TELANGANA STATE POWER GENERATION CORPORATION LIMITED (TSGENCO)

5X800 MW TSGENCO YADADRI TPS (STAGE 2)

PART 2

TECHNICAL SPECIFICATION

FOR

VENTILATION SYSTEM

SPECIFICATION NO.: - PE-TS-417-554-A002
(REV 00)

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT

SECTOR-16A, PLOT NO.-25, NOIDA, INDIA

	TITLE: 5X800 MW YADADRI TPS TECHNICAL SPECIFICATINS FOR VENTILATION SYSTEM STAGE 2 (LOW SIDE)	SPECIFICATION No: PE-TS-417-554-A002
		SECTION
		REV. 00 / DATE: JUNE 23
		SHEET : 1 OF 2

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This Technical specification consists of two sections:

SECTION - I

SECTION - II

SECTION-I

SUB-SECTION-A

INTENT OF SPECIFICATION

1.0 INTENT OF SPECIFICATION

1.1 The specification covers 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, fill of lubricants, chemicals, reagents and consumables required for pre-commissioning, commissioning , performance testing and till one year of operation after handing over, 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 & preservation at site, in-site transportation, assembly, erection & commissioning, final painting at site, minor civil and structural work, trial run at site and carrying out Performance guarantee / Functional / Demonstration tests at site, training of customer/client O&M staff, operation and maintenance of the system till handing over and handover in flawless condition to BHEL's customer of **VENTILATION SYSTEM with mandatory spares** as per details in different sections / volumes of this specification and various pre award agreements for **5X800 MW YADADRI TPS TELANGANA.**

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/demonstration testing of **VENTILATION 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

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 documents or requirements of different codes and standards specified, Sub-Section - C shall prevail over Sub-section – D, however more stringent requirement 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 NIT.

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 मीटर METRES

प्रक्षणों पर आधारित BASED ON OBSERVATIONS 1975-2000

माह / MONTH		स्टेशन का सतह दाब / STATION LEVEL PRESSURE	वायु तापमान / AIR TEMPERATURE										आर्द्रता / HUMIDITY		मेघ की मात्रा / CLOUD AMOUNTS		वर्षा / RAINFALL						
			माध्य / MEAN						चरम / EXTREMES														
			शुष्क बल्ब DRY BULB	नम बल्ब WET BULB	दैनिक अधिक नम DAILY MAX	दैनिक न्यून तम DAILY MIN	माह में उच्चतम HIGHEST IN THE MONTH	माह में निम्नतम LOWEST IN THE MONTH	उच्चतम HIGHEST	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST	दिनांक और वर्ष DATE AND YEAR	सापेक्ष आर्द्रता RELATIVE HUMIDITY	वाष्प दाब VAPOUR PRESSURE	समस्त मेघ ALL CLOUDS	निम्न मेघ LOW CLOUDS	मासिक योग MONTHLY TOTAL	वर्षा के दिनोंकी संख्या NO. OF RAINY DAYS	वर्षसहित सबसे नम महीने का योग TOTAL IN WETTEST MONTH WITH YEAR	वर्षसहित शुष्कतम महीने का योग TOTAL IN DRIEST MONTH WITH YEAR	24 घंटोकी सबसे भारी वर्षा HEAVIEST FALL IN 24 HOURS	दिनांक और वर्ष DATE AND YEAR	माध्य पवन गति MEAN WIND SPEED
		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		प्रतिशत %	एच.पी.ए hPa	आकाश के अष्ठमाश Oktas of sky		मि.मि. mm		मि.मि. mm	मि.मि. mm	मि.मि. mm		कि.मी. प्र. घं. Kmph
जनवरी JAN	I	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	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	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	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	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	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	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	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	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	
अक्तूबर OCT	I	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	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	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	983.9	26.7	23.4	34.8	23.7	44.3	15.9	46.3	2	12.6	16	75	26.6	3.7	3.2	696.8	32.5	631.7	631.7	163.5	4	
	II								6	1998	12	1993							1982	1982	11	1987	
वर्षोंकी सं NUMBER OF YEARS	I	19	19	19	19	19	21	22	19		19		19	19	18	17	20	20	16	16	23		
	II																						

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : नलगोंदा
STAION : Nalgonda

माह / MONTH	मौसम परिघटना — के साथ दिनों की संख्या / WEATHER PHENOMENA — No. OF DAYS WITH						पवन — पवन की गती के साथ दिनों की संख्या (कि. मी. प्र. घं.) / WIND — No. OF DAYS WITH WIND SPEED (Km. p. h.)				पवन — पवन की दिशा के दिनों की संख्या का प्रतिशत / PERCENTAGE No. OF DAYS WIND FROM										मेघ — मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्ठमांश / CLOUD — No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS					मेघ — निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्ठमांश / No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS						दृश्यता — दृश्यता सहित दिनों की संख्या / VISIBILITY — No. OF DAYS WITH VISIBILITY				
	वर्षण 0.3 मि.मि.या अधिक / PFT 0.3 mm Or more	ओले / HAIL	गर्जन / THUNDER	कुहरा / FOG	धूल भरी आंधी / DUST STORM	चंड वात / SQU ALL	62 या अधिक / 62 Or more	20-61 / 20-61	1-19 / 1-19	0 / 0	उ / N	उपू / NE	पू / E	दपू / SE	द / S	दप / SW	प / W	उप / NW	शांत / CALM	0	ले-2 / T-2	3-5 / 3-5	6-7 / 6-7	8 / 8	0	ले-2 / T-2	3-5 / 3-5	6-7 / 6-7	8 / 8	कुहरा 8 / FOG 8	1 कि.मी. तक / UP TO 1 Km.	1-4 कि.मी. / 1-4 Kms.	4-10 कि.मी. / 4-10 Kms.	10-20 कि.मी. / 10-20 Kms.	20 कि.मी. से अधिक / 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
							0	0	31	0	0	29	10	51	3	1	0	4	2	25	2	3	0	1	27	1	2	0	1	0	0.0	1.8	3.1	24.1	1.9
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
							0	0	28	0	1	19	7	64	3	2	0	2	2	22	1	4	1	0	24	1	3	0	0	0	0.0	0.4	4.2	21.2	2.2
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
							0	1	30	0	2	12	5	69	1	4	0	5	2	26	1	2	1	1	27	1	2	1	0	0	0.0	0.3	4.4	24.2	2.1
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
							0	0	30	0	1	11	2	65	3	8	0	8	2	21	1	5	2	1	22	1	4	2	1	0	0.0	0.4	3.8	24.3	1.5
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
							0	0	31	0	1	20	2	29	2	19	2	24	1	6	2	18	3	2	20	2	5	2	2	0	0.0	0.6	3.6	24.4	2.4
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
							0	1	29	0	2	5	0	7	0	43	6	35	2	2	1	4	4	19	3	1	5	4	17	0	0.0	1.1	5.2	21.4	2.3
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
							0	0	31	0	0	3	0	3	0	40	9	43	2	1	0	3	4	23	1	1	3	4	22	0	0.0	1.7	4.7	22.4	2.2
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
							0	0	31	0	2	4	0	2	0	26	8	57	1	0	0	1	2	28	1	0	1	2	27	0	0.0	2.8	3.9	22.7	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
							0	0	29	1	4	17	1	10	0	25	6	31	6	1	0	2	3	24	2	0	2	2	24	0	0.0	1.3	4.5	22.2	2.1
अक्तूबर / 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
							0	0	30	1	2	37	6	26	1	7	2	12	7	22	1	3	2	3	23	1	3	1	3	0	0.1	1.5	3.9	23.6	2.0
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
							0	0	28	2	2	38	11	24	2	6	1	8	8	20	1	3	2	4	22	1	2	2	3	0	0.1	3.7	5.3	17.6	3.4
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
							0	0	30	1	1	55	7	28	1	1	0	3	4	23	2	3	1	2	24	2	2	1	2	0	0.0	4.6	3.3	21.9	1.1
वार्षिक योग या माध्य / ANNUAL TOTAL OR MEAN	33.3	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
							1	3	355	6	1	21	4	33	1	15	3	19	3	238	14	39	26	48	257	14	34	20	40	0	0.1	20.1	49.9	269.9	25.0
वर्षों की सं / NUMBER OF YEARS	22						22				22									21					21						22							

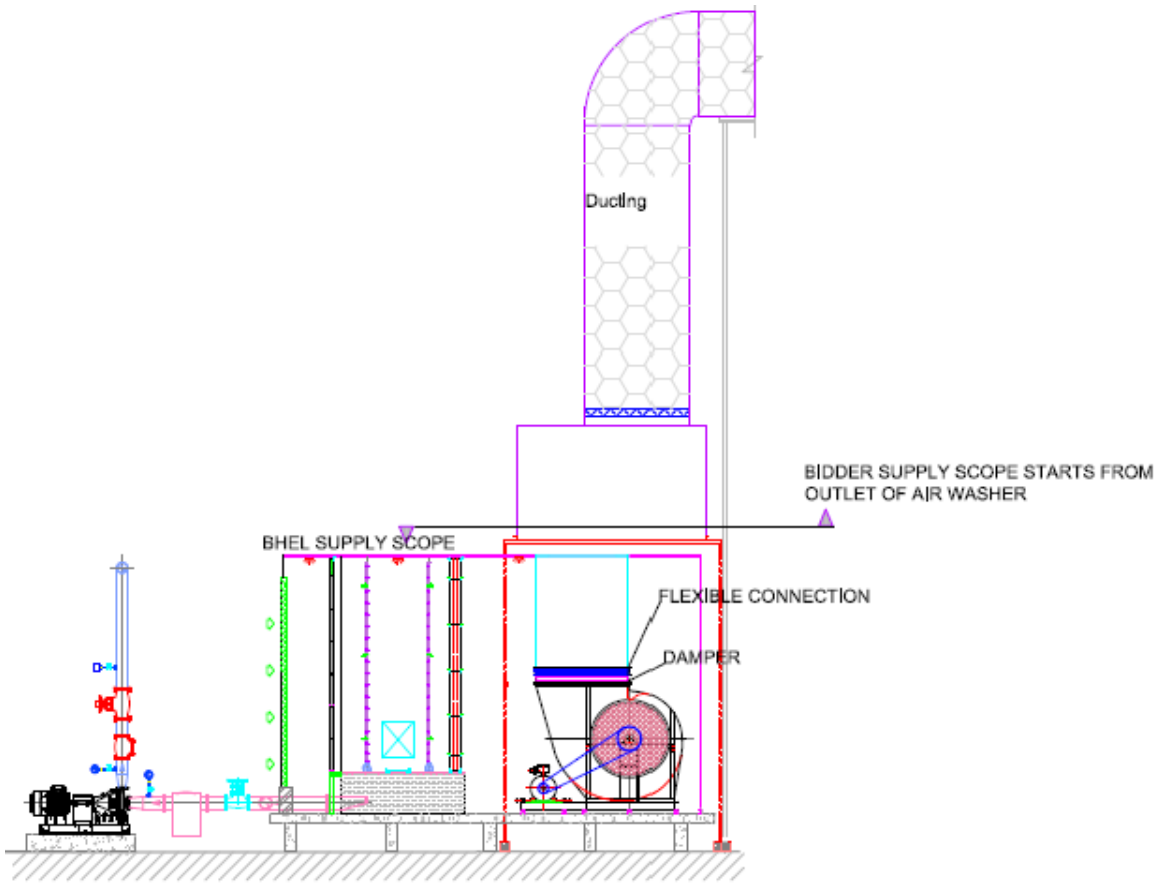
SECTION: I

SUB SECTION – C1A

SPECIFIC TECHNICAL REQUIREMENT FOR VENTILATION SYSTEM

1.0 SCOPE OF WORK

Typical Terminal points shall be as per below snap



Typical notes

E&C of whole Ventilation system in bidder scope

Flexible connection and Damper at FAN outlet shall be In BHEL scope .Connecting ducts shall be in bidder scope

