



**5x800MW YADADRI TPS
AIR CONDITIONING SYSTEM
INTENT OF SPECIFICATION**

SPECIFICATION No: PE-TS-417-553-A001

SECTION : I

Sub Section: A

REV. 00

SHEET 1 OF 3

SECTION-I

SUB-SECTION-A

INTENT OF SPECIFICATION



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SPECIFICATION No: PE-TS-417-553-A001

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1.0 INTENT OF SPECIFICATION

- 1.1 The specification covers Supply part, Services part and Mandatory spares 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), fill of lubricants, chemicals, reagents and consumables required for pre-commissioning, commissioning , performance testing and till one year of operation after handing over including chemicals for softening plant, mandatory spares 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, trial run at site and carrying out Performance guarantee test at site, training of customer/client O&M staff, operation and maintenance of the AC Plant(s) after commissioning for a duration of 12 months and handover in flawless condition of the package to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification as specified above, amendment & agreements till placement of order for **5X800 MW YADADRI TPS..**
- 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 the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee testing of **AIR CONDITIONING SYSTEM.**
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to highest 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 and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 1.5 The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all



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attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

- 1.6 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 SEC-II of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the 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.
- 1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Sec – II); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.
- 1.9 In the event of any conflict between the requirements of two clauses of this specification & requirements of different codes/standards and between respective clauses of sub-section C & sub-section D, more stringent clause as per the interpretation of the owner shall apply.
- 1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.11 For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser Employer, consultant, please refer relevant clause of General Conditions of Contract (GCC).



**5X800 MW YADADRI TPS
AIR CONDITIONING SYSTEM
PROJECT INFORMATION WITH WIND AND
SEISMIC DESIGN CRITERIA**

SPECIFICATION No: PE-TS-417-553-A001

SECTION : I

Sub Section : B

REV. 0

DATE: JUN 2020

SECTION: I

SUB-SECTION: B

PROJECT INFORMATION

YADADRI THERMAL POWER STATION

PROJECT INFORMATION

1	Name of the Project	YADADRI Thermal Power Station
2	Station Capacity	5X800 MW (Coal based)
3	Owner	Telangana State Power Generation Corporation Limited (TSGENCO)
4	Site Location	Site is located 7 km from the NH5.
5	Latitude	16° 42'20.40 N
6	Longitude	79° 34'41.56 E
7	Nearest Town	30 Km Miryalaguda
8	Nearest Railway Station	6.5 Km Damercherla
9	Nearest Airport	130 Kms (Vijayawada)
10	Site Conditions	
	Ambient Temperature	
	Daily minimum (average)	10°C
	Daily maximum (average)	47°C
	Design Ambient Temperature	50°C
	Ambient temperature (performance)	38°C
	Relative Humidity for design / efficiency	48-84 %
	Annual rainfall, mm	600 mm
	Plant Elevation above MSL	85 m above MSL
	Mean Wind Speed	44 m/s
	Wind Pressure	As per the latest revision of IS 875/1987
	Seismic co-efficient	Zone-III as per IS- 1893 (Part-IV)

जलवायवी सारणी
CLIMATOLOGICAL TABLE

BACK

स्टेशन : नलगोंदा
STATION : Nalgonda

अक्षांश
LAT. 17°03'
देशांतर
LONG. 79°16'

समुद्री तल माध्य से ऊंचाई
HEIGHT ABOVE M.S.L. 227 METRES

प्रक्षेपों पर आधारित
BASED ON OBSERVATIONS 1975-2000

माह		स्टेशन का सतह दाब	वायु तापमान										आर्द्रता		मेघ की मात्रा		BASED ON OBSERVATIONS 1975-2000							
			माध्य				चरम										वर्षा							
			शुष्क बल्व	नम बल्व	दैनिक अधिकतम	दैनिक न्यूनतम	माह में उच्चतम	माह में निम्नतम	दिनांक और वर्ष	उच्चतम	निम्नतम	दिनांक और वर्ष	सापेक्ष आर्द्रता	वाष्प दाब	समस्त मेघ	निम्न मेघ	मासिक योग	वर्षा के दिनों की संख्या	वर्षा सहित सबसे नम महीने का योग	वर्षा सहित शुष्कतम महीने का योग	24 घंटों की सबसे भारी वर्षा	दिनांक और वर्ष	माध्य पवन गति	
MONTH		STATION LEVEL PRESSURE	AIR TEMPERATURE						EXTREMES				HUMIDITY		CLOUD AMOUNTS		RAINFALL						MEAN WIND SPEED	
			DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	HIGHEST	DATE AND YEAR	LOWEST	DATE AND YEAR	RELATIVE HUMIDITY	VAPOUR PRESSURE	ALL CLOUDS	LOW CLOUDS	MONTHLY TOTAL	NO. OF RAINY DAYS	TOTAL IN WETTEST MONTH WITH YEAR	TOTAL IN DRIEST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS	DATE AND YEAR		
		एच.पी.ए. hPa	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	प्रतिशत %	एच.पी.ए. hPa	आकाश के अष्टमारा Oktas of sky		मि.मि. mm		मि.मि. mm	मि.मि. mm	मि.मि. mm		कि.मी. प्र. घं. Km/h	
जनवरी JAN	I II	989.9	21.3	19.3	30.8	18.4	33.8	16.1	36.0	17 1998	14.4	7 1992	82	21.2	2.0	1.8	13.5	0.4	155.7 1978	0.0	55.4	11 1978		
फरवरी FEB	I II	988.0	23.6	21.5	33.5	20.7	36.5	18.0	39.0	26 1980	15.4	5 1988	82	24.1	3.0	2.5	7.2	0.5	14.0 1999	0.0	49.2	20 2000		
मार्च MAR	I II	985.8	26.2	23.7	37.3	22.8	40.9	19.9	42.0	14 1983			80	27.4	1.7	1.4	6.5	0.4	88.5 1981	0.0	43.6	13 1981		
अप्रैल APR	I II	983.6	29.2	25.5	39.6	25.5	43.0	22.4	44.5	30 1991	14.6	15 1987	73	29.7	2.1	2.0	17.6	1.0	65.6 1981	0.0	40.6	24 1981		
मई MAY	I II	980.8	31.9	26.3	41.2	28.2	44.8	23.5	46.1	26 1984			63	29.7	2.7	2.5	27.0	1.4	94.3 1991	0.0	49.0	5 1981		
जून JUN	I II	978.2	29.8	25.7	37.6	27.2	42.6	23.4	46.3	2 1998	21.8	12 1991	71	29.9	5.1	4.4	65.9	3.5	48.2 2000	0.0	81.7	12 1991		
जुलाई JUL	I II	978.8	27.7	24.7	33.9	25.5	37.3	23.2	39.2	7 1992	22.0	2 1992	77	28.6	6.3	5.8	124.6	6.0	176.7 1977	36.8 1979	99.2	24 1977		
अगस्त AUG	I II	979.6	27.1	24.3	32.8	25.0	35.4	22.8	37.5	25 1979	22.0	2 1981	78	28.2	6.1	6.0	133.0	6.7	189.0 1998	33.2 1979	88.2	14 1977		
सितम्बर SEP	I II	982.0	27.4	24.4	33.6	24.9	36.4	22.8	38.5	23 1987	21.6	8 1989	77	28.3	4.9	4.2	145.5	5.8	393.1 1991	20.3 1984	152.2	21 1991		
अक्टूबर OCT	I II	985.3	26.6	23.8	33.1	23.7	36.2	21.4	36.5	1 1987	19.2	28 1980	78	27.2	4.0	3.7	104.3	3.8	333.1 1981	4.2 1984	109.2	6 1987		
नवम्बर NOV	I II	987.9	24.2	21.0	31.1	21.2	33.5	17.9	35.5	7 1996	14.6	27 1981	75	22.6	3.2	2.6	48.1	2.8	66.8 1991	1.1 1981	163.5	4 1987		
दिसम्बर DEC	I II	990.3	21.7	18.6	30.0	18.6	32.2	15.7			12.6	16 1993	73	19.4	2.7	2.3	3.8	0.3	3.1 1987	0.0	3.1	10 1987		
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I II	983.9	26.7	23.4	34.8	23.7	44.3	15.9	46.3	2 1998	12.6	16 1993	75	26.6	3.7	3.2	696.8	32.5	631.7 1982	631.7 1982	163.5	4 1987		
वर्षों की सं NUMBER OF YEARS	I II	19	19	19	19	21	22		19		19		19	19	18	17	20	20	16	16	23			

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : नलन्दा
STATION : Nalanda

	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	वर्षा 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) O K T A S					No. OF DAYS WITH LOW CLOUD AMOUNT O K T A S									No. OF DAYS WITH VISIBILITY					
MONTH	PFT 0.3 mm Or more	HAIL	THUN DER	FOG	DUST STORM	SQU ALL	52 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 JAN	0.5	0.0	0.0	0.0	0.0	0.0	0	0	29	2	0	30	3	39	3	4	0	11	10	25	0	2	1	3	25	0	2	1	3	0	0.6	6.7	21.3	2.3	0.1					
फरवरी FEB	0.6	0.0	0.0	0.0	0.0	0.0	0	0	28	0	1	26	1	55	3	5	0	7	2	18	1	3	2	4	21	1	2	1	3	0	0.1	7.8	18.0	1.7	0.5					
मार्च MAR	0.7	0.0	0.1	0.0	0.0	0.0	0	1	30	0	1	25	1	55	3	5	0	9	1	23	2	3	1	2	25	1	3	1	1	0	0.0	3.8	24.1	2.9	0.3					
अप्रैल APR	1.1	0.0	0.0	0.0	0.0	0.0	0	0	29	1	0	20	1	46	4	18	0	8	3	20	2	4	2	2	21	1	4	2	2	0	0.0	3.0	21.5	4.3	1.1					
मई MAY	1.8	0.0	0.0	0.0	0.0	0.0	0	0	31	0	1	14	0	27	3	21	3	30	1	19	2	5	2	3	21	2	4	1	3	0	0.0	3.1	22.5	3.4	1.9					
जून JUN	4.5	0.0	0.0	0.0	0.0	0.0	0	1	29	0	1	2	0	6	0	36	8	47	0	5	1	5	4	15	7	1	4	3	15	0	0.0	4.7	20.2	3.1	2.0					
जुलाई JUL	7.1	0.0	0.1	0.0	0.0	0.0	0	1	30	0	1	1	0	1	0	43	10	44	0	2	1	3	5	20	4	1	2	3	21	0	0.0	4.3	23.1	1.9	1.6					
अगस्त AUG	7.7	0.0	0.0	0.0	0.0	0.0	0	1	30	0	1	1	0	2	0	32	8	55	1	2	1	5	3	20	3	1	4	2	21	0	0.0	4.1	22.8	2.5	1.6					
सितम्बर SEP	6.6	0.0	0.0	0.0	0.0	0.0	0	0	29	1	1	6	0	11	1	29	4	42	6	4	1	6	4	15	5	1	4	3	17	0	0.0	3.2	20.9	3.6	2.3					
अक्टूबर OCT	3.9	0.0	0.0	0.0	0.0	0.0	0	0	29	2	1	29	4	16	1	15	2	23	9	18	1	5	2	5	21	0	3	2	5	0	0.1	3.7	22.4	3.8	1.1					
नवम्बर NOV	3.3	0.0	0.0	0.0	0.0	0.0	0	0	26	4	3	33	7	18	2	4	0	19	14	16	1	4	3	6	21	1	2	2	4	0	0.0	8.8	17.8	2.9	0.4					
दिसम्बर DEC	0.4	0.0	0.0	0.0	0.0	0.0	0	0	29	2	3	46	3	22	1	2	1	14	8	21	1	4	1	4	23	1	3	1	3	0	0.1	6.8	20.8	3.3	0.0					
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	39.3	0.0	0.1	0.0	0.0	0.0	1	5	346	13	1	19	2	24	2	18	3	26	5	205	13	48	29	70	238	11	37	22	57	0	0.8	60.1	255.4	35.6	13.0					
वर्षों की संख्या OF YEARS	22						22				22									21					21					22										



**5x800MW YADADRI TPS
AIR CONDITIONING SYSTEM
TECHNICAL SECIFICATION**

SPECIFICATION No: PE-TS-417-553-A001

SECTION : I

SUB-SECTION : C

REV. 00

SECTION: I

SUB-SECTION: C

TECHNCAL SPECIFICATIONS



**5x800MW YADADRI TPS
AIR CONDITIONING SYSTEM
SPECIFIC TECHNICAL REQUIREMENT –
COMPLETE PLANT EXCEPT SWITCHYARD AREA**

SPECIFICATION No: PE-TS-417-553-A001

SECTION : I

SUB-SECTION : C1

REV 00

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SECTION-I

SUB-SECTION-C1

**SPECIFIC TECHNICAL REQUIREMENT – COMPLETE
PLANT EXCEPT SWITCHYARD AREA**



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

SECTION –I

REVISION 00

DATE: JULY 2020

SUB-SECTION –C1

1. **FUNCTION**

This specification includes, but not limited to Supply part, Services part and Mandatory spares 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), fill of lubricants, chemicals, reagents and consumables required for pre-commissioning, commissioning , performance testing and till one year of operation after handing over including chemicals for softening plant, mandatory spares 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, trial run at site and carrying out Performance guarantee test at site, training of customer/client O&M staff, operation and maintenance of the AC Plant(s) after commissioning for a duration of 12 months and handover in flawless condition of the package to the end customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for Air conditioning System except for following buildings:

- a) Canteen building
- b) Permanent stores and store office
- c) Security building
- d) Chemical Lab building (PCRI)
- e) Simulator building
- f) Main gate building
- g) Workshop building
- h) Fire station building

Bidder to note that even though the supply of Air conditioning equipment's of the above 8 buildings are not included in their scope, the engineering and selection/sizing of equipment's of Air conditioning system of these 8 buildings shall still be included in their scope.

For Air conditioning requirement of Switchyard, kindly refer **Section II**

2. **SYSTEM DESCRIPTION**

2.1 **POWER HOUSE BUILDING**

Water-cooled Chilled water type air conditioning plant shall be provided to cater to the air conditioning requirements of the following areas of **unit #1, #2, #3, #4, #5:**

- Unit Control Room.
- Control Equipment Room (CER)
- Computer Room
- Conference Room



TECHNICAL SPECIFICATION FOR AIR
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- UPS Room
- Battery charger Room (Cassette AC shall be provided)
- SWAS Room
- Shift in-charge room
- Office area etc.

AC PLANT-1 (shall cater to the air conditioning areas of Unit#1 & 2):

The AC Plant shall consist of 2 x 100% water-cooled Screw chiller and shall cater to the requirements of Unit #1 & 2. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S). FRP induced draft cooling towers. The chilled water produced by the chilling units shall be circulated to the Air Handling Units by (1W + 1S) centrifugal pump sets. These AHU shall be located in AHU rooms located adjacent to air-conditioned areas in Power House Building. The conditioned air from AHUs is distributed to the air-conditioned areas by galvanised sheet steel ducting and extruded Aluminium grilles / diffusers with volume control dampers and supporting frames. The return air is led back to the AHU Room in ducts for air conditioned areas at 17.0M level in control tower. There shall be a separate AHU rooms for the air conditioning of UPS room and control room areas at 17.0M level in control tower. The AHU room for the UPS room shall be located at 32.5 M whereas the AHU room for the control room areas shall be located at 24M.

The 2 x 50 % AHU's at 24.0M serving the control room areas at 17.0M shall be provided with 3 X 50% DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor. M.S. Scroll casing of the fan will be suitably painted.

The 2 x 50 % AHU's at 32.5M serving the UPS room at 17.0M shall be provided with 2 X 100% DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor. M.S. Scroll casing of the fan will be suitably painted.

FCU shall be provided for SWAS room for Unit-1 & 2.

Individual capacities of Air Handling Units/Fan Coil Units should be calculated and furnished by the Bidder.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a sump through HDPE piping at ground level near each building gravity/pumping for further handling in ETP system (by other)

One no. Non Chemical water treatment device at the common outlet of CW pumps shall be provided.



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

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One no. expansion tank of MS spray galvanised or FRP and shall be of adequate thickness & suitably reinforced and insulated shall be provided.

Two nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

AC PLANT-2 (shall cater to the air conditioning areas of Unit#3 & 4):

The AC Plant shall consist of 2 x 100% water-cooled Screw chiller and shall cater to the requirements of Unit #1 & 2. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers. The chilled water produced by the chilling units shall be circulated to the Air Handling Units by (1W + 1S) centrifugal pump sets. These AHU shall be located in AHU rooms located adjacent to air-conditioned areas in Power House Building. The conditioned air from AHUs is distributed to the air-conditioned areas by galvanised sheet steel ducting and extruded Aluminium grilles / diffusers with volume control dampers and supporting frames. The return air is led back to the AHU Room in ducts for air conditioned areas at 17.0M level in control tower. There shall be a separate AHU rooms for the air conditioning of UPS room and control room areas at 17.0M level in control tower. The AHU room for the UPS room shall be located at 32.5 M whereas the AHU room for the control room areas shall be located at 24M.

