside dia. so established, thickness calculation shall be made as per ANSI B 31.1 OD and thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B 36.19 as the case may be.

1.06.00 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).

1.07.00 Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.

1.08.00 High points in piping system shall be provided with vents along with valves as per the system requirement. Low points shall be provided with drains along with drain valves as per the system requirement. Drain lines shall be adequately sized so as to clear condensate in the lines. Material for drain and vent lines shall be compatible with that of the parent pipe material.

1.09.00 Material of construction for pipes carrying various fluids shall be as specified elsewhere.

1.10.00 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.

1.11.00 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.

1.12.00 Threaded joints shall be provided with Teflon sealant tapes.

1.13.00 Following types of valves shall be used for the system/service indicated.

SYSTEM	**TYPES OF VALVES**					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & vents		x	x	x		
Fuel oil (if any)		x	x	x	x	x

1.14.0 Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30%design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.

2.00.00 **TECHNICAL SPECIFICATION**

2.01.00 **GENERAL**

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.

2.02.00 **Pipes and fittings**

2.02.01 All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.

2.02.02 Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.

2.02.03 Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.

2.02.04 Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).

2.02.05 Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.

2.02.06 The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.

2.02.07 Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.

2.02.08 For rubber lined ERW pipes, beads shall be removed for pipe size 80 NB and above.

2.02.09 Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.

2.02.10 At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.

2.02.11 For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code.

Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location , number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.

2.03.00 **Material**

2.03.01 Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified, The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.

2.03.02 No extra credit would be given to offers containing materials superior to those specified. Likewise no extra credit would be given to offers containing pipe thickness more than specified.

2.03.03 All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.

2.03.04 All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.

2.03.05 Material of construction for pipes carrying various fluids shall be as follows:

Sl No	Type of Fluid	Material
1.	i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E'Gr.B/IS-3589 Gr. 410 /IS-1239 Heavy.
2.	i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below
3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.
4.	(Condensate) spill water	ASTM A 106 Gr. B
5.	Effluents from Neutralization pit	MSRL

2.03.06	In water lines, pipes upto 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr.B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.
2.03.07	Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr.E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr.E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).
2.03.08	In demineralised water service, the pipes upto 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB upto and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness. Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.
2.04.00	**Field routed pipes:**
2.04.01	Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.
2.05.00	**Slope/Drains and Vents**
2.05.01	Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size

up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes.

2.05.02 Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.

2.06.00 **Pipe Joints**

In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.

2.06.01 **Screwed Joints**

(a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT/ ANSI B1.20.1 (taper) NPT / IS: 554 unless specified otherwise.

(b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating. Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & out side) after welding with zinc rich electrode, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.

(c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.

(d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. Any site welding done on galvanized pipes shall be done with zinc-rich special electrodes and the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges with zinc-rich electrode will be permitted only when any flange is leak-prone during hydro testing.

(e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection (with zinc-rich special electrodes) followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where

galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

2.06.02 **Welded Joints**

(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

2.06.03 **Flanged Joints**

(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.

(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.

(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

2.07.00 **Bends/elbows/mitre bends/ Tees/ Reducers & other fittings**

2.07.01 For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11.Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1).

However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.

2.07.02 For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. However, mitre bends are also acceptable for rubber lined pipes above 1200 NB. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

2.07.03 For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.

2.07.04 Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes upto and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.

2.07.07 In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

2.08.00 **Flanges**

2.08.01 Flanges shall be slip on type or weld neck type. Welding of flanges in tension is not permitted.

2.08.02 All flanges and-flanged drilling shall be to ANSI B 16.5 / BS EN-1092 / AWWA C - 207 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.

2.09.00 **Specific technical requirement of laying buried pipe with anti-corrosive treatment**

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

2.09.01 **Trenching**

(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.

2.09.02 **Preparation and cleaning of piping**

(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.

(b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.

2.09.03 **Coating and wrapping/ Anti corrosive Protection Coal tar tape**

a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:

(1) Coating primer (coal tar primer)

(2) Coating enamel (coal tar enamel)

(3) Wrapping materials.

All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.

Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat.
Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity/resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.

Total thickness of completed coating and wrapping shall not be less than 4.0 mm.

b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total thickness of the finished protective coating shall be 4.0 mm minimum.

2.09.04 **Trench bed preparation and back filling**

Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.

2.09.05 **Laying of galvanized steel (GI) pipes**

All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

2.10.00 **Cleaning and flushing**

2.10.01 All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.

2.10.02 Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing . However for pipe sizes below 100nb the pipes may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.

2.10.03 After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.

2.10.04 All compressed air pipe work shall be cleaned by blowing compressed air.

2.11.00 **Specification for hangers and supports**

2.11.01 All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.

2.11.02 The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.

2.11.03 At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.

2.12.00 **Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.**

2.12.01 **GENERAL**

(a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.

(b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required.

(c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.

(d) The actuator-operated valves shall be designed on the basis of the following:

(1) The internal parts shall be suitable to support the pressure caused by the actuators;

(2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.

(3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.

(4) All actuators operated valves shall open/ close fully within time required by the process.

(e) Valves coming under the purview of IBR shall meet IBR requirements.

(f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

(g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer

2.12.02 **VALVE BODY MATERIAL**

Valve body material for various services shall be as follows:

Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below.

For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.

DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable.

Condensate: Cast Carbon Steel / Forged Carbon Steel.

2.12.03 The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of

applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

Standards and Codes

AWWA-C-504	Rubber seated butterfly valves.
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.
BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valves.
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves.
ANSI B 16.34	Standard for valves.
API-594	Standard for Dual-check valves.
API-600	Steel gate valves.
ANSI-B-16.10	Valves face to face and other relevant dimension.
API-598	Valves inspection test.

2.12.04 **End Connections**

The end connections, shall comply with the following:

Socket welding (SW) - ANSI B 16.11

Butt Welding (BW) - ANSI B 16.25.

Threaded (SC) - ANSI B 2.1

Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).

2.13.00 **Gate/Globe/Check Valves**

(a) All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).

(b) All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or

socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.

(c) All gun metal body valves shall have screwed ends.

(d) All flanged end valves/specialties. shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.

(e) Gate/sluice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position the bore of the valve shall not be constricted by any part of the gate.

Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items:

(1) Hand wheel

(2) Position indicator (for above 50 mm NB valve size)

(3) Draining arrangement wherever required.

(f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have radiused or spherical seating and discs shall be free to revolve on the spindle.

The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.

(g) Check valves shall be used for non-return service. They shall be swing. check type or double door (Dual plate)check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB.

(h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);

(i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.

(j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type.

(k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.

(l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.

(m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.

2.13.01 **MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)**

(a) The materials shall generally comply with the following:

(1) **Cast Steel Valves**

Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent

(2) **Stainless steel valves**

Body & Bonnet	SS 304
Disc	-do-
Trim.	SS 316

(3) **Cast iron valves**

Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260
Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay
Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260
Hinge pin for non-return valves	AISI 316
Stem for gate globe valves	13% chromium steel or Equivalent
Back seat	13 % chromium steel / 13% Chrome overlay

(4) **Gun Metal valves**

Body and bonnet	IS 318 Gr. 2/ Equivalent Standard
Trim.	-do-

(b) Cast iron body valves shall have high alloy steel stem and seat.

(c) Material for counter flanges shall be the same as for the piping.

(d) Forged carbon steel valves are also acceptable in place of Gun metal valves.

2.14.00 **Air Release Valve**

(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.

(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.

(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.

(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.

2.15.00 **Butterfly valves**

2.15.01 **Design/Construction**

(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or AWWA-C-516 or any other approved equivalent standard latest edition depending on size. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm nb diameter.

(b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However for sizes 600 NB and below the valves of Wafer construction are also acceptable

(c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

(d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

2.15.02 **Material of Construction (Butterfly Valves)**

Materials and other design details shall be as indicated below :

(a) **Cast Iron Butterfly Valves**

Body & Disc ASTM A48, Gr. 40 with 2% Ni /
IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated

Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
Seal	Nitrile Rubber

(b) **Stainless Steel Butterfly Valves**

Body & Disc	SS 304
Shaft	SS 316
Seat Rings	EPT/BUNA-N/Neoprene

(c) **Carbon steel Butterfly Valves**

Body & Disc	ASTM A 216, Gr. WCB
Shaft	SS 304
Disc & Seat Rings	EPT/BUNA-N/Neoprene

(d) **Elstomer lined Butterfly Valves**

Body & Disc	ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.
Shaft	SS 316

2.15.03 **Proof of Design Test (Type Test) for Butterfly Valves**

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.

All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.

2.16.00 **Float operated valves**

(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.

(b) DESIGN AND CONSTRUCTION FEATURES

The following design and construction feature of the valve shall be the minimum acceptable.

(c) Valves shall be right-angled or globe pattern.

(d) Valves shall be balance piston type with float ball.

(e) Leather liner shall not be provided.

(f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.

(g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.

(h) The valves shall have flanged connections.

2.17.00 **Tanks and Accessories**

2.17.01 The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.

2.17.02 **DESIGN AND CONSTRUCTION**

(a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650.

(b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement.

(c) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature.

(f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.

(j) Tanks shall be provided with float operated level indicators/level gauges/level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.

(k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing dm water, alkaline water or power cycle water the vent to atmosphere shall be through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals.

(l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes/inspection covers as required and also platform suitably located.

(m) Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.

(o) Tank fabrication drg. and design calculations shall be approved by the Project Manager.

2.17.03

Corrosion protection

(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.

(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.

(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. ~~Material of cleats shall be same as that of the shell.~~

Sl. No.	Description	Tech. Particulars
DRINKING WATER TANK		
a)	Quantity	One per each Unit
b)	Liquid to be handled	Drinking Water
c)	Size and Min. Plate Thickness	5m long x 2.5m wide x 2.5m high; Plate Thk. (min.) 8mm Overall Cap.= 31.25 M^3 (Effective cap.: 25M^3).
d)	Type	Pressed steel rectangular tank Closed top/ welded construction
e)	Design pressure	Atmospheric
f)	Tank Standard	BS-1564/IS-804 (Latest Edition)
g)	Material of Construction	Plates to ASTM-A-36/IS-2062 Gr.B
h)	Flange Material Standard	ASTM-A-105/IS-2062-Gr. B
i)	Accessories	
	(i) Vent, Overflow, drain piping & valve	To be provided
	(ii) Manhole	To be provided
	(iii) Stair/Platform	To be provided
	(iv) Supporting structure	To be provided
	(v) Internal ladder	To be provided
	(vi) Level indicator	To be provided
	(vii) Root valve for level transmitter	To be provided
j)	Protection of Internal surface	Two coats of food grade epoxy paint

k) Protection of external surface	Two coats of EPOXY based paint preceded by one(1) coat of primer. (minimum DFT 100 micron)
l) Location	On Power House roof.

1.00 **CONDENSATE STORAGE TANKS**

1.01 Number required	one for each unit
1.02 Capacity of each tank (Effective)	350 Cu.m (for 660MW units),
1.03 Size (Dia & Height)/Plate Thickness	~~8.6mX7.2m minimum,~~ Shell & Roof plate Thickness 8mm and Base plate thickness 10mm
1.04 Type and pressure class	Vertical, cylindrical, atmospheric
1.05 Material of construction	MS- (IS-2062 Gr.B or equivalent) as per specified code, 8mm thickness (minimum)
1.06 Location	Outdoor
1.07 Overflow, drain, vent and Sample connection(piping &valve)	required
1.08 Level Indicator	
a) Number	One for each tank
b) Type	Mechanical float type with dial type indicator (Guide wire, Float and Housing of Stainless steel - 316 Gr. construction)
1.09 Manhole (minimum 500mm size)	Two (2)-one on shell and the other on roof
1.10 Special Fittings	
a) Hydraulic Seal of Overflow/Drain	Required

b)	Additional nozzle Connection	number and size to be indicated to successful Bidder
c)	Nozzle connection for Instrument/spare	Three (3) nos. for each tank
d)	CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level)	required
e)	Outside stair case (spiral)	required
f)	Inside Ladder	Required
g)	Draw off sump	required
h)	Root valve for level Transmitter	Root valves for two (2) nos. level transmitter for each tank Required

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2.18.00 **RUBBER EXPANSION JOINTS**

2.18.01 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.

2.18.02 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.

2.18.03 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.

2.18.04 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.

2.18.05 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.

2.18.06 Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.

2.18.07 The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the' duck' shall be either a superior quality braided cotton or synthetic fibre having maximum flexibility and non-set characteristic.

2.18.08 The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.

2.18.09 All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber

when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.

2.18.10 The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.

2.18.11 All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.

2.18.12 Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.

2.18.13 Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.

2.18.14 Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.

2.18.15 **Life cycle test for RE Joints of Condenser CW Inlet Outlet lines:**

Life cycle test certificates shall be furnished by the bidder for each type and size of RE joints supplied by the Bidder, in the absence of which actual Life cycle test shall be conducted on one rubber expansion joint of each type and size .

2.19.00 **STRAINERS**

2.19.01 **Simplex type**

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows:

(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)
(b)	Strainer Element	Stainless steel (AISI 316)
(c)	End connection	Screwed upto 50 mm Nb, and Flanged above 50 mm Nb

2.19.02 **Duplex type**

(a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting

pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.

(b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.
Strainer element	Stainless steel (AISI 316)
End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type

(c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.

(d) The size of the strainer and the flow direction will be indicated on the strainer body casting.