a) Supply Scope

Following is in Bidder scope under supply part for the tender

Table 1

Sl no.	Equipment	Supply Scope	Attached reference Document
1	Ducting related	Manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, along with spares for erection as required, start-up and commissioning spares as required, forwarding, proper packing, shipment and delivery - **By Bidder**	Pl refer table 2 for list of drawings
a	GI/MS sheet		
b	Insulation		
c	Duct support		
d	Grills/Diffuser		
e	Back Draft Damper/ Gravity Damper		
f	Intake Louver		
g	VCD		
h	Other associated accessories		
2	Motorized Fire Damper /Fusible type Fire Damper		
3	Electrical items		
a	Junction box		
b	Branch Cable tray		
c	Conduits		
d	Cable Lugs		
e	Cable Glands		
f	Distribution board /panel ,if required		
4	Tools and Tackles		Pl refer price format
5	Any other item not mentioned directly but required to complete the Ventilation system	**By Bidder**	

b)Services scope

Following shall be services scope of bidder

Table 2

Sl no.	Equipment	Supply Scope	Service Scope	Attached reference Document
1	Air Washer & UAF consisting of following accessories such as tanks, Air washer casing, piping, Nozzles, Drift Eliminator, Air distribution plate, intake louvers etc	BHEL	Unloading, handling, transportation, storage & preservation at site, in-site transportation, assembly, erection & commissioning, final painting at site, minor civil work, trial run at site and carrying out Performance guarantee / Functional / Demonstration tests at site, training of customer/client O&M staff and handover in flawless condition of the package to the end customer - **By Bidder**	DATA SHEET & GA FOR AIR WASHER & UAF ALONGWITH FAN AND PUMP AIR WASHER LAYOUT ALONG A ROW AND B ROW P&ID DATA SHEET & GA FOR VALVES AND STRAINER
2	Pumps for UAF and Air washers	BHEL		
3	Centrifugal fan for AWU/UAF and its accessories	BHEL		
4	Valves/ Strainer/Piping	BHEL		
5	Motors for above fan and pumps	BHEL		DATA SHEET FOR MOTOR FOR FAN AND PUMPS
6	Pre-Filters	BHEL		DATA SHEET & GA FOR PRE AND FINE FILTERS FOR VENTILATION SYSTEM
7	Instrument such as transmitter, Flow meter, Temperature Gauge, Pressure indicator temp cum / Humidity sensor etc.	BHEL		INSTRUMENT SCHEDULE WITH TAG NUMBER DATA SHEET FOR INSTRUMENTS FOR VENTILATION SYSTEM
8	Insulation GI/MS sheet Duct support Grills/Diffuser All types of Dampers Intake Louver VCD Other associated accessories	Bidder		TYPICAL Details DUCT FABRC DRG / SUPPORT / EREC.FOR VENTILATION SYSTEM INSUL OF DUCT / PIPING & EQUIPMENTS PIPE ERECTION P&ID AND AIR DISTRIBUTION FAN SCHEDULE FOR LOUVER/DAMPER DATA SHEET FOR PIPE AND INSULATION. DUCT LAYOUTS/EQUIPMENT LAYOUT FOR POWERHOUSE AND ESP AREAS
9	Motorized Fire Damper /Fusible type Fire Damper	Bidder		DATA SHEET FOR FIRE DAMPER
10	Electrical items such as Junction box, Branch Cable trays, Conduits, Lugs, glands etc	Bidder		IO LIST, DRIVE LIST, DATASHEET OF MOTORS
11	Any other item not mentioned directly but required to complete the Ventilation system	Bidder		

Items/ equipment under BHEL scope of supply (being issued to the bidder as 'free issue' items) shall be handed over to the bidder at site. Bidder shall check and match required material as per shipping/packing list. In case any mismatch /shortfall in receipt of material is noticed by the bidder, the same shall be brought to BHEL site notice immediately. After receipt of the material, storage & preservations including ward and watch of the material issued to them by BHEL shall be under bidder's scope. Loss/ damage of material, if any after handing over the same to bidder shall be on bidder's account and shall be made good by bidder without any commercial impact to BHEL.

Bidder shall ensure their acceptance of the drawings attached with this specification for overall system integration and carrying out the performance test of the system. Discrepancy in the drawings, if any, noticed by the bidder shall be brought in notice of BHEL during pre-bid clarification stage.

Civil Requirements

Bidder to note that civil details have already been finalized based on attached mechanical drawings and are under various stages of construction by BHEL. Bidder to erect air washers/UAF and its associated systems such as pumps, piping, Valves trainer etc on already provided Civil inputs for powerhouse and ESP building. Any change required by bidder in these civil facilities during erection shall be carried out by bidder themselves.

S. No.	Equipment	Civil Foundation Details	Foundation Scope
Containerized Air washer with pump (outside AWU)			
a.	280000 CMH	AWU with Fan 8500x8500 mm Pump 2050 x950x350 mm	BHEL
UAF with pump			
b.	100000 CMH	UAF 4000x300x625(Ht)mm UAF Fan 2606x2536x600mm Pump 1800 x950x300mm	BHEL
C	Duct Support	Primary Duct support along 'A row' and 'B row'	BHEL
D	Duct Openings	Wall openings and Floor openings (as per attached drawing)	BHEL

Electrical & Control Requirements

Bidder to note that electrical and C&I details have already been finalized based on attached mechanical drawings. For supply of miscellaneous electrical items viz. cable lugs, glands etc. bidder may refer electrical drawings attached with this specification. Feeder details of motors and tentative BOQ of instruments to be erected and commissioned for the system is indicated in the table below.

Sr.	Items	Motor rating (Kw)	Configuration W-working S- Stand by
1.	Centrifugal fan (140000 CMH / 85 mm WC SP)	55	24 W
2.	Centrifugal pump (min 310 CMH / min 30 m head)	45	12 W+12 S
1.	Centrifugal fan (100000 CMH / 60 mm WC SP)	30	5 W
2.	Centrifugal end suction pump (min 77 CMH / 30 m head)	15	5 W+ 5 S

BOQ of Instruments to be installed and commissioned by bidder

Instrument type	**Tentative qty**
Differential pressure transmitter	**34**
Pressure transmitter for pump	**68**
Pressure transmitter for Fan	**58**
Level Transmitter for AWU tank	**34**
Flow meter in make up line	**17**
Humidistat (for LT,HT and Boiler MCC)/Temp cum RH Sensor	**20**
Temperature Gauge	**51**
Pressure Indicator	**68**
Temperature Indicator	**34**

E&C of Control cable locally i.e Instruments to junction box shall be in bidder scope

For scope matrix of Electrical items between BHEL & vendor, please refer attached table below:

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: VENTILATION SYSTEM

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL BHEL BHEL	 BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: VENTILATION SYSTEM

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

Specific Points to be taken care by bidder:

1) Supervision of erection and commissioning of Air washer /UAF, if required, shall be arranged by BHEL.
2) After erecting the equipment, Bidder shall integrate all Electrical and Control and instrumentation requirement at site for Air washers and UAF for smooth operation and arrange demonstration of PG test(approved document for the same is attached in drawings section.)Any item/ equipment not specifically mentioned in this tender but required for complete erection, commissioning and successful PG test of the system shall be in bidder's scope of supply.
3) Drawings such as of GA of Junction box, FGD building duct layout stage 2 etc shall be provided by bidder.

In addition to above, Bidder shall provide detailed fabrication drawing of ducting for the project .BOQ of which shall include size and quantity of Duct sheets , Cleats, Gaskets , nuts, bolts , Duct supports material , duct internal bracing material etc and shall be submitted to BHEL for review and approval.

2.0 SPECIFIC REQUIREMENTS

2.1 Design Criteria for Ventilation system:

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

i) Fire Dampers (Motorized type electrically operated) shall be provided in at the duct / Fan opening of Switch Gear Room. The operation of these automatic dampers shall be interlocked suitably with the Air-Conditioning system PLC system by clubbing of multiple fire dampers and cabling through junction box (bidder's scope). Fire dampers shall be fusible link type for Oil room

ii) The air washer shall have minimum 90% saturation efficiency and UAF shall have 60% saturation efficiency.

iii) Air Velocity through different system equipment should be maintained as follows:

a. Intake Louvers (except for AWU/UAF Units): 2m/s through face area (Max.)

b. Exhaust Louver: 2m/s through face area (Max.)

c. Volume Control dampers: 10m/s through face area (Max.)

d. Back Draft dampers: 5m/s through face area (Max.)

e. Moisture eliminators and Intake Louvers for AWU/UAF Units: 2.5m/s through face area (Max.)

f. Supply Air Grills: 6m/s through face area (Max.)

3.0 SYSTEM DESCRIPTION

3.1 The Ventilation System is provided in the following locations within the Power House by Air washers. Coursing of air in desired direction / areas shall be made by using roof extractors.

i) TG bay (ground, mezzanine and operating floor), HP/LP heater area, condenser area, Boiler feed pump area Oil cooler area

ii) MCC Rooms.

iii) Cable Spreader Rooms

iv) Switchgear Rooms

v) Battery Charger Rooms

Cooled and filtered air from Air Washer Unit shall be distributed by means of ducting to the TG building near various heat sources like turbo-generator, condenser, Boiler feed pump HP & LP heaters etc. The hot air from the hall shall be exhausted by means of roof extractors. The quantity of air exhausted should be kept lower than the quantity of air supplied (usually 60% of the supply air is exhausted) in such a way that a little over pressure is maintained inside the hall. This will reduce infiltration of outside hot and dusty air.

The supply air quantity is supplied from Four (4) nos. Packaged type AWU for TG Building provided for each unit

- 2 nos. being located outside A-Row of TG building at 0.0 floor; and
- 2 nos. being placed on B-C bay at 32.5M floor level

Such division and location area decided to achieve effective air distribution.

The Air Washer Units will primarily serve TG hall and the electrical areas like MCC Room, Switchgear Room, and Cable Spreader Room. The washed air supplied to MCC / Switchgear/Cable Spreader Rooms shall be exhausted outside through Back Draft Dampers. Fire dampers are provided in the supply air ducting leading to all electrical rooms (MCC, Switchgear etc.)

The supplied air in the lower level of TG hall after taking the heat load of TG bay rises through different openings to the upper floors and is then finally exhausted (60% of total supplied by Air washers) by means of roof exhausters placed over the roof of TG Hall. Some quantity of air leaks out through various leakage areas thus maintaining slight positive pressure inside w.r.t. outside.

These being package type of air washers placed, outside, exposed to ambient and hence shall be designed accordingly. Further the casing colour shall be similar to the TG building

cladding. Also the pump motors exposed of atmosphere shall be provided with IP-55 protection. Pump motor set shall be provided with canopy for protection from rain etc.

4.0 PLANT CONTROL FOR EVAPORATIVE COOLING AND VENTILATION SYSTEM

1. The operation of the Ventilation plant and associated Air washers/UAF shall be done from the PLC based control System which is common with air conditioning system (PLC shall be part of the air conditioning system package).

   - PLC based controls in the ventilation system is provided only for the air washers of the powerhouse building and UAF for ESP control building and FGD MCC cum control building.

2. Air washer units shall be started/stopped by initiation from air conditioning system PLC and the starting/stopping of fans and pumps shall be automatic upon such initiation.

3. There shall be inter-locking of the Fire dampers & AWU/UAF with the PLC panel of the air conditioning system (part of air conditioning system package) and the fire alarm panel (part of fire protection and detection system package).

4. The operation of the pumps shall be interlocked with the low level of water in the sump. High level of the sump shall be annunciated. The standby pump shall be started automatically when the working pump is stopped/tripped.