The 2 x 50 % AHU's at 24.0M serving the control room areas at 17.0M shall be provided with 3 X 50% DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor. M.S. Scroll casing of the fan will be suitably painted.

The 2 x 50 % AHU's at 32.5M serving the UPS room at 17.0M shall be provided with 2 X 100% DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor. M.S. Scroll casing of the fan will be suitably painted

FCU shall be provided for SWAS room for Unit-3 & 4.

Individual capacities of Air Handling Units/Fan Coil Units should be calculated and furnished by the Bidder.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a sump through HDPE piping at ground level near power house building by gravity/pumping for further handling in ETP system (by other)

One no. Non Chemical water treatment device at the common outlet of Condenser Water pumps shall be provided.

One no. expansion tank of MS spray galvanised or FRP and shall be of adequate thickness & suitably reinforced and insulated shall be provided.



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Two nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

AC PLANT-3 (shall cater to the air conditioning areas of Unit#5):

The AC Plant shall consist of 2 x 100% water-cooled Screw chiller and shall cater to the requirements of Unit #1 & 2. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers. The chilled water produced by the chilling units shall be circulated to the Air Handling Units by (1W + 1S) centrifugal pump sets. These AHU shall be located in AHU rooms located adjacent to air-conditioned areas in Power House Building. The conditioned air from AHUs is distributed to the air-conditioned areas by galvanised sheet steel ducting and extruded Aluminium grilles / diffusers with volume control dampers and supporting frames. The return air is led back to the AHU Room in ducts for air conditioned areas. There shall be AHU room located at 24 M for the air conditioning of UPS room and control room areas at 17.0M level in control tower.

The 2 x 50 % AHU's at 24.0M serving the control room areas at 17.0M shall be provided with 3 X 50% DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor. M.S. Scroll casing of the fan will be suitably painted.

FCU shall be provided for SWAS room for Unit-5.

Individual capacities of Air Handling Units/Fan Coil Units should be calculated and furnished by the Bidder.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a sump through HDPE piping at ground level near power house building by gravity/pumping for further handling in ETP system (by other)

One no. Non Chemical water treatment device at the common outlet of Condenser water pumps shall be provided.

One no. expansion tank of MS spray galvanised or FRP and shall be of adequate thickness & suitably reinforced and insulated shall be provided.

Two nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

SERVICE BUILDING



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Water-cooled Chilled water type air conditioning plant shall be provided to cater to the air conditioning requirements Service Building.

AC PLANT-4 & 5 (shall cater to the air conditioning areas of Service Building #1 & 2 respectively):

Each AC Plant shall consist of 2 x 100% water-cooled Screw chiller and shall cater to the requirements of each floor of the service building. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers. The chilled water produced by the chilling units shall be circulated to the Air Handling Units by (1W + 1S) centrifugal pump sets. These AHU shall be located in AHU rooms on each floor of the service building adjacent to air-conditioned areas (Each AHU room shall contain 2 x 50% capacity AHU).

Individual capacities of Air Handling Units should be calculated and furnished by the Bidder. Further the no. and capacity of the DIDW Centrifugal Fan having forward/backward curved blades and belt driven by TEFC squirrel cage Induction motor for each AHU shall be calculated and furnished by the bidder during detail engineering.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a sump through HDPE piping at ground level near power house building by gravity/pumping for further handling in ETP system (by other)

One no. Non Chemical water treatment device at the common outlet of Condenser water pumps shall be provided.

One no. expansion tank of MS spray galvanised or FRP and shall be of adequate thickness & suitably reinforced and insulated shall be provided.

Two nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

2.2

ESP BUILDING

Water cooled precision type package AC shall be provided for ESP control room for each unit i.e. **unit #1, #2, #3, #4, #5.**

AC PLANT-6, 7, 8, 9, & 10 (shall cater to the air conditioning areas of ESP Control Building of #1, 2, 3, 4 & 5 respectively):

Each AC Plant shall consist of 3 Nos (2W + 1S) Water cooled precision type Package AC to cater to the air conditioning requirements ESP Control Building. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers.



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One no. Non Chemical water treatment device at the common outlet of Condenser water pumps shall be provided.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a sump through HDPE piping located in boiler area by gravity/pumping for further handling in ETP system (by other)

One nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

2.3 FGD MCC & CONTROL ROOM

Water cooled precision type package AC shall be provided for FGD control room for each Stage i.e. Stage #1 & #2.

AC PLANT-11 & 12 (shall cater to the air conditioning areas of FGD Control Room of Stage # 1 & 2 respectively):

Each AC Plant shall consist of 5 Nos (3W + 2S) Water cooled precision type Package AC to cater to the air conditioning requirements FGD Control Building. The condenser cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers.

One no. Non Chemical water treatment device at the common outlet of Condenser water pumps shall be provided.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and **cooling tower blow down** shall be taken to a sump **through HDPE piping located** near respective FGD Control room building by gravity/pumping for further handling in ETP system (by other)

One nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

2.4 DM PLANT CONTROL ROOM AND ITS ASSOCIATED AREAS

Water cooled precision type package AC shall be provided for DM Plant control room & adjoining areas.

AC PLANT-13 (shall cater to the air conditioning areas of DM Plant Control Room):

Each AC Plant shall consist of 3 Nos (2W + 2S) Water cooled precision type Package AC to cater to the air conditioning requirements FGD Control Building. The condenser



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cooling water shall be circulated by means of (1W + 1S) centrifugal pump sets and (1 W + 1S) FRP induced draft cooling towers.

One no. Non Chemical water treatment device at the common outlet of Condenser water pumps shall be provided.

(1W +1S) water softening plant to take care of the make-up water requirements of the cooling tower. The reject of water softening plant and cooling tower blow down shall be taken to a neutralising pit of DM plant sump through HDPE piping by gravity/pumping for further handling in ETP system (by other)

One nos. Make-up water tank made of M.S RL or FRP and of adequate thickness & suitably reinforced. This tank will supply make-up water to Cooling towers and make up to Expansion tank and humidifiers shall be taken from the make-up inlet to softening plant directly.

2.5 ADMINISTRATION BUILDING

Air cooled type package AC shall be provided for each floor of administration building. **6 nos. PAC shall be provided in each floor (3 nos. on each wing)**, capacity shall be decided based on heat load and equipment rating available. Fresh Air unit consisting of Air Inlet Louver with Bird Screen, Dry panel HDPE filters, Tube Axial Flow Fan with Drive Motor, Volume control damper, Supports and supporting structures etc. shall be provided for each PAC Room.

2.6 SPLIT TYPE AIR CONDITIONERS/ CASSETTE TYPE AC/AIR COOLED PACKAGE AC

Split type/Cassette ACs/Air cooled Package ACs (air cooled) shall be provided to cater to the air conditioning requirements of control room areas having workstation for auxiliary plant.

Split type/Cassette ACs/Air cooled Package ACs shall be suitable for operating at 50 Deg C ambient.

For selection of numbers of split AC's/Cassette AC's , refer to clause 2.05.00 of section C2-A, customer specifications.

Hand operated remote and other accessories as specified. Local Distribution Boards containing isolating Switch / MCB shall be provided for Split Air Conditioners/Cassette Air conditioners and FCUs. Each split unit/ Cassette Air conditioners shall also be provided with suitable rating stabiliser.

3. DESIGN CRITERIA

3.1 SYSTEM DESIGN CRITERIA - AIR CONDITIONING SYSTEM



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3.1.1 Outdoor conditions shall be considered as follows: -

Summer		Monsoon	Winter
DBT (°C)	42.7	30.9	15.7
WBT (°C)	26.5	26.3	13.6

3.1.2 The inside design conditions to be maintained are as follows: -

22°C ± 1°C & RH 55% ± 5% for control room, CER, Computer room, UPS rooms, AVR room etc.

24°C ± 1°C & RH not exceeding 60% for non-critical areas like offices, conference room, SWAS room, etc. and the areas served by split AC.

3.1.3 Fresh air at the rate of 1.5 air changes per hour for the control rooms and 1 air change per hour for office areas or at least 34 Cu. M/Hr. per person, whichever is higher. For other areas, Fresh air shall be considered as per ISHRAE (latest Version).

3.1.4 A design margin of 10% on total sensible and latent heat shall be considered while designing the AC Plant capacity for each area. An overall margin of 10% on calculated cooling load shall be considered in selecting Plant capacity.

3.1.5 Lighting load considered shall be 21.4 W/m² except shift in charge engineer's room and offices where 16 W/m² shall be considered.

3.1.6 The Occupancy considered shall be 1 person in 12SQM or (actual).

3.1.7 Necessary Heater and Humidifier shall be provided.

3.1.8 Efficiency of centrifugal fan and pump shall not be less than 70%.

3.1.9 For other design parameters refer to clause 5.01.00 and other relevant clauses of section C2-A, customer specifications..

3.1.10 **SPECIAL CONSIDERATION**

- Water flow rate for chilled water pump selection: 0.7 CMH/TR.
- Water flow rate for condenser water pump selection: 1.0 CMH/TR.
- Condenser water pumps, chilled water pumps, AHUs and FCUs shall have further 10% margin on their flow capacities.
- Water flow rate for Cooling Tower Selection shall be equivalent to finally selected condenser water pump capacity.
- Chiller/Water Cooled Precision AC's/Water cooled Package AC's shall be designed for minimum condensate inlet water temperature as 33 Deg C



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- Design margins in various equipment shall be as per relevant clauses of section C2-A, customer specifications.
- All equipment shall be of high quality and high efficiency meeting the stipulated power consumption as defined elsewhere in the specifications.

3.2 SYSTEM CAPACITY AND CONFIGURATION:

For system capacities and configuration please refer Annexure-D.

3.3 LAYOUT CONSIDERATION:

For location of the AC Plants-1 to 13 please refer Annexure-C.

4.0 BRIEF SPECIFICATION OF AC EQUIPMENT

4.1 Water Cooled Chiller Package

- Refer to clause 3.01.00, 4.01.00 & 6.03.00 and other relevant clauses of section C2-A, customer specifications.
- The IKW/TR of screw chillers shall not be more than 0.7 at 100%.
- Accessories (valves, pressure gauges, water flow switches, controls and instruments etc shall be provided with each screw chiller as per PID indicated in Annexure-A.

4.2 Water Cooled Precision Package AC

- For water cooled precision type package, refer to clause 4.02.00, 4.03.00, & 6.12.01 and other relevant clauses of section C2-A, customer specifications

4.3 Chilled & Condenser Water Pump sets

- Refer to clause 3.01.05, 3.01.06, 6.04.00 and other relevant clauses of section C2-A, customer specifications.
- Accessories (valves, pressure gauges, water flow switches, controls and instruments etc shall be provided with pump as per PID indicated in Annexure-A.
- Vibration pads/shims shall be provided for isolation vibrations

4.4 Cooling Tower

- Design ambient wet bulb temp: 29 deg C.
- Approach: 4 deg C.
- COC-5



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Induced draft (single cell) FRP type shall consist of all accessories i.e. fan, motor, FRP basin, FRP louvre, PVC eliminators, nozzles, make up connection, drains overflow & piping, valves & fittings, strainer of brass wire mesh, ladder and supporting structure and all accessories as specified shall be provided.

Refer to clause 3.01.07, & 6.05.00 and other relevant clauses of section C2-A, customer specifications

4.5 Air Handling Units (Double Skin Type)

Refer to clause 3.02.00, 6.08.01 and 6.08.02, 6.17.01 and other relevant clauses of section C2-A, customer specifications.

- a) High efficiency filter having an efficiency of 99% down to 5 microns mounted in supply air duct shall be provided for air conditioning of all areas excepting areas served by FCUs.
- b) Dry panel type pre-filters (50mm thick) having efficiency of 90% down to 10microns shall be provided for all other AC areas.
- c) Motors shall be installed inside the AHU.
- d) Accessories (valves, pressure gauges, water flow switches, controls and instruments etc shall be provided with pump as PID indicated in Annexure-A.
- e) Drain piping from the AHUs up to nearest drain point.
- f) Serrated rubber pads for vibration isolation

4.6 Strip Heater Package & Humidification Package

- a) One set of electrical strip heater package of suitable capacity shall be provided in supply air duct. Heater package shall be connected with thermostat / Humidistat which will be provided in return air path inside AHU Room / Package AC Room.

Temp gauge, temp element shall also be provided and the same shall be hooked with PLC system. RH and temp sensor shall be provided and the same shall be hooked with PLC system.

- b) One No. electrode humidification system comprising heater, humidistat, water tank, low level switch over flow, draining, make up connection, float valves etc for each AHU Room.
- c) Refer to relevant clause 3.05.00, 3.06.00, 6.12.01, 6.14.01, 6.14.02 and other relevant clauses of section C2-A, customer specifications



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4.7 Sheet Metal Work

- a) Refer to clause 6.10.00 and other relevant clauses of section C2-A, customer specifications.
- b) Supply air diffusers / grilles (Frame and Louvers of Diffuser/Grilles shall be of extruded aluminium of 1.2 mm thick section, duly powder coated) with volume control dampers. Return air Diffusers will have no Volume control Damper.
- c) For fire damper refer to clause 3.08.00, 6.10.00, 4.01.00, 6.10.11(ii) and other relevant clauses of section C2-A, customer specifications.
- d) Motorized fire damper will be installed at supply and return air duct at suitable locations where duct pass through wall & floors for ease of isolation, maintenance and as well as for emergency operation. Fire damper in the supply and return air duct will be closed on receiving fire signal from fire protection system and shall also be possible manually from remote control panel. Necessary arrangement shall be incorporated in the duct for providing duct mounted multi- sensor detectors in the return air duct for all air conditioned areas. Also respective Air Handling Units, Air washers/UAFs shall trip on receiving fire signal from fire protection system

4.8 Smoke Exhaust fan

- a) Refer to clause 2.08.06, 3.07.00 and other relevant clauses of section C2-A, customer specifications.

4.9 Insulation

- a) Refer to clause 6.11.00 and other relevant clauses of section C2-A, customer specifications

4.10 Split Air Conditioner

For the split type air conditioner/Cassette air conditioner, the condensing unit is to be located on roof or at grade and indoor units to be located inside the air-conditioned areas. Each unit shall be complete with reciprocating / rotary compressor, air cooled condenser, cooling coil, evaporator fan, dry panel filters, necessary refrigerant piping (insulated suction lines), necessary controls and first charge of refrigerant and oil etc. and damper at outlet of the fan.

Hand operated remote and other accessories as specified.

Split Air Conditioner/Cassette air conditioner shall be of maximum rating available as per BEEE rating regulation presently prevalent and latest model.

For further details refer to relevant clauses of Section-C, Sub-Section C2A.

4.11 Water Softening Plant

Each Softening plant of various AC systems (as defined in tender specification) shall be designed for **effective capacity of cooling tower makeup water requirement considering the evaporation, cooling tower blow down, misc. drift losses and water required for**



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regeneration plant. The service cycle (i.e., time between two successive regeneration) shall not be less than 20 Hrs.

The clarified water analysis is attached in Sub-Section-E, Annexure-X of this specification. The make-up water to AC Cooling Tower will be a soft water (Total Hardness ~ 20-30 ppm as CaCo3) which shall be achieved through the blending of clarified & soft water (Softening plant Outlet) the CT is expected to operate at **5 Cycle of concentration** & accordingly provision for suitable blowdown to be provided.

The softening plant shall be resin based & it is proposed to have it on a prefabricated & preassembled skid (comprising of Softener, ACF & DMF) to minimize Site activities.

Suitable disposal of brine solution shall be envisaged as shown in sketch attached (Refer Annexure A).

The softening plant shall be complete with all instrumentation & required facilities as per the system requirement including initial fill of resin.

Suitable cooling water treatment program (Viz scale inhibitor/Corrosion inhibitor/Bio dispersant etc.) must be dosed to maintain a corrosion and scale free water chemistry in the cooling water circuit. The required chemicals for initial commissioning and further till handing over shall be in the scope of bidder. Further the reject of the water softening plant shall be terminated at the nearest ETP pit by the bidder.

As soft water shall be corrosive in nature, piping and valves from softening plant to make up water tank and from make water tank up to cooling tower shall be of MS RL or suitable material which shall be decided during detail engineering without any implication.

4.12 Online Non Chemical Water Treatment Equipment

- a) Refer to clause 6.14.03 and other relevant clauses of section C2-A, customer specifications.

4.13 Piping, Valves Etc

- a) Refer to clause 6.06.00, 6.07.00 and other relevant clauses of section C2-A, customer specifications.
- b) Condenser cooling water and Chilled water piping for 150 NB or below GI-Heavy Class conforming to IS-1239, Part-I, for higher sizes black steel pipe, heavy grade conforming to IS-3589, Fe 410 grade.
- c) Drain water piping shall be of M.S. heavy grade. Condensate drain piping shall be insulated as per the specification (Refer Section C2-A, customer specifications).
- d) HDPE Piping (1"/2"/3") complying to IS 4984, PN 10, PE80 carbon black, UV rating) along with valves shall be used for transferring softening plant reject and cooling tower blow down to nearest ETP sump.