(e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

SUB–SECTION – A-7

SURFACE PREPARATION & PAINTING

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**Specification of surface preparation & painting**
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labeled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.
1.05.0	**SURFACE PREPARATION**
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil, grease and other foreign matter. Surfaces shall be free of moisture and contamination from chemicals and solvents.
1.05.02	The following surface schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Phospating SP6 Emery sheet cleaning/Manual wire brush cleaning.
1.06.00	**APPLICATION OF PRIMER/PAINT**
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminium paint to IS 2339. PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC) PS13 - Rust preventive fluid by spray, dip or brush. PS14 - Weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15'. PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=35.0(min.). PS-20 - Epoxy based finish paint
1.06.06	All weld edge preparation for site welding shall be applied with one coat of wieldable primer.
1.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.

1.06.08 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														As per NTPC Colour shade/ coding scheme
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
2.	All un -insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	Design temperature < or equal to 60^{0}C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 $	35 $	155 $	
		Design temperature above 60 ^{0}C-200^{0}C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200^{0}C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH), Variable Load Hanger (VLH).		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4.	Piping hangers/ supports (other than (3) above. (un-insulated)		SP3/SP5	PS 5	2	25	-	-	-	PS4	2	25	100	
5.	Valves													

	Cast/Forged	Design temperature < or equal to 60 degC #	SP3/SP5	PS 5	2	35	-	-	-	PS4	2	25	120
		Design temperature above 60 degC	SP3/SP5	PS 9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a))Epoxy coat b)Final coat of paint PS17	2 1	25 30	150
7.	Weld Edges		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25

1. $ The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.
2. For valves below 65NB and temperature upto and including 540 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.
3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable.
4. For spring cages, 2 coats of 30 µm(min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm(min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.
5. For corrosion protection for all inner parts of the hangers shall be atleast in full compliance to Corrosion category C3 as per EN ISO12944.
6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.

B) LOW PRESSURE PIPING

		Surface Preparation	Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Min. Total DFT (Microns)	
													As per NTPC Colour shade/ coding scheme
1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**COMPRESSED AIR SYSTEM**
1.00.01	One number of Unit Air Receiver of capacity 10 m^3 for each unit to be located in each TG building. (Total: 02 numbers). Foundation & grouting of the same is in Bidder's scope of work. The compressed air scheme and piping network shall generally be in line with the enclosed Tender drawing. Any additional items required to make the system complete.
2.00.00	**AIR RECEIVERS**
2.01.00	The capacity of the Unit air receivers shall be minimum 10 M^3 or to suit the emergency storage requirement (if any) for any of the Bidder's requirement whichever is higher.
2.02.00	Receivers shall be located inside TG building.
2.03.00	The design pressure and temperature shall be minimum 10 Kg/cm^2 (g) and 50 deg.C respectively. Receivers shall be designed in accordance with Section VIII, Division 1 of ASME Code or equivalent.
2.04.00	Air receivers are to be provided with gasketted inspection manhole of minimum 500 mm diameter with cover plate, lifting handle, davit cap etc.
2.05.00	Receivers shall be of welded construction with minimum number of joints. Longitudinal seam in adjacent sections shall not be in same line. Welding shall be as per relevant codes. Filler material to have composition & structure as that of material welded. Welding electrodes to be approved by Employer. Electrodes to be dried before use.
2.06.00	Relief valves shall be provided and set pressure of the same shall be atleast 10% above working pressure (8-8.5 Ksc). The spring in relief valve shall not reset for any pressure more than 10% above or below the design set pressure.
2.07.00	Each receiver shall be provided with pressure indicator, temperature indicator and drain connection with electrically operated automatic drain trap arrangement with isolation and bypass valves. The drain trap shall be timer based. Manual draining facility shall also be provided in the drain trap.
2.08.00	The material of construction of shell, dished ends, flanges, etc. of the air receivers shall be of carbon steel as per IS:2062 or equivalent.
3.00.00	**PAINTING**
3.01.00	All the Equipments shall be protected against external corrosion by providing suitable painting.
3.02.00	All Painting shall be done as per approved painting scheme of the vendors/Manufacture which shall be submitted by bidder and as approved by Employer.

DOCUMENTS/DRAWINGS SUBMISSION COPIES

ANNEXURE-I

S.NO.	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
1.	PLANT DEFINITION MANUAL-	2 sets	4 CD-ROMs
2.	Drawings "FOR APPROVAL"		
	i) Layout drawings / P&IDs	6	2 CD - ROMs
	ii) Other drawings	2	2 CD - ROMs
3.	Drawings "FOR INFORMATION"	2	2 CD - ROMs
4.	Drawings "FINAL DRAWING"	15	4 CD-ROMs
5.	Drawings "AS BUILT "	15	4 CD-ROMs
6	DATASHEETS, DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc. and Other type of documents		
	i) For Approval	2	2 CD - ROMs
	ii) FINAL	15	4 CD-ROMs -
	iii) Analysis reports of equip-ments/ piping/ structures components/ systems employing software packages as detailed in the specifications	2	2 CD - ROMs
7.	Erection manual "1st Submission"	4 Sets	2 CD - ROMs
8	Erection manual "FINAL"	4 Sets	4 CD ROMs
9	Operation & Maintenance manual "1st submission"	4	2 CD - ROMs

S.NO.	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
10	Operation & Maintenance manual "FINAL"	4 Sets	4 CD-ROMs
11	Plant Hand Book "1st Submission"	4 Sets	2 CD ROMs
12	Plant Hand Book "FINAL"	4 Sets	4 CD ROMs
13	Commissioning and Performance Procedure manual "1st Submission"	4 Sets	2 CD-ROMs
14	Commissioning and Performance Procedure manual "FINAL"	4 Sets	4 CD ROMs
15	Performance and Functional GURANTEES TEST REPORT	4 Sets	4 CD ROMs
16	Project completion report	15	4 CD ROMs
17	QA programme including Organi-sation for implement-ation and QA systemmanual (with revision-servicing)	1	1 CD ROM
18	Vendor details in respect of pro-posed vendors including contractor's evaluation report.	1	1 CD ROM
19	Manufacturing QPs, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, PQR etc.		
	(i) For review/comment	2	2 CD-ROMs
	(ii) For final approval	2	2 CD ROMs

S.NO.	DESCRIPTION OF DOCUMENTS	NO OF PRINTS	NO. OF CD-ROMs
20	Welding Manual, HeatTreatment Manuals, Storage & preservation manuals		
	1st Submission	4 Sets	2 CD ROMs sets
	Final	4 sets	4 CD ROMs
21	QA Documentation Packagefor items / equipmentmanufactured and and despatched to site	2 sets	4 CD ROMs
22	QA Documentation Package for field activities on equipment / systems at site	2 sets	4 CD ROMS

ANNEXURE-I
LIST OF MAKES OF SUB-VENDOR ITEMS
MISCELLANEOUS TANKS & AIR RECEIVER

SUB-VENDORS - MISCELLANEOUS TANKS				
S.NO	**ITEM**	**SUB-VENDORS**	**PLACE**	**TECHNICAL LIMIT**
1	**CS PIPES ERW**	TISCO	JAMSHEDPUR	UP TO 350 NB
		SAIL	ROURKELA	
		SURYA ROSHNI	BAHADURGARH	UP TO 400 NB
		JINDAL	GHAZIABAD	UP TO 350 NB
		RATNAMANI	KUTCH	UP TO 400 NB
		MAHARASHTRA SEAMLESS	RAIGARH	UP TO 500 NB
		WELSPUN	ANJAR	UP TO 400 NB (IS 3589)
2	**CS PIPES SEAMLESS**	MAHARASHTRA SEAMLESS	RAIGARH	UP TO 350 NB
		ISMT	AHMEDNAGAR	UP TO 150 NB
		JINDAL SAW	NASHIK	
		REMI METAL GUJRAT LTD	BHARUCH	UP TO 150 NB HOT FINISH & UPTO 100NB COLD FINISH
		ISMT	BARAMATI	UP TO 200 NB
3	**SS PIPES**	REMI	TARAPUR	
		RATNAMANI	KUTCH	
		APEX TUBES	BEHROR (ALWAR)	
		PRAKASH STEELAGE LTD	MUMBAI	SS SEAMLESS PIPE UPTO 50MM
		SUMITAMO	JAPAN	
4	**STRUCTURAL STEEL / MS-PLATE**	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		M/S UTTAM VALUE STEEL (LLOYDS)		
		ISPAT		
		JSW		
		INDIAN IRON & STEEL CO. LTD		
5	**GATE, GLOBE AND CHECK (STAINLESS STEEL VALVES)**	A.V. VALVES LTD	AGRA	
		MICON VALVES(INDIA) PVT LTD	MUMBAI	**GATE VALVES**: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 600 NB- Class up to 600 with MOC as CCS/CSS. **NR VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 700 NB- Class up to 600 with MOC as CCS/CSS. **GLOBE VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 80 NB- Class 150 with MOC as CCS.
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	

		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO		
		OSWAL INDUSTRIES		
6	**GATE, GLOBE AND CHECK (CS STEEL VALVES)**	A.V. VALVES LTD	AGRA	
		MICON VALVES(INDIA) PVT LTD	MUMBAI	**GATE VALVES**: Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 600 NB- Class up to 600 with MOC as CCS/CSS. **NR VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 700 NB- Class up to 600 with MOC as CCS/CSS. **GLOBE VALVES:** Up to 50NB – Class-800 with MOC as FCS. Class 150 with MOC as CSS. Size 65 NB to 80 NB- Class 150 with MOC as CCS.
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2

		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO -L&T	CHENNAI / COIMBATORE	
		OSWAL INDUSTRIES		
		HITECH	AHMEDABAD	
		KSB WATER PUMPS / VALVES	COIMBATORE	
		KBL	KONDHAPURI	
		HAWA ENGINEERS	AHMEDABAD	
		BHEL	GOINDWAL	
		FOURESS ENGG	MUMBAI	UPTO 600 NB, CL-300 & 300NB CL-600
		FOURESS ENGG	AURANGABAD	
7	**LEVEL INDIATOR FLOAT AND BOARD TYPE**	FLOW STAR	FARIDABAD	
		SCIENTIFIC DEVICES	MUMBAI	
		GAUGES BOURDEN	PANVEL	
		PUNE TECHTROL	PUNE	
		SBEM	PUNE	
		LEVCON	KOLKATA	
		SIGMA	MUMBAI	
		CHEMTROL		
		DK INSTRUMENT	KOLKATA	
		V AUTOMAT	DELHI	
8	**PAINT**	ASIAN PAINT		
		BERGER		
		KANSAI NEROLAC		
		JOTUN		
		SHALIMAR		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		AKZONOBEL COATINGS		
9	**FITTINGS (MS/SS)**	PIPE FIT ENGINEERS	VADODARA	
		GUJRAT INFRA PIPES	VADODARA	
		MS FITTINGS	KOLKATA	
		TUBE PRODUCT	VADODARA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	

		NL HAZRA	KOLKATA	
		EXCEL METAL		
		INTERTECH		
		FITTECH		
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
10	**SEAL POT / NAOH BREATHER**	SELF MANUFACTURED ITEM		
11	**AIR RECEIVER**	INTEGRATED ENGINEERS	MUMBAI	
		DIAMOND FABRICATORS	PUNE	
		PARKAIRE	DELHI	
		TEMASME VESSELEX	NOIDA	
		UNITED ENGINEERING WORKS	NASIK	
	INSPECTION CATEGORIZATION			
	1. CAT I :INSPECTION BY OWNER, BHEL/BHEL NOMINATED TPIA & VENDOR .MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.			
	2. CAT II:INSPECTION BY BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.			
	3. CAT III: MDCC WILL BE ISSUSED BASED COC & MTC ISSUSD BY VENDOR AND VERIFICATION BY BHEL/OWNER IN LINE WITH APPROVED QAP/CHECK LIST			

The make of Sub-vendor items shall be generally as indicated above which is subject to customer / BHEL approval during detail engineering.

Make of any unlisted items shall be subject to customer / BHEL approval during detail engineering. For such items, bidder to furnish list of sub-vendors during detail engineering stage for Customer / BHEL's review and approval. Bidder shall furnish following supporting documentation within 1 month of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained.

a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.

b) Documentation in the form of certificate that the equipment/system has been operating satisfactorily for two years as on the scheduled date of bid opening.

The successful bidder will get the makes of all items approved from Customer/ Consultant during detail engineering within two months of placement of LOI. The complete list will be necessarily being submitted within one month of placement of LOI to ensure timely placement of order for BOIs

Bidder to assess the capability of their proposed 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.

Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION- D	
		REV. 00	DATE: MAR 2021
		SHEET : 1 OF 1	

ANNEXURE-II

REFRENCE QUALITY PLANS

	MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE: XX.XX.XX
		CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(PI)	DATE: 11.02.2020
		PROJECT:		PO NO.: LATER	DATE: XX.XX.XX
		ITEM: PIPE FITTINGS ,FLANGES & ACCESSORIES	SYSTEM: MISC.TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	**			
					M	C/ N			*D	M	C	N	
1	Pipes Fittings, Flanges & Accessories	Check for Type, Model No., Tag No.,	MI	Visual	100%		As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	
2		Dimensions	MI	Dimensional	100%		As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	
3		Physical and chemical Properties	MI	Review of TC	For Lot		As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Mfgr. TC	P	V	V	
4		Hydro test	MA	Hydro Test	100%		As per Approved Data Sheet/ Tech spec.	As per Approved Data Sheet/ Tech spec.	Inspection Report	P	V	V	

NOTES:

1. BHEL reserves the right for conducting repeat test, if required.
2. Photographs of packing of material before final dispatch is to submitted.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	11.2.2020	S. K. YADAV	Checked by:	11.02.2020	ASHISH PANIGRAHI
Reviewed by:	11.02.2020	SAYAN ROY	Reviewed by:	11/2/2020	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE:XX.XX.XX
		CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(LI)	DATE:11.02.2020
		PROJECT:		PO NO.:LATER	DATE: XX.XX.XX
		ITEM: LEVEL INDICATOR	SYSTEM: MISC. TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	**			
					M	C/ N			*D	M	C	N	
1	Level Indicator	Check for Type, Model No., Tag No.	MA	Visual	100%		Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
2		Float Leakage Test	CR	Mechanical	100%		Approved Data Sheet	Approved Data Sheet	Mfgr. TC	P	V	V	
3		Review of TC for Material	CR	Visual	For Lot		MTC	MTC	Mfgr. TC	P	V	V	

NOTES:

1. BHEL reserves the right for conducting repeat test, if required.
2. Photographs of packing of material before final dispatch is to submitted.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	11.2.2020	S. K. YADAV	Checked by:	11.2.2020	ASHISH PANIGRAHI
Reviewed by:	11.02.20	BAYAN ROY	Reviewed by:	11/02/2020	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-XXX-167-A001	DATE: XX.XX.XX
		CUSTOMER :		QP NO.: PE-QAP-XXX-167-A001(PL)	DATE: 11.02.2020
		PROJECT:		PO NO.: LATER	DATE: XX.XX.XX
		ITEM: MS PLATES	SYSTEM: MISC.TANKS (SITE FABRICATED)	SECTION:	SHEET 1 OF 1

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*				
					M	C/ N				D	M	C	N	
1.0 RAW MATERIAL														
1	STEEL PLATES	Chemical composition and Mechanical test	MA	Review of corelated MTC	one/heat		IS:2062	IS:2062	Mfgr. TC	√	P	V	V	Refer Note below
2		Visual and dimensional check	MA	Visual and measurement	100%		Mfg.TC	Mfg.TC IS1852	Mfgr. TC	√	P	** W	** W	
3		Identification/ marking	MA	Corelation establish	100%		As per manufacturing practice	As per manufacturing practice IS 2062	Mfgr. TC	√	P	V	** W	

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

** **NOTE:** i) In case material is dispatched directly from Approved sub-vendor plant/stockyard or procured from dealer against co related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of approved sub vendor.

** ii) In case material is procured from dealer and co related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from them at NABL certified/approved laboratory for chemical & physical properties, however dimensional check shall be witnessed by BHEL.

iii) BHEL reserves the right for conducting repeat test, if required.

iv) Photographs of packing of material before final dispatch is to submitted.

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	11-2-2020	S. K. YADAV	Checked by:	11-2-2020	ASHISH PANIGRAHI
Reviewed by:	11.02.2020	SAYAN ROY	Reviewed by:	11/2/2020	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

254785/2021/PS-PEM-MAX

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बी एच ई एल BHEL		CUSTOMER :		QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
		PROJECT:		PO NO.: LATER	DATE: XXX
		ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL	SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 1 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
1.0 MATERIAL:														
1.1	BODY, BONNET, YOKE,WEDGE/ DISC, SEAT, SPINDLE BODY SEAT, BACK SEAT, THRUST PLATE	1. PHYSICAL & CHEMICAL PROPERTIES	MA	PHYS, CHEM. TESTS	ONE/ HEAT	-	APPD. DRG.	APPD. DRG.	MTC	√	P/ W	V	V	CORRELATION OF BODY & BONNET REQD. WITH MTC HEAT NO.
		2. HEAT TREATMENT	MA	REVIEW OF H.T. RECORDS	100%	-	-DO-	-DO-	H.T. INTERNAL INSPN RECORDS	√	P/ W	V	V	SOLUTION ANNEALING FOR SS VALVES
		3. SURFACE DEFECTS	MA	VISUAL	100%	-	MSS-SP-55	MSS-SP-55	INSPN REPORT	√	P/ W	V	V	
1.2	BODY, BONNET & DISC/ WEDGE	a) CASTINGS 1. SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34	ASME B16.34	INSPN REPORT	√	P/ W	V	V	RT ON CHANGE OF SECTION FOR 1.ALL VALVES. (RT FILM REVIEW BY BHEL)
		2. SUB-SURFACE DEFECTS	CR	RT/UT	100%		ASME B16.34	ASME B16.34	INSPN REPORT					
		b) FORGINGS 1. SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34	ASME B16.34	INSPN REPORT	√	P	V	V	
		2. SUB-SURFACE DEFECTS	CR	UT	100%		-DO-	-DO-	-DO-					
2.0	SS/ STELLITE DEPOSIT ON DISC & BODY SEAT, BACK SEAT	1. SURFACE DEFECTS	CR	PT	100%	-	ASTM E165 & APP.DRG.	ASME B16.34	INSPN REPORT	√	P/ W	V	V	
		2. HARDNESS	MA	TESTING	100%		APP.DRG.	APP.DRG./ASME B16.34	MTC	√	P/ W	V	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	17.01.20	GK Morye	Checked by:	17.01.2020	KK Yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal			Approved by:			

254785/2021/PS-PEM-MAX

MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN	SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
	CUSTOMER :	QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
	PROJECT:	PO NO.: LATER	DATE: XXX
	ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL — SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 2 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
3.0 GEAR BOX (AS APPLICABLE)														
3.1	GEAR, WORM GEAR & SHAFT	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	1/BATCH	-	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	MTC	√	P/W	V	V	
		2. HARDNESS	MA	MEASUREMENT	100%		REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	MTC	√	P/W	V	V	
3.2	GEAR BOX ASSEMBLY	1. APPEARANCE	MA	MEASUREMENT	100%		APPD. DRG/ IS 8935	APPD. DRG./ DATA SHEET/ IS 8935	ACTUATOR CERT.	√	P/W	V	V	
		2. PERFORMANCE	MA	ELECTRICAL	SAMPLE		MFG. STD.	MFG. STD.	TEST REPORT	√	P/W	V	V	
		3. DIMENSIONS	MA	PHYSICAL	100%		APPD. DRG/ IS 8935	APPD. DRG/ IS 8935	-DO-	√	P/W	V	V	
		4. DESIGN VERIFICATION												
		a) TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/SIZE/RATED TORQUE	-	APPROVED PROCEDURE	APPROVED PROCEDURE	MTC	√	P/W	V	V	**REFER NOTE-3**
		b) GEAR BOX P.O.D. (LIFE CYCLE TEST)	MA	CYCLE TESTING	ONE/ TYPE/SIZE/RATED TORQUE		APPROVED PROCEDURE	APPROVED PROCEDURE	MTC	√	P/W	V	V	**REFER NOTE-3**
4.0 IN-PROCESS INSPECTION														
4.1	MACHINING OF ALL COMPONENTS INCLUDING BW	1. DIMENSIONS, WORKMANSHIP AND FINISH	MA	MEAS.,VISUAL	100%	-	MFG.DRG.	MFG.DRG.	LOG BOOK	-	P	V	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	17-01-20	GK Morye	Checked by:	20/1/2020	KK Yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal			Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN	SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बी एच ई एल BHEL		CUSTOMER :	QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
		PROJECT:	PO NO.: LATER	DATE: XXX
		ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL — SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 3 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
	ENDS	2.SURFACE & SUB-SURFACE DEFECTS	CR	1. PT 2. MPI (ACCESSIBLE AREA OF BODY & BONNET)	100%	-	ASME B16.34	ASME B16.34.	LOG BOOK	-	P/W	V	V	
		3.SUB SURFACE DEFECTS (SPINDLE, BODY / DISCS SEAT RING)	CR	UT	100%	-	ASME B16.34	ASME B16.34	LOG BOOK	-	P/W	V	V	1. IF DIA/THK IS EQUAL OR GREATER THAN 40 mm. 2 IF BODY/ DISC SEATS THICKNESS EQUAL OR GREATER THAN 25 MM
4.2	WEDGE/DISC & SEAT RING, SPINDLE AND BACK SEAT	1. LAPPING	CR	BLUE MATCHING	100%	-	UNIFORM METAL TO METAL CONTACT	UNIFORM METAL TO METAL CONTACT	INSPN REPORT	√	P	V	V	
5.0	ASSEMBLY	1. DIMENSIONS	MA	MEAS.	100%	-	APPD.DRG.	APPD.DRG.	-DO-	√	P	V	V	
		2. WEAR TRAVEL	MA	MEAS.	100%	-	BSEN ISO 10434	-DO-	-DO-	√	P	V	V	FOR GATE VALVE ONLY
		3. VALVE LIFT	MA	MEAS.	100%	-	APPD.DRG.	-DO-	-DO-	√	P	V	V	
6.0 TESTING														
6.1	BODY, SEAT, BACK SEAT	1. LEAK TIGHTNESS OF BODY	CR	HYDRAULIC TEST	100%	REFER NOTE-2	APPD. DRG. /ASME B16.34	NO LEAKAGE	INSPN. REPORT	√	P	W	V	
		2. LEAK TIGHTNESS OF BACK SEAT AND SEAT	CR	HYDRAULIC TEST	100%		-DO-	LEAKAGE PERMISSIBLE AS PER API 598	-DO-	√	P	W	V	
		3. LEAK TIGHTNESS OF SEAT	CR	PNEUMATIC TEST	100%		-DO-	-DO-	-DO-	√	P	W	V	
6.2	OPERATIONAL TESTING FOR MANUALLY OPERATED VALVES	SMOOTH & FULL OPENING AND CLOSING	CR	MANUAL	100%	REFER NOTE-2	-DO-	SMOOTH OPERATION OF VALVES & CLEAR BORE	INSPN. REPORT	√	P	W	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	17-01-20	GK Morye	Checked by:		KK Yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	24.1.2020	RK Jaiswal			Approved by:			

254785/2021/PS-PEM-MAX

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN	SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बीएच ई एल BHEL		CUSTOMER :	QP NO.: PE-QP-435-100-M004(C)	DATE: 17.01.2020
		PROJECT:	PO NO.: LATER	DATE: XXX
		ITEM: CAST SS GATE/ GLOBE VALVE (ABOVE 50NB SIZE),CLASS 150, MANUAL — SYSTEM: LP PIPING (WATER SYSTEM)	SECTION:	SHEET 4 OF 4

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		10
					M	C/N				D	M	C	N	
7.0	COMPLETE VALVES	OVERALL DIMENSION	MA	MEASUREMENT	SAMPLE	-	APPD.DRG	APP.DRG.	INSPN. REPORT	√	P	V	V	
8.0	END CONNECTION DETAILS	DIMENSIONS	MA	MEASUREMENT	100%	REFER NOTE-2	APPD. DRG.	APPD. DRG.	-DO-	√	P	W	V	
9.0	FINAL INSPECTION	CLEANLINESS & COMPLETENESS, NAME WITH VALVE TAG NOS.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P	V	V	
10.0	PACKING	APPD. DRG.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTO GRAPH	-	P	V	V	REFER NOTE-4

NOTES:

1. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
2. 10% or min. 2 nos. at random by BHEL/Customer & 100% by supplier for each type, size & rating.
3. Review/ Verification of Test Report/Certificate, in case these tests have been carried out earlier (Within the last 5 years from placement of PO) on the identical Model/Type/Rating of tested Gear Box at an independent laboratory or witnessed by reputed customer like NTPC etc. or third party inspection agency like Lloyds, TUV, DNV etc. if the above Test Reports/Certificates are not available or not found satisfactory by BHEL/Customer, then the required TYPE TEST to be carried out by the Vendor on Gear Box without any commercial implications at his own cost & witnessed by BHEL/Customer.
4. Supplier to provide the followings:
   a. Photographs of valves duly placed inside the wooden box just before the final packing.
   b. Photographs of the wooden box in which valves have been finally packed just before dispatch.
   c. Clearance for dispatch of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

LEGENDS:

*D: Records, identified with "Tick"(√) shall be essentially included by supplier in QA Documentation.