5. Auto/manual selector switches and working/standby selector switches for the pump shall be provided in the panel.

6. A selection switch enabling the running of AWU/UAF fan or pump alone shall be provided.

7. All instrument Air distribution for SOV shall be through SS manifold with SS isolation and auto drain traps

8. Solenoid valves, if applicable, shall be kept in pneumatic junction boxes only. SS tubing from SOV to valve shall not be more than 10 meters.

9. Miscellaneous control requirements

   a. Separate emergency local stop push button shall be provided for each pump, fans etc. of ventilation system.

   b. Lamps shall be provided for indicating the status of each pump, fans etc. of ventilation system in the main and local panel.

   c. All the annunciations related to failure of equipment, tripping of equipment, source of failure / reason due to which the equipment is stopped / tripped, low & high limits of parameters such as level, temperature, pressure drop, pressure etc. shall be provided for each pump, fan, AWU etc. in the respective panel.

8.0 ACCEPTANCE TEST

Temperature test at the out let of Air washer & UAF. Both DB and WB temperature shall be measured by measured by sling psychrometer which will have accuracy of +/-0.5% with at least count of 0.5 deg C. This will be carried out for 24 hrs. Continuously and readings will be taken every one hours interval. Standby equipment should be changed over during these 24 hours. This test shall be carried out during summer. The format for recording the readings is enclosed at Annexure C.

Performance test of the Ventilation system shall be carried out at site after proper installation. The site test shall include performance testing of equipment for 72 continuous hours in summer or monsoon and 24 continuous hours in winter. Bidder, as may be required to carry out site tests shall arrange all instruments, tools etc.

The following measurements are also to be done prior to the acceptance of the plant by the client:

01. Air Quantity measurement to be taken at the Inlet Louver to establish the Equipment capacity in line with the specification requirement.
02. Power consumption to be measured for each equipment to establish the total Guaranteed Power consumption.
03. Measurement of Noise and Vibration for different Equipment.
04. Establishment of the saturation efficiency for all the Air Washer and Unitary Air Filtration Units.
05. Design dry bulb temperature and relative humidity of conditioned air

Instruments required for performance testing of various equipment / system of the package shall be arranged by Vendor at site. All calibrated instruments to be used for the tests at manufacturer's works/site shall be arranged by the bidder. Any Electrical/C&I items and accessories like junction box, glands etc. shall be included by vendor in his scope.

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 equipment’s as per design basis / details furnished.

9.0 GENERAL

9.1 Drawings/documents required for scope of supplies under this contract, if any, shall be subject to customer approval during detail engineering stage.

9.2 All drawings and documents shall be computer based.

9.3 All commissioning spares & consumables for trouble free operation shall be provided.

9.4 Indicative list of makes is enclosed elsewhere in the specifications; however, this equipment's / items shall be subject to Customer & BHEL approval during detail engineering Stage.

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

9.6 Instrument for testing shall be calibrated by Ventilation plant supplier before taking up testing.

9.7 Inserts or any support arrangement for fixing ducting, fans, piping etc. shall not be provided by BHEL except for supporting structure mentioned in exclusion. Necessary supports may be taken from nearest structure / walls / roofs / floors etc. by Vendor.

9.8 Fixing frame works for diffusers and grilles in the scope of Vendor.

9.9 Anchor fastener shall be used by vendor for fixing duct pipes etc. wherever applicable.

9.10 Drain piping for ventilation equipment shall be terminated to the nearest drain by bidder.

9.11 The tools and machine required for erection of equipment shall be arranged by Vendor.

9.12 Tools & tackles as required for regular maintenance shall be supplied by Vendor.

9.13 Temperature gauges shall be provided with thermo wells and fixing arrangement.

9.14 Pressure gauges shall have provision for air venting. Three-way valves shall be used which shall have air venting provision.

9.15 Matching sockets/ stubs (weld type) for flow switches and other instruments shall be supplied.

9.16 Motorized fire damper will be installed at supply air duct in electrical areas like MCC / Switchgear room / cable spreader room etc. in power house building, ESP building and FGD MCC cum Control Building. Fire damper will close on receiving fire signal from fire protection system and shall also be possible manually from remote control panel. Also respective Air washers / UAFs shall trip on receiving fire signal from fire protection system.

9.17 All openings required in brick wall for ducting, louvers and damper etc shall be provided by BHEL as mentioned in this spec. Grouting of fans along with anchor fasteners shall also be done by bidder.

9.18 The openings shall be finished properly. In case openings are done once the wall have been painted, repainting, to match with the existing wall paint shall also be done by the bidder. Sealing of duct opening, grouting of foundation / foundation bolts etc. including special type of grouting like GPX2 etc. are in the scope of Ventilation system bidder.

9.19 Flat, platform type RCC / PCC foundation shall be provided for installing Air washer / UAF and UAF fan / pumps etc. Vendor shall fix the equipment using proper anchor fasteners to secure the equipment and obtain parameter related to vibration and noise.

9.20 All chemical, lubricants and consumables such as grease etc. required for pre-commissioning, commissioning, performance testing and till one year of operation after handing over shall be provided.

9.21 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.

9.22 Bidder should suitably group the signals coming from various instrument etc. and the same shall terminate in local JB, from Local JB common cable to PLC / 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. Only those items shall be provided free of cost which are categorically listed in the Electrical scope sheet of technical specification.

9.23 Feeder for a combination of fire dampers / valves etc. shall be derived from respective control panel by bidder. Distribution through junction box / distribution board shall be in bidders' scope and shall have provision for isolation of individual fire damper / valves. Suitable transformer shall be provided by bidder (if required) to derive the power input.

9.24 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.

9.25 Bidder 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%.

9.26 Secondary supports, anchoring/fastening, tie rods and other duct supports for the ducts along A-row and B –row in all areas of the plant shall be in bidder scope.

9.27 The guarantee tests shall cover but not limited to the following rated parameters for smooth operation of ventilation system.

- Design dry bulb temperature and relative humidity of conditioned air, Auxiliary power consumption, Vibration and noise level etc.
- Performance test of the Ventilation system shall be carried out at site after proper installation. The site test shall include performance testing of equipment for 72 continuous hours in summer or monsoon and 24 continuous hours in winter. Bidder, as may be required to carry out site tests shall arrange all instruments, tools etc.
- All calibrated instruments to be used for the tests at manufacturer's works/site shall be arranged by the bidder. Any Electrical/C&I items and accessories like junction box, glands etc. shall be included by vendor in his scope. Only those items shall be provide free of cost which are categorically listed in the Electrical scope sheet of technical specification.

10.0 EXCLUSIONS

Items of works listed below are excluded from scope of the Ventilation plant supplier.

10.1 Construction of foundations for Ventilation equipment's i.e, air washer unit and UAF along with pumps, roof/wall openings for dampers/louvres. The openings shall be provided by BHEL and its dimensions shall strictly be in accordance to the dimensions of dampers/louvres mentioned in this specification. Further, making good, the civil works after completion of erection of HVAC equipment's for all the areas in the scope of this specification, where bidder's equipment's are going to be installed is in bidder' scope

10.2 Slab cut out for running ducts, pipes, cables, grilles/dampers, cable trenches for above mentioned buildings. However, sealing of duct opening, grouting of foundation / foundation bolts etc. including special type of grouting like GPX2 etc. are in the scope of Ventilation system bidder

10.3 For C&I scope, refer C&I specification.

10.4 Primary Structure for running the ventilation ducting header outside 'A'- Row and along the B-row, however required inputs shall be provided by the bidder. Further the secondary supports, anchoring/fastening, tie rods and other duct supports for the ducts in all areas of the plant shall be in bidder scope. (Refer approved drawing)

	CUSTOMER SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS	DOCUMENT NO.: PE-TS-417-554-A002
		REVISION 00 / DATE: JUNE 23

SECTION: I

SUB-SECTION: C 2

CUSTOMER SPECIFICATION

	CUSTOMER SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS	DOCUMENT NO.: PE-TS-417-554-A002	
		REVISION 00	DATE: AUG 2022

SECTION: I

SUB-SECTION: C 2A

CUSTOMER SPECIFICATION-TECHNICAL REQUIREMENT

VOLUME: IIID

SECTION-II

TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM

test and Uniformity of Zinc coating as per relevant IS shall be conducted on cable tray and accessories.

8.02.12 Gauges, Switches, Instruments, etc.

Accuracy, calibration, repeatability, material, dimension, functional tests and other checks as applicable shall be checked.

8.02.13 Painting

Painting of all surfaces shall be checked for shade, surface finish, uniformity, coating thickness (DFT) and adhesion test/peal off test.

9.00.00 **FIELD TEST**

9.01.00 **Type Tests**

Bidder should have performed the applicable type tests as per the IS / applicable standards on various components of each type and rating. Reports not older than five years shall be submitted to this effect. All such type test reports shall be subjected to the approval of Purchaser. In case the bidder has to carry out these type tests, all such tests shall be done at bidder's risk and cost within the schedule specified herein. No deviation in this regard is acceptable.

9.02.00 **Field Test**

Overall performance of the ventilation system shall be tested after complete installation at site. This test shall be carried out to determine whether the plant meets the performance requirements specified here in and shall include measurements of all parameters under various outside conditions and establishment of correct supply of equipment. All testing and calibrating instruments required for this purpose shall be supplied by the contractor.

10.00.00 **PERFORMANCE GUARANTEE, TOLERANCE, PENALTY AND TEST RECORD**

10.01.00 The Tenderer shall have to guarantee the performance of individual equipment. The Tenderer shall also guarantee maintenance of the inside conditions and the minimum air changes as indicated under "design criteria".

10.02.00 The test shall be conducted at the manufacturer's works / site in accordance with the specification and if the shop / site performance tests indicate the failure of the guaranteed performance for the equipment concerned, it would be necessary for the manufacturer to make good the deficiency at its own cost by incorporating the necessary modification, alteration and replacement.

10.03.00 The additional test required to show the effect of such alteration shall be performed by the manufacturer at no expense to the purchaser.

10.04.00 **TEST RECORDS**

Refer PG/Demonstration test procedure in list of drawings for details

	CUSTOMER SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS	DOCUMENT NO.: PE-TS-417-554-A002
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SECTION: I

SUB-SECTION: C 2B

CUSTOMER SPECIFICATION-PROJECT SPECIFIC GENERAL REQUIREMENT

VOLUME : X

SECTION - I

PERFORMANCE GUARANTEES

CONTENT

VOLUME : X

SECTION-I

PERFORMANCE GUARANTEES

1.00.00 **PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE**

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.

b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

OR

ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

i) Mechanical Completion
ii) Preliminary Operation
iii) Initial Operation
iv) Reliability Operation
v) Trial Operation
vi) Performance Guarantee Tests

2.01.00 **Mechanical Completion**

(a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the

works.

(b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:

(i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.

(ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and

(iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00 **Specific Requirements of Mechanical Completion**

(a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:

(i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.

(ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.

(b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:

(i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.

(ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.

(iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.

(iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.

(v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.

(vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.

(vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.

(viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

2.03.00 **Other Prerequisites for Mechanical Completion**

The Contractor shall also meet the following prerequisites for mechanical completion:

(a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.

(b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.

(c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

(d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.

(e) All safety features and safety equipment are functional.

(f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.

(g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

2.04.00 **Preliminary Operation**

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

2.05.00 **Initial Operation**

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

2.06.00 **Reliability Operation**

(a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

(b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.

(c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.

(d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

(e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.

(f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.

(g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.

(h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

2.07.00 **TRIAL OPERATION:**

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.

2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.

3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.

5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.

6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

2.08.00 **Performance Tests**

(a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trail operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

(b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

(c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/'equipment' with the performance

guarantees.

(d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.

(e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.

(f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.

(g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.

(h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.

(i) It is Contractor's responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor's offer shall also be conducted.

(j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.

(k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.

(l) **Reporting of Test Results**

(a) Within two weeks after the conclusion of the performance test,

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

(b) The report(s) shall include as a minimum, the following:-

(i) Scope

(ii) Various guaranteed parameters & tests as per the contract.