4.14 Electrical Items

Refer to clause 6.16.00 and other relevant clauses of section C2-A, customer specifications and section C-3, electrical portion of specifications.



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4.15 ETP Pumps (For handling of Softening Plant Rejects)

Polypropylene (PP) Monoblock/split pumps shall be used for the carrying the rejects of the water softening plant to the nearest ETP pits in case gravity flow to ETP sumps is not feasible due to layout constraints. The pump shall be complete with casing, impeller, renewable type wearing rings, shaft, shaft sleeve, bearings, stuffing box, Mechanical Seal (if applicable), cowlings, base plate etc. as applicable.

Material of the pump shall preferably as follow (all material shall be of tested quality).

- a) Casing & Impeller – Polypropylene
- b) Stuffing Box & Shaft – SS316
- c) Mechanical Seal – Rubber Bellow Seal
- d) Face – Carbon / Ceramic.

4.16 Fresh Air Fans

Fresh air unit for Control room areas and areas served by Precision air conditioners shall consist of a tube axial flow/centrifugal fan with drive motor, inlet louver with bird screen, dry panel HDPE filters, volume control damper, supports, supporting structures etc. 1 x100% capacity Fresh air unit shall be provided in each AHU room / PAC room.

4.17 For other items refer to the relevant clauses of section C2-A, customer specifications.

5 CONTROL AND INSTRUMENTATION -

1. Stage wise PLC (Stage # 1 & 2) has been envisaged for Air conditioning and ventilation system. Stage # 1 comprises of Unit # 1 & 2 and Stage # 2 comprises of Unit # 3, 4 & 5 respectively.
 - a. Following areas wherein Air conditioning and ventilation system has been envisaged to be controlled and monitored from Stage # 1 PLC located in AC plant control room at ground floor of CCR/CER Stage # 1 (Unit # 1 & 2)
 - i. Power house (Unit # 1 & 2)
 - ii. ESP buildings (Unit # 1 & 2)
 - iii. FGD Control room (Stage # 1)
 - iv. Service Building (Stage # 1)
 - v. Softening plants provided for AC plants located in above areas
 - b. Following areas wherein Air conditioning and ventilation system has been envisaged to be controlled and monitored from Stage # 2 PLC located in AC plant control room at ground floor of CCR/CER Stage # 2 (Unit # 3 & 4)
 - i. Power house (Unit # 3, 4 & 5)



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- ii. ESP buildings (Unit # 3,4 & 5)
 - iii. FGD Control room (Stage # 2)
 - iv. Service Building (Stage # 2)
 - v. Softening plants provided for AC plants located in above areas
2. Switchyard and DM plant along with softening plants shall be hooked to PLC of both stages.
 3. Chiller, Water Cooled Precision ACs, Water Cooled Package ACs, Air cooled Precision ACs and Air cooled Package ACs shall be provided with microprocessor controller also as specified in technical specification elsewhere
 4. AWU and UAF units of ventilation package for power house buildings (stage # 1 & stage 2), ESP control and FGD control buildings (stage # 1 & stage 2) shall be also be controlled through PLC's provided in respective stages.
 5. For details of PLCs, RIO panels and associated equipment, kindly refer C & I specification (Sub Section-C4)

6 ACCEPTANCE TEST

Room condition test shall consist of taking the reading of dry bulb and wet bulb temp at different locations points to be mutually decided at site in the areas which are air-conditioned by the respective system/plant. Room condition test shall be done after stabilization of the system.

The dry and wet bulb temp shall be measured by measured by sling psychrometer which will have accuracy of +/-0.5% with aleast count of 0.5 degC. This will be carried out for 72 hrs continuously and readings will be taken every six hours. Standby equipment should be changed over during these 72 hours.

This test shall be carried out during month April to June when the dry bulb temp is generally high and during. Relative humidity shall be determined from psychometric chart

All shop testing and test at site as specified shall be carried out.

Instruments required for performance testing of various equipment / system of the package shall be arranged by Vendor at site.

Bidders shall guarantee to maintain specified inside design conditions during summer, monsoon and winter and also even if the internal equipment load varies from 100% to 25%.

Besides the system performance as above, bidder shall guarantee major technical parameters of various equipments as per design basis / details furnished.



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7 GENERAL NOTES

- 1) Basis of design all calculations including heat load calculations for summer seasons, equipment selection criterion, layout drawings/ schemes/G.A. dwg and documents like data sheet/ technical particulars etc are subject to Customer approval during detail engineering stage.
- 2) Vendor to furnish characteristic curves for all major equipment offered indicating duty point during detailed engineering.
- 3) All drawings and documents shall be computer based.
- 4) All commissioning spares, consumables, lubricants, chemicals, reagents required till handing over and till one year of operation after handing over of the system, shall be provided
- 5) Quality Requirements in the Technical Specification are indicating minimum requirements for inspection and testing. Vendor shall note that quality plan is subject to Customer & BHEL-approval during detail engineering stage. Standard QP format is enclosed in the technical specification for reference.
- 6) Indicative list of makes is enclosed as per Sub-Section-E, Annexure-I. However, these makes shall be subject to Customer & BHEL approval during detail engineering Stage.
- 7) Fixing frame works for diffusers and grilles in the scope of Vendor.
- 8) Anchor fastener shall be used by vendor for fixing duct pipes etc. wherever applicable.
- 9) Necessary supports and structures / frames etc. as required for supporting the duct / piping / equipment etc. as lump-sum basis is in the scope of Vendor and no unit rates shall be applicable for these items.
- 10) Drain piping for AC equipment shall be terminated to the nearest drain by bidder
- 11) Vendor shall furnish schedule of power and control cables. Vendor shall also furnish cable termination details interconnection drawings etc. during detail engineering stage.
- 12) The tools and machine required for erection of equipment shall be arranged by Vendor.
- 13) Minimum Tools & tackles has been specified. Any additional tools & tackles as required for regular maintenance shall be supplied by Vendor.
- 14) Instruments required for performance testing of various equipment / system of the package shall be arranged by Vendor at site.
- 15) Instrument for testing shall be calibrated by Air-conditioning plant supplier before taking up testing.
- 16) Temperature gauges shall be provided with thermo wells and fixing arrangement.
- 17) Pressure gauges shall have provision for air venting. Three way valves shall be used which shall have air venting provision.



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- 18) Matching sockets / stubs (weld type) for flow switches and other instruments shall be supplied.
- 19) Bidders shall guarantee to maintain specified inside design conditions during summer, monsoon and winter and also even if the internal equipment load varies from 100% to 25%.
- 20) Besides the system performance as above, bidder shall guarantee major technical parameters of various equipment as per design basis / details furnished.
- 21) The guarantee tests shall be performed as per clause no. 4.11.00 of General technical requirement (Sub Section – C2B) and Clause no.11.00.00 of technical requirement (Sub Section C2A) of customer specification.
- 22) For motorized fire damper / 3 Way valve actuators / motorised valves, power supply shall be derived by vendor from respective control panels. BHEL shall not provide any feeder for them. Suitable transformer shall be provided by bidder (if required) to derive the power input. Further distribution through junction box / distribution board shall be in vendor scope and shall have provision for isolation of individual fire damper/ valves.
- 23) Tender drawings enclosed form the part of specification and the bidder shall check the space requirements for installing the equipment as per the specification and layout requirements given in the specifications.
- 24) Bidder should suitably group the signals coming from various instruments etc. & the same shall terminate in local JB, from Local JB common cable to DCS / panel / MCC shall be selected. Any Electrical / C&I items and accessories like junction box, glands etc. shall be included by vendor in his scope.
- 25) In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.
- 26) Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Bidder to ensure proper net connectivity at their end.
- 27) The drawings/ documents submitted by vendor shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor's account. For any clarification/discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer's place as per the requirement for across the table discussions/ finalizations/ submissions of drawings.
- 28) Sealing of duct opening, grouting of foundation / foundation bolts etc. including special type of grouting like GPX2 etc. are in the scope of Air-conditioning system vendor.
- 29) Flat, platform type RCC / PCC foundation shall be provided for installing AHU and FAN etc. Vendor shall fix the equipment using anchor fasteners, as applicable, to secure the equipment obtain parameters related to vibration and noise.
- 30) Bidder to note that the P&ID shows only the bare minimum requirement of valves and instruments. Any instrumentation & valves as required for the completion of the system in line with technical specification shall be provided by bidder during detailed engineering without any commercial implication.
- 31) RCC foundation of cooling tower, tanks, pumps, water softening plants, AHU's, Precision AC's , Package AC's shall be provided by BHEL. However, steel beam / joist etc as required shall be supplied by air-conditioning plant supplier.



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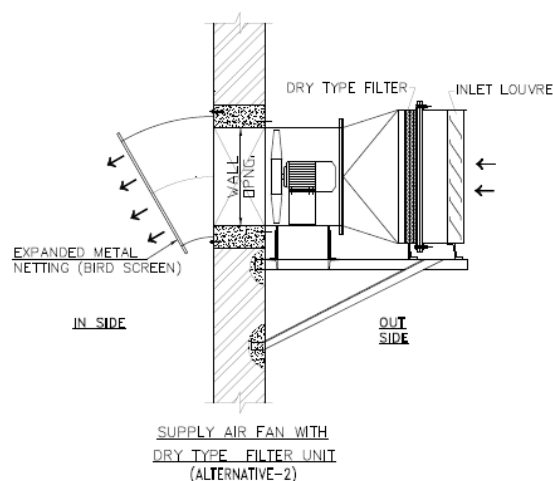
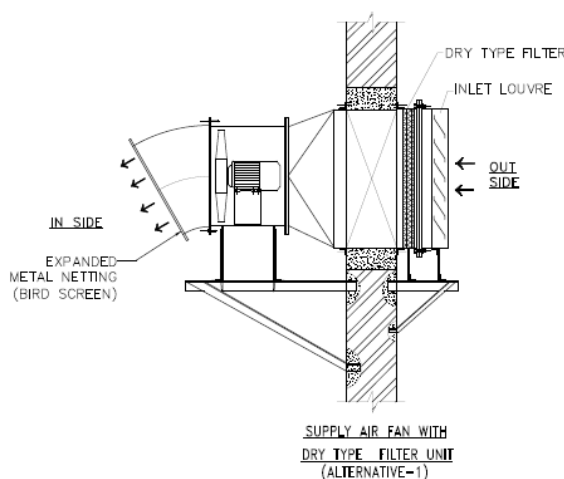
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- 32) Air-conditioning plant supplier to furnish drawings/ documents as per the dwg. / documents distribution as per project requirement.
- 33) Each motor terminal box shall be provided with cable gland and lugs for the size and type of power and control cable of respective motor.
- 34) All electrical equipment shall be suitable for the power supply fault levels and other climatic conditions indicated in project information / synopsis / specifications enclosed.
- 35) The bidder shall furnish complete tech. Particulars in data sheet and schedules as specified elsewhere in the specification during detail engineering.
- 36) Training of officials, for AC system shall be provided as per customer specification Section I C2-B.
- 37) Supports required for supporting the fan and/or filter section for FA fans shall be under bidder's scope



- 38) The sizes of equipment's mentioned in this specification are minimum requirement. Bidder to submit the basis of design, all calculations including heat load calculations for all seasons, equipment selection criterion, layout drawings/ schemes/G.A. dwg and documents like data sheet/ technical particulars etc during detail engineering and the same are subject to Customer approval during detail engineering stage without any commercial implication.
- 39) All drawings and documents shall be computer based.
- 40) Inserts or any support arrangement for fixing ducting, fans, piping etc. shall not be provided by BHEL. Necessary supports may be taken from nearest structure / walls / roofs / floors etc. by bidder.
- 41) Construction of AC plant room, air handling unit room, foundations for AC equipment's for the powerhouse (all units), Service building #1 & 2, ESP Control room, FGD MCC and Control Room, DM Plant Control Room, Admin building and other building wherein Package AC's are provided, based on the inputs furnished by the vendor, shall be in BHEL/Customer scope. However, making good, the civil works after completion of erection of HVAC equipment's for the above mentioned area and any other area in BHEL scope, where bidder's equipment's are



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going to be installed is in bidder' scope. Sealing of duct opening, anchoring and fastening, grouting of foundation / foundation bolts etc. including special type of grouting like GPX2 etc. are in the scope of Air-conditioning system vendor.

8 EXCLUSIONS

Items of works listed below are excluded from scope of the air-conditioning plant supplier.

- a) Construction of AC plant room, air handling unit room, foundations for AC equipments.
- b) False ceiling, drop ceiling.
- c) Slab cut out for running ducts, pipes, cables, grilles/dampers. Underground masonry trenches and masonry risers. However minor civil work like making opening to suit / finishing of opening, sealing of duct opening, grouting of foundation bolts including special type of grouting like GPX2 etc. are in the scope of AC system vendor.
- d) Provision of drain traps / points,
- e) For Electrical scope, refer Electrical scope matrix sheet.

9 TERIMINAL POINTS

- 1 Instrument and Service air: Refer Instrument and service air distribution scheme
- 2 Service water: Refer Annexure – B & Service water scheme in Section –III, Sub-Section-7.

10 ANNEXURES

Annexure-A: P&I Diagram for AC Plant and Scheme for Water Softening Plant (6 Sheets)

Annexure-B: Make-Up Water Scheme

Annexure-C: Locations of AC Plant rooms and Areas for Air conditioning in the service building, Power House, ESP Building, FGD Control Room.

Annexure-D : System Capacity and Configuration



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OPERATION AND MAINTENANCE SERVICES FOR AC SYSTEM



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1.0 OPERATION AND MAINTENANCE SERVICES

The bidder scope also covers the Operation and Maintenance (O&M) services for Preventive and Breakdown maintenance from the date of successful commissioning till handing over to end customer. However, actual date of start of O&M services shall be communicated to successful bidder by BHEL site personnel.

Bidder to note that the spares and consumables required for maintenance of the equipment during this O&M period shall be in bidder's scope of supply. Bidder shall use only genuine parts as mentioned in O&M Manual. Any damage or malfunction caused by the use of unauthentic parts or unqualified personnel shall be responsibility of bidder and as a consequence of above bidder is required to replenish the unauthorised part and abridge the qualified person without any commercial implication to BHEL.

O&M Services scope also covers all regular maintenance by trained service engineers and supply of genuine parts and lubricants as per the original equipment manufacturer's recommendations.

For the purpose of Operation of AC System, One-day shall be considered as 24 hours i.e. 3 shifts of 8 hours each. The AC System (along with related accessories) shall be operated on Round-the-clock basis on all the days of the year including Sundays and Public Holidays

O & M Personnel should be acquainted with local language. Governmental / Statutory approval w.r.t. O&M service as applicable shall be in bidder's scope.

Total duration of the Operation and Maintenance services has been envisaged for twelve (12) months for individual AC plants/control buildings identified in price format/specification. The duration of operation & maintenance services can be increased or decreased as per requirement and payment in such case shall be made on pro-rata basis.

The operation and maintenance services can be continuous or intermittent as per site requirement for individual AC plants/control buildings identified in price format/specification.

Bidder has to compulsorily maintain log book for the O & M staff engaged for O&M jobs and submit to Engineer in charge for certification for realization of the bills. After certification of the bill by Engineer in charge of BHEL, bidder shall claim the amount after completion of minimum 30 days.

Depending on start of O&M services, there is a possibility that some period of O&M services and Warranty period may overlap. **However, it is clarified that any maintenance required or any spare of AC System required to be replaced during Warranty period (as part**



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of warranty clause requirement) shall not be made part of O&M Services. Bidder may take care of this fact while working out the prices of O&M services.

Wherever AC system has been written in O&M Service Specification, the same shall be deemed as complete AC System.

The vendor shall deploy following minimum manpower for Operation of AC System.

- i. Two qualified and experienced AC operator per shift on "Round the Clock" basis throughout the year for all days of the year including Sundays & Public Holidays. There must be minimum 30 minutes overlapping between two shift operators to get familiarize with the status of AC System.
- ii. Two Helper per shift on " Round the Clock" basis throughout the year for all the days of the year including Sundays and Public Holidays. The helper shall assist the AC System Operator in day to day operation of AC System and accessories and shall assist him for keeping AC System equipment's in neat and tidy condition.