** M: Supplier/ Manufacturer/ Sub-Supplier
P: Perform
MA: Major Characteristic
MTC: Mill Test Certificate
RT= Radiographic Test

C: Main Supplier/BHEL/ Third Party Inspection agency
W: Witness
MI: Minor Characteristic
PT: Penetrant Test
MPI=Magnetic Particle Inspection

N: Customer
V: Verification
CR: Critical Characteristic
UT: Ultrasonic Testing

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	17.01.20	GK Morye	Checked by:		KK Yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	21/1/2020	RK Jaiswal			Approved by:			

254785/2021/PS-PEM-MAX

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN	SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बीएचईएल BHEL		CUSTOMER :	QP NO.: PE-QP-435-100-M004(A)	DATE: 17.01.2020
		PROJECT:	PO NO.: LATER	DATE: XXX
		ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION — SYSTEM:	SECTION:	SHEET 1 OF 3

SL. NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	
1.0 MATERIAL:														
1.1	BODY, BONNET, DISC, SPINDLE,	1. PHYS. & CHEM. PROPERTIES	MA	PHYSICAL & CHEMICAL TEST	ONE/ HEAT	-	APPROVED DRAWING	APPROVED DRAWING	MTC	√	P/ W	V	V	**CORRELATION OF BODY& BONNET REQD. WITH MTC HEAT NO.**
		2. HEAT TREATMENT	MA	REVIEW OF H.T.	100%	-	-DO-	-DO-	HT(MTC)	√	P/ W	V	V	**SOLUTION ANNEALING FOR STAINLESS STEEL**
1.2	BODY, BONNET	SURFACE & SUB SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34 AND TECH. SPEC.	ASME B16.34	MTC	√	P/ W	V	V	**PT FOR SS VALVES**
2.0	SS/ STELLITE DEPOSIT ON DISC & BODY SEAT	SURFACE DEFECTS	CR	PT	100%	-	ASME B16.34 & APPD DRG.	ASME B16.34 & APPD DRG.	MTC	√	P/ W	V	V	
3.0 IN-PROCESS INSPECTION:														
3.1	MACHINING OF ALL COMPONENTS	1. DIMENSIONS, WORKMANSHIP AND FINISH	MA	MEAS.,VISUAL	100%	-	MFG.DRG.	MFG DRG.	LOG BOOK	-	P	V	V	
		2.SURFACE & SUB SURFACE DEFECTS	CR	PT (machined hard surfaces)	100%	-	ASME B16.34	ASME B16.34	-DO-	-	P	V	V	
3.2	DISC & SEAT RING	LAPPING	CR	BLUE MATCHING	100%	-	UNIFORM METAL TO METAL CONTACT		INSPN. REPORT	√	P	V	V	
4.0 TESTING:														
4.1	BODY, SEAT, BACK SEAT	1. LEAK TIGHTNESS OF BODY	CR	HYDRAULIC TEST	100%	REFER NOTE-2	APPD. DRG./ BSEN ISO 15761	NO LEAKAGE	INSPN REPORT	√	P	W	V	
		2. LEAK TIGHTNESS OF BACK SEAT AND SEAT	CR	HYDRAULIC TEST	100%		-DO-	LEAKAGE PERMISSIBLE AS PER API 598	-DO--	√	P	W	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	01.22	GK Morye	Checked by:		KK yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal			Approved by:			

254785/2021/PS-PEM-MAX

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बी एच ई एल BHEL		CUSTOMER :		QP NO.: PE-QP-435-100-M004(A)	DATE: 17.01.2020
		PROJECT:		PO NO.: LATER	DATE: XXX
		ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION	SYSTEM:	SECTION:	SHEET 2 OF 3

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9					10
					M	C/N				D	M	C	N	
		3. LEAK TIGHTNESS OF SEAT	CR	PNEUMATIC TEST	100%	REFER NOTE-2	APPD. DRG./ BSEN ISO 15761	LEAKAGE PERMISSIBLE AS PER API 598	INSPN REPORT	√	P	W	V	
4.2	OPERATIONAL TESTING FOR MANUALLY OPERATED VALVES	SMOOTH & FULL OPENING AND CLOSING	CR	MANUAL	100%	REFER NOTE-2	SMOOTH OPERATION OF VALVES & CLEAR BORE		INSPN. REPORT	√	P	W	V	
5.0	COMPLETE VALVES	OVERALL DIMENSION	MA	MEAS	SAMP-LE.	-	APPD.DRG	APP.DRG.	-DO-	√	P	V	V	
6.0	END CONNECTION DETAILS	DIMENSIONS	MA	MEAS.	100%	REFER NOTE-2	APPD. DRG.	APPD. DRG.	-DO-	√	P	W	V	
7.0	FINAL INSPECTION	CLEANLINESS & COMPLETENESS, NAME WITH VALVE TAG NOS.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P	V	V	
8.0	PAINTING	1. SURFACE PREPARATION 2.UNIFORMITY & THICKNESS	MI MI	VISUAL MEASUREMENT	100% 100%		APPD. DRG. -DO-	APPD. DRG. -DO-	-DO- -DO-	√	P	V	V	APPLICABLE FOR FCS HOSE VALVE
9.0	PACKING	APPD. DRG.	MA	VISUAL	100%	-	APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTOGRAPH	√	P	V	V	REFER NOTE '3'

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	17.01.20	GK Morye	Checked by:	20.01.2020	KK yadav			Reviewed by:			
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20.1.2020	RK Jaiswal			Approved by:			

254785/2021/PS-PEM-MAX

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-435-100-M001	DATE: 17.01.2020
बी एच ई एल BHEL		CUSTOMER :		QP NO.: PE-QP-435-100-M004(A)	DATE: 17.01.2020
		PROJECT:		PO NO.: LATER	DATE: XXX
		ITEM: FORGED SS GATE,GLOBE VALVE/ HOSE VALVE(FCS), SIZE 25 TO 50NB,CLASS 800,MANUAL OPERATION	SYSTEM:	SECTION:	SHEET 3 OF 3

SL NO.	COMPONENT & OPERATIONS	CHARACTERIST-ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			10
					M	C/N				D	M	C	N	

NOTES:

1. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.
2. 10% or min. 2 nos. at random by BHEL/Customer & 100% by supplier for each type, size & rating.
3. Supplier to provide the followings:
   a. Photographs of valves duly placed inside the wooden box just before the final packing.
   b. Photographs of the wooden box in which valves have been finally packed just before dispatch.
   c. Clearance for dispatch of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

LEGENDS:

***D**: Records, identified with "Tick"(√) shall be essentially included by supplier in QA Documentation.

** **M**: Supplier/ Manufacturer/ Sub-Supplier
P: Perform
MA: Major Characteristic
MTC: Mill Test Certificate

C: Main Supplier/BHEL/ Third Party Inspection agency
W: Witness
MI: Minor Characteristic

N: Customer
V: Verification
CR: Critical Characteristic

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	17-01-20	GK Morye	Checked by:	17/01/2020	KK yadav
Reviewed by:	20.1.2020	Sanjay Kumar	Reviewed by:	20/1/2020	RK Jaiswal

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

QUALITY PLAN FOR PRESSURE VESSEL

MANUFACTURER :

DOC. NO. :
REVISION :
DATED :

EQUIPMENTS AIR RECEIVERS

SHEET : 1 of 1

PROJECT

Sr. NO.	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CLASS	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMETS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY N	REMARKS
1.0	**RAW-MATERIAL**											
1.1	PLATES/ PIPES FOR SHELL, DISHED ENDS FLANGES, NOZZLES, PIPES	PHYSICAL / CHEMICAL DIMENSION	CRITICAL	PHYSICAL & CHEMICAL TESTS	1 / HEAT / BATCH	APPROVED DRG. DATA SHEET RELEVANT STD.	APPROVED DRAWING DATA SHEET RELEVANT STD.	MILL TC OR LAB REPORT	P	V	V	
2.0	**WELD QUALITY**											
2.1	ALL COMPLETED WELDS SEALED RUN AFTER BACK CHIPPING	DYE PENETRATION TEST	MAJOR	VISUAL	AS PER DRG/ STD./ 100%	ASME SEC VIII DIV 1 ASTM E 165	ASME SEC VIII DIV 1 ASTM E 165	LPT CERTIFICATE	P	V	V	
2.2	ALL BUTT WELDS	SOUNDNESS	CRITICAL	VISUAL	AS PER DRG.	AS PER ASME SECT. VIII ASME SECT. V	ASME SECT. VIII DIV.1	RADIOGRAPHY REPORTS	P	V	V	
3.0	**FINAL INSPECTION**											
3.1	COMPLETED VESSEL	DIMENSION	MAJOR	MEASUREMENT	100 %	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	INSPEC. REPORT	P	V	W	
		ORIENTATN. OF NOZZLE		VISUAL/ MEASUREMENT	100 %	APPROVED DRG	APPROVED DRG	INSPEC. REPORT	P	V	W	
		LEAK TIGHTNESS HYDRO TEST	CRITICAL	HYDRO TEST VISUAL	100 %	1.5 TIMES OF D.PR FOR 30 MINUTES	ASME VIII	INSPEC. REPORT NO LEAKAGE	P	V	W	
		EXTERNAL CLEANING	MAJOR	VISUAL	100 %	AS PER APPRD DRG	AS PER APPRD DRG	---	P	V	V	
3.2	PAINTING & STAMPING	STAMPING & MARKING	MAJOR	VISUAL	100 %	ASME SEC VIII	ASME SEC VIII	---	P	V	V	
		UNIFORMITY,PRIMER THICKNESS	MAJOR	VISUAL SHADE , DFT	100 %	APPROVED DRG./SPEC. PROVIDED BY CLIENT	TECHNICAL SPECIFIC APPROVED DRAWING	---	P	V	V	

LEGENDS:
M :- MANUFACTURER/SUB SUPLIER
C :- ACIL
N :- BHEL/TPI/
P:- PERFORM, V:- VERIFICATION
W:- WITNESS

Prepared By : Ranjeet Singh Saundh

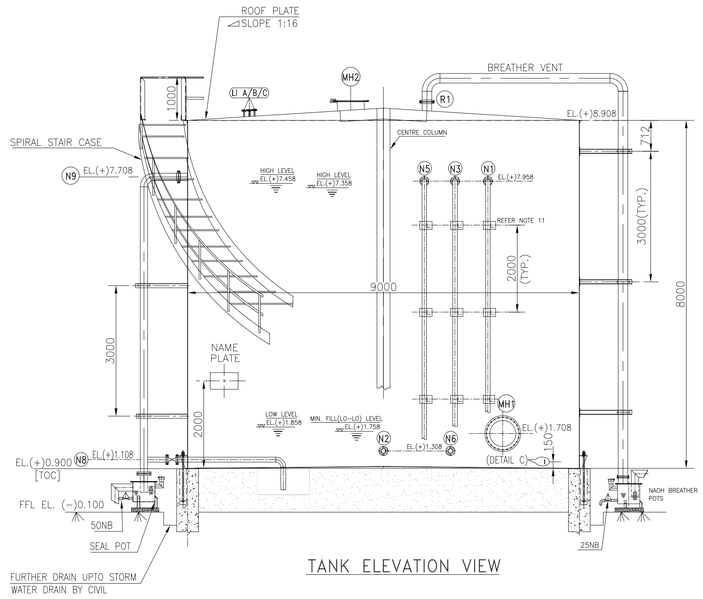
Sign :
Date :

Approved by :

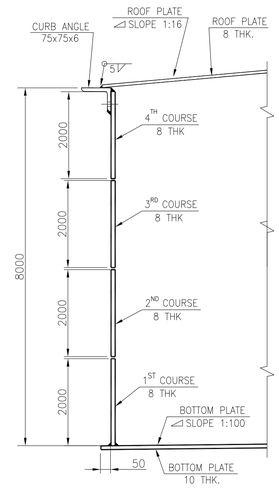
Sign
Date

ANNEXURE-III

GENERAL ARRANGEMENT DRAWINGS OF CONDENSATE STOAREG TANKS



TANK ELEVATION VIEW



SHELL ARRANGEMENT FOR 1ST TO 04TH COURSE

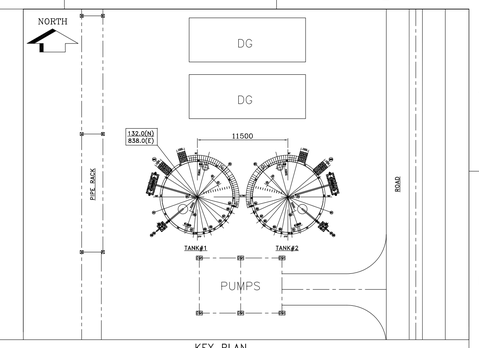
Name of Manufacturer:	BHEL
TANK NOMINAL DIAMETER	9.0 M
TANK NOMINAL HEIGHT	8.0 M
MAXIMUM WORKING CAPACITY	417 M3
DATE OF MANUFACTURE	
DESIGN LIQUID LEVEL	6.55 M
DESIGN CODE	API650
MAXIMUM OPERATING PRESS.	AMBIENT
MAXIMUM OPERATING TEMP.	AMBIENT
DESIGN TEMPERATURE	50 DEGC
MATERIAL OF TANK	IS 2062 GR. E250 BR/B0

150

3 MM THK. MATERIAL - SS

200

NAME PLATE DETAIL



KEY PLAN

DESIGN DATA

DESCRIPTION	UNIT	DETAIL
DESIGN CODE	-	API 650
STORED PRODUCT	-	CONDENSATE
DENSITY OF PRODUCT STORED	kg/m3	1000
TYPE OF TANK	-	VERTICAL CYLINDRICAL, SUPPORTED CONE ROOF
NUMBER OF TANKS	no	TWO (2)
DIAMETER OF TANK (ID)	mm	9000
HEIGHT OF TANK	mm	8000
TANK EMPTY WEIGHT (APPROX)	kg	28160
TANK FILLED WEIGHT (APPROX)	kg	445160 (28160+417000)
NET WORKING CAPACITY	m3	350 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPCITY	m3	417 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED	m/s	47 (AS PER SUB SECTION D-01, APPENDIX-1, SITE SPECIFIC DESIGN PARAMETERS)
DESIGN TEMPERATURE	°C	50
DESIGN PRESSURE	KPa	0.62 Kpa (AS PER CL 1.1.1 OF API 650)
OPERATING PRESSURE	-	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2.0
SEISMIC FACTORS (PEAK GROUND HORIZONTAL ACCELERATION)	Xg	0.32 (AS PER SUB SECTION D-01, APPENDIX-1, SITE SPECIFIC SESIMIC PARAMETERS)
SEISMIC MOMENTS	KNM	RING WALL MOMENT -2680.31 (AS PER S.N. E2.7.4 OF DESIGN CALC OF CST)
WIND LOAD	KN	VERTICAL -56.88, HORIZONTAL - 83.30 (AS PER S.N. F.29 & F.33 OF DESIGN CALC OF CST)
WIND MOMENT	KNM	602.37 (AS PER S.N. F.46 OF DESIGN CALC OF CST)
ROOF LOAD (UNIFORM LIVE)	KPa	1 (AS PER CL 5.2.1 F) OF API 650)
TESTING	-	AS PER CL7.3 AND SECTION 8 OF API650
RATE OF FILLING OF TANK (MAX)	m3/hr	300 (ASSUMED, CUSTOMER TO CONFIRM AS DM WATER TR PUMPS ARE IN CUSTOMER SCOPE)
RATE OF EMPTYING OF TANK (MAX)	m3/hr	500 , FOR TWO NOS CONDENSATE TRANSFER PUMPS (250 M3/HR)