(iii) Codes/standards used

(iv) . Description of the test procedures

(v) Full schematic diagrams with indication of test instruments locations and identification tags of same.

(vi) Instrumentation details and calibration.

(vii) Duration of test, frequency of readings and number of test runs

(viii) Test logs and summary of test readings used for performance calculations.

(ix) Full set of correction curves.

(x) Computation of test results.

(xi) Sample calculation

(xii) Performance calculation

(xiii) Computations to prove measurement uncertainty is within acceptable limits.

(xiv) Acceptance criteria

(xv) Any other information required for conducting the test

(xvi) Conclusions of performance tests.

(m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-

(i) That Purchaser concurs with the information provided in the test report(s), or

(ii) That Purchaser disputes some or all of the information provided

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

(n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.

(o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

2.09.00 **Delayed Tests**

(a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.

(b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

(c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

(d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.

Demonstrated without disturbing normal operation.

4.07.00 **Coal Handling Plant**

Refer Cl. No. 10.00.00 in Volume-IV-A.

4.08.00 **Water Treatment System**

Performance Guarantee of Chemical Feed System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-II-B of the EPC Bid Specification.

Performance Guarantee of Condensate Polishing System shall be in accordance with Cl. No. 8.04.00 in Section-VI, Volume-II-C of the EPC Bid Specification.

Performance Guarantee of River Water Pre-Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-I, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Demineralisation System shall be in accordance with Cl. No. 8.04.00 in Section-II, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Circulating Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-III, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Waste Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-III-C of the EPC Bid Specification.

4.09.00 **Instrumentation and Control**

The Bidder shall demonstrate that the Instrumentation and Control system meets all the functional/performance requirements, specified in technical specifications.

4.10.00 **Noise Level**

The Bidder shall demonstrate Noise Level of various plants/equipments/systems as per Clause no. 17.02.00 in Section-IV of Volume-II-A.

4.11.00 **Air Conditioning & Ventilation system**

The rating and performance figures of the AC & Ventilation system & equipment as indicated in the respective technical specification shall be guaranteed by the Bidder. In the event of any deficiencies in meeting the guarantees as indicated in the technical specification after conducting the performance test, the bidder shall put all his efforts to rectify the deficiencies or will replace the equipment / accessories to achieve the specified performance parameters within a reasonable time.

5 x 800 MW YADADRI TPS

SECTION IA

(GENERAL TECHNICAL REQUIREMENT)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
NOIDA-INDIA

GENERAL TECHNICAL REQUIREMENTS

components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.00.00 MATERIALS

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Owner to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.00.00 LUBRICATION

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.00.00 **LUBRICANTS AND CONTROL FLUIDS**

10.01.00 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of the unit.

10.02.00 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 **OPERATION AND MAINTENANCE**

11.01.00 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.

The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.

11.02.00 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

11.03.00 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

11.04.00 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

11.05.00 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

11.06.00 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.00.00 PLANT LIFE AND MODE OF OPERATION

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

Cold start-up (>72 hrs. shutdown)	:	6 per year
Warm start-up (between 10 to 72 hrs. of shutdown)	:	40 per year
Hot start-up (less than 10 hrs. shutdown)	:	160 per year

13.00.00 PACKAGING & MARKING

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

a)	Width of the Package (from centre-line of rails - 1.6 metres on both sides)	:	3.2 Meters
b)	Height of the package from rail top	:	4.47 Meters

The above indicates the dimensions which can be normally transported on the

wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

14.00.00 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of

piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

15.01.00 Environment Protection

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.

15.01.01 For Liquid Effluent

a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.

b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

15.01.02 For Air Emission

a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/Nm^3 (with worst coal and one field out at TMCR).

b) NO_x - 365 ppm Max. or 750 mg/Nm^3 (Equivalent NO_2).

c) SO_2 - Concentration based standard 2000 mg/Nm^3. Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

DOCUMENT DISTRIBUTION

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

a) Bidder shall apply in writing to Owner for handing over of the complete Control & Instrumentation System after successful demonstration of tests as specified up to "Availability Guarantee Test".

b) Owner shall take over charge of the C&I system subject to fulfillment of the conditions enumerated hereunder :

i) Site check-list prepared by Owner are fruitfully attended by Bidder and certified by Owner.

ii) Operation/ Instruction manuals are updated to incorporate changes made up to Availability Test Run.

iii) Drawings/ sketches are submitted as per Contract, on as- built basis.

iv) Close loop controls, Binary & Sequential controls should be working on auto and interlocks are demonstrated to be functional.

v) Equipment and system supplied by Bidder are in working condition.

vi) Short supply items, as per Contract, are refurnished by Bidder.

vii) The above conditions are in addition to fulfillment of any/all other contractual obligations of Bidder towards Owner. Partial handing-over of systems /equipments shall not be permissible, except if desired so by Owner in special cases.

11.00.00 TRAINING OF PERSONNEL

11.01.00 Bidder shall include in the proposal training of Owner's personnel of different categories for operation, maintenance and troubleshooting of the supplied equipment. Training courses shall be conducted by experienced personnel of Bidder. Course participants shall receive individual copies of technical manuals at the time the course is conducted. Upon completion of each course, training manuals shall be property of Owner. Bidder shall supply all updates and revisions to the manuals.

11.02.00 Training shall be provided to operating, programming and maintenance personnel. The training shall be conducted at original equipment designer / manufacturer's works. While the exact content and duration of such training shall be guided by Bidder's experience , following gives the basic and minimum requirement of operation and mainteanance , troubleshooting training from Owner's point of view.

11.03.00 PLANT OPEARTION TRAINING

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
12	Control Engineer	Main plant through DDCMIS OS	8 weeks each
16	Control Engineer	PADO System Usage	2 weeks each

	CUSTOMER SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS	DOCUMENT NO.: PE-TS-417-554-A001
		REVISION 00 / DATE: FEB 2020

SECTION: I

SUB-SECTION: C 2C

CUSTOMER SPECIFICATION-PAINTING SPECIFICATION

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a) SSPC SP 10 / NACE 2 /	:	Near White Blast Cleaning
b) SSPC PA 2	:	Measurement of dry film Coating Thickness with magnetic gauges.
c) ASTM D 4541	:	Method for pull off strength using portable Adhesion Tester.
d) NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings
e) NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

f)	NACE RP 0169 – 2002	:	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
h)	IS 3589:2001 Annexure B	:	Steel Pipes for Water and Sewage Specification.
i)	AWWA C222-2000	:	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
j)	IS 13213 : 2000	:	Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a hume pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of ±20% and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 $\sqrt{T}$ ± 10 percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.03.00 Adhesion Pull off Test :

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.03.02 Prepare the test surface :

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

	TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS	DOCUMENT NO.: PE-TS-417-554-A002	
		REVISION 00	DATE: AUG 2022

SECTION: I

SUB-SECTION: C3

TECHNICAL SPECIFICATION (C&I PORTION)

C&I TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM

Table of Contents

SECTION –C

SPECIFIC TECHNICAL REQUIREMENT

1. The bidder shall provide comp lete Instrumentation for control, monit oring and operation of entire Ventilation system. Items not specifically mentioned howe ver requ ired for the c ompleteness of th e system shall be supplied by bidder.

2. A common PLC based control system cum Annunciation panel with solid state annunciation windows along with product integrated microprocessor panel for the chiller unit shall be provided for the operation of Air Conditioning and Ventilation plant.

3. Common PLC for A ir-Conditioning a nd Ventilation System is be ing pro vided a nd P LC shall be supplied by Air-conditioning supplier. PLC based controls in the ventilation system is provided only for the air washers of the powerhouse building and UAF for ESP control building and FGD control building.

4. Supply air fans, e xhaust air fans / roof ex tractor uni ts of each area shal l be pro vided with their lo cal starter panel in BHEL's scope.

5. The v entilation system shall be c ontrolled from this co mmon Air Conditioning sy stem PLC panel. Bidder to fu rnish the list of driv es/motors/fans/pumps et c., Input/output Lists, Instrument list, Control philosophy etc. to be hooked up to the PLC panel and other necessary inputs so that necessary provision and hardware requi rement can be ensured at PLC panel by the AC syste m bidder for des igning and fabrication of its panel.

6. All transmi tters shall be smart t ype and shall ha ve 4-20mA DC sig nal w ith superimposed digital communication (HART). Each Temperature element sha ll be provided with compensating cable, JB/rack & oth er ere ction hardware. All tran smitters sha ll be fitted with a l ocal analog/digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.

7. Bidder to note that all the transmi tters/instruments supplied by Bidder sh all be ra ck mo unted. The racks shall be preass embled and provided b y Bidder. Also no i nstruments / an alysers & JBs/Ra cks should be
protruding on the walkway.

8. All field i nstruments/motor/pump/blower s hall b e termi nated on J unction box /Local contro l panel in field. A ll ere ction hardware including j unction bo xes/Local control pan el, canopies, s tructural steel , LI E, LIR, system cabinets are in bidder's scope. Number of junction boxes shall be sufficient and positioned in the fie ld to minimize local cab ling and trunk cable. 20% spare terminals s hall be provided in J unction Boxes.

9. Each instrument/ equipment shall have a unique KKS Tag No. Fi eld instru ment specification and respective data sheet are given elsewhere in this specification. Each valve/instrument shall be fitted with a stainless steel or aluminium nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.

10. Instruments must ha ve separate t apping poi nts. Sharing of the same tapping poi nts for redundant instruments or various different instruments is not acceptable.

11. The s cope of C&I cables and their erecti on & commissioning shall be as per Electrical sc ope sheet defined in Electrical specification.

12. Bidder shall provide Cable Schedule in BHEL excel forma t whic h shall be pro vided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope as per

Electrical scope between BHEL and Bidder.

13. The solenoid operated valves/Dampers/Gates shall have limit switches for open/close feedback. Operating coil voltage of solenoid valve shall be 24 V DC.

14. Instrument installation and accessories required shall be in Bidder's scope. Bidder shall submit 'Instrument Installation Diagram' and same shall be subject to customer approval during detail engineering without any commercial and time implication.

15. All manual valves at pump discharge shall be provided with Open and Close Limit Switches.

16. All the root valves shall be in bidder's scope. Double root valve shall be provided for all pressure tapping where the pressure exceeds 40kg/cm2.

17. Electrical Actuators shall be with integral starter. Datasheets and specifications are given elsewhere in the specification.

18. Redundancy of sensors shall be provided by bidder as given below, irrespective of the instrumentation shown in P&ID:
Two out of three measurements philosophy shall be adopted for all CLCS and Protection for reliability of operation. The control system shall select the median value for the normal control purpose. In case of deviation of one transmitter output from the other two, the same shall be automatically isolated and average output of the remaining transmitters shall be fed to the control and measurement system and the control loop in this case shall be maintained on auto, with an alarm on the operator's work station as well as engineer's station. In case of failure of the two remaining transmitters in circuit, deviation of one transmitter output is more than the preset limit compared to the other transmitter, there shall be automatic bump less transfer to manual and change overs shall have suitable alarms in the operator's work station as well as engineer's station. For signal compensations, separate signals from separate tran smitters other than used for measurement & control shall be used. For OLCS all sensors used for the protection shall be triple redundant. All sensors for permissive and interlock shall be dual redundant.

19. The bidder shall provide critical group alarms to be hardwired to plant DCS.

20. All the fire dampers offered by the bidders shall have the necessary provisions to accept the fire signals so as the damper gets closed in the event of fire.

21. Bidder to furnish electrical/ UPS load data in his proposal.

22. Interface of MCC, field instruments, Solenoid valve/actuators etc. with PLC/ DDCMIS based control system shall be as per Drive Control Philosophy enclosed in Section-D.