1.1 Responsibility of AC System Operator

- i. AC System operator shall be responsible for proper sequential operation of AC System including operation of standby equipment in a predefined sequence and stopping the same (when necessary) as per the procedural practice. In case of any abnormality (like non availability of power supply at incomer of AC System), he shall immediately report the matter to BHEL site Engineer for further action. Similarly, any malfunctioning in the system shall be immediately reported by him to BHEL site Engineer for suitable corrective action irrespective of time of occurrence of malfunctioning / abnormality in the system. A log book of all such outrages shall be maintained by AC system operator, which shall be shared with BHEL site engineer on periodic basis.
- ii. AC System operator shall take hourly readings of all the parameters of AC System / Equipment's including reading on main electrical panel of AC System. Temperature & RH readings inside all AC areas shall be taken at least once in a day. All the readings shall be recorded in a logbook register.

1.2 Responsibility of Helper.

- i. The AC System helper shall assist AC System operator for day to day smooth operation of AC System, like Checking of water levels of cooling tower, cleaning of Tanks, cleaning of strainers, checking water parameters of softening plant cleaning of AHU filters and other filters etc. as and when required. He shall be responsible for keeping all the equipment's of AC System as applicable in clean and tidy condition. He shall also carry out general cleaning of all AC equipment's including Electrical Panels (Part of AC System), AHU's etc. on regular basis.



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- ii. The helper shall work under the control of AC System operator and shall always ensure that unusable junk materials are not allowed to be kept in AC System room or AHU rooms. Under such eventuality, he will report the matter to Plant Operator, who in turn will take suitable action including reporting the matter to BHEL site Engineer.
- 1.2.1 All the log book registers shall be arranged by vendor. Log book register duly paged and bounded will be maintained in good condition by vendor.
- 1.2.2 All the necessary tools & tackles and other materials, required for operation of AC System shall be kept by vendor under the control of AC System operator. These tools & tackles shall be separate from tools & tackles (as per price format) which shall be handed over to customer in new condition. Required testing instruments like refrigerant leak detector, Multi Meter (for Electrical portion of AC System), Sling psychrometer, Line Tester, Tool Kit, Torch, vacuum pump, oil charging pump, Pressure testing kit etc. should also be always available with Plant Operator.
- 1.2.3 In case of any operator / helper being on leave, vendor shall immediately take advance action and provide substitution so that minimum manpower as indicated above is not reduced on any day. In case a particular shift duty A/C Operator or helper does not turn up due to any reasons, the earlier duty person shall continue to make sure that AC System never remains unattended.

2.0 Maintenance of AC System

- i. Maintenance work under scope of the vendor shall broadly include but in no way limited to the following:
 - a) Preventive maintenance of the plant.
 - b) Servicing of the AC plants and associated equipment's at regular interval
 - c) Attending to complaints.
 - d) Replacement of worn out or defective components
 - e) Replacing of consumables like refrigerant gas, oil, chemicals and salt for softening plant as and when required.

No consumable or any other items of AC system shall be arranged by Customer and no extra payment shall be made by customer in this regard.

- ii. Vendor shall be responsible at all time, during the entire period of contract for satisfactory performance of AC system (including accessories) with zero down time. During emergency or breakdown, vendor's Engineer along with related technicians shall be available immediately even though it may be beyond normal working



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hours or on public holidays till the AC System is restored back into normal satisfactory condition. Response time for attending breakdown complaints shall not exceed 2 hours.

- iii. Defective / worn out components shall be replaced only by genuine and original parts. OEM or its authorized dealer's invoice shall be submitted as proof of using genuine parts. All common spares required for AC system shall normally be kept available in the plant by the vendor. However, for critical spares, the same shall be made available in not more than 72 hours from the time of break-down requiring such spare.
- iv. Preventive Maintenance, servicing of AC System equipment's and accessories etc. shall be done by vendor in a planned manner in consultation with concerned customer's engineer. Preventive maintenance and service should be done as per the recommendations / guidelines of various OEMs
- v. Major servicing & over handling of equipment's like compressors, evaporators, condensers, pumps, AHU's, piping / ducting works, valves etc. shall be done by vendor once in a year.
- vi. In case any repair/services of particular equipment of system like chiller unit is to be carried out by vendor through OEM (or their authorized dealer), all the arrangements including tools, O&M spares etc. shall be the total responsibility of vendor.
- vii. Vendor shall arrange and maintain separate logbook register for services / maintenance of AC System. Record of work done for services/maintenance repairs etc. shall be recorded by vendor's engineer in this register. This register shall always be with updated records & shall be produced to customer's engineer on weekly basis or as & when required by him.
- viii. Vendor shall arrange and maintain sufficient stock of spares and consumable at site (AC room). Similarly, all necessary tools & instruments required for the purpose of servicing / maintenance / routine testing etc. shall also be arranged by vendor and should be available at site at all times.
- ix. Repairs / servicing works shall normally be done by vendor at site up to maximum possible extent. However, in case any equipment or accessories is essentially required to be taken by vendor out of the plant premises for repairing / servicing, all necessary arrangements including to and fro transportation shall be the responsibility of vendor. Vendor shall also inform concerned customer's engineer for doing procedural formalities (like issue of gate pass etc.), prior to taking out the materials out of Plant premises.
- x. In case bidder fails to supply the spares required for maintenance of the equipment, same shall be provided by BHEL at Bidders risk and cost.



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- xi. Vendor shall be fully responsible for safety of his personal at all times. Vendor shall also be responsible for taking all safety precautions at all the times, especially during servicing / preventive maintenance and repairs of AC System equipment's etc.
- xii. All the safety controls of AC Plant such as HP, LP, OP, Water pressure switch, inter locking etc. shall be positively checked at least once a month and same shall be recorded by vendor engineer
- xiii. Technicians & helpers engaged by the vendor shall wear uniform with nameplate for easy identification, while being within plant premises
- xiv. Vendor's engineer shall be focal point for customer. He shall report to customer engineer on daily basis, for taking necessary instructions and to update the status of AC system
- xv. If any damage to the equipment and its accessories has happened due to improper maintenance by bidder shall be recovered from the bidder.
- xvi. Bidder is to arrange all the safety gears like helmets, air plugs, safety shoes etc. during the maintenance for the O&M Staff.
- xvii. Bidder shall have to maintain storage shed along with site office during O & M contract also
- xviii. Fabrication and erection of platform/extra support for AC areas if felt necessary during operation and maintenance of the system has to be done by the bidder.

Notes:

1. The bidder shall take approval from Engineer-in charge of BHEL by submitting organization Chart of O&M staff for this site clearly indicating man power deployment with their educational background & experience with supporting documents.
2. The bidder shall be solely and wholly responsible for safety and security of workers engaged in the job and the BHEL property. In case of any accident the contractor shall pay proper compensation to the workers as per workmen's compensation act and repair/replace BHEL property at their own cost & arrangement. The bidder shall also make adequate provision of insurance for their workers at their own cost to cover them against the risk of accident.
3. The bidder and their workers engaged in the job shall follow all safety rules at the time of execution of work. It shall be responsibility of the bidder to supply all safety equipment as necessary to its O&M staff.
4. Beyond general shift if any trouble/breakdown occurs in the plant, Maintenance team must reach the plant without any delay along with Engineer/Site In-charge.



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5. No Person from the list of manpower shall leave the plant site without prior permission from the Engineer in charge of BHEL.
6. However, in operation part, if any person is absent, substitute must be given immediately otherwise proportionate deduction will be made.
7. The replacement / substitute personnel for maintenance, manpower shall have the same educational qualification and experience.
8. If any additional manpower is required during O&M whatsoever under the scope of contract the same shall be made available by bidder in time within the cost. To cater the need of time bound maintenance jobs, the bidder shall depute additional manpower without any cost implication to BHEL
9. During execution of work if any personnel is found not suitable for the job or his presence inside powerhouse premises is felt undesirable, the personnel has to be replaced within 15 days.
10. BHEL will not be responsible for payment towards idle labour charges

Statutory Compliance by the bidder:

All Statutory compliances related to Labour, Health & Safety, Quality & Environment protection and insurance shall be as GCC Rev-07.

LOW PRESSURE PIPING, VALVES AND SPECIALTIES

1.00.00 GENERAL INFORMATION

This section covers all the low-pressure piping up to 400mm NB size, associated valves and specialties that include but is not limited to the following systems.

- 1.01.00 Service Air System - shall consist of distributions service air to different buildings.
- 1.02.00 Instrument Air System - shall comprise of distribution of instrument quality air to pneumatically operated instruments/ valves/dampers.
- 1.03.00 Demineralised Water Supply system including hot well make-up water piping from condensate storage tank.
- 1.04.00 Demineralised Water closed cycle cooling system.
- 1.05.00 Service water system.
- 1.06.00 Potable water system.
- 1.07.00 Any other low pressure piping as found necessary during detail engineering shall also be included.

2.00.00 CODES AND STANDARDS

- 2.01.00 In addition to the requirements spelt out in Volume IIA, the design, manufacture, inspection and testing of the piping, fittings, valves and specialties covered under this specification shall conform, in general, to the standards and codes (latest edition) mentioned below:

- 2.01.01 IS-1239 : Mild steel tubes, tubular and other wrought steel fittings
[Part-I & II]
- 2.01.02 IS-3589 : Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
- 2.01.03 IS-554 : Dimensions for pipe threads where pressure tight joints are required on the threads.
- 2.01.04 IS-1363 : Hexagonal head bolts, screws and nuts (size range M5
[Part-I & II] M36)

2.01.05	IS-1364	:	Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)
2.01.06	IS-3138	:	Hexagon bolts & nuts (M42 to M150)
2.01.07	IS-5312	:	Swing check type reflux (non-return) valves.
2.01.08	IS-2379	:	Colour code for the identification of pipelines.
2.01.09	IS-2016	:	Plain washers
2.01.10	IS-2712	:	Compressed asbestos fibre jointing
2.01.11	ANSI B-16.5	:	Steel pipe flanges and flanged fittings
2.01.12	ANSI B-16.9	:	Wrought steel Butt welding flanged
2.01.13	ANSI B-16.11 : ANSI B-36.10 :		Forged steel fittings, Socket-welding and Threaded. Steel pipes thickness
2.01.14	API-600	:	Steel gate valves
2.01.15	BS-2633	:	Class I Arc welding of ferrite steel pipe work for carrying fluids.
2.01.16	BS-534	:	Specification for steel pipes and specials for water and sewage.
2.01.17	BS-5351	:	Specification for Ball valves.
2.01.18	AWWA-C-504	:	Specification for Butterfly valves.
2.01.19	AWWA-C-208	:	Dimension for fabricated steel water pipe fittings.
2.02.00	Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Purchaser.		
3.00.00	SCOPE OF WORK		
3.01.00	The equipment and materials to be supplied shall include but not be limited to the following:		
	a)	Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc. as required for the piping system under the scope of this section.	
	b)	Matching pipes, matching pieces like reducers/enlargers etc., counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc.	
	c)	Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.	

- d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc. complete with the counter flanges and matching connecting pieces as required within the entire low pressure piping system.
- e) Anchors, hangers and supports, etc. as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc.
- f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping should be avoided to the extent possible.
- g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches.
- h) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc. as required for interconnecting piping, valves & fittings.
- i) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop.

3.02.00 Following general requirements shall however be provided

- a) Instrument Connections including instruments, root valves, sensing lines etc.
- b) Pipe stubs and blanking plates etc. required for chemical cleaning and hydro testing.

For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.03.00 All miscellaneous instruments

4.00.00 **GENERAL DESIGN AND CONSTRUCTION**

4.01.00 **General Considerations**

4.01.01 The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.

4.01.02 The piping system shall be complete in every detail and in accordance with the highest standard of workmanship.

- 4.01.03 All design and fabrication shall be in accordance with codes/standards specified.
- 4.01.04 No pipe work shall be run in trenches carrying electrical cables.
- 4.01.05 Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.
- 4.01.06 All piping shall be identified by means of colour strips and by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.
- 4.01.07 Air release and drain branches shall be provided wherever necessary depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.
- 4.01.08 Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher.
- 4.01.09 **Drain Pipe Work**
- a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.
 - b) Unless otherwise stated, all drain piping shall be of 25 mm NB minimum and all vent pipings shall be of 15 mm NB size minimum. For pipes up to 50mm NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.
 - c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.
- 4.01.10 Specification of pipes used in different services included in the L.P piping section has been detailed in Annexure-I.
- 4.02.00 **Material Specification**
- 4.02.01 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Purchaser depending on the merits of alternative material.
- 4.02.02 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.

4.03.00 **Fabrication**

Except where otherwise specified all piping shall have butt-welded connections with a minimum of flanged joints necessary for maintenance. Where flanges are adjacent to welded fittings, weld neck flanges shall be used.

Branches shall, in general, be formed by welding. Standard fittings may be used in positions and for sizes where approval has been given in detail drawings. Pipe bends and tees shall be truly cylindrical and of uniform section. all welded branches shall be reinforced where needed as per the applicable codes/regulations.

4.03.01 Piping shall be fabricated in the shop in the largest transportable sections to minimize the number of field weld joints. The choice of field weld joints locations shall be based on the traverse of the pipe through walls, floors, sleeves or other restrictive areas. Support attachments for major piping shall be done at shop.

4.03.02 All pipes bends shall be made true to angle with no negative tolerance and shall have a smooth surface free of flat spots, crease and corrugations. A cross section through any bent portion of the pipe shall be true in diameter, within plus or minus 3% of the pipe diameter. Pipe bends shall be made from straight pipe pieces of sufficiently higher thickness so that after thinning, the minimum thickness of bends shall not be less than the minimum thickness required for the straight pipe. Thinning allowance shall be considered as per the relevant code.

4.03.03 For bends in pipes straight piece of pipes shall be bent by the contractor to required bend radius. However, forged bends (Bend radius = $1.5 \times$ pipe diameter) wherever required shall be provided.

4.03.04 The ends of Pipe and welded fittings shall be bevelled according to details shown in the relevant piping code. All welding shall be made in such a manner that complete fusion and penetration are obtained without an excessive amount of filler metal beyond root area. The reinforcement shall be applied in such a manner that it shall have a smooth contour merging gradually with the surface of adjacent pipe and welded fittings. Backing rings shall not be used on any pipe welds, unless otherwise approved by the Engineer.

4.03.05 Cutting and Bevelling

- a) Carbon steel piping - End preparation for butt welding shall be done by machining/flame cutting.
- b) Socket welding - Socket weld and preparation shall be done by saw or machine cutting.

4.04.00 **Hangers, Supports, Anchors**

Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item shall be supported in such a way that the weight of the piping is not taken by the plant item.

4.04.01 Support spacing shall be as per good engineering practice. However in no case it shall be less than support spacing stipulated in ANSI B31.1.

4.04.02 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.

4.04.03 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required.

4.04.04 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by welding, by bolting or by beam clamps. Bolt holes shall be drilled not burned. Support components may be bolted to concrete using approved concrete anchors.

4.05.00 **Valves and Accessories**

4.05.01 General Requirements

- a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure-II & III. In general all pumps (other than sump pumps), discharge valves shall be motor operated only. Tank inlet valves shall be motor operated only.
- b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs should be avoided as far as possible.
- c) All valves shall, unless otherwise stated, have the internal diameter same/as the internal diameter of the pipes to be joined.
- d) All valves shall receive tests at manufacturer's or contractor's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Purchaser.
- e) Gate valve and Ball valve have been specified with the intention of achieving isolation and tight shut-off. In full open condition, these valves should offer minimum of resistance to fluid flow.

- f) Globe valves have been specified with the intention of achieving good control of fluid passing. The plug and seat will have therefore suitable profiles for obtaining such controlling action.
- g) Check valves have been specified in order to prevent reverse flow through them.
- h) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate.
- i) Material, design, manufacture, testing etc. for all valves and specialties along with the accessories shall conform to the latest editions of codes.
- j) By pass valves shall be provided for larger size valves as per standards followed and as felt necessary for smooth and easy operation, even though not specifically mentioned in the specification.
- k) All flanged valves and specialties to be supplied under this section shall be provided with two (2) counter flanges, bolts, nuts, washers, gaskets etc.
- l) All valves shall be of approved design and manufacture. Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Purchaser's approval.
- m) All valves shall have outside screwed spindles and screwed thread of spindle shall not pass through or into the stuffing box. Where valves are exposed to the weather, protective covers shall be provided for the spindles, which shall be subject to approval.
- n) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items:
 - i) Hand wheel with embossed open and shut directions.
 - ii) Local position indicator.
 - iii) Motorised operation as specified by Engineer.
- o) Gate valves, in addition shall be provided with following extra features
 - i) Bypass valve for larger valves
 - ii) Draining arrangement
 - iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation.
 - iv) Motorised operation as specified by Engineer.
- p) All gate and globe valves shall be rising stem type.

- q) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also.
- r) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties.
- s) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position.
- t) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided.
- u) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction.
- v) All valves shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.
- w) Plastic or bakelite valve hand wheels will not be accepted.
- x) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers.
- y) Wherever practicable heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500 kg. shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable.
- z) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.
- aa) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.

- bb) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should include a parts list referring to the various materials used in the valve construction.
 - cc) All sampling and root valves shall be of integral body bonnet type.
- 4.05.02 For Design Requirements for different valves refer Annexure-II & III.
- 4.06.00 **Safety/Relief Valves**

Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.