SHELL NOZZLES & APPURTENANCES FOR TANK

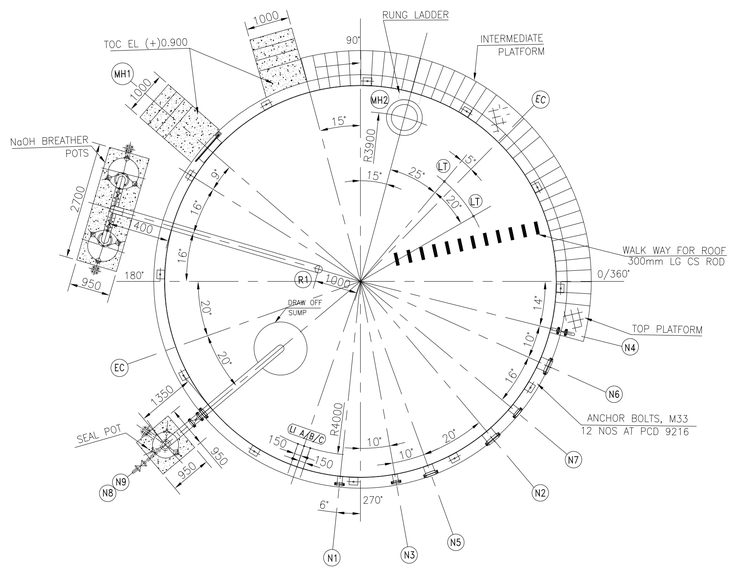
MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
N1	100	1	SORF,150#	7050	175	8.56	DM WATER INLET
N2	250	1	SORF,150#	400	225	12.70	DM WATER OUTLET
N3	100	1	SORF,150#	7050	175	8.56	CT PUMPS RECIRCULATION
N4	50	1	SORF,150#	400	150	5.54	SAMPLING CONNECTION WITH VALVE
N5	200	1	SORF,150#	7050	200	12.7	EXCESS CONDENSATE DUMP
N6	250	1	SORF,150#	400.0	225	12.70	OUTLET SPARE WITH VALVE
N7	150	1	SORF,150#	7050	200	10.97	INLET SPARE WITH VALVE
N8	100	1	SORF,150#	200.0	175	8.56	DRAIN WITH VALVE
N9	150	1	SORF,150#	6800	200	10.97	OVERFLOW
MH1	600	1	AS PER FIG 5.7 OFAPI650	800.0	300	8.0	SHELL MANHOLE AS PER FIG 5.7a&b AND THK AS PER TABLE 5.4a OF API 650
EC	-	4	AS PER DETAIL C	-	-	-	EARTHING CLIT AT APPROXIMATELY EQUIDISTANCE ON TANK PERIPHERY

ROOF NOZZLES & APPURTENANCES FOR TANK

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM ROOF PLATE AS PER TABLE 5.14a OF API650	NOZZLE THK IN MM	SERVICE
R1	150	1	SORF, #150	1000	150	REFER MOC	BREATHER VENT
LI A/B/C	25	3	SORF, #150	4000	150	REFER MOC	LEVEL INDICATOR (FLOAT & ARROW TYPE)
LT A/B	80	2	SORF, #150	3000	150	REFER MOC	LT CONNECTIONS
MH2	600	1	AS PER FIG 5.16 OFAPI650	3900	150	6	ROOF MANHOLE WITH COVER

REFERENCE DRAWINGS

S.N	DRAWING NO.	TITLE
1.	9915-371-110-PEM-PVM-B-100	DESIGN CALC OF CONDENSATE STORAGE TANKS
2.	9915-371-110-PEM-PVM-F-214	P&ID FOR CONDENSATE TRANSFER SYSTEM
3	9915-370-301-PVC-B-034C	GENERAL LAYOUT PLAN



NOZZLE ORIENTATION OF CS TANK#1 (TAG NO. 00LCP01BB008)
CENTER COORDINATES OF TANK = N132.0, E838.0

TANK PAINTING SPECIFICATION

DESCRIPTION	INTERNAL	EXTERNAL	UNDERNEATH
SURFACE PREPARATION	POWER TOOL CLEANING/PHOSPHATING	POWER TOOL CLEANING/PHOSPHATING	POWER TOOL CLEANING/WIRE BRUSH CLEANING
PRIMER	1 COAT OF UNMODIFIED EPOXY RESIN ALONG WITH POLYAMIDE HARDENER OF 60 MICRONS	2 COATS OF RED OXIDE ZINC PHOSPHATE PRIMER (ALKYD BASE) TO IS 12744 OF 25 MICRONS EACH	2 COATS OF HIGH BUILD COAL TAR EPOXY SUITABLY PIGMENTED OF 100 MICRONS EACH
INTERMEDIATE COAT	NA	1 COAT OF SYNTHETIC ENAMEL (LONG OIL ALKYD) TO IS2932 OF 30 MICRONS	NA
FINISH	2 COATS OF UNMODIFIED EPOXY RESIN ALONG WITH AROMATIC ADDUCT HARDENER OF 170 MICRONS EACH	2 COATS OF SYNTHETIC ENAMEL (LONG OIL ALKYD) TO IS2932 OF 35 MICRONS EACH	NA
TOTAL DFT (MICRONS)	400	150	200

NOTES:
1. GI PIPES AND SS PIPES & FITTINGS SHALL NOT BE PAINTED.
2. ALL STRUCTURAL STEEL SHALL BE PAINTED AT SITE.
3. METHOD OF PAINTING APPLICATION SHALL BE AS PER PAINT MANUFACTURER'S RECOMMENDATION.
4. SHADE FOR TANK SHALL BE SEA GREEN.

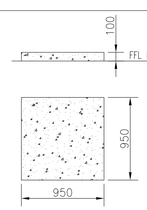
NOTES:-

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. EL. (+)0.00 CORRESPONDS TO FINISH FLOOR OF STG. BUILDING I.E. RL.(+)194.5M.
3. TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
4. VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
5. BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION. THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
6. EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
7. ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
8. WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
9. TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
10. LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
11. PAD PLATES ALONG WITH 1.0M ISA (SUITABLE AS PER PIPE SIZE) FOR SUPPORTING ALL INLET PIPINGS OF TANK SHALL BE PROVIDED BY TANK SUPPLIER.
12. FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
13. TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
14. FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
15. ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
16. ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
17. THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
18. ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER.
19. SEAL POT AND NAOH BREATHER POTS SHALL BE PLACED ON CIVIL FOUNDATION BY USING THE ANCHOR FASTENER BY TANK SUPPLIER. NO POCKETS BY CIVIL AGENCY WILL BE PROVIDED IN FOUNDATION OF SEAL POT AND NAOH BREATHER.
20. OPERATING PLATFORM SHALL BE PROVIDED FOR VALVE INSTALLED ON SPARE INLET NOZZLE OF TANK.

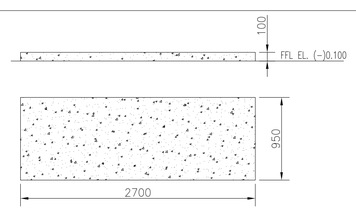
MATERIAL SPECIFICATION

ITEM	MATERIAL	REFERENCE OF SPECIFICATION
SHELL, BOTTOM, ROOF, RF PL	IS 2062 GR E250 BR/B0	CL 2.17.00 OF LP PIPING SPECIFICATION OF TENDER , ANNEXURE-A TO AMENDMENTNO.4
NOZZLES/PIPES	STAINLESS STEEL TO A312 GR. TP-304 CONSTRUCTION SCH 40S SEAMLESS FOR PIPE UPTO 50 NB AND SCH 10S WELDED FOR PIPES ABOVE 50 NB	CL 2.03.08 OF LP PIPING SPECIFICATION.
PIPE END CONNECTION	UP TO 50 NB : SOCKET WELDED, ABOVE 50 NB : BUTT-WELDED	CL 2.03.08 OF LP PIPING SPECIFICATION.
MANHOLE NECK	IS 2062 GR E250 BR/B0	CL 2.17.00 OF LP PIPING SPECIFICATION.
NOZZLE FLANGES	STAINLESS STEEL TO A182 GR. F-304 FOR PIPE SIZES 50NB & BELOW AND TO A240 GR. 304 FOR PIPE SIZES ABOVE 50 NB)	CL 2.08.02 OF LP PIPING SPECIFICATION.
HAND RAILING (32 NB)	IS:1239 PART-I, MED GRADE, GALVANIZED TO IS:4736	-
GASKETS	TEFLON	-
BOLTING (NUTS & BOLTS)	IS:1367 FOR ANCHOR BOLTS, SA 193 GR B7 &SA 194 GR 2H FOR BOLTS AND NUTS.	-
STRUCTURALS	IS 2062 GR E250 A/BR/B0	-
FITTINGS OF 50 NB & BELOW (SW END)	STAINLESS STEEL TO A182 F304, SW TO ANSI B16.11	CL 2.07.04 OF LP PIPING SPECIFICATION.
FITTINGS ABOVE 50 NB (BW END)	STAINLESS STEEL TO A403 GR. WP-304, BW TO ANSI B16.9	CL 2.07.04 OF LP PIPING SPECIFICATION.
NAME PLATE AND EARTHING CLIT	SS 304	-

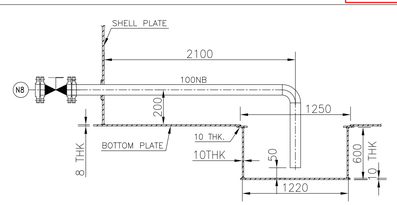
Note:
The technical requirements mentioned under this drawing are bare minimum. Any additional technical requirement (e.g. increase in plate thickness, requirement of girders, Anchors etc) , if found applicable as per design calculation of tanks by bidder during detailed engineering , shall be provided without any techno commercial implication to BHEL.



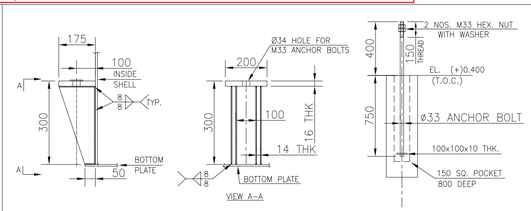
CIVIL FOUNDATION DETAILS
SEAL POT



CIVIL FOUNDATION DETAILS
NaOH BREATHER

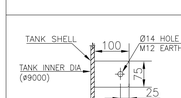


DRAW OFF SUMP
AS PER FIG 5.21 OF API650



DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT

CUSTOMER STAMP



DETAIL-C
EARTHING CLIT
AS PER FIG 5.23 OF API650

JOB NO.	: 475
STATUS	: CONTRACT

REV	DATE	DESN.	CHD.	APPD.

NTPC DRAWING NO. 9915-371-110-PEM-PVM-B-101, R-00

OWNER: THDC INDIA LIMITED (A JV of GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT: NTPC LIMITED (A GOVT. OF INDIA ENTERPRISE)

PROJECT: KHURJA SUPER THERMAL POWER PROJECT (2 X 660MW) (TURBINE GENERATOR & ASSOCIATED PACKAGES)

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

DEPT CODE	DRAWING	NAME	SIGN	DATE
C	DRN	PK	-SD-	25.02.2021
	DESN	PK	-SD-	25.02.2021
	CHD	AVG	-SD-	25.02.2021
	APPD	MM	-SD-	25.02.2021

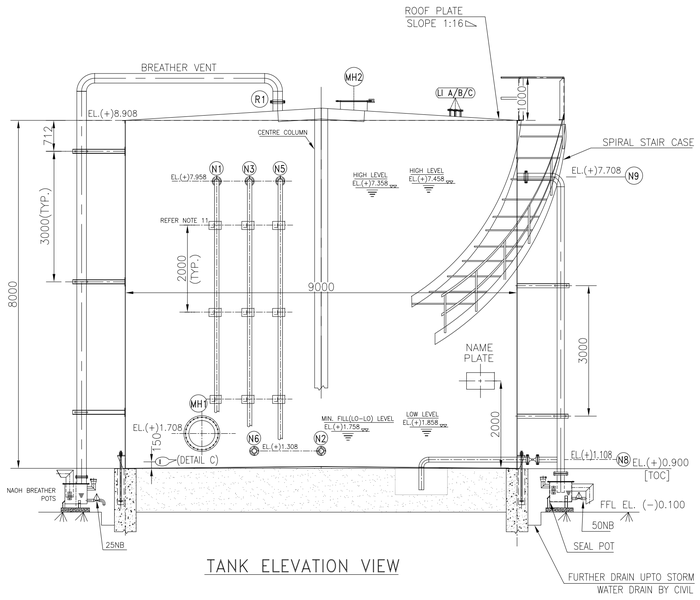
TITLE: GA DRAWING OF CONDENSATE STORAGE TANK # 1 CAP 350 M3, TAG NO. 00LCP01BB008