23. 230 V AC UPS supply/ 415 V AC shall be provided by BHEL at a single point as per 'Electrical scope split sheet' in Electrical portion of the specification. Further distribution to various instruments/Equipment shall be in Bidder's scope. Bidder to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Bidder's scope.

24. The quantity of instruments for the system shall be as per tender P &ID of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the

bidder, even if the same is not specifically appearing in the P & ID and as per detailed specification. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

25. The specifications for instruments mentioned in the specification are minimum requirements. Datasheets of instrument shall be subject to customer/owner approval.

26. The requirements given below are to be read in conjunction with detailed Technical specification enclosed.

27. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty.

28. The make/model of various instruments/items/systems shall be from approved sub-vendor list subject to approval of owner/purchaser. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

29. Generally, equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of three years' operational use on similar projects.

30. Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification.

31. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.

32. Bidder shall provide the signal exchange list, to Plant DCS in BHEL prescribed format to be furnished during detailed engineering.

NOTES:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.

2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

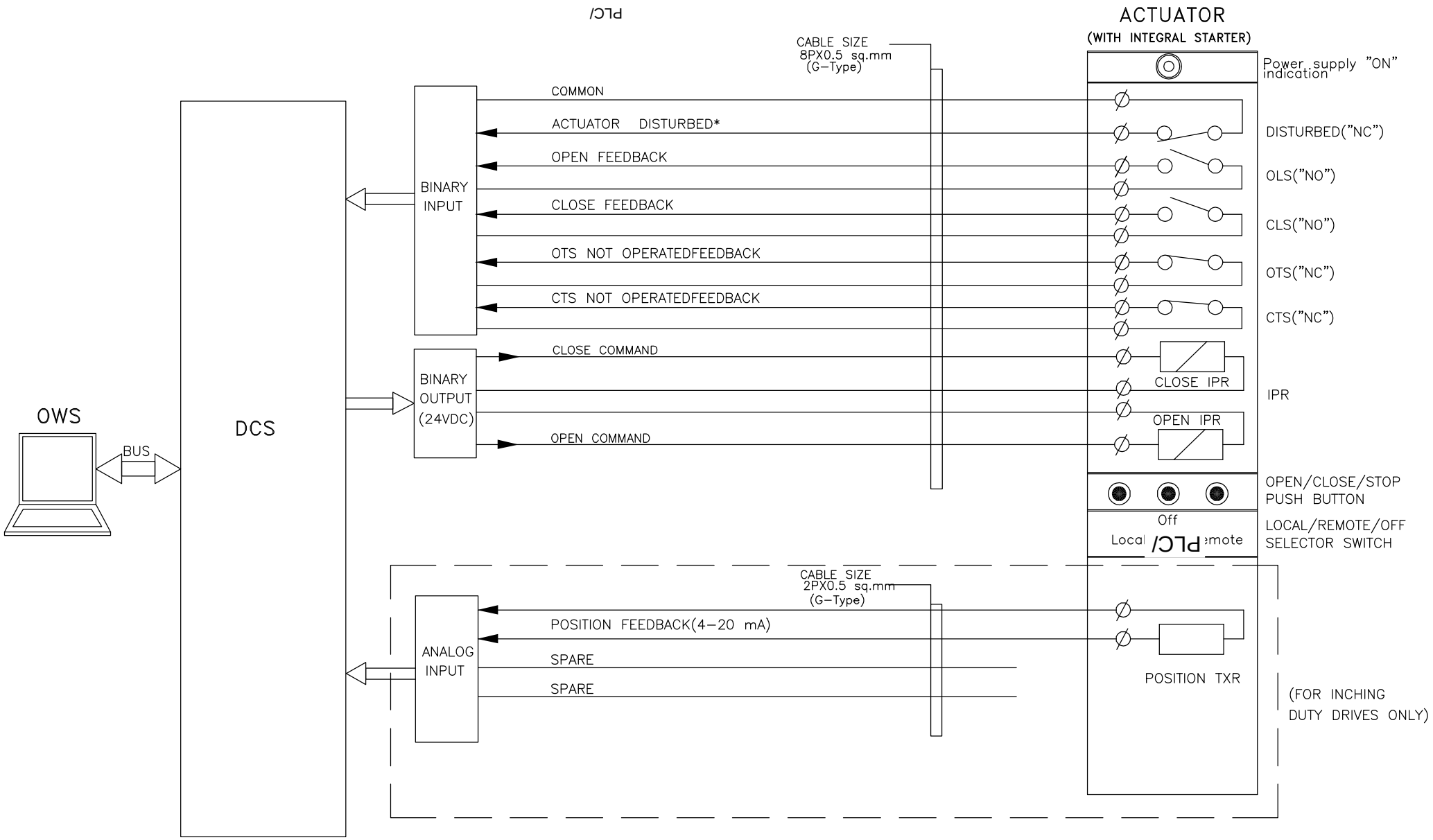
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.

CABLE BOQ

CABLE SIZES FOR 5X800 MW YADADRI TPS	
SI no.	Cable Type
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
	CONTROL CABLE
1	5C x 2.5 sq mm
2	12C x 2.5 sqmm

Drive Control Philosophy

DCS INTERFACE FOR BIDIRECTIONAL DRIVE (WITH INTEGRAL STARTER)

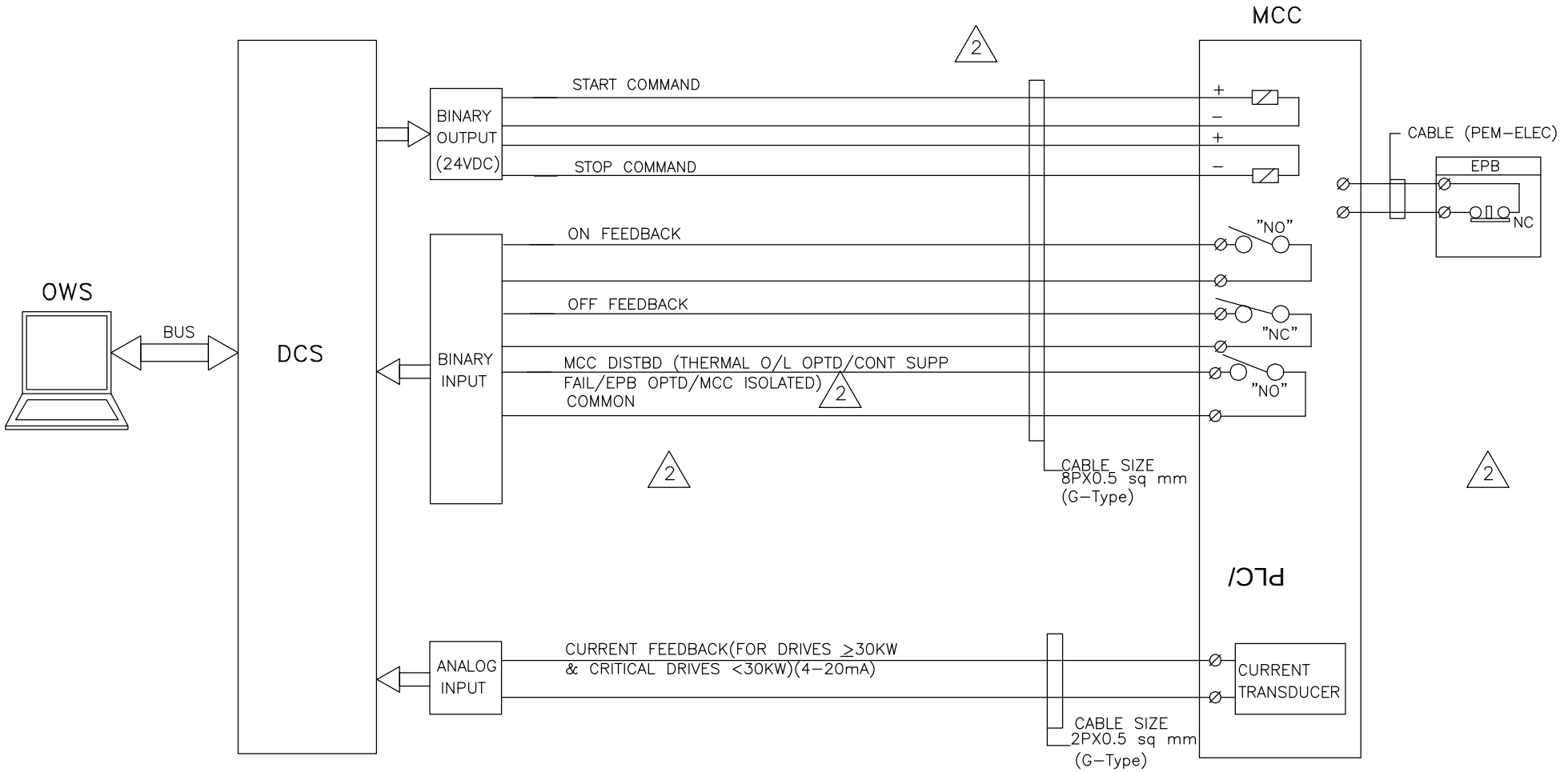


NOTE:

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply/ Motor thermostat trip/ Thermal over load/Torque open/close cutoff Local/Off/Remote Sel. switch Stop PB optd.

	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO 5	DRG.NO.	PE-DM-417-145-I002
		DATE	06.12.2019
	TITLE: DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE	REV.NO.	03
		SHT	7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



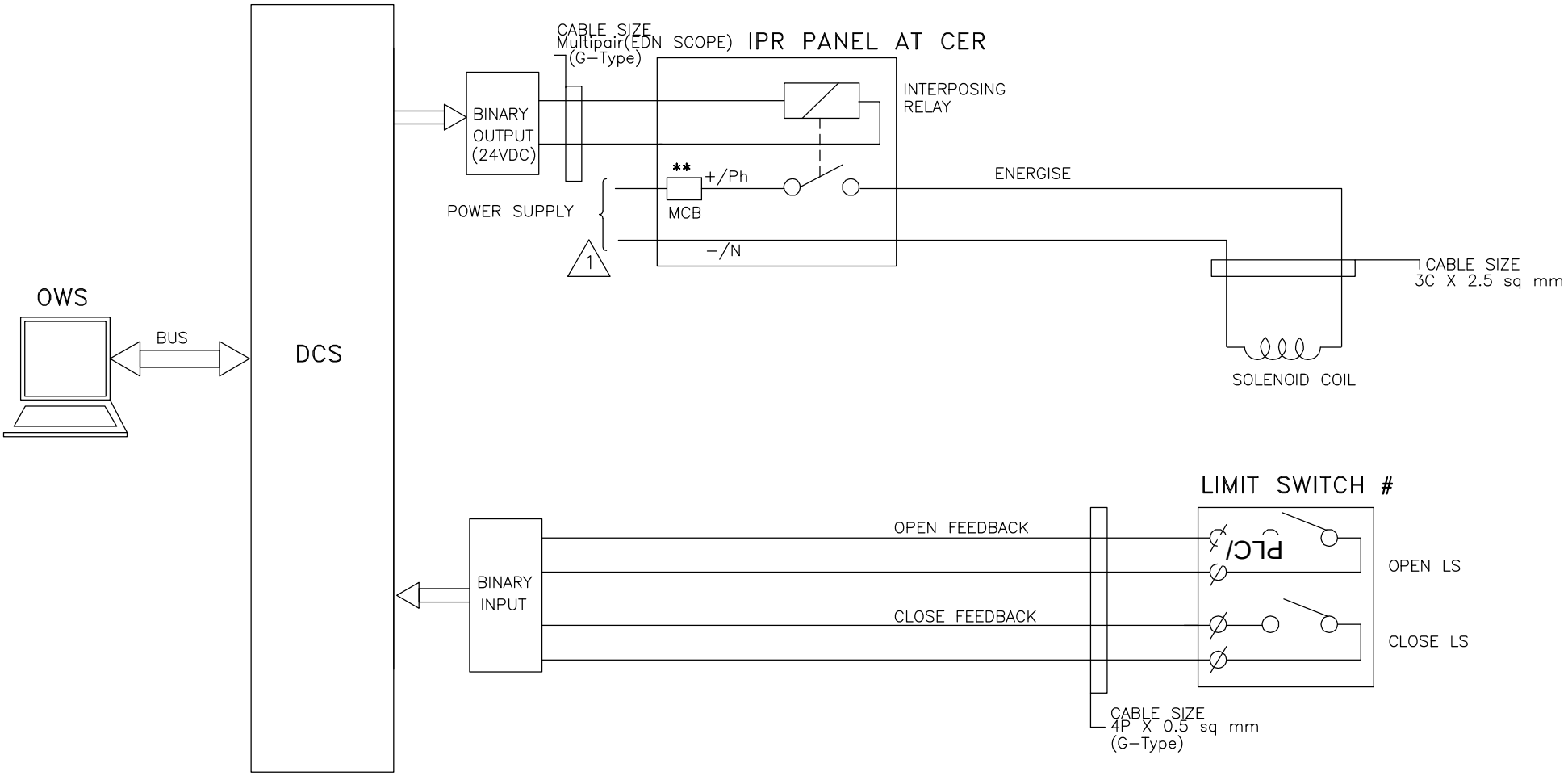
NOTE:–

1) EPB OF RESPECTIVE DRIVE WILL BE MOUNTED NEAR TO DRIVE ONLY.