All safety valves shall be provided with manual lifting lever.

Valves used for air and any other compressive fluid shall be of pop type.

Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure.

Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer.

The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting.
- 4.07.00 **Hosepipe and Accessories**
- 4.07.01 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves.
- 4.07.02 Hose pipes with fittings for Service Water System:
 - a) The water hose shall be as per IS-444 (Type-3).
 - b) Length of each hose shall be 15 metres.
 - c) For each hose, one end shall be fitted with M.S. female coupling with swiveling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swiveling nut of a second hose whereby two hose lengths may be joined.
- 4.07.03 Hose pipes with fittings for Compressed air System
 - a) The compressed air hose shall be as per IS-911 (Type 2).

- b) The length and type of each end shall be similar to as specified in above clause no. (4.07.02) above.

5.00.00 **DRAWINGS, DATA, INFORMATION & MANUALS**

5.01.00 Drawings, data, Information to be furnished by the Bidder besides those already mentioned in volume : IIA with the offer.

5.01.01 A complete list of all piping and fittings of various sizes with their quantities and details e.g. nominal size, O.D., I.D. (as applicable) thickness, design pressure, design temperature, material of construction/code/standards etc.

5.01.02 A complete list of all valves with their type, quantities & ratings.

5.01.03 Manufacturer's catalogue indicating complete range of available size and rating of pipes & fittings.

5.01.04 Descriptive literature on the manufacturing process and quality control procedures highlighting the manufacturing, fabricating and testing facilities available in the shop.

5.02.00 **After Award of Contract**

Detail drawings including fabrication drawings of all shop fabricated piping system indicating design parameters and complete bill of material (Relevant Standards and grades to be indicated) and information/data pertaining to the hydrostatic and non-destructive test requirements to be submitted progressively.

5.02.01 Detail dimensioned drawing of each valve, specialties, indicating tag no., pressure rating, manufacturing standard, the bill of materials and hydrostatic test pressures. The drawing shall include the end preparation details and shall indicate the position of the hand wheel/operator. Technical particulars of motor operators wherever applicable shall also be indicated.

5.02.02 General arrangement drawing for each hanger/support/anchor etc. indicating identification number, auxiliary supporting structural details, other details & information as required in the specification.

5.02.03 Wiring diagram for all limit switches of motor operated valves.

5.02.04 The loading data required for design of structures shall be furnished well in advance to suit Purchaser's time schedule.

6.00.00 **BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING**

6.01.00 All fittings like "T" pieces, flanges, reducers etc. shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.

6.02.00 Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered

part of work and is required to carry out such work as per instruction of Owner, which shall include specified heat-treatment procedures, etc. also wherever required.

- 6.03.00 Certain adjustments in length may be necessary while erecting high pressure pipelines and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.
- 6.04.00 Suspension for piping, pressure parts, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 6.05.00 All the valves, lifting equipments, actuators, power cylinders, etc., shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and also during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, they have to be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.
- 6.06.00 All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over the end caps shall be put back in tube openings till such time they are welded to other tubes.
- 6.07.00 Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even after completion of erection, which shall be carried out by the Bidder without any extra cost to the Purchaser. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions.
- 6.08.00 No temporary supports shall be welded on the pressure parts. Welding of temporary supports, cleats, etc., on the building columns shall also be avoided. In case of absolute necessity, Contractor shall take prior approval from Engineer. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Engineer.
- 6.9.00
- a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.
 - b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance.
 - c) Piping shall be routed above ground unless otherwise specifically indicated/ approved by the Engineer. In such special case, the piping may be arranged in trenches, or buried and properly protected as per AWWA Standards.

- d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 7 meters above roadways unless otherwise approved by the Engineer.
- e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective drawings or not. The pipelines shall be sloped towards the drain points.

6.10.00 All drips and drains for piping and equipment whether shown in the drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. Leading such drains up to station drainage is also the responsibility of the Contractor.

ANNEXURE-I
SPECIFICATION OF PIPES FOR DIFFERENT SERVICES

	A		B		C	D
Services	1. Clarified Water piping 2. DMCW piping		1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)		1. Demineralised Water, Service and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB
1.00.00 Material of Pipe	Carbon Steel IS-1239 Heavy Grade upto 150 mm NB and IS-3589 for sizes above 150 mm with minimum pipe thickness of 6 mm.		Carbon Steel as per IS-1239 Heavy Grade for sizes upto 150 mm NB and IS-3589 for sizes above 150 mm NB with minimum pipe thickness of 6 mm. The pipes shall be galvanized as per IS-4736		Stainless Steel as per ASTM A-312 Gr. 304. Size- as per schedule 40 ANSI B36.10	Stainless steel as per ASTM A-312 Gr. 304. Size-upto 150 mm NB as per schedule 10S, ANSI B-36.10.
2.00.00 Construct ion	ERW / Seamless		ERW / Seamless		ERW	ERW
3.00.00 Joints	Slip-on Flange and butt weld for size 65 mm NB and above and Socket weld joint for size 50 mm NB and below.		Screwed flange for sizes 65 mm NB and above and screwed socket for size 50 mm NB and below.		Socket welded for size 50 NB and below	Slip-on flange and butt weld joint.
4.00.00 Fittings	Pipe Sizes > = 65 mm NB	Pipe Sizes < = 50 mm NB	Pipe Sizes > = 65 mm NB	Pipe Sizes < = 50 mm NB		

	A		B		C	D
Services	1. Clarified Water piping 2. DMCW piping		1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)		1. Demineralised Water, Service and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB
4.01.00 Materials	ASTM-A-234 Gr. WPB	ASTM-A-105	ASTM-A-234 Gr. WPB galvanized as per IS-4736	ASTM-A-105 galvanised as per IS- 4736	ASTM-A-182 F304	ASTM-A-351-CF8
4.02.00 Construct ion	Welded/ Seamless	Forged	Welded/ Seamless	Forged	Forged	Welded/Seamless
4.03.00 Standard	ANSI-B-16.9 for fabricated fitting AWWA- C-208	ANSI-B- 16.11	ANSI-B-16.9	ANSI-B-16.11	ANSI-B-16.11	MSS-SP-43
4.04.00 End details	Pipe size >=65mm NB Butt welded as per ANSI-B- 16.25	Pipe size <=50 mm NB Socket welded as per ANSI-B- 16.11	Pipe size >=65 mm NB Screwed Flanged	Sizes <=50 mm Screwed socketed as per ANSI-B- 16.11All fittings shall be galvanized.	Socket welded	Slip - on flanges

	A	B	C	D
Services	1. Clarified Water piping 2. DMCW piping	1. Drinking/ Potable Water Supply, piping (Clarified water, chlorinated)	1. Demineralised Water, Service and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water, Service and Instrument air piping for sizes equal to greater than 65 mm NB
5.00.00 Flanges	150 lb class as per ANSI-B-16.5 complete with nuts, bolts and gaskets	As per ANSI-B-16.5 pressure class 150lbs - galvanised-complete with nuts, bolts and gaskets.	As per ANSI-B-16.5 pressure class 150lb complete with nuts, bolts and gaskets. Material as per class 4.01.00.	150lb class, flat face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets.
Pipes which fall under IS:1239 shall be hydrostatically tested according to the said code, for others refer Section-V, Vol.: II-A.				

SERVICES OF VARIOUS CATEGORIES OF VALVES

Valve Classification		Service		
A.	Cast iron body Gate/Globe/Check Valve	i)	Service Water	For sizes 65mm NB and above.
		ii)	Clarified Water	
		iii)	Drinking/ Potable Water	
		iv)	Inhibited Demineralised Water	
B.	Stainless steel body/ Gate/Globe /Check/Ball Valve	i)	For Demineralised water	For all sizes
		ii)	Potable/ Drinking Water	For sizes less than and equal to 50 mm NB
		iii)	Service and Instrument Air	For all sizes. Ball valves to be used in air line.
C.	Steel Body valves	i)	Clarified Water	For sizes less than and equal to 50 mm NB
		ii)	Inhibited Demineralised Water for DMCW system	
D.	Cast Iron body butterfly valve	i)	For Demineralised Water	For butterfly valve specification refer Annexure II, Sec.IV of Vol. IIIE. For DM water line rubber lining/ EPDM/equivalent protection to be provided
		ii)	Raw water	
		iii)	Clarified Water	
		iv)	Filtered Water	
		v)	Inhibited Demineralised Water for DMCW system	

ANNEXURE-III

SPECIFICATION OF VALVES

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
1.00.00	Valve Classification Code	CIGC	SSGC	STGC
2.00.00	Basic Design Code			
	a) Gate	a) i) IS 780 for 50 mm - 300 mm NB ii) IS2906 for 350 mm NB and above or as per MSS-SP-70	a, b, c) ANSI-B-16.34	i) API 600 for 50mm ii) API 602 for size
	b) Globe	b) MSS - SP - 85		b) BS-1873/ANSI-B-16.34
	c) Check	c) IS-5312/MSS - SP -71		c) BS-1868/ANSI B16.34
	d) Ball		d) BS-5351	
3.00.00	Pressure Class	To be suitably chosen considering the pressure requirement. Refer Clause No. 4.01.08 in this regard.		
4.00.00	Construction	Cast body and bonnet / cover	Forged body up to 50mm NB and Cast body above that	Same as Group-B
5.00.00	Material			
5.01.00	Body & Bonnet/ cover	IS 210 Gr. FG 260	ASTM-A-182 F304 for Ball Valves: A351 CF8M for cast body, A 182 F304 for forged body.	ASTM-A-216 Gr. WCB for cast body & ASTM-A-105 for forged body

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
5.02.00	Trim / Disc.	IS-210 Gr. FG 260	ASTM-A-182 F304 for Gate, Globe, Check valves and 351CF 8M for Ball valves. For DKW system : ASTM-A-182 F6A (min. 250 HB)	13% Cr Steel as per ASTM-A- 182 Gr. F6 heat treated and hardened(min 250 NB) for cast body and ASTM-A-105 Hard faced with Stellite (min 350 HB) for forged body
5.03.00	Seating surface	13% Cr steel as per IS 1570	For Ball valves PTFE seats and seals.	13% Cr. Steel as per ASTM-A- 182 Gr. F6
6.00.00	End Preparation	Socket welded for size equal to and below 50mm NB and flanged with counter flanges for 65mm NB and above.		
7.00.00	Testing			
	a) Gate	i) As per IS - 780 for 50 mm - 300 mm NB ii) IS-2906 for sizes equal to and above 350 mm NB	As per ANSI B-16.34	API-598
	b) Globe	Hydrostatic Test as per MSS-SP-85		BS-1873
	c) Check	IS-5312/MSS-SP-71		BS--1868

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SECTION-III

MISCELLANEOUS HOISTS

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL INFORMATION
2.00.00	CODES AND STANDARDS
3.00.00	SCOPE OF WORK
4.00.00	SPECIFIC DESIGN REQUIREMENTS
5.00.00	DESIGN AND CONSTRUCTION
6.00.00	INSPECTION AND TESTING
7.00.00	DRAWINGS, DATA AND INFORMATION

ATTACHMENT

ANNEXURE-I	LIST OF LOCATION FOR MONORAIL HOISTS
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VOLUME : IIIF

SECTION-III

MISCELLANEOUS HOISTS

1.00.00 GENERAL INFORMATION

1.01.00 The hoists will be used for erection and maintenance of various equipment in different buildings.

1.02.00 Hoists are divided into two separate groups - (a) Hand operated and (b) Electric operated.

2.00.00 CODES AND STANDARDS

The design, manufacture and testing of the equipment covered under this specification shall conform to the latest editions of the following Indian Standards:

2.01.00 IS : 3832 : Specification for Hand Operated Chain Pulley-blocks.

2.02.00 IS : 807 : Code of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of Cranes and Hoists.

2.03.00 IS : 6216 : Short link Chain, Grade T(8) for Pulley-blocks & other Lifting Appliances.

2.04.00 IS : 4164 : Lifting 'C' Hooks with Eye Capacity upto 25 tonnes.

2.05.00 IS : 2429 (part -I) : Non-calibrated Load Chain for Lifting Purposes.

2.06.00 IS : 3938 : Specification for Electric Wire Rope Hoists. and other Indian Standards referred to in the above standards.

3.00.00 SCOPE OF WORK

3.01.00 Hoists shall be provided in all areas where any equipment/component weighing above 500 kg is installed and needs to be handled for maintenance purposes. Number of monorail beams shall be such that the centre line of the hoist and the centre line of equipment to be handled shall be not more than 500 mm.

- 3.01.01 The location and no. of hoists is to be finalised during detailed engineering. Final arrangement is subject to approval of Owner/Consultant.
- 3.01.02 Monorail hoists shall at least be provided in the areas mentioned in Annexure-I. The list is indicative only and not an exhaustive one.
- 3.02.00 All drive motors and driving gears as necessary.
- 3.03.00 Limit switches for electrical hoist as necessary.
- 3.04.00 Trailing cable with all supporting fixtures as necessary for electric hoists.
- 3.05.00 Pendant control station with all accessories for electric hoists.
- 3.06.00 Lifting lug, eye bolts etc., for handling hoist parts.
- 3.07.00 Protection guard as specified.
- 3.08.00 Lifting hook block assembly for hoists.
- 4.00.00 **SPECIFIC DESIGN REQUIREMENTS**
- 4.01.00 Lifting capacity
- 4.01.01 Capacity of each hoist shall be 1.2 times the maximum working load.
- 4.01.02 Hoists of capacity upto 5 tones shall be manual hoists.
Hoists of capacity above 5 tones shall be electric hoists.
- 4.02.00 **Effort for Mechanical Hoists**
- 4.02.01 Hoisting
Hoisting effort for hoists upto 3 tones capacity shall not be more than 20 kg.
Hoisting effort for hoists above 3 tones capacity shall not be more than 25 kg
- 4.02.02 Trolley Motion
Effort for trolley motion for hoists upto 3 tones capacity shall not be more than 15 kg.
Effort for trolley motion for hoists above 3 tones capacity shall not be more than 20 Kg.
- 4.02.03 For Electric operated hoist both hoisting and trolley motion shall be motor operated.
- 4.03.00 **Lift**

4.03.01	Lift above operating floor
	Highest position of the hook shall be such that during operation of hoists, the vertical distance between bottom of any equipment handled and top of any permanent structure or equipment in the operating area shall be at least one metre.
4.03.02	Approach below operating floor
	To be decided by the Bidder for safe and reliable handling of any equipment above half ton below the operating floor.
4.04.00	Length of Monorail Hoist
	To be decided by the Bidder depending on the floor and machine layout. The horizontal distance between the centre line of the hoist and centre line of any installed equipment in its operating shall not be more than half metre.
5.00.00	DESIGN AND CONSTRUCTION
5.01.00	All parts requiring replacement or lubrication shall be easily accessible without the need for dismantling of other equipment and structures.
	Robust construction and ample rating merging which experience has shown to be necessary shall be ensured throughout manufacture.
5.02.00	All components of hoists of identical capacity and duty shall be interchangeable. The hoists of identical capacity and duty shall be identical in all respects unless otherwise required. The hoist design shall be such that these can be quickly removed from one monorail beam and fixed on another beam without disassembling major components.
5.03.00	All machinery and equipment included under this specification must be equipped with safety devices and clearances to comply with recognized standards and specification requirements.
5.04.00	Cast iron parts wherever used, shall conform to IS:210 - FG 260. Also no wood or other combustible materials shall be used.
5.05.00	Defects in material like fractures, cracks, blowholes, laminations, pitting etc. are not allowed. Rectifications of any such flaw is permissible only with the approval of the Purchaser.
5.06.00	Each hoist shall be permanently and legibly stamped with the tag number, manufacturer's name, safe working load, grade of load chain (where applicable), range of lift etc.

- 5.07.00 Load chain (where applicable) shall be of grade T(8) as per IS:6216 and Hand chain shall be as per IS:2429 (Part-I) grade 30.
- 5.08.00 Wheels in trolley unit travel shall be single flanged with straight/tapper/barrel shaped tread to suit the monorail. Wheels should be preferably of forged steel construction. Material of construction for wheels of traversing block and hoist gear for hoist used in hazardous areas shall be of non-ferrous material to avoid spark during operation.
- 5.09.00 All gears shall be hardened and tempered steel with machine cut teeth.
- 5.10.00 **Hoist (Manually Operated)**
- 5.10.01 Manually operated hoists shall be of spur gear chain pulley block type. It shall be suspended from the trolley by a hook. The design of the hoist shall conform to IS:3832 (Specification for hand operated chain pulley blocks). The hooks and brakes of hoist shall conform to the requirements stipulated in (a) and (b) below
- a) Hooks shall conform to and IS:3832. The load hook shall be swivelling type fitted with a locking device.
 - b) The pulley blocks shall be fitted with an automatic mechanical load brake to prevent self lowering of load in all working positions. The load brake shall also allow smooth lowering of load without serious overheating.
 - c) All manually operated hoists, unless stated otherwise, shall be trolley suspended type.
- 5.10.02 The trolley of hoists shall be manually operated.
- 5.10.03 The hoists shall be of Mechanism class 2 as per IS:3832.
- 5.11.00 **Electric Hoist**
- 5.11.01 Electric hoist shall be electric wire rope trolley suspended type. The design, operation, testing of electric hoist shall conform to IS:3938 (Specification for electric wire rope hoist).
- Minimum speed for hoisting shall be 3 m/min. and that of for trolley motion shall be 15 m/min.
- 5.11.02 Lifting hook shall conform to IS-4164 as applicable.
- 5.11.03 Wire rope for hoists shall conform to IS-2266.
- 5.11.04 Electro-mechanical brakes of fail to safety type shall be provided for hoist motion as well as per trolley motion for electrically driven trolley. Load brake shall allow smooth lowering of load and arrangement shall be such as it can not be released accidentally. Capacity of brake and other relevant data shall conform to IS:3938.