DEPT. / SCALE VARIES / SIGN / DATE

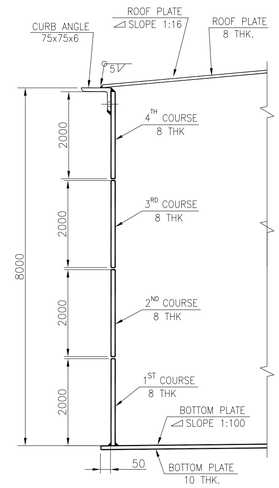
BHEL DRAWING NO. PE-DG-475-167-A001

SHEET 1 OF 2 REV. 0

SIZE-A1



TANK ELEVATION VIEW

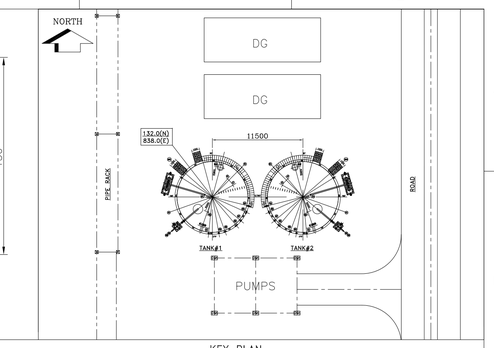


SHELL ARRANGEMENT FOR 1ST TO 04TH COURSE

Name of Manufacturer:	BHEL
TANK NOMINAL DIAMETER	9.0 M
TANK NOMINAL HEIGHT	8.0 M
MAXIMUM WORKING CAPACITY	417 M3
DATE OF MANUFACTURE	2021
DESIGN LIQUID LEVEL	6.55 M
DESIGN CODE	API650
MAXIMUM OPERATING PRESS.	AMBIENT
MAXIMUM OPERATING TEMP.	AMBIENT
DESIGN TEMPERATURE	50 DEGC
MATERIAL OF TANK	IS 2062 GR.B

3 MM THK.
MATERIAL - SS
200
150

NAME PLATE DETAIL



KEY PLAN

DESIGN DATA

DESCRIPTION	UNIT	DETAIL
DESIGN CODE	-	API 650
STORED PRODUCT	-	CONDENSATE
DENSITY OF PRODUCT STORED	kg/m3	1000
TYPE OF TANK	-	VERTICAL CYLINDRICAL, SUPPORTED CONE ROOF
NUMBER OF TANKS	no	TWO (2)
DIAMETER OF TANK (ID)	mm	9000
HEIGHT OF TANK	mm	8000
TANK EMPTY WEIGHT (APPROX)	kg	28160
TANK FILLED WEIGHT (APPROX)	kg	445160 (28160+417000)
NET WORKING CAPACITY	m3	350 (AS PER FIG 5.4 OF API650)
MAXIMUM TANK CAPCITY	m3	417 (AS PER FIG 5.4 OF API650)
BASIC WIND SPEED	m/s	47 (AS PER SUB SECTION D-01, APPENDIX-I, SITE SPECIFIC DESIGN PARAMETERS)
DESIGN TEMPERATURE	°C	50
DESIGN PRESSURE	KPa	0.62 Kpa (AS PER CL 1.1.1 OF API 650)
OPERATING PRESSURE	-	ATMOSPHERIC
CORROSION ALLOWANCE	mm	2.0
SEISMIC FACTORS (PEAK GROUND HORIZONTAL ACCELERATION)	Xg	0.32 (AS PER SUB SECTION D-01, APPENDIX-I, SITE SPECIFIC SESIMIC PARAMETERS)
SEISMIC MOMENTS	KNM	RING WALL MOMENT -2680.31 (AS PER S.N. E2.7.4 OF DESIGN CALC OF CST)
WIND LOAD	KN	VERTICAL -56.88, HORIZONTAL - 83.30 (AS PER S.N. F.29 & F.33 OF DESIGN CALC OF CST)
WIND MOMENT	KNM	602.37 (AS PER S.N. F.46 OF DESIGN CALC OF CST)
ROOF LOAD (UNIFORM LIVE)	KPa	1 (AS PER CL 5.2.1 F) OF API 650)
TESTING	-	AS PER CL7.3 AND SECTION 8 OF API650
RATE OF FILLING OF TANK (MAX)	m3/hr	300 (ASSUMED, CUSTOMER TO CONFIRM AS DM WATER TR PUMPS ARE IN CUSTOMER SCOPE)
RATE OF EMPTYING OF TANK (MAX)	m3/hr	500 , FOR TWO NOS CONDENSATE TRANSFER PUMPS (250 M3/HR)

SHELL NOZZLES & APPURTENANCES FOR TANK

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE ELE FROM TOP OF BOTTOM PLATE AS PER TABLE 5.6a OF API650	PROJ. DIST. FROM SHELL PLATE AS PER TABLE 5.6a OF API650	NOZZLE THK IN MM AS PER TABLE 5.6a OF API650	SERVICE
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N2	250	1	SORF,150#	400	225	12.70	DM WATER OUTLET
N3	100	1	SORF,150#	7050	175	8.56	CT PUMPS RECIRCULATION
N4	50	1	SORF,150#	400	150	5.54	SAMPLING CONNECTION WITH VALVE
N5	200	1	SORF,150#	7050	200	12.7	EXCESS CONDENSATE DUMP
N6	250	1	SORF,150#	400.0	225	12.70	OUTLET SPARE WITH VALVE
N7	150	1	SORF,150#	7050	200	10.97	INLET SPARE WITH VALVE
N8	100	1	SORF,150#	200.0	175	8.56	DRAIN WITH VALVE
N9	150	1	SORF,150#	6800	200	10.97	OVERFLOW
MH1	600	1	AS PER FIG 5.7 OFAPI650	800.0	300	8.0	SHELL MANHOLE AS PER FIG 5.7a&b AND THK AS PER TABLE 5.4a OF API 650
EC	-	4	AS PER DETAIL C	-	-	-	EARTHING CLIT AT APPROXIMATELY EQUIDISTANCE ON TANK PERIPHERY

ROOF NOZZLES & APPURTENANCES FOR TANK

MARK	SIZE NB	QTY. (NO.)	FLANGE TYPE, RATING	NOZZLE CENTRE DISTANCE FROM ROOF CENTRE	PROJ. DIST. FROM ROOF PLATE AS PER TABLE 5.14a OF API650	NOZZLE THK IN MM	SERVICE
R1	150	1	SORF, #150	1000	150	REFER MOC	BREATHER VENT
LI A/B/C	25	3	SORF, #150	4000	150	REFER MOC	LEVEL INDICATOR (FLOAT & ARROW TYPE)
LT A/B	80	2	SORF, #150	3000	150	REFER MOC	LT CONNECTIONS
MH2	600	1	AS PER FIG 5.16 OFAPI650	3900	150	6	ROOF MANHOLE WITH COVER

REFERENCE DRAWINGS

S.N	DRAWING NO.	TITLE
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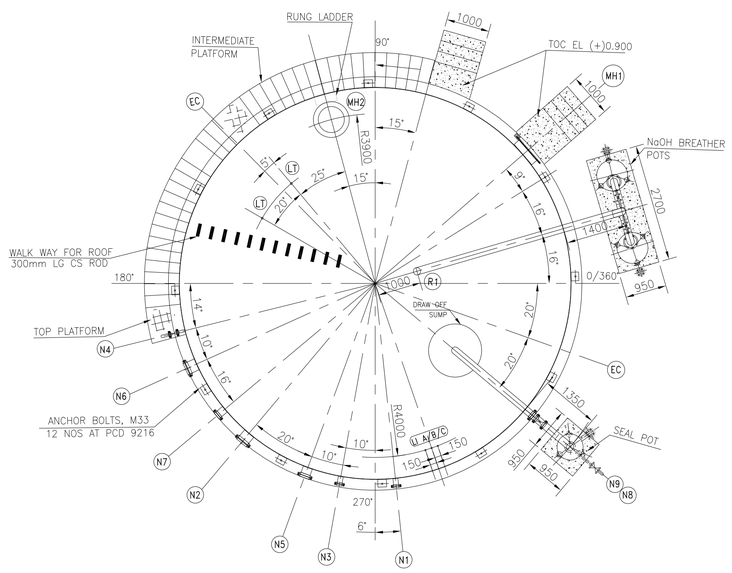
2.	9915-371-110-PEM-PVM-F-214	P&ID FOR CONDENSATE TRANSFER SYSTEM
3	9915-370-301-PVC-B-034C	GENERAL LAYOUT PLAN



NOZZLE ORIENTATION OF CS TANK#2 (TAG NO. 00LCP02BB008)
CENTER COORDINATES OF TANK = N132.0, E849.5

TANK PAINTING SPECIFICATION

DESCRIPTION	INTERNAL	EXTERNAL	UNDERNEATH
SURFACE PREPARATION	POWER TOOL CLEANING/PHOSPHATING	POWER TOOL CLEANING/PHOSPHATING	POWER TOOL CLEANING/WIRE BRUSH CLEANING
PRIMER	1 COAT OF UNMODIFIED EPOXY RESIN ALONG WITH POLYAMIDE HARDENER OF 60 MICRONS	2 COATS OF RED OXIDE ZINC PHOSPHATE PRIMER (ALKYD BASE) TO IS 12744 OF 25 MICRONS EACH	2 COATS OF HIGH BUILD COAL TAR EPOXY SUITABLY PIGMENTED OF 100 MICRONS EACH
INTERMEDIATE COAT	NA	1 COAT OF SYNTHETIC ENAMEL (LONG OIL ALKYD) TO IS2932 OF 30 MICRONS	NA
FINISH	2 COATS OF UNMODIFIED EPOXY RESIN ALONG WITH AROMATIC ADDUCT HARDENER OF 170 MICRONS EACH	2 COATS OF SYNTHETIC ENAMEL (LONG OIL ALKYD) TO IS2932 OF 35 MICRONS EACH	NA
TOTAL DFT (MICRONS)	400	150	200

NOTES:
1. GI PIPES AND SS PIPES & FITTINGS SHALL NOT BE PAINTED.
2. ALL STRUCTURAL STEEL SHALL BE PAINTED AT SITE.
3. METHOD OF PAINTING APPLICATION SHALL BE AS PER PAINT MANUFACTURER'S RECOMMENDATION.
4. SHADE FOR TANK SHALL BE SEA GREEN.

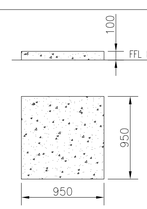
NOTES:-

1. ALL DIMENSIONS ARE IN MM., ELEVATIONS ARE IN METRE UNLESS OTHER WISE SPECIFIED.
2. EL. (+)0.00 CORRESPONDS TO FINISH FLOOR OF STG. BUILDING I.E. RL.(+)194.5M.
3. TANK SURFACE SHOULD BE CLEANED THOUGHLY AFTER FABRICATION FROM LOOSE SUBSTANCES AND FOREIGN MATERIALS SUCH AS DIRT, RUST, SCALE, OIL, GREASE AND WELDING FLUX ETC.
4. VERTICAL SHELL JOINTS SHALL BE OFFSET FROM EACH OTHER WITH A MINIMUM DISTANCE OF 5 TIMES THE THICKNESS OF SHELL COURSE UNDER CONSIDERATION.
5. BOTTOM PLATE SHALL UNIFORMLY REST ON THE FOUNDATION, THREE PLATE JOINTS IN BOTTOM PLATE SHALL NOT BE CLOSER THAN 300mm FROM EACH OTHER AND ALSO FROM THE TANK SHELL.
6. EARTHING LUG AND NAME PLATE SHALL BE WELDED TO THE TANK AS PER SITE REQUIREMENT.
7. ALL THE INLET PIPING SHALL BE EXTENDED UPTO BOTTOM OF TANK AND CLEARANCE BETWEEN THE BOTTOM OF TANK AND THE THE EDGES OF INLET PIPING SHALL BE 500 MM MAXIMUM.
8. WEIR PLATE SHALL BE PROVIDED AT THE BOTTOM OF ALL THE INLET PIPES INSIDE TANK TO AVOID EROSION OF BOTTOM PLATE.
9. TREAD AND RISE FOR STAIRCASE OF THE TANK SHALL BE 250 AND 200 MM RESPECTIVELY.
10. LEVEL INDICATOR SUPPORTS SHALL BE PROVIDED ON THE SHELL & ROOF.
11. PAD PLATES ALONG WITH 1.0M ISA (SUITABLE AS PER PIPE SIZE) FOR SUPPORTING ALL INLET PIPINGS OF TANK SHALL BE PROVIDED BY TANK SUPPLIER.
12. FINAL PAINTING SHALL BE CARRIED OUT AS PER APPROVED PAINTING SCHEDULE AFTER HYDRO TEST OF TANK.
13. TANK NOZZLE FLANGES SHALL BE PROVIDED WITH COUNTER FLANGES ALONG WITH NUTS & BOLTS BY TANK VENDOR.
14. FOR MANUAL WELDING PROCESSES, FILLET WELD LEGS OR GROOVE WELD DEPTHS GREATER THAN 6MM SHALL BE MULTIPASS.
15. ALL TANK SHELL WELD INTERSECTIONS WHERE VERTICAL JOINTS MEET THE HORIZONTAL JOINTS SHALL BE RADIOGRAPHED, REGARDLESS OF THICKNESS.
16. ALL RADIOGRAPHY OR OTHER NDE AND ANY WELDING SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING.
17. THE TANK HYDROSTATIC TEST SHALL BE CONDUCTED BEFORE PERMANENT EXTERNAL PIPING IS CONNECTED TO THE TANK EXCEPT FOR PIPING THAT IS NECESSARY TO FILL AND EMPTY THE TANK, WHICH SHOULD HAVE A FLEXIBLE COMPONENT TO ALLOW FOR SETTLEMENT.
18. ALL INLET PIPING TO THE TANK SHALL BE PROVIDED WITH SUITABLE SIPHON BREAKER.
19. SEAL POT AND NAOH BREATHER POTS SHALL BE PLACED ON CIVIL FOUNDATION BY USING THE ANCHOR FASTENER BY TANK SUPPLIER. NO POCKETS BY CIVIL AGENCY WILL BE PROVIDED IN FOUNDATION OF SEAL POT AND NAOH BREATHER.
20. OPERATING PLATFORM SHALL BE PROVIDED FOR VALVE INSTALLED ON SPARE INLET NOZZLE OF TANK.