2) 4–20mA CURRENT TRANSDUCER SHALL BE CONSIDERED. FOR LTUDs >30 KW AND IMPORTANT DRIVES, LUBE OIL PUMPS (REFER CLAUSE D, SHEET 6 OF 11)

BHEL PSER	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO PLC/	DRG.NO.	PE–DM–417–145–I002
		DATE	06.12.2019
	TITLE: DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	03
		SHT	8 OF 11

DCS INTERFACE FOR SOLENOID DRIVE
(24V DC / 240V AC UPS)



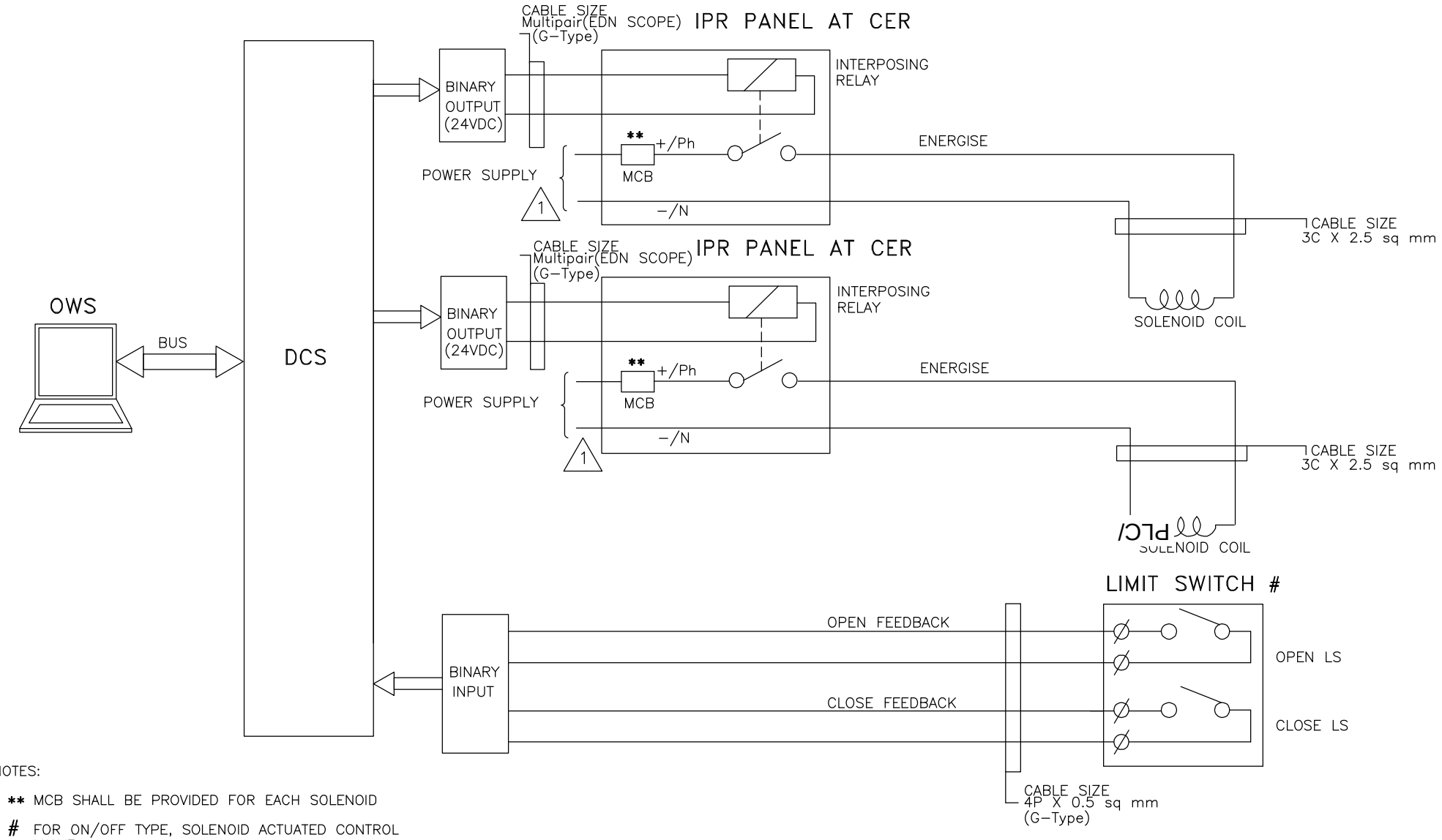
NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 5	DRG.NO.	PE-DM-417-145-I002
		DATE	06.12.2019
	TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE (SINGLE COIL)	REV.NO.	03
		SHT	9 OF 11

DCS INTERFACE FOR SOLENOID DRIVE
(24V PLC/ DC / 240V AC UPS)



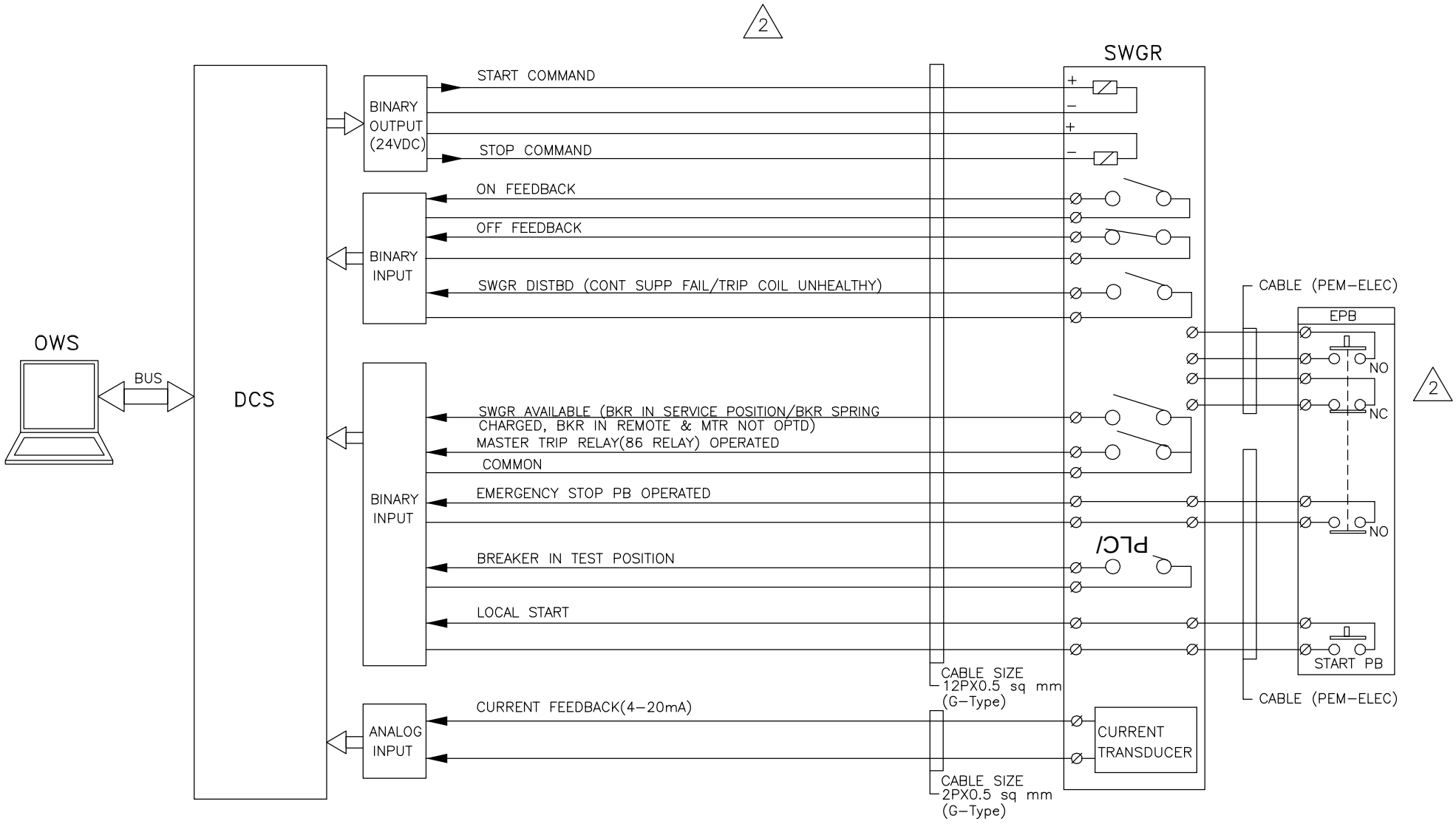
NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

BHEL	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # PLC/ 5	DRG.NO.	PE–DM–417–145–I002
		DATE	06.12.2019
	TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE (DOUBLE COIL)	REV.NO.	03
		SHT	9a OF 11

DCS INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)

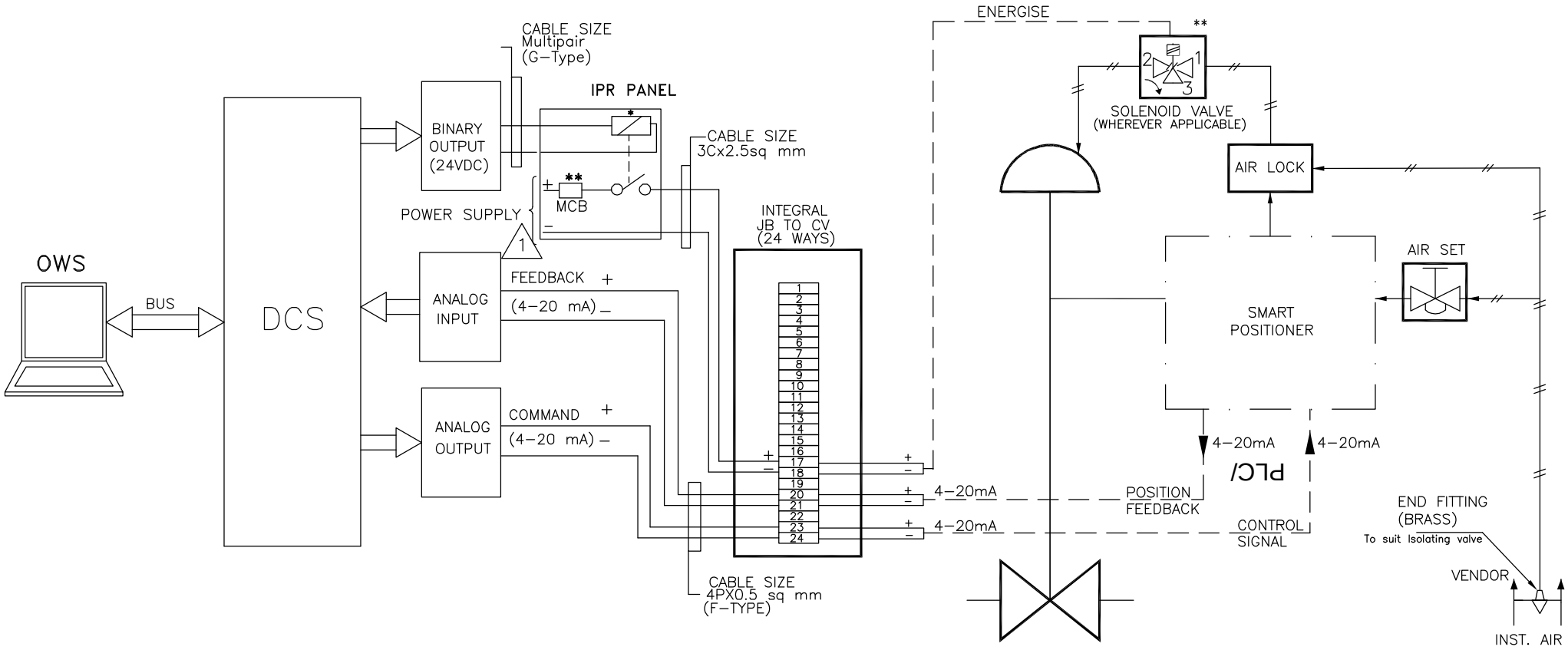


NOTE:-
EPB OF RESPECTIVE DRIVE WILL BE MOUNTED NEAR TO DRIVE ONLY.