- 5.11.05 The trolley of the hoists shall be electrically driven.
- 5.11.06 For other components of hoist such as rope, sheave, drum, bearings, gears etc. stipulations of IS: 3938 shall be followed.
- 5.11.07 Motor shall be rated for duty S4. Service class of motor shall be "M8" as per IS:3177. Conditions given in IS:3938 for hoist motor shall be followed over and above the specification of electric motor in Volume-V. In case of any contradiction of the aforesaid standard and the motor specification, the conditions which are more stringent shall be considered. All the motors shall be suitable for reversing, frequent starting and braking. Motors shall be provided with suitable space heating arrangement.
- 5.11.08 Hoist shall be designed so that remote control can be effected by means of pendant push button switch from the operating floor. Operation, arrangement etc. of pendant push button switch shall conform to IS:3938.
- 5.11.09 Micro-speed attachment in hoist shall be provided if considered necessary by the Bidder.
- 5.11.10 The hoists shall be of mechanism class 2 as per IS-3938.
- 5.12.00 Ball and roller bearings of reputed make shall be used throughout.
- 5.13.00 Suitable lubrication system shall be provided for all gear drives.
- 5.14.00 **Other Electrical Items**
- 5.14.01 The cross conductor on monorail for power supply to the hoist shall be of festoon type flexible insulated cable conductors. All fixtures and accessories shall be provided by the Bidder for this purpose.
- 5.14.02 Necessary insulators, supports, clamps and all other accessories shall be provided as per standard design.
- 5.14.03 Each hoist shall be provided with a starter panel with protective relays.
- 5.14.04 One main isolating switch shall be used to cut-off the supply to the hoist assembly.
- 5.14.05 One main electro-magnetic contactor together with magnetic overload relay (hand reset) for each motor circuit shall be housed in the protection panel.
- 5.14.06 The operation of overload relay shall interrupt the main magnetic contactor.
- 5.14.07 Adequate short circuit protection shall be provided for main and individual circuits.
- 5.14.08 415V $\pm$ 10%, 3 Phase, 4 Wire, 50 Hz $\pm$ 5%, power supply for the hoist shall be arranged through MCCB unit mounted at standing height at a convenient location near each hoist.
-

- 5.14.09 Transformers to step down the voltage and rectifiers as necessary shall be provided by the Bidder.
- 5.14.10 All external and internal power, control and auxiliary circuit wiring of the electrical drive and accessories and panels shall be provided. The wiring shall be done with 1100 V grade PVC insulated stranded aluminium conductor cable of suitable size not less than 2.5 sq.mm nominal equivalent copper area of cross-section. All control and auxiliary circuit wiring shall be done with 1100 V grade PVC insulated, 2.5 sq.mm stranded copper conductor. Control wire terminations to the panels shall be made with compression type connectors. Multiway terminal blocks shall be furnished for terminating panel wiring and outgoing cable.
- 5.14.11 The hoist structure, motor frame and metal cases of all electrical equipment including metal conduit shall be effectively connected to earth. All grounding materials shall be supplied under this specification to grounding risers.
- 5.14.12 Single speed control shall be used for both hoist and trolley travel in each direction of motion.
- 6.00.00 **INSPECTION AND TESTING**
- 6.01.00 The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of the specification and in compliance with the requirements of the latest edition of IS:3832 or equivalent standards for manually operated hoists and shall be as per IS:3938 for electrically operated hoist.
- 6.02.00 All the mono-rail hoists shall also be tested at site as per the stipulation of relevant Indian Standards.
- 7.00.00 **DRAWINGS, DATA AND INFORMATION**
- 7.01.00 General arrangement drawings incorporating all dimensions information on head rooms, lift, wheel loads, hook suspension arrangement and other relevant data for all the hoists.
- 7.02.00 For Mandatory Spares, Spares required for erection and commissioning, Recommended Spares, Special Tools And Tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered and supply of first charge of lubricating oil, inhibitor oil and also adequate quantity of the consumables, please refer Technical Specification Volume-II A.
- 7.03.00 Design calculation for selection of electric motor capacities for electric hoist.
- 7.04.00 Complete list of location, number and capacity of hoists provided.



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

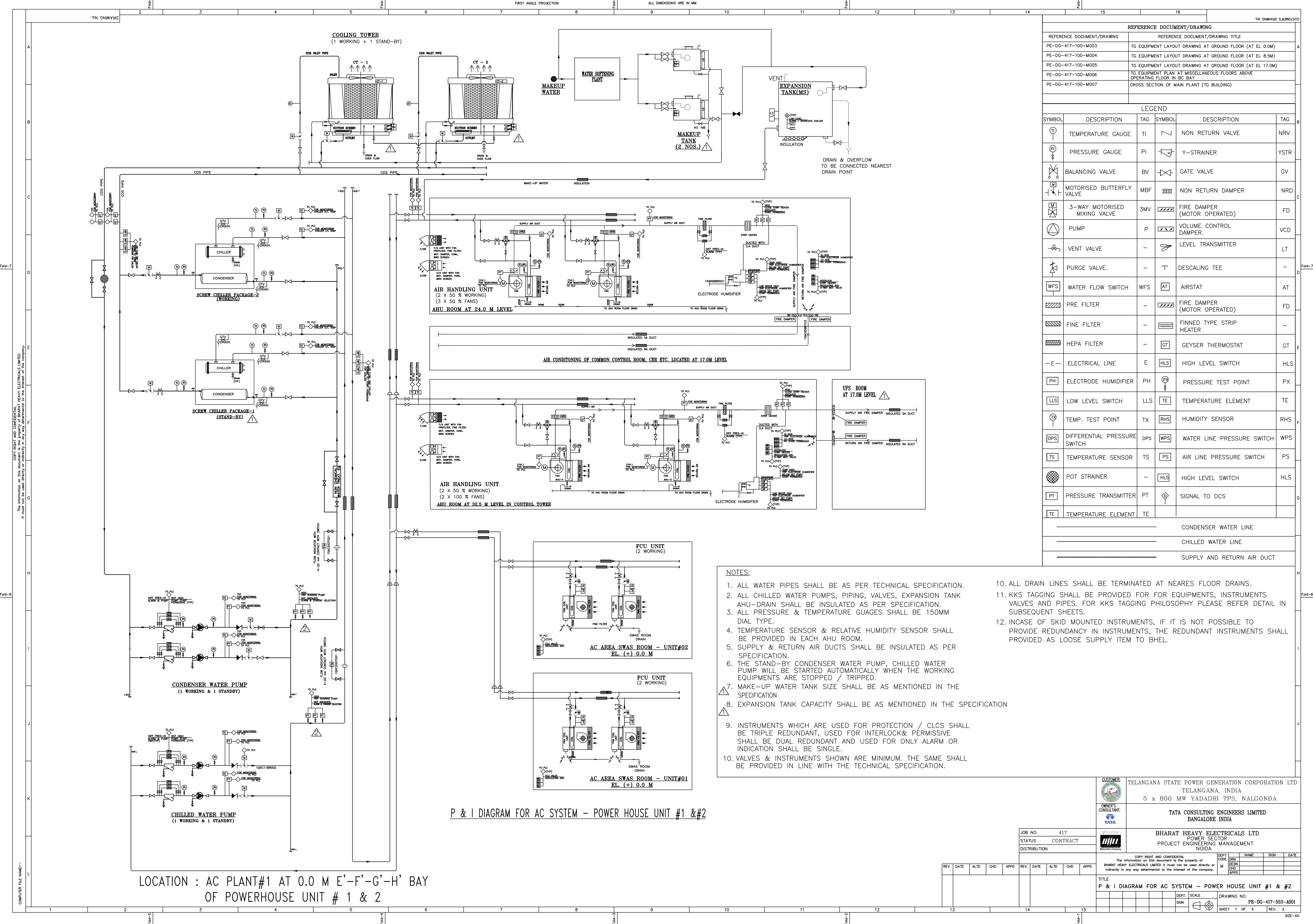
SECTION –I

REVISION 00

DATE: JULY 2020

SUB-SECTION –C1

**ANNEXURE-A: P&I DIAGRAM FOR AC PLANT & SCHEME
FOR WATER SOFTENING PLANT (6 SHEETS)**



REFERENCE DOCUMENT/DRAWING	
REFERENCE DOCUMENT/DRAWING	REFERENCE DOCUMENT/DRAWING TITLE
PE-DG-417-100-M003	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 0.0M)
PE-DG-417-100-M004	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 8.5M)
PE-DG-417-100-M005	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 17.0M)
PE-DG-417-100-M006	TG EQUIPMENT PLAN AT MISCELLANEOUS FLOORS ABOVE OPERATING FLOOR IN BC BAY
PE-DG-417-100-M007	CROSS SECTION OF MAIN PLANT (TG BUILDING)

LEGEND				
SYMBOL	DESCRIPTION	TAG	SYMBOL	DESCRIPTION
	TEMPERATURE GAUGE	TI		NON RETURN VALVE
	PRESSURE GAUGE	PI		Y-STRAINER
	BALANCING VALVE	BV		GATE VALVE
	MOTORISED BUTTERFLY VALVE	MBF		NON RETURN DAMPER
	3-WAY MOTORISED MIXING VALVE	3MV		FIRE DAMPER (MOTOR OPERATED)
	PUMP	P		VOLUME CONTROL DAMPER
	VENT VALVE	-		LEVEL TRANSMITTER
	PURGE VALVE.	-		DESCALING TEE
	WATER FLOW SWITCH	WFS		AIRSTAT
	PRE FILTER	-		FIRE DAMPER (MOTOR OPERATED)
	FINE FILTER	-		FINNED TYPE STRIP HEATER
	HEPA FILTER	-		GEYSERS THERMOSTAT
	ELECTRICAL LINE	E		HIGH LEVEL SWITCH
	ELECTRO HUMIDIFIER	PH		PRESSURE TEST POINT
	LOW LEVEL SWITCH	LLS		TEMPERATURE ELEMENT
	TEMP. TEST POINT	TX		HUMIDITY SENSOR
	DIFFERENTIAL PRESSURE SWITCH	DPS		WATER LINE PRESSURE SWITCH
	TEMPERATURE SENSOR	TS		AIR LINE PRESSURE SWITCH
	POT STRAINER	-		HIGH LEVEL SWITCH
	PRESSURE TRANSMITTER	PT		SIGNAL TO DCS
	TEMPERATURE ELEMENT	TE		

CONDENSER WATER LINE
CHILLED WATER LINE
SUPPLY AND RETURN AIR DUCT

CUSTOMER:		TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, NALGONDA
OWNER'S CONSULTANT:		TATA CONSULTING ENGINEERS LIMITED BANGALORE INDIA
JOB NO.		417
STATUS		CONTRACT
DISTRIBUTION		
Bharat Heavy Electricals Ltd		POWER SECTOR PROJECT ENGINEERING MANAGEMENT Noida

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		M		DES			
				CHD			
				APPD			
TITLE		P & I DIAGRAM FOR AC SYSTEM - POWER HOUSE UNIT #1 & #2					
		DEPT.	SCALE	DRAWING NO.			
		SIGN		PE-DG-417-553-A001			
		SHEET		1 OF 5		REV. 2	

REFERENCE DOCUMENT/DRAWING	
REFERENCE DOCUMENT/DRAWING	REFERENCE DOCUMENT/DRAWING TITLE
PE-DG-417-100-M003	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 0.0M)
PE-DG-417-100-M004	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 8.5M)
PE-DG-417-100-M005	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 17.0M)
PE-DG-417-100-M006	TG EQUIPMENT PLAN AT MISCELLANEOUS FLOORS ABOVE OPERATING FLOOR IN BC BAY
PE-DG-417-100-M007	CROSS SECTION OF MAIN PLANT (TG BUILDING)

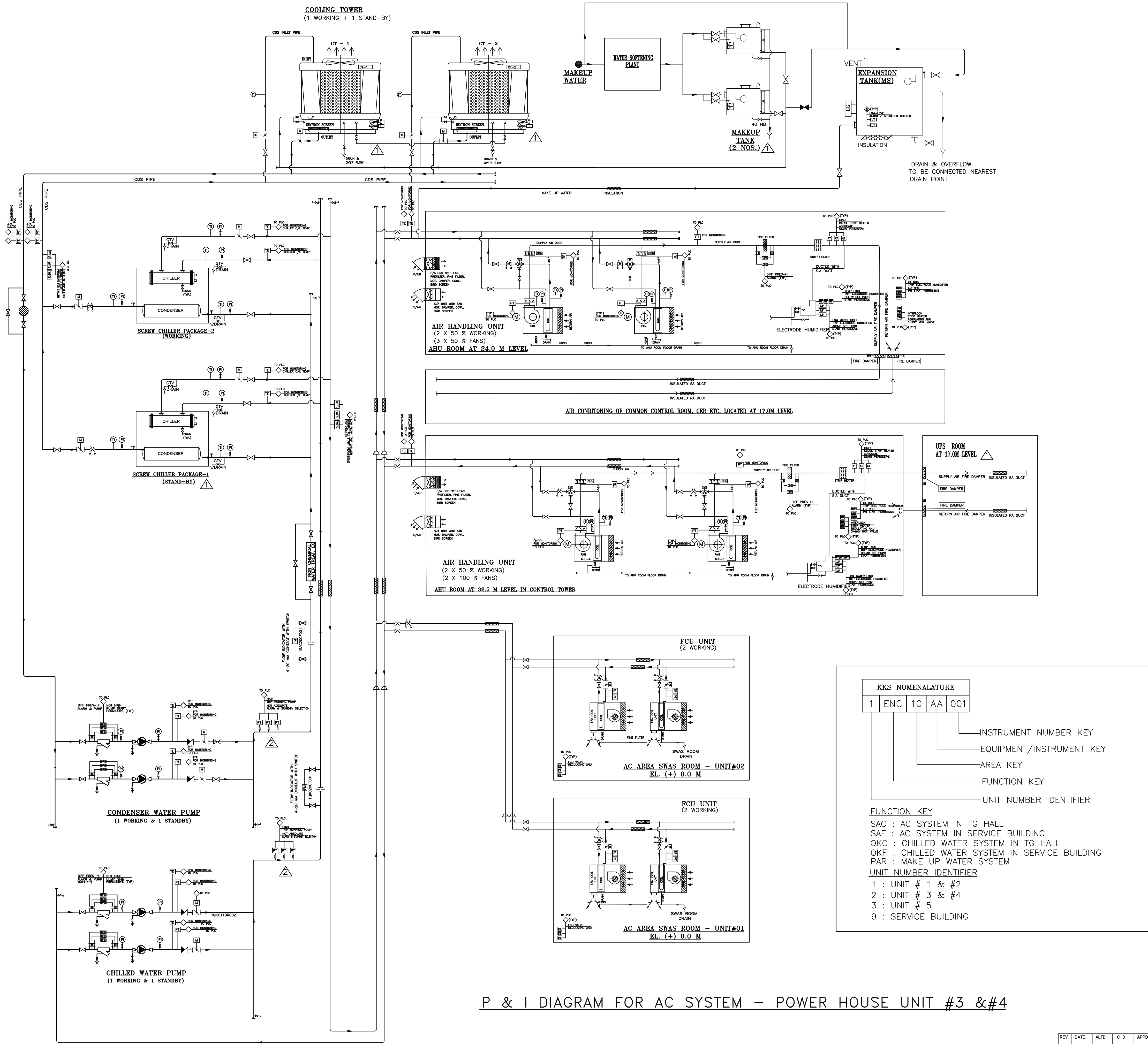
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1. FOR NOTES AND LEGENDS REFER SHEET 1 OF 5