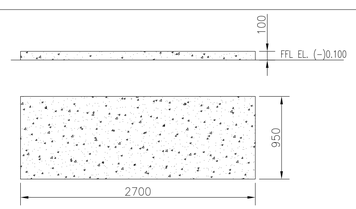
Note:
The technical requirements mentioned under this drawing are bare minimum. Any additional technical requirement (e.g. increase in plate thickness, requirement of girders, Anchors etc) , if found applicable as per design calculation of tanks by bidder during detailed engineering , shall be provided without any techno commercial implication to BHEL.

MATERIAL SPECIFICATION

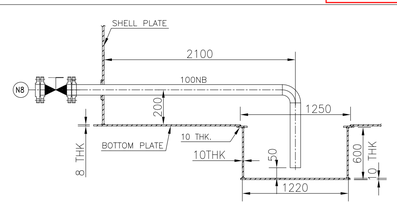
ITEM	MATERIAL	REFERENCE OF SPECIFICATION
SHELL, BOTTOM, ROOF, RF PL	IS 2062 GR E250 BR/B0	CL 2.17.00 OF LP PIPING SPECIFICATION OF TENDER , ANNEXURE-A TO AMENDMENTNO.4
NOZZLES/PIPES	STAINLESS STEEL TO A312 GR. TP-304 CONSTRUCTION SCH 40S SEAMLESS FOR PIPE UPTO 50 NB AND SCH 10S WELDED FOR PIPES ABOVE 50 NB	CL 2.03.08 OF LP PIPING SPECIFICATION.
PIPE END CONNECTION	UP TO 50 NB : SOCKET WELDED, ABOVE 50 NB : BUTT-WELDED	CL 2.03.08 OF LP PIPING SPECIFICATION.
MANHOLE NECK	IS 2062 GR E250 BR/B0	CL 2.17.00 OF LP PIPING SPECIFICATION.
NOZZLE FLANGES	STAINLESS STEEL TO A182 GR. F-304 FOR PIPE SIZES 50NB & BELOW AND TO A240 GR. 304 FOR PIPE SIZES ABOVE 50 NB)	CL 2.08.02 OF LP PIPING SPECIFICATION.
HAND RAILING (32 NB)	IS:1239 PART-I, MED GRADE, GALVANIZED TO IS:4736	-
GASKETS	TEFLON	-
BOLTING (NUTS & BOLTS)	IS:1367 FOR ANCHOR BOLTS, SA 193 GR B7 &SA 194 GR 2H FOR SS PIPES AND MANHOLES	-
STRUCTURALS	IS 2062 GR E250 A/BR/B0	-
FITTINGS OF 50 NB & BELOW (SW END)	STAINLESS STEEL TO A182 F304, SW TO ANSI B16.11	CL 2.07.04 OF LP PIPING SPECIFICATION.
FITTINGS ABOVE 50 NB (BW END)	STAINLESS STEEL TO A403 GR. WP-304, BW TO ANSI B16.9	CL 2.07.04 OF LP PIPING SPECIFICATION.
NAME PLATE AND EARTHING CLIT	SS 304	-



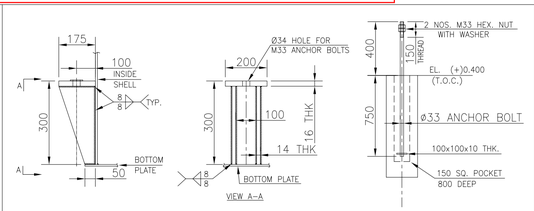
CIVIL FOUNDATION DETAILS
SEAL POT



CIVIL FOUNDATION DETAILS
NaOH BREATHER

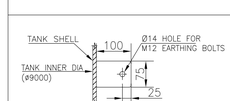


DRAW OFF SUMP
AS PER FIG 5.21 OF API650



DETAIL OF ANCHOR CHAIR AND ANCHOR BOLT

CUSTOMER STAMP



DETAIL-C
EARTHING CLIT
AS PER FIG 5.23 OF API650

JOB NO.	: 475
STATUS	: CONTRACT

REV	DATE	DESN.	CHD.	APPD.

NTPC DRAWING NO. 9915-371-110-PEM-PVM-B-101, R-00

OWNER: THDC INDIA LIMITED (A JV of GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT: NTPC LIMITED (A GOVT. OF INDIA ENTERPRISE)

PROJECT: KHURJA SUPER THERMAL POWER PROJECT (2 X 660MW) (TURBINE GENERATOR & ASSOCIATED PACKAGES)

CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

DEPT CODE	DRAWING	NAME	SIGN	DATE
C	DRN.	PK		-SD- 25.03.2021
	DESN.	PK		-SD- 25.03.2021
	CHD.	MVC		-SD- 25.03.2021
	APPD.	MM		-SD- 25.03.2021

TITLE: GA DRAWING OF CONDENSATE STORAGE TANK # 2 CAP 350 M3, TAG NO. 00LCP02BB008

DEPT. / SIGN / DATE — SCALE VARIES — BHEL DRAWING NO. PE-DG-475-167-A001 — SHEET 2 OF 2 — REV. 0

SIZE-A1

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION- D	
		REV. 00	DATE: Mar 2021
		SHEET : 1 OF 1	

ANNEXURE-IV

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the following drawings / documents during detail engineering for approval / information / reference (as he case may be): -

Sl. No.	BHEL Drawing / Document No.	Title	Schedule Submission Date from LOI	Resubmission after incorporating comments	Drawing classification
1	PE-V0-475-167-A001	DESIGN CALCULATION OF CONDENSATE STOAREG TANKS	4 weeks	Within 1 week	Primary
2	PE-V0-475-167-A002	SIZING CALCULATION AND GA DRAWING OF AIR RECEIVERS	4 weeks	Within 1 week	Primary
3	PE-V0-475-167-A003	FABRICATION DRAWINGS OF CONDENSATE STOARGE TANKS	5 weeks	Within 1 week	Primary
4	PE-V0-475-167-A004	DATASHEET & GENERAL ARRANGEMENT DRAWING OF COMPONENTS OF CST	6 weeks	Within 1 week	Secondary
5	PE-V0-475-167-A005	STAAD CALCULATION OF ROOF STRUCTRE AND SHELL BUCKLING CHECK OF CONDENSATE STORAGE TANKS	3 weeks	Within 1 week	Secondary
6	PE-V0-434-167-A006	GA DRWG OF ROOF STRUCURE FOR CST	5 weeks	Within 1 week	Secondary
7	PE-V0-434-167-A007	SUB-VENDOR LIST WITH INSPECTION CATEGORISATION PLAN FOR CST	3 weeks	Within 1 week	Secondary
8	PE-V0-434-167-A008	QAP FOR VALVES(SS) OF CST	6 weeks	Within 1 week	Secondary
9	PE-V0-475-167-A009	QAP OF OTHER COMPONENTS FOR CST	6 weeks	Within 1 week	Secondary
10	PE-V0-475-167-A010	QAP OF AIR RECEIVER	7 weeks	Within 1 week	Secondary
11	PE-V0-475-167-A011	O&M MANUAL FOR CST	8 weeks	Within 1 week	Secondary

NOTE:

1. Any other drwgs/docs indicated else where in the specification shall be submitted by vendor for approval of BHEL/customer.
2. Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
3. Internet explorer version – Minimum Internet Explorer 7.
4. Internet speed – 2 mbps (Minimum preferred).
5. Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
6. Vendor's internal proxy setting should not block DMS application's link (http://dmsserver.bhelpem.com/Wrench%20Web%20Access/Login.aspx.).

COMPANY SEAL

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION- D	
		REV. 00	DATE: MAR 2021
		SHEET : 1 OF 1	

ANNEXURE-V

DATASHEETS FOR LEVEL INDICATOR AND SS VALVES

	TITLE: 2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION-I, SUB-SECTION- D	
		REV. 00	DATE: MAR 2021
		SHEET : 1 OF 1	

DATASHEET OF LEVEL INDICATOR

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

DATASHEET OF VALVES

S.N	COMPONENT	DESCRIPTION
1.	Body & Bonnet	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
2.	Wedge & Seat ring	ASTM A182 Gr.F304 (50NB & below) ASTM A351 Gr.CF8M (50NB above)
3.	Trim	ASTM A182 Gr F304
4.	Rating	Class 800 (50NB & below) Class 150 (50NB above)
5.	Ends	SW to B16.11 (50NB &below) Flanged to B16.5 (50NB above)

6.	Design Standards	B16.34 / API600 for Gate valve B16.34 / BS1873 for Globe valve
7.	Testing standards	API 598 for all valve (All sizes)
8.	Bolts & Nuts	A193 Grb7 & A194 Gr.2H

NOTE:

For Pipes, fittings, structure, plates, handrails, flanges, gaskets, bolts, nuts etc., refer GA drawing of CST.

SECTION-II

SUB-SECTION-A

STANDARD TECHNICAL SPECIFICATIONS- MECHANICAL

1.0 SCOPE

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

2.0 CODES & STANDARDS

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

I. IS-800: Code of practice for use of steel in general building construction

II. IS-803: Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.

III. IS-804: Specification for rectangular pressed steel tanks

IV. IS-805: Code of practice for use of steel in gravity water tank.

V. IS-816: Code of practice for metal arc welding for general construction in MS.

VI. IS-817: Code of practice for training and testing for metal arc welder

VII. IS-2825: Code of practice for unfired pressure vessel

VIII. BS-2594: Specification for carbon steel welded horizontal cylindrical storage tank

IX. BS-2654: Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry

X. Indian Factories Act

XI. American code for oil tanks API 650

XII. Material Specification as per relevant IS / or approved equal

XIII. American water works association standards (AWWA D100)

3.0 DESIGN REQUIREMENT

3.1 General Requirement

3.1.1 All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid which these tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain.

The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.

3.1.2 Tank thickness shall be calculated as per IS803/API650 latest edition. Intermediary wind girder design, Wind Design, Seismic design, anchor bolt design / selection etc. shall be done as per API 650 latest edition, latest addendum available at the time of detail engineering.

3.1.3 All tanks will be designed for the capacities, dimensions and working conditions as specified in this specification. The tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. A **2.0 mm corrosion allowance** for shells, bottom and roofs above and beyond the required thickness / calculated thickness / nominal thickness as specified in the design code shall be provided.

3.1.4 Vessel seams shall be so positioned that they do not pass through nozzle connections on vessel. For vessels consisting of more than two sections, longitudinal seams shall be offset.

3.1.5 The inside seam should be ground smooth, suitable for application of corrosion resistant primer. If the stiffening of shell, bottom and / or roof is necessary, tanks will be stiffened from outside.

3.1.6 Flange faces of all nozzles shall be machined and squared with the vessel center line.

3.1.7 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m^2 of projected area.

3.1.8 The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.

3.1.9 When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicated in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface. The plate shall not be gouged or torn in process of removing lugs.

3.1.10 In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.

3.1.11 Material of construction of all tanks shall be mild steel conforms to IS – 2062 grade – B unless otherwise specified in the specification.

3.2 Alignment

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

3.2.2 In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate

thickness exceeding 8 mm except that for plate thickness 8 mm and under, the maximum shall be 1.5 mm.

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

3.3 WELDING

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

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

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

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

3.3.5 Each tank shall be complete with access staircase, ladder and safety cage and fittings like drain connection, overflow connection(pipe) till bottom of tank, tank inlet and outlet covers, level gauge glass, fittings with isolation cocks and protection covers, tank vent connection etc. all complete with needed accessories for the completeness of the tanks.

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

3.4 STAIRCASE / ACCESS LADDER AND HAND RAILING

3.4.1 All cylindrical vertical tanks shall be provided with spiral staircase and shall conform to the requirements specified in design codes / standards unless specified otherwise. All stair treads shall be **32 mm steel fabricated gratings**. Each tread, if needed, shall be housed in individual steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall have minimum 1200 mm clear width.

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

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

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

3.4.5 Unless otherwise specified, bolts and nuts shall be hexagonal head conforming to bolts and nuts shall be SA 193 and 194 resepctively.

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

3.4.7 Void.

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

3.5 VERTICAL CYLINDRICAL STORAGE TANKS

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

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

3.5.3 All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.

3.5.4 All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.

3.5.5 All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non-injurious methods.

3.5.6 Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all

vertical joints be staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 6 mm.

3.5.7 The tank height shall be completed by the provision of top curb/ angle which shall be butt-welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.

3.5.8 Tank roof shall be either self-supported or supported from rafters / steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding bolted connections at one end and preferably on the tank periphery side. The roof-supporting frame shall have needed tie rods or bracing sets.

3.5.9 Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.

3.5.10 Openings needed for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall the bolted and hinged covers unless otherwise specified.

3.5.11 All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

3.6 RECTANGULAR TANKS

3.6.1 Rectangular tanks shall be fabricated in steel material and shall be designed to withstand internal hydrostatic pressure. In addition, these shall be checked for a wind pressure and seismic coefficient as specified wherever applicable. While worst of these two shall be considered, the permissible stress shall be increased as per good engineering practice when their effect considered with tank load.