1

PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO 5 /PLC	DRG.NO.	PE-DM-417-145-I002
	DATE	06.12.2019
TITLE: DDCMIS INTERFACE FOR /PLC UNIDIRECTIONAL HT DRIVE	REV.NO.	03
	SHT	10 OF 11

DCS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:

** APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.

BHEL	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO 5 /PLC	DRG.NO.	PE–DM–417–145–I002
		DATE	06.12.2019
	TITLE: TYPICAL HOOK–UP DIAGRAM ANALOG DRIVE (WITH SMART POSITIONER)	REV.NO.	03
		SHT	11 OF 11

ERECTION HARDWARES

1.00.00 GENERAL TECHNICAL REQUIREMENTS

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

However, any item required for erection of Bidder supplied system but not categorically indicated in this section, shall be supplied by the Bidder and all these items shall conform to International / National standards / codes.

1.01.00 Electrical Accessories

Electrical conduit and associated materials shall conform to the requirements of the articles which follow :

a) Rigid Steel Conduit

i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.

ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.

iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II(1981).. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel lacker or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.

iv) All rigid conduit fittings shall conform to requirements of IS:2667,1976. Galvanised steel fittins shall be used wth steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fitting shall be compatiable with the flexible conduit supplied.

b) Flexible Conduit

i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.

ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.

c) Special Fittings

i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.

ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

1.02.00 Electrical Junction Box:

Please refer to Section VII , Subsection – D of this volume of the Specification.

1.03.00 Cable Gland

1.	Type	: Double compression
2.	Entry Thread	: NPT / ET
3.	Material	: Brass
4.	Finish	: Cadmium Plated.
5.	Protection	: IP 54 or better
6.	Accessories	: Neoprene gasket, locknuts, reducers etc

1.04.00 Cable Tray

1.	Material	: Mild steel, slotted
2.	Thickness	: not less than 2.0 mm
3.	Finish	: Hot dip galvanized
4.	Perforation	: As per MFR standard
5.	Cover	: Suitable for tray

1.05.00 Process Hook Up Accessories & specification

Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner's approval.

1.05.01 Seamless Stainless Steel Pipe

1.	Reference	: ASTM A-312 TP 316
2.	Material Grade	: TP 316
3.	Type	: Seamless /Plain end
4.	Size	: As applicable (e.g.½" NB etc)
5.	Schedule	: 40
6.	Standard Length	: 5 meter

1.05.02 Stainless Steel Pipe Fittings

INSTRUMENT STUB DETAILS

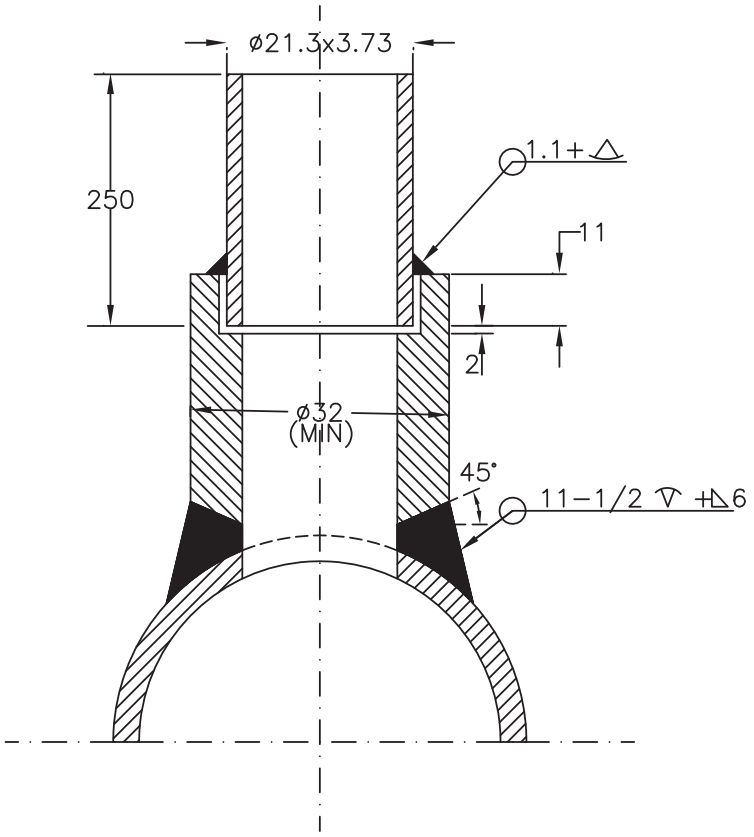
CUSTOMER:	TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, UNIT # 1 TO 5
CONSULTANT:	TATA CONSULTING ENGINEERS LIMITED BANGALORE, INDIA
JOB NO. 417 STATUS CONTRACT DISTRIBUTION	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA

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

DEPT CODE		NAME	SIGN	DATE
I	DRN	AKS		20.01.18
	DESN	AKS		20.01.18
	CHD	RKR		20.01.18
	APPD	SSB		20.01.18

TITLE: INSTRUMENT STUB DETAILS

DEPT.	SCALE	DRAWING NO.
SIGN		PE-DG-417-145-I101
		SHEET 1 OF 6 REV. 00



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1/2" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATION VALVES ARE TO BE USED FOR PRESSURE EXCEEDING 40 Kg/Cm2.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

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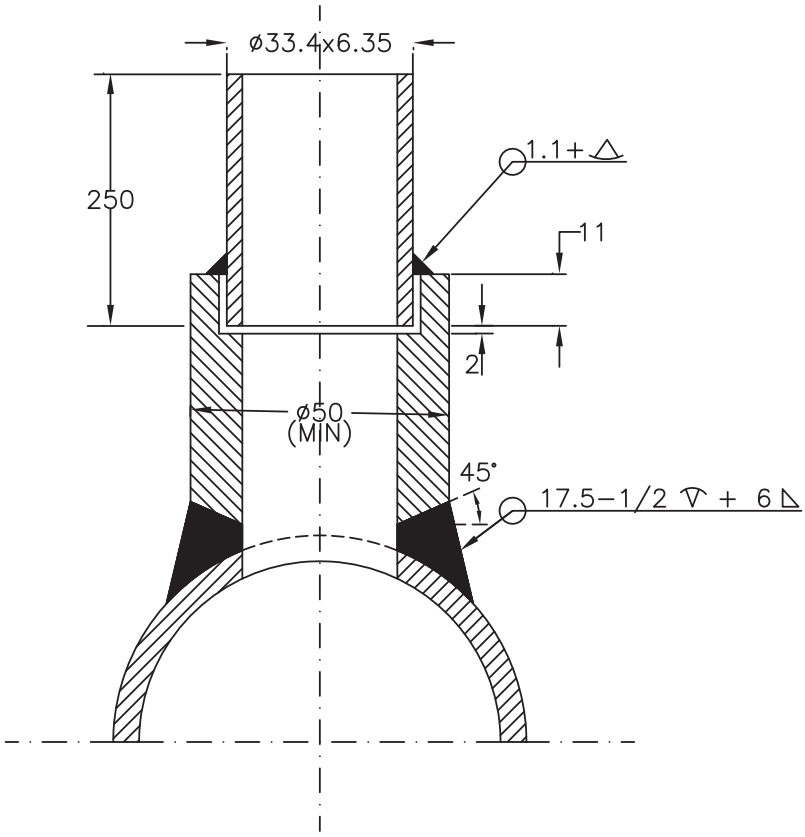
TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB DETAILS

PRESSURE STUB

SYSTEM PRESS < 60Kg/Cm2 & SYSTEM TEMP<425 Deg C, Nb15 , CL3000

DRG. NO.
PE-DG-417-145-I101
REV. 00
SH. 02 OF 06



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB DETAILS

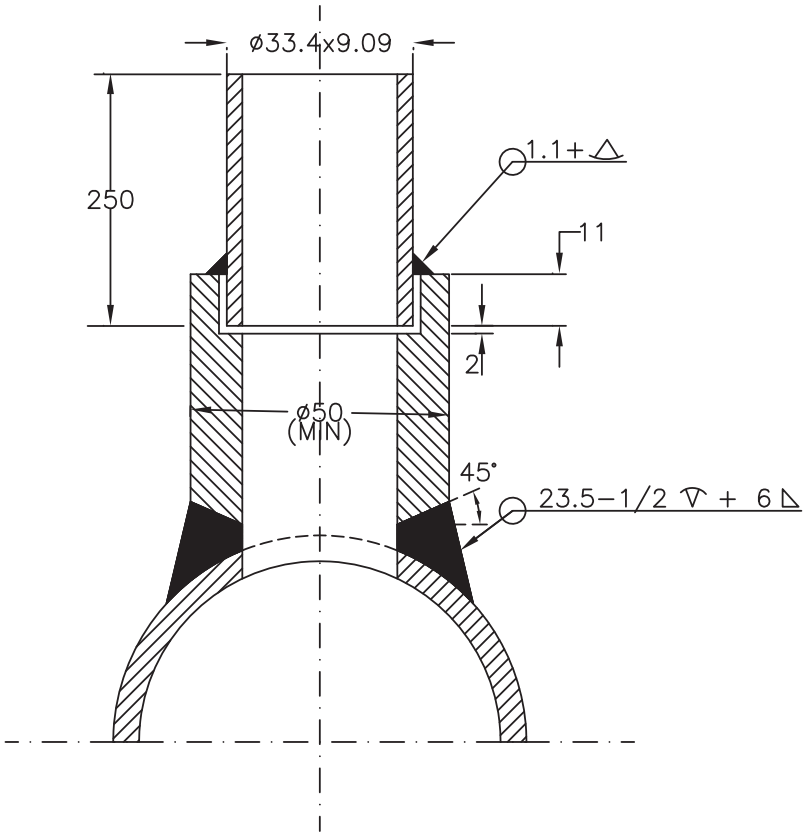
PRESSURE STUB

DRG. NO. PE-DG-417-145-I101

REV. 00

SH. 03 OF 06

SYSTEM PRESS > 60Kg/Cm2 & 425 Deg C < SYSTEM TEMP <= 500 Deg C , Nb25 , CL3000/6000



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

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TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB DETAILS

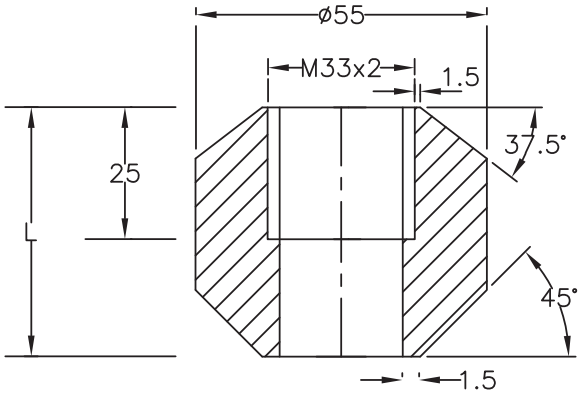
PRESSURE STUB

SYSTEM TEMP > 500 Deg C , Nb25 , CL9000

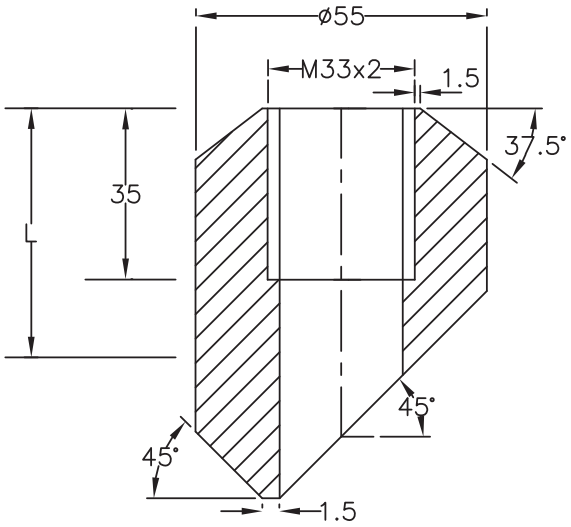
DRG. NO.
PE-DG-417-145-I101

REV. 00

SH. 04 OF 06



TEMPERATURE STUB FOR STRAIGHT IMMERSION



TEMPERATURE STUB FOR SLANT IMMERSION

NOTE :

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 64/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9 mm TO 159 mm STUB HEIGHT SHALL BE=64mm & FOR PIPE OD ⩾219.1mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3 mm & ABOVE. THE STUB HEIGHT FOR PIPE OD 168.3 mm TO <219.1 mm SHALL BE 64 mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9 mm TO 159 mm.
5. FOR MAIN PIPE OD'S 88.9 mm & BELOW SUITABLE EXPANDER SHALL BE USED.
6. PLEASE REFER SHEET–6 FOR THERMOWELL INSTALLATION.

TITLE : 5 x 800 MW YADADRI TPS

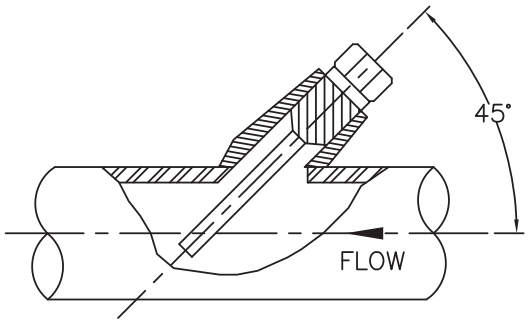
STD INSTRUMENT STUB DETAILS

TEMPERATURE STUB

DRG. NO. PE-DG-417-145-I101

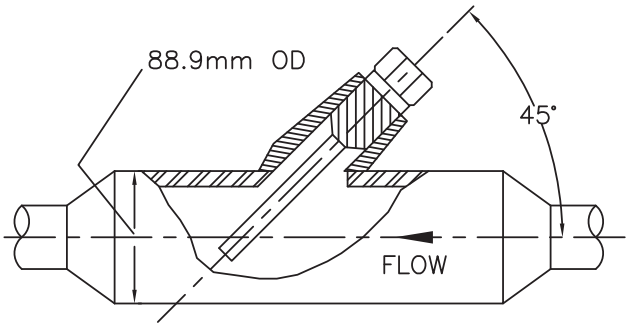
REV. 00

SH. 05 OF 06



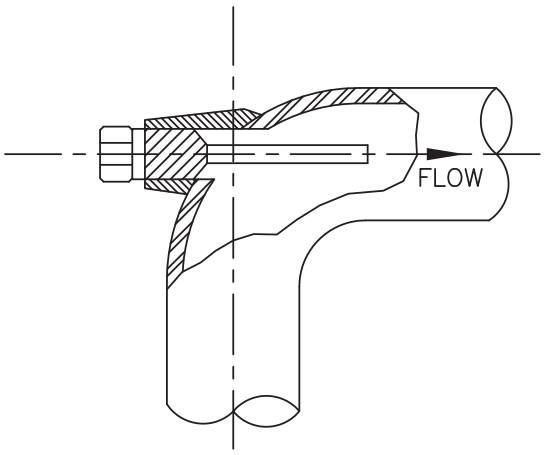
INSTALLATION TYPE–1

FOR MAIN PIPE OD 88.9mm to 159mm



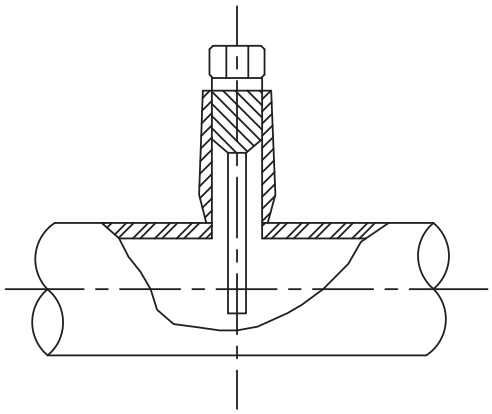
INSTALLATION TYPE–2

FOR MAIN PIPE OD BELOW 88.9mm



INSTALLATION TYPE–3

FOR MAIN PIPE OD 88.9mm & BELOW



INSTALLATION TYPE–4

FOR MAIN PIPE OD 168.3mm & ABOVE

TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB DETAILS

THERMOWELL INSTALLATION

DRG. NO.
PE-DG-417-145-I101
REV. 00
SH. 06 OF 06

SECTION: I

SUB-SECTION: E

ANNEXURE-I

LIST OF MAKES OF SUB-VENDOR ITEMS

Customer Approved Sub vendor list

Sl. No.	Item Description	Vendor proposed for approval
1	AIR WASHER & UAF	Refer BHEL approved Sub vendor list *Any further vendor addition is subjected to customer approval
2	CENTRIFUGAL FANS	
3	AXIAL FANS	
4	ROOF EXHAUSTER FANS	
5	GRILL/VOLUME CONTROL DAMPER/ DAMPER	

PART-B (Sub vendors)

Sl. No.	Item Description	SL. No.	Vendor proposed for approval	
1	HORIZONTAL CENTRIFUGAL PUMPS<=75KW	1	FLOWMORE LTD., GHAZIABAD	Approved
		2	WILO MATHER & PLATT PUMPS LTD., MUMBAI	Approved
		3	KIRLOSKAR BROTHERS LTD., PUNE	Approved
		4	JYOTI LTD., GUJRAT	Approved
2	LT MOTORS(=<55KW)	1	LAXMI HYDRAULICS PVT. LTD., SECUNDARABAD	Approved
		2	BHARAT BIJLEE LIMITED, MUMBAI	Approved
		3	SIEMENS INDIA LTD., CHENNAI	Approved
		4	ABB LTD., SECUNDARABAD	Approved
3	BUTTERFLY VALVES	1	WEIR BDK VALVES-A UNIT OF WEIR, INDIA	Approved
		2	TYCO VALVES & CONTROLS INDIA P LTD., INDIA	Approved
		3	INTER VALVE (INDIA) LTD., INDIA	Approved
		4	DELVAL FLOW CONTROLS PVT. LTD.	Approved
		5	ATAM VALVES PVT. LTD., JALANDHAR	Approved
		6	HAWA ENGINEERS LTD., AHMEDABAD	Approved
		7	MICON VALVES (INDIA), MUMBAI	Approved
		8	SURYA VALVES & INSTRUMENTS MFG CO., CHENNAI	Approved
		9	DEMBLA VALVES LTD., THANE	Approved
		10	FLOWSERVE, CHENNAI	Approved

Sl. No.	Item Description	SL. No.	Vendor proposed for approval	
	PR./DP.SWITCH	4	TRAFAG CONTROL INDIA PVT. LTD., GURGAON	Approved
		5	BAUMER TECHNOLOGIES (I) PVT. LTD., KOLKATA	Approved
10	JUNCTION BOX	1	SUCHITRA I INDUSTRIES, BANGALORE	Approved
		2	BALIGA LIGHTING EQUIPMENT PVT. LTD., CHENNAI	Approved
		3	DEVI POLYMERS PVT. LTD., CHENNAI	Approved
		4	HENSEL ELECTRIC INDIA PVT. LTD., CHENNAI	Approved
		5	MANISHA COMPOSITEK PVT. LTD., PUNE	Approved
		6	PYROTECH, UDAIPUR	Approved
		7	CHEMIN CONTROLS, PONDICHERY	Approved
		8	K S INSTRUMENTS PVT. LTD., BANGALORE	Approved
		9	ELECTROMECHANICAL, KOLKATA	Approved
		10	KHODAY CONTROL SYSTEMS, BANGALORE	Approved
		11	PRAMMEN INDUSTRIES, PUDDOKOTTAI	Approved
		12	SHRENIK & COMPANY, GUJRAT	Approved
11	CABLE TRAY (UPTO 50MM)	1	RATAN PROJECTS & ENGINEERING CO. PVT. LTD., KOLKATA	Approved
		2	JAMNA METAL COMPANY, NEW DELHI	Approved
		3	APT ENGINEERING WORKS, NEW DELHI	Approved
12	LEVEL GAUGE	1	V AUTOMAT INSTRUMENTS PVT.LTD., NEW DELHI	Approved
		2	PUNE TECHTROL PVT. LTD., PUNE	Approved
13	LEVEL SWITCH (FLOAT TYPE)	1	V AUTOMAT INSTRUMENTS PVT., NEW DELHI	Approved
		2	D K INSTRUMENTS PVT. LTD., KOLKATA	Approved
14	LEVEL INDICATOR	1	V AUTOMAT INSTRUMENTS PVT LTD., FARIDABAD	Approved
		2	PUNE TECHTROL PVT LTD., PUNE	Approved
15	INSTRUMENT FITTINGS	1	PANAM ENGINEERS LTD., MUMBAI	Approved
		2	PRECISION ENGINEERING INDUSTRIES, MUMBAI	Approved
		3	VIKAS INDUSTRIAL PRODUCTS, NOIDA	Approved
		4	AURA INCORPORATED, NEW DELHI	Approved

Sl. No.	Item Description	SL. No.	Vendor proposed for approval	
	INSTRUMENT FITTINGS	5	HP VALVES & FITTINGS (INDIA) PVT. LTD., CHENNAI	Approved
		6	ARYA CRAFTS & ENGG. PVT. LTD., GUJARAT	Approved
		7	PMT ENGINEERS, AHMEDABAD	Approved
		8	PRIME ENGINEERS, MUMBAI	Approved
		9	FLOWTECH, KOLKATA	Approved
16	PAINT	1	BERGER	Approved
		2	ASIAN PAINTS	Approved
		3	KANSAI NEROLAC	Approved
17	THREE WAY VALVE	1	SIEMENS BUILDING TECHNOLOGY, GERMANY	Approved
		2	RAPID CONTROL, DELHI	Approved
		3	BELIMO, MUMBAI (HQ)	Approved
18	GM VALVES (GATE/GLOBE/CHECK)	1	SANT VALVES, PUNJAB	Approved
		2	LEADER VALVES LTD., PUNJAB	Approved