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

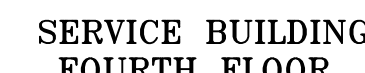
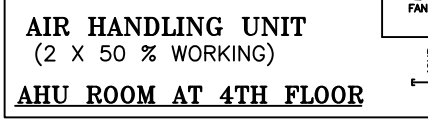
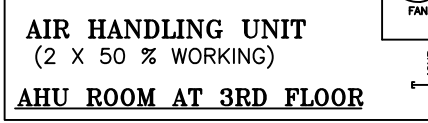
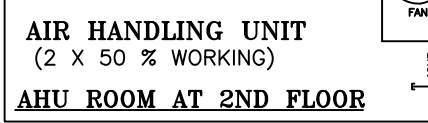
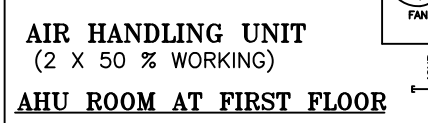
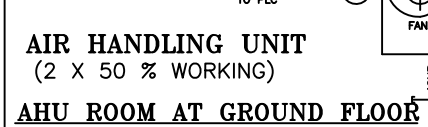
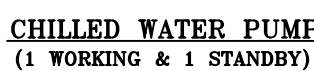
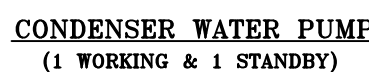
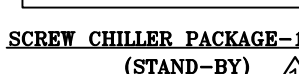
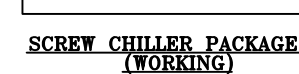
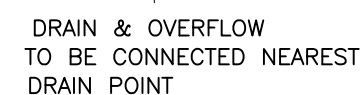
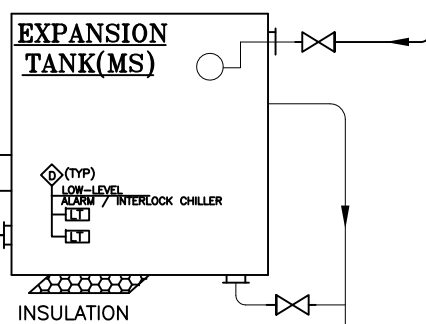
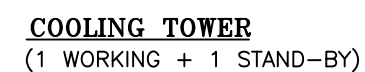
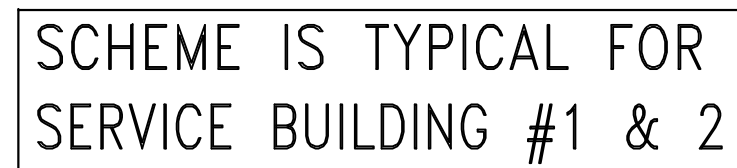
CUSTOMER 	TELANGANA STATE POWER GENERATION CORPORATION LTD				
	TELANGANA, INDIA				
OWNER'S CONSULTANT: 	5 x 800 MW YADADRI TPS, NALGONDA				
	TATA CONSULTING ENGINEERS LIMITED				
	BANGALORE INDIA				
 Bharat Heavy Company	BHARAT HEAVY ELECTRICALS LTD				
	POWER SECTOR				
	PROJECT ENGINEERING MANAGEMENT				
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	DEPT	CODE	NAME	SIGN	DATE
	M	DRN			
		CHD			
		APPD			
TITLE					
P & I DIAGRAM FOR AC SYSTEM – POWER HOUSE UNIT #3 & #4					
		DEPT.	SCALE	DRAWING NO.	
		SIGN		PB-DG-417-553-A001	
					
		SHEET	2 OF 5	REV.	2

P & I DIAGRAM FOR AC SYSTEM - POWER HOUSE UNIT #3 & #4

LOCATION : AC PLANT#2 AT 0.0 M E'-F'-G'-H' BAY
OF POWERHOUSE UNIT # 3 & 4



KKS NOMENALATURE				
1	ENC	10	AA	001
INSTRUMENT NUMBER KEY				
EQUIPMENT/INSTRUMENT KEY				
AREA KEY				
FUNCTION KEY				
UNIT NUMBER IDENTIFIER				
FUNCTION KEY				
SAC : AC SYSTEM IN TG HALL				
SAF : AC SYSTEM IN SERVICE BUILDING				
QKC : CHILLED WATER SYSTEM IN TG HALL				
QKF : CHILLED WATER SYSTEM IN SERVICE BUILDING				
PAR : MAKE UP WATER SYSTEM				
UNIT NUMBER IDENTIFIER				
1 : UNIT # 1 & #2				
2 : UNIT # 3 & #4				
3 : UNIT # 5				
9 : SERVICE BUILDING				



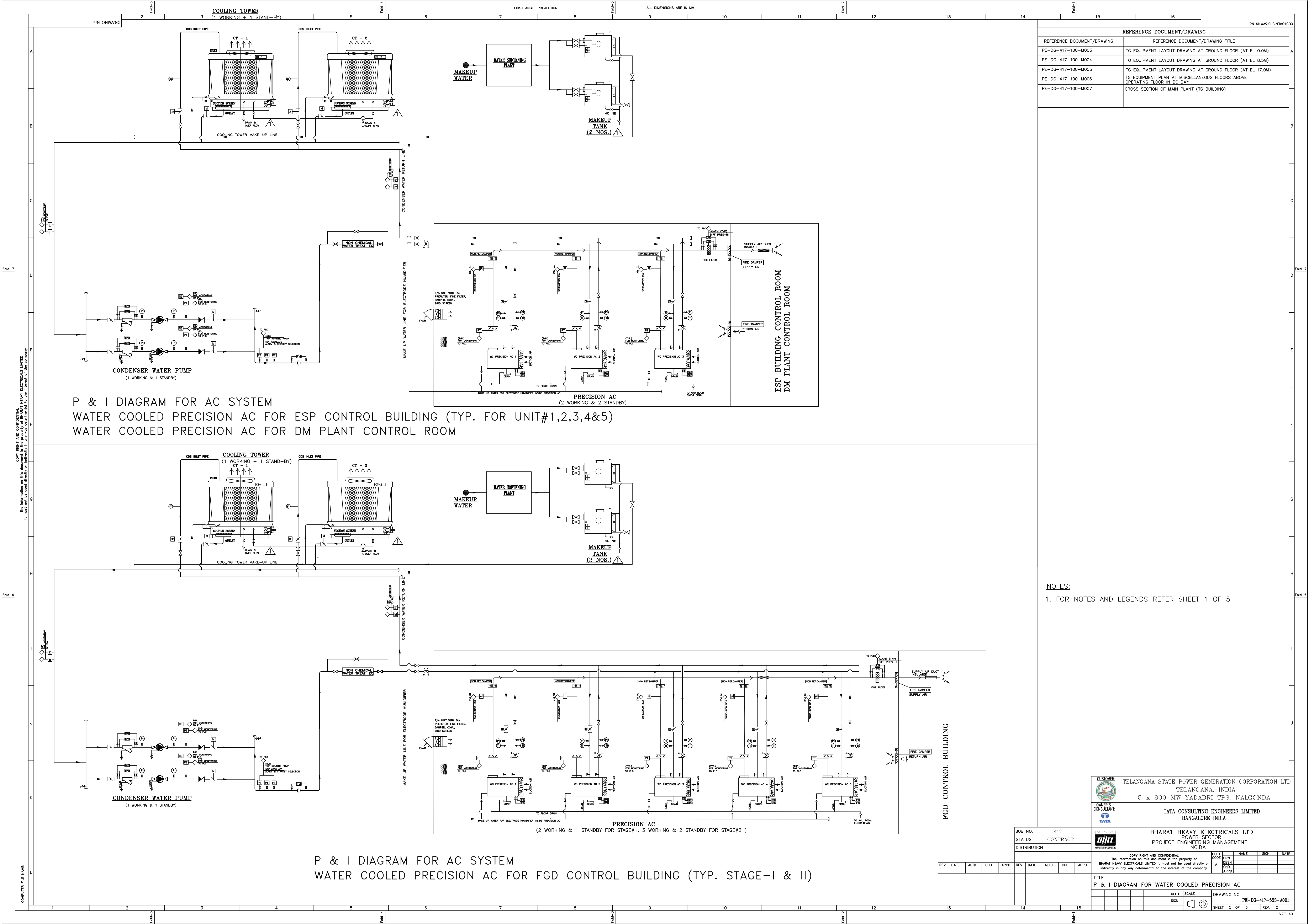
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PE-DG-417-100-M004	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 8.5M)
PE-DG-417-100-M005	TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR (AT EL 17.0M)
PE-DG-417-100-M006	TG EQUIPMENT PLAN AT MISCELLANEOUS FLOORS ABOVE OPERATING FLOOR IN BC BAY
PE-DG-417-100-M007	CROSS SECTION OF MAIN PLANT (TG BUILDING)

NOTES:

1. FOR NOTES AND LEGENDS REFER SHEET 1 OF 5

LOCATION : AC PLANT#4 & 5 AT 0.0 M
OF SERVICE BUILDING # 1 & 2

	TELANGANA STATE POWER GENERATION CORPORATION LIMITED TELANGANA, INDIA 5 x 800 MW YADADRI TPS, NAGANDA				
	OWNER'S CONSULTANT: 				
	TATA CONSULTING ENGINEERS LIMITED BANGALORE INDIA				
	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA				
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TITLE P & I DIAGRAM FOR AC SYSTEM – SERVICE DRAWING #1 & #2		DEPT M	NAME DINI DEVI CHID APPD	SIGN 	DATE
DEPT. SCALE SIGN			DRAWING NO. PG-DG-417-553-A001		
		SHEET 4 OF 5	REV. 2		



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Fold-5

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COMPUTER FILE NAME

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Fold-4

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Fold-1

Fold-1

NOTES:
1. FOR NOTES AND LEGENDS REFER SHEET 1 OF 5

CUSTOMER: 					TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, NALGONDA																
					OWNER'S CONSULTANT: 					TATA CONSULTING ENGINEERS LIMITED BANGALORE INDIA											
JOB NO. 417					 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA																
STATUS CONTRACT																					
DISTRIBUTION																					
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TITLE P & I DIAGRAM FOR WATER COOLED PRECISION AC															DEPT.	SCALE	DRAWING NO.	PR-DG-417-553-A001			
															SHEET	5	OF	5	REV.	2	
14				15																	

SIZE-A0



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

SECTION –I

REVISION 00

DATE: JULY 2020

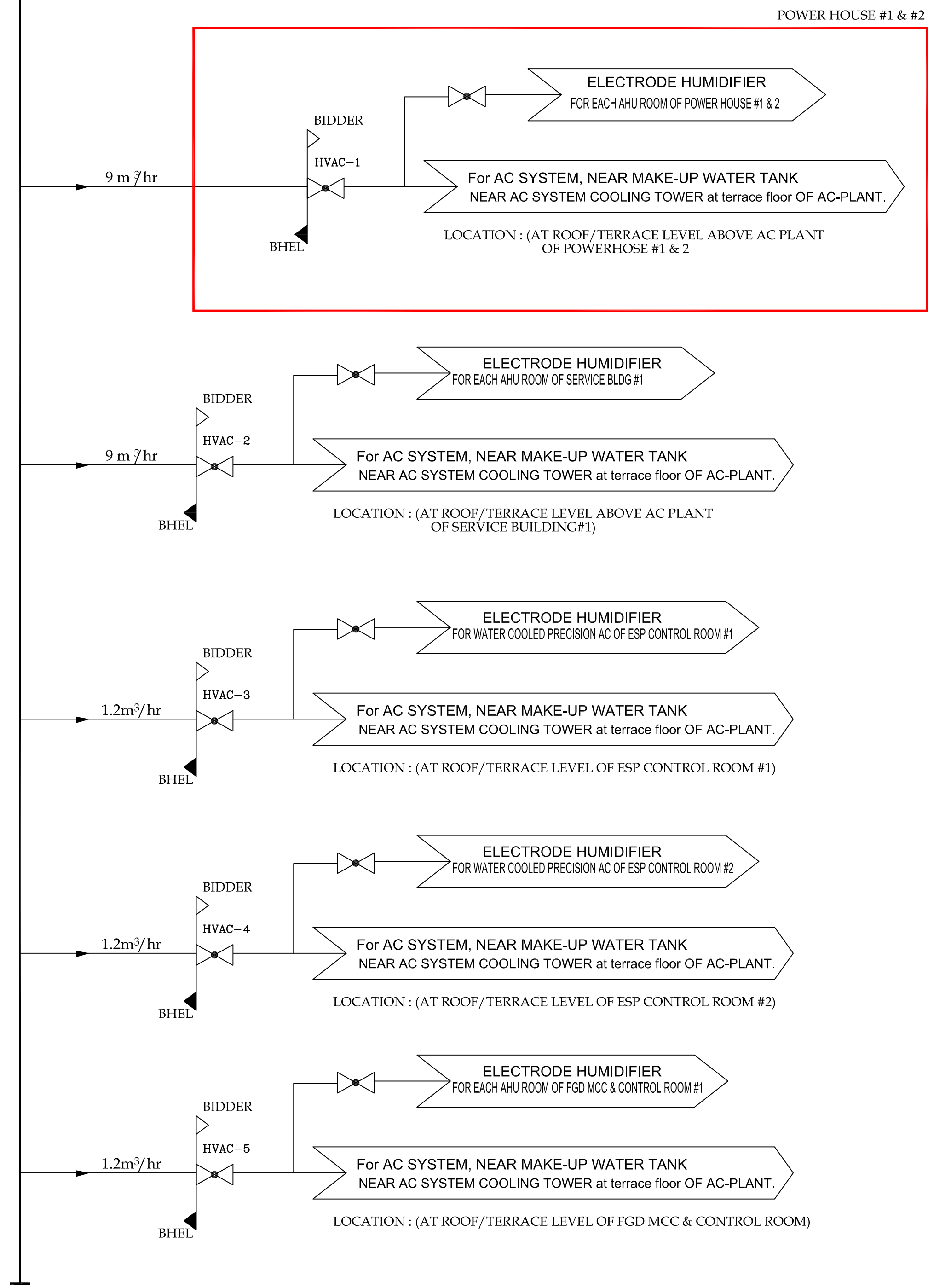
SUB-SECTION –C1

ANNEXURE-B: MAKE WATER SCHEME



REFER P&ID OF
PLANT WATER SYSTEM:

HVAC MAKE-UP (Clarified water)
FOR HVAC MAKE-UP
DISTRIBUTION AT VARIOUS
PLACES AND TERMINAL POINT
AS SHOWN IN DRG.



POWER HOUSE #1 & #2

ELECTRODE HUMIDIFIER
FOR EACH AHU ROOM OF POWER HOUSE #1 &

For AC SYSTEM, NEAR MAKE-UP WATER TANK
NEAR AC SYSTEM COOLING TOWER at terrace floor OF AC-PLANT.

LOCATION : (AT ROOF/TERRACE LEVEL ABOVE AC PLANT
OF POWERHOSE #1 & 2

ELECTRODE HUMIDIFIER
R EACH AHU ROOM OF SERVICE BLDG #1

For AC SYSTEM, NEAR MAKE-UP WATER TANK
NEAR AC SYSTEM COOLING TOWER at terrace floor OF AC-PLANT.

LOCATION : (AT ROOF/TERRACE LEVEL ABOVE AC PLANT
OF SERVICE BUILDING#1)

ELECTRODE HUMIDIFIER
R WATER COOLED PRECISION AC OF ESP CO

For AC SYSTEM, NEAR MAKE-UP WATER TANK
NEAR AC SYSTEM COOLING TOWER at terrace floor OF AC-PLANT.

LOCATION : (AT ROOF/TERRACE LEVEL OF ESP CONTROL ROOM #1)

ELECTRODE HUMIDIFIER
R WATER COOLED PRECISION AC OF ESP CO

For AC SYSTEM, NEAR MAKE-UP WATER TANK
NEAR AC SYSTEM COOLING TOWER at terrace floor OF AC-PLANT.

LOCATION : (AT ROOF/TERRACE LEVEL OF ESP CONTROL ROOM #2)

ELECTRODE HUMIDIFIER
FOR EACH AHU ROOM OF FGD MCC & CONTROL

For AC SYSTEM, NEAR MAKE-UP WATER TANK
NEAR AC SYSTEM COOLING TOWER at terrace floor OF AC-PLANT.