3.6.2 Tank bottom and / or side plates shall be of minimum 8 mm thick plate. Corrosion margin of at least 2.0 mm shall be provided over the design thickness of bottom and / or side plates.

3.6.3 To support tank plates and to maintain required unsupported plate length, adequately sized and spaced steel structural closed frame shall be provided inside the tank. Longitudinal and / or vertical structural members to connect and adequately support these frames shall be provided at corners. Horizontal diagonal members / sway bracings at corner shall also be provided.

3.6.4 Tank plates cut to size shall be welded on these frames. Plate butt weld joints at other locations shall be eliminated to avoid warping of the plates at free joints. Adequate openings in the structural frames, particularly at the bottom shall be provided to ensure complete unrestricted drainage of tank at one point. Suitable sized drain valve of size minimum 25 NB unless otherwise specified, shall be provided below the tank bottom for proper draining of the tank.

3.6.5 Complete assembled tank shall have at its bottom longitudinal steel fabricated bearer beams welded to it. The tank with bearer will rest over number of concrete blocks to be provided by purchaser. The

tank shall be adequately bolted / welded to the concrete blocks. Needed inserts / anchor bolts shall be furnished by the bidders. Grouting of tank over concrete blocks in approved manner shall be included in bidder's scope of work, if erection is also awarded to the bidder.

3.6.6 Where rectangular tanks are flushed in dual compartments the inside partition plate shall be well reinforced to withstand hydrostatic test pressure completely on one side throughout the full height.

3.6.7 The rectangular tank shall be designed as per good engineering practice and reference shall be taken from the book named "Theory of plates and shells" by Timoshenko. Design calculation shall be done in accordance with the above mentioned book.

3.6.8 Suitable steel structural e.g. channels shall be provided below the bottom plate so that tank can rest on the foundation / slabs through the structural supports.

3.9 HORIZONTAL CYLINDRICAL TANK

3.9.1 The horizontal cylindrical tank with dished ends shall be of mild steel welded construction and shall be designed in accordance with BS – 2594 / IS – 2825 / ASME as specified. The tank shall be designed for a wind pressure and seismic coefficient as specified. While worst of these two shall be considered, the permissible stress shall be increased as per relevant code / standard.

3.9.2 The shell and dished end plate thickness shall be chosen as per design requirement but in no case the dished end and shell plate thickness shall be less than 8 mm.

3.9.3 All seams, longitudinal as well as circumferential, shall be butt-welded. Longitudinal seams should not be situated in the lower one-third of a tank or on the top center line.

3.9.4 All tank shall be supplied with integral saddle support and shall be designed in accordance with BS-2594 / IS – 2825 / ASME as specified.

4.0 TESTING AND INSPECTION AT MANUFACTURERER'S WORKS

4.1 General

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

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

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

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

4.2 TESTING AND INSPECTION FOR TANKS

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

I. Examination and approval of fabrication drawings to ensure that design, materials and fabrication details meet requirement of code and specifications. Purchaser will review these drawings for interface problems and conformity with the general arrangement drawings and accord their approval.

II. Examination of materials of construction and identification with material test certificates.

III. All the plates of thickness 50 mm or more shall be ultrasonically tested to ensure freedom from laminations.

IV. Ensuring the relevant weld procedure and welder qualification tests are in accordance with stipulated code requirements.

V. Inspection of dished end flanges and alloy steel bolting where required.

VI. Inspection during fabrication at appropriate stages including fit ups.

VII. For all butt welds, the root run and final run shall be subjected to dye-penetrate or magnetic particle inspection. For all fillet welds the final run shall be subjected to dye-penetrate / magnetic particle examination.

VIII. Examination of radiographs including radiographic techniques, supervision of other non - destructive tests and heat treatment procedure as required by codes and specifications.

IX. Examination of internal cleanliness before final closure.

X. Dimensional examination of completed vessel including axis marking, proof marking, match marking etc.

XI. Witnessing of hydrostatic, pneumatic or vacuum tests or special tests as required by the code and specification. In case of hydrostatic tests, the test pressure must be kept for a minimum of two hours.

XII. Witnessing cleanliness, preservation, packing and marking.

XIII. Stamping of vessel and issue of certificates.

XIV. All tanks under this specification shall be tested as per the relevant design and testing code / standard. Supplier shall submit the detailed testing procedure for the tanks during detail engineering stage for BHEL / customer / consultant's approval and approved document shall be adhered by them and testing shall be done accordingly without any commercial implication.

4.2.2 **NON - PRESSURE TANKS**

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

i. Identification of materials to manufacturer's test certificates.

ii. Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling.

iii. Checking of dimension and match marking.

iv. Bottom testing

a. After the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

b. Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of purchaser.

c. Alternatively, the bottom seams may be tested by vacuum box method subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS- 803, 1976 (figure-24)

v. Shell testing

The shell of fixed roof non - pressure tanks shall be tested after completion of roof. Testing shall be done by filling the tank with water to the level of the top leg of the top curb angle and noting any leaks.

vi. Roof testing

The roof of the tank shall be tested by pumping air under the roof plates while the tank is still full of water. In the non - pressure tank, the roof shall be tested to a pressure of 75 mm of water gauge and in case of pressure roof tanks, to a pressure of one and a quarter times the pressure at which the pressure sides of the pressure / vacuum relief valve is designed to open. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

vii. All field-testing shall be performed prior to any painting or coating application.

4.3 REPAIR OF LEAKS

4.3.1 All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

4.3.2 In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity, the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

4.3.3 In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only by welding and if necessary, after first cutting out the defective part.

4.3.4 When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

4.3.5 No welding shall be done on any tank unless all lines connecting thereto have been completely blanked off. No repairs shall be attempted on tanks while filled with oil, nor any tanks which have contained oil until the tanks have been emptied, cleaned and freed from gas in a safe manner. No repair shall be attempted on a tank which has contained oil except in a manner approved in writing by the purchaser, and in absence of the purchaser's inspector.

SUB-SECTION-B

FORMAT FOR OPERATION AND MANITENANCE

Format for Operation & Maintenance Manual

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				

4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				

6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

SUB-SECTION-C

SITE STORAGE AND PRESERVATION GUIDELINES

254785/2021/PS-PEM-MAX

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1 SCOPE OF THE DOCUMENT

2 PURPOSE OF STORAGE & PRESERVATION

3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

b) GENERAL PRESERVATION REQUIREMENTS

c) GENERAL INSPECTION REQUIREMENTS

4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT

5. CONCLUSION

6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. ‘No smoking’ signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	**Description of the equipment**	**Type of Storage**	**Check for**	**Remarks**
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

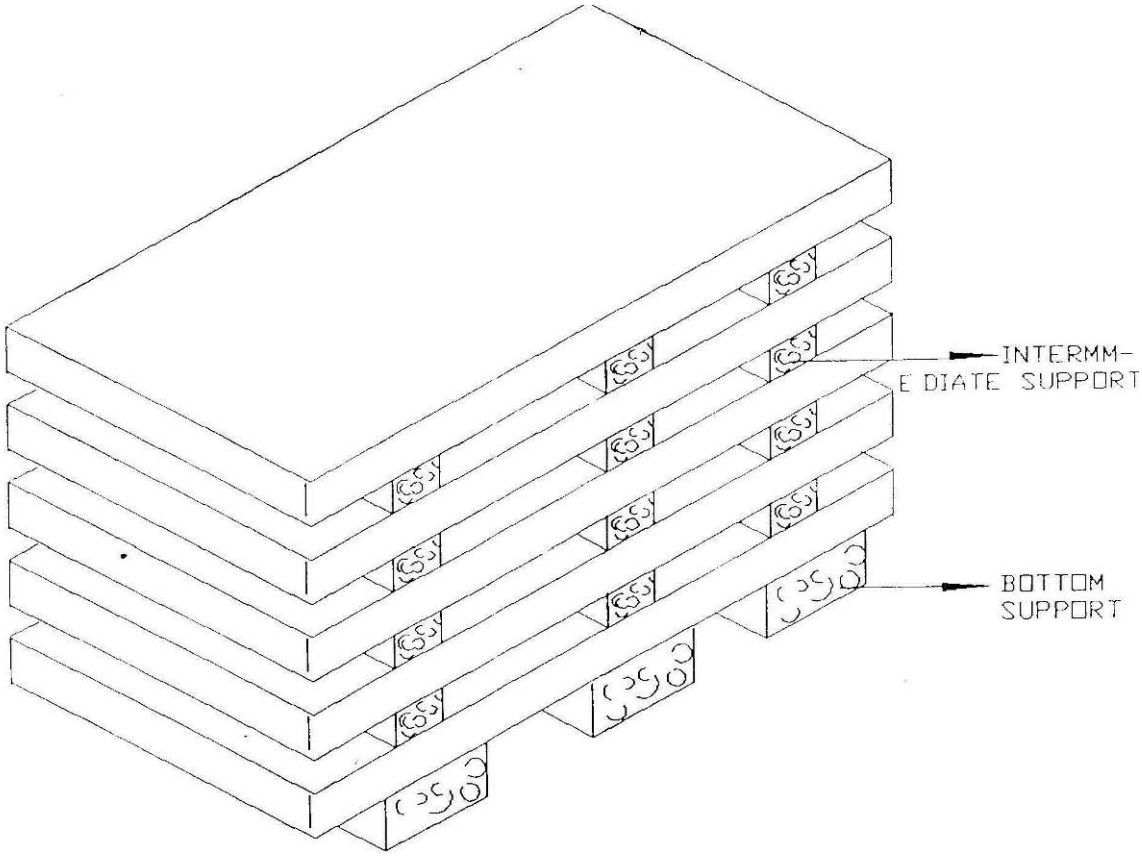


Figure – 1 – PLATE STACKING ARRANGEMENT

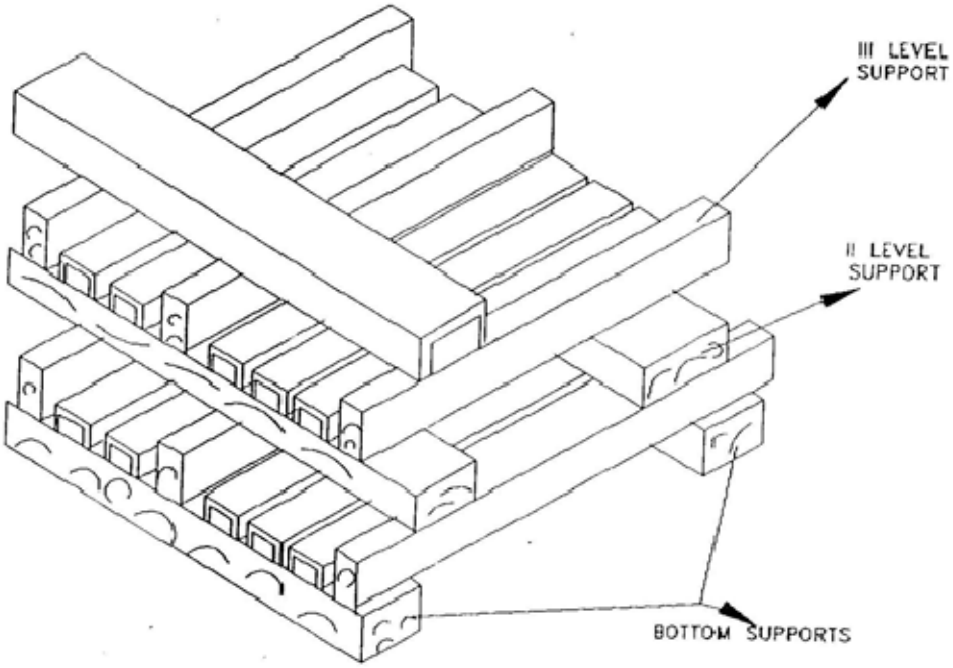


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION-III

	2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001	
		SECTION : III	
		REV: 00	DATE: MAR 2021
		SHEET 1 OF 1	

ANNEXURE-1

LIST OF DOCUMENTS TO BE SUBMITTED WITH THE BID

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

1. Compliance cum confirmation certificate.
2. Pre-bid clarification schedule in case of any clarifications.
3. Deviation schedule in case of any deviations by bidder.
4. Un priced copy of priced format for package (mentioning quoted against each item)

Note: Offer will be considered as incomplete in absence of any of above documents. Document/s other than above, if any, submitted with the offer will not form part of contract and accordingly will not be considered for bid evaluation.

ANNEXURE-2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to

approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

	2x660 MW KHURJA STPP (TG PKG) MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS TECHNICAL SPECIFICATION	SPECIFICATION No: PE-TS-475-167-A001
		SECTION : III
		REV: 00 DATE: MAR 2021
		SHEET 1 OF 1

ANNEXURE - 3

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

ANNEXURE-4 (DEVIATION SHEET WITH COST OF WITHDRAWL)

TITLE: TECHNICAL SPECIFICATION FOR MISC. TANKS - SITE FABRICATED AND AIR RECEIVERS
PROJECT:-2x660 MW KHURJA STPP (TG PKG)

TECH SPC NO: PE-TS-475-167-A001

TENDER ENQUIRY REFERENCE:-

NAME OF BIDDER:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. Cost of withdrawal of deviation will be applicable on the basic price (i.e, excluding taxes, duties & freight) only.
2. All the bidders has to list out all their Technical and Commercial Deviations (if any) in detail in the above format.
3. Any deviation not mentioned above and shown separately of found hidden in offer, will not be taken cognizance of.
4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. in the absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT
5. Bidder shall furnish price copy of above format along with price bid.
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per **Annexure-VII of GCC, Rev-07** will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in un-priced copy of this format.
11. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.