LOCATION : (AT ROOF/TERRACE LEVEL OF FGD MCC & CONTROL ROOM)

PIPE SIZE - CARBON STEEL

NB	OD (mm) MAX	THICKNESS (mm)
50	60.8	4.5
40	48.8	4
25	34.2	4

NOTE:-

1. FOR NOTES REFER SHEET 2 OF 2

 CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD 5 x 800 MW YADADRI TPS, NALGONDA	OWNERS CONSULTANT:  BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NALDA COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company.																				
JOB NO. 417 STATUS CONTRACT DISTRIBUTION	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>DEPT</th> <th>NAME</th> <th>SECN</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>M</td> <td>DEN</td> <td></td> <td></td> </tr> <tr> <td></td> <td>DES</td> <td></td> <td></td> </tr> <tr> <td></td> <td>CHD</td> <td></td> <td></td> </tr> <tr> <td></td> <td>APPD</td> <td></td> <td></td> </tr> </tbody> </table>	DEPT	NAME	SECN	DATE	M	DEN				DES				CHD				APPD		
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	CHD																				
	APPD																				

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TITLE
SCHEMATIC DIAGRAM FOR HVAC MAKE UP STAGE-I

DEPT	SCALE
SECN	

DRAWING NO.
PE-DG-417-554-A005

SHEET	1 OF 2
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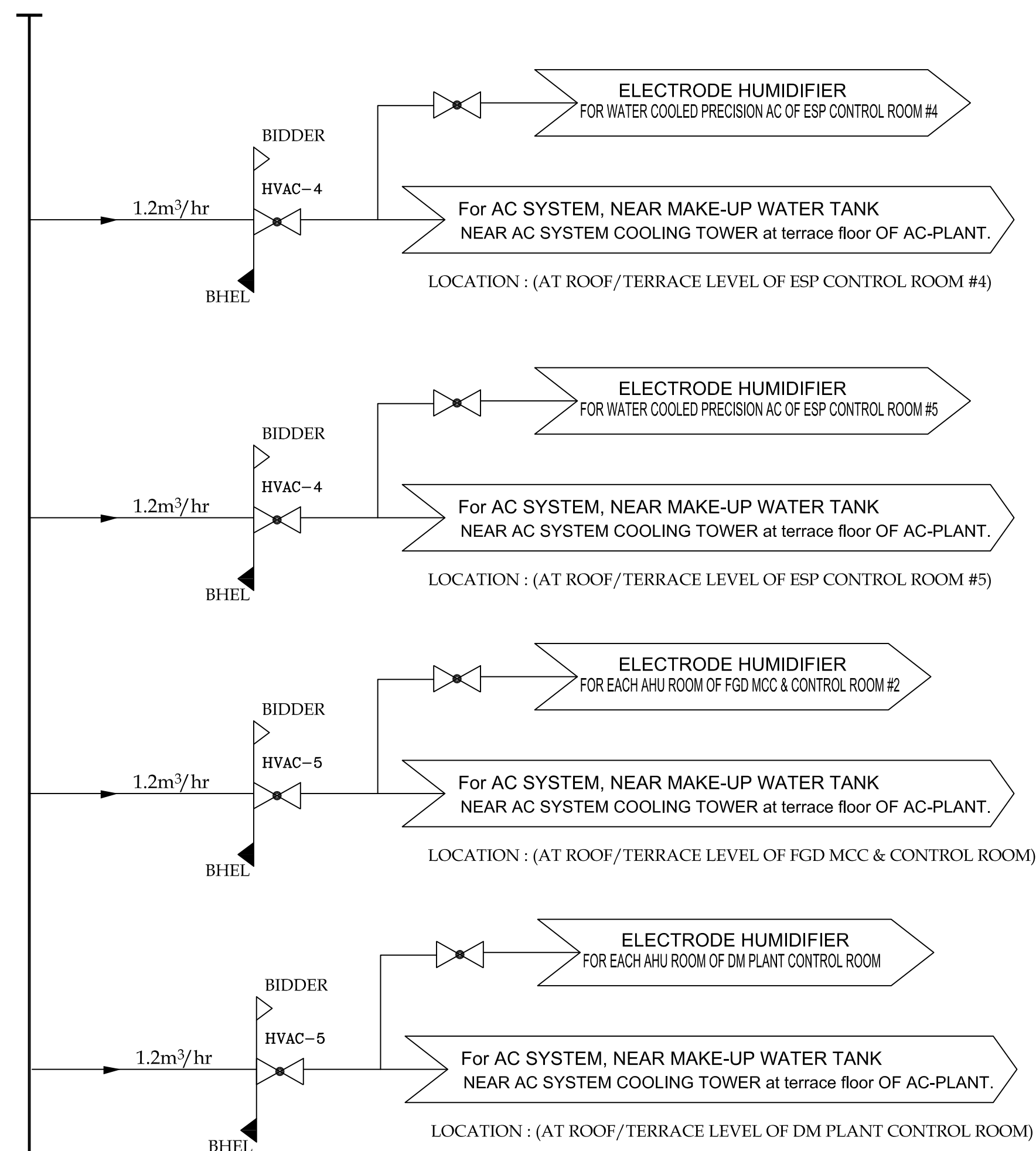
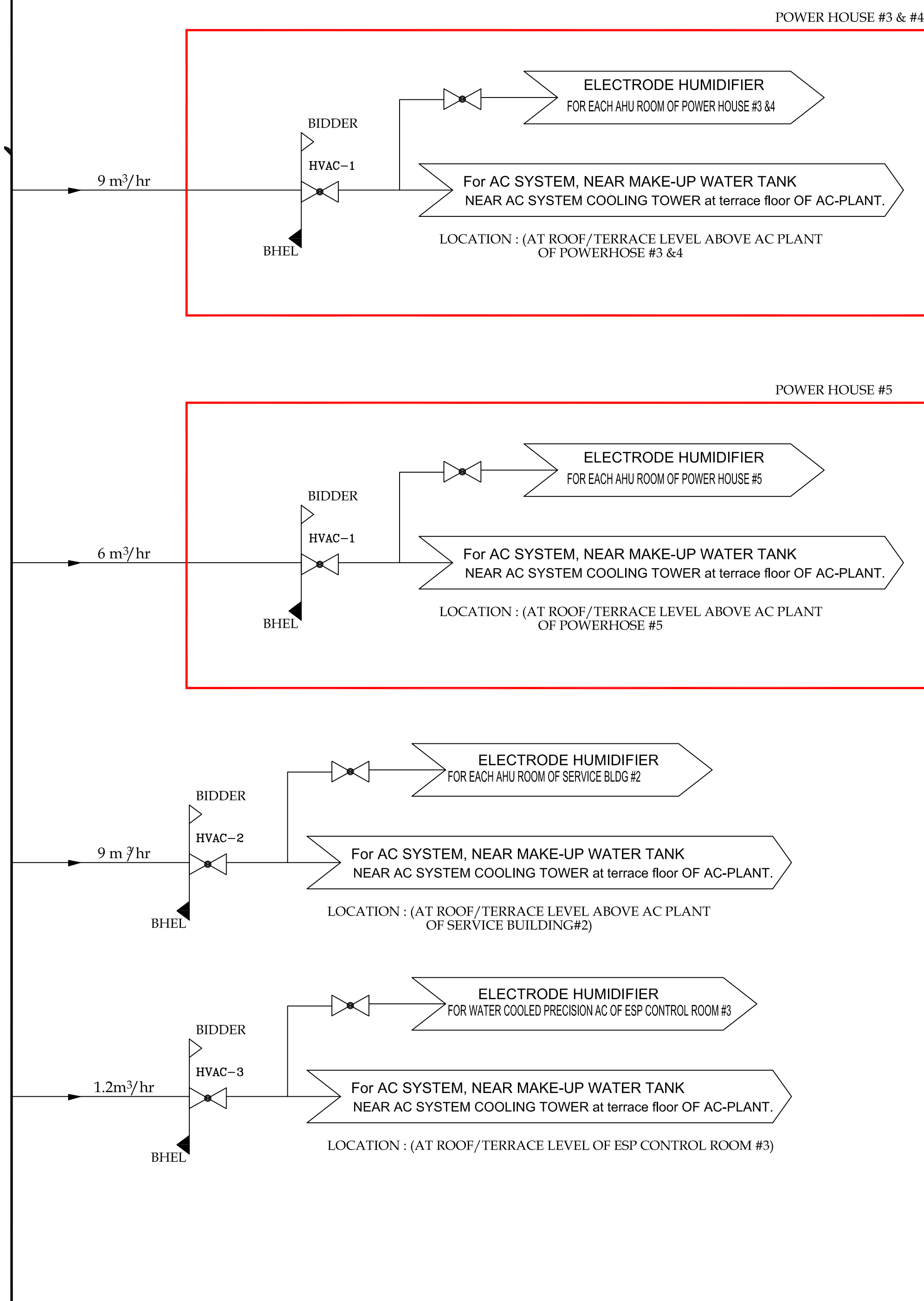
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SIZE-A0



REFER P&ID OF
PLANT WATER SYSTEM:

HVAC MAKE-UP (Clarified water)
FOR HVAC MAKE-UP
DISTRIBUTION AT VARIOUS
PLACES AND TERMINAL POINT
AS SHOWN IN DRG.



PIPE SIZE - CARBON STEEL

NB	OD (mm) MAX	THICKNESS (m)
50	60.8	4.5
40	48.8	4
25	34.2	4

NOTE:-

1. VOID
2. HVAC MAKE-UP WATER PIPING INCLUDING FITTINGS SHALL BE TERMINATED WITHIN THE RANGE OF 5 METER DISTANCE FROM WATER SOFTENING PLANT BY BHEL.
FURTHER PIPING SHALL BE DONE BY RESPECTIVE PLANT SUPPLIER AS MARKED IN THIS DRG.
3. HVAC MAKE-UP WATER PRESSURE at EACH TERMINAL POINT SHALL BE AVAILABLE 0.5 kg/cm2.

[illegible]



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

SECTION –I

REVISION 00

DATE: JULY 2020

SUB-SECTION –C1

**ANNEXURE-C: LOCATIONS OF AC PLANT ROOMS AND AREAS
FOR AIR CONDITIONING IN THE SERVICE BUILDING, ESP
BUILDING, FGD CONTROL BUILDING & POWER HOUSE.**

(PLEASE REFER SECTION-III, SUB-SECTION-7 FOR DETAILS)



**TECHNICAL SPECIFICATION FOR AIR
CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

SECTION –I

REVISION 00

DATE: JULY 2020

SUB-SECTION –C1

ANNEXURE-D: SYSTEM CAPACITY AND CONFIGURATION

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
1	AC-Plant-1 (TG Hall U #1 &2)	2 X 100 % water cooled screw chiller	300 TR(actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, chilled water pumps, condenser water pumps, AHU's, water softening plant, Make up water tanks, expansion tank etc. shall be sized according to the chiller capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) 2 X 50% AHU's (each AHU with 3 X 50 % centrifugal fans) shall be provided for air conditioning of the control room areas at 17M level of the main power house. c)2 X 50% AHU's (each AHU with 2 X 100 % centrifugal fans) shall be provided for air conditioning of the UPS room at 17M level of the main power house.
2	AC-Plant-2 (TG Hall U #3 &4)	2 X 100 % water cooled screw chiller	300 TR(actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, chilled water pumps, condenser water pumps, AHU's, water softening plant, Make up water tanks, expansion tank etc. shall be sized according to the chiller capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) 2 X 50% AHU's (each AHU with 3 X 50 % centrifugal fans) shall be provided for air conditioning of the control room areas at 17M level of the main power house. c)2 X 50% AHU's (each AHU with 2 X 100 % centrifugal fans) shall be provided for air conditioning of the UPS room at 17M level of the main power house.

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
3	AC-Plant-3 (TG Hall U #5)	2 X 100 % water cooled screw chiller	150 TR(actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, chilled water pumps, condenser water pumps, AHU's, water softening plant, Make up water tanks, expansion tank etc. shall be sized according to the chiller capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) 2 X 50% AHU's (each AHU with 3 X 50 % centrifugal fans) shall be provided for air conditioning of the control room areas & UPS at 17M level of the main power house.
4	AC-Plant-4 (Service Building #1)	2 X 100 % water cooled screw chiller	300 TR(actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, chilled water pumps, condenser water pumps, AHU's, water softening plant, Make up water tanks, expansion tank etc. shall be sized according to the chiller capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) 2 X 50% AHU's shall be provided for air conditioning of each floor of the service building.

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
5	AC-Plant-5 (Service Building #2)	2 X 100 % water cooled screw chiller	300 TR(actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, chilled water pumps, condenser water pumps, AHU's, water softening plant, Make up water tanks, expansion tank etc. shall be sized according to the chiller capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) 2 X 50% AHU's shall be provided for air conditioning of each floor of the service building.
6	AC Plant-6 (ESP Control Building -Unit # 1)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 20 TR (actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.
7	AC Plant-7 (ESP Control Building -Unit # 2)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 20 TR (actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
8	AC Plant-8 (ESP Control Building -Unit # 3)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 20 TR (actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.
9	AC Plant-9 (ESP Control Building - Unit #4)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 20 TR (actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.
10	AC Plant-10 (ESP Control Building -Unit # 5)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 20 TR (actual capacity)	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
11	AC Plant-11 (FGD MCC & Control Room (Stage#1))	5 Nos (3W + 2S) Water cooled precision type package AC	5 X 15 TR (actual capacity) *	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) The final capacity of the of each water cooled precision AC's shall be decided and finalized based on the input architectural drawings provided with the technical specification during detail engineering.
12	AC Plant-12 (FGD MCC & Control Room (Stage#II))	5 Nos (3W + 2S) Water cooled precision type package AC	5 X 20 TR (actual capacity) *	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) The final capacity of the of each water cooled precision AC's shall be decided and finalized based on the input architectural drawings provided with the technical specification during detail engineering.
13	AC Plant-13 (DM Plant Control Room)	3 Nos (2W + 1S) Water cooled precision type package AC	3 X 15 TR (actual capacity) *	a) Sizes of other equipment's of the AC plant viz. cooling tower, condenser water pumps, water softening plant, Make up water tanks etc. shall be sized according to the Precision AC capacity, Heat load calculations & technical specification. Minimum capacities specified in technical specification and price format needs to be adhered. b) The final capacity of the of each water cooled precision AC's shall be decided and finalized based on the input architectural drawings provided with the technical specification during detail engineering.
14	Administrative Building	Air cooled type package AC for each floor (3 x 50 % in each PAC room). There are two rooms on each floor.	a) 12 X 20 TR (actual capacity) on second and third floor (6 nos of each floor) b) 6 x 15 TR (actual capacity on first floor) *.	The final capacity of the Air cooled package AC's per floor shall be decided by bidder based on the input architectural drawings provided with the technical specification. Minimum capacities specified in technical specification and price format needs to be adhered.

ANNEXURE-D : SYSTEM CAPACITY & CONFIGURATION

Sl.No.	Location/Building	Equipment configuration	Capacity (Minimum)	Remarks
15	TG Hall Battery Charger Room at 8.5M	Cassette AC's (with 100 % standby)	Rating shall be decided during detail engineering	Air-cooled cassette type AC units consisting of condensing unit & evaporating unit including refrigerant pipes & fittings with insulation etc. Indoor unit of ceiling mounted casstte type unit (multi flow type) should have same decorative panel size regardless of their differece in capacity.
Notes				
1	The Air conditioning system equipment capacities and quantity provided above are minimum requirements. Although it will be endeavoured that there is no change in the capacities of main equipment yet in an unforeseen event of minor change in capacity of main equipment during detail engineering , the same shall be accommodated by bidder in already ordered prices.			
2	The Air conditioning system equipment sizes for all areas other than those mentioned above shall be decided during detail engineering .			



**CUSTOMER SPECIFICATION
FOR AIR CONDITIONING SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-553-A001

REVISION 00

DATE: JUN 2020

**SECTION: I
SUB-SECTION: C 2
CUSTOMER SPECIFICATION**

Kothagudem Air conditioning to be followed for Yadadri project also.
For configuration of various AC Plant, kindly refer Section I, Sub
Section - C1

VOLUME : IIID

SECTION-I

**TECHNICAL SPECIFICATION
FOR
AIR CONDITIONING SYSTEM**

VOLUME: IIID

SECTION - I

AIR CONDITIONING SYSTEM

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AIR CONDITIONING SYSTEM

1.00.00 **INTRODUCTION**

1.01.00 The purpose of the system is to provide Air Conditioning System for the different areas of 1X800 MW Supercritical Thermal Power Plant, Stage – VII Unit #12 at Kothagudem Thermal Power Station, Telangana.

Various control rooms in power station, housing a group of sophisticated and precision control panels and desks call for controlled environment for proper functioning and for the comfort of working personnel.

2.00.00 **SYSTEM DESCRIPTION**

2.01.00 The air conditioning system shall cover the following areas as a minimum:

- a. Power House Building including Control Room
 - i. Unit Control Room
 - ii. Control Equipment Room (CER)
 - iii. Shift Charge Engineers' Rooms
 - iv. Computer Room
 - v. Uninterrupted Power Supply (UPS) Room
 - vi. Steam and Water Analyzer (SWAS) Panel Room (Dry Panel)
 - vii. Excitation room
 - viii. AVR room
 - ix. Relay panel room
 - x. Other Office areas like Telephone Exchange Room, Conference Hall, library, Laboratory Rooms etc, if any, on the operating floor
- b. Service Building
 - i. Maintenance Office areas, conference rooms, lecture rooms and any other areas needs Air Conditioning.
 - ii. AC plant control room (in Central AC plant equipment room proposed to be located in ground floor of Service Building)
- c. ESP Control Room.
- d. VFD Control Room (if applicable)
- e. Ash Handling Plant Control Room
- f. DM plant control room, office and Laboratory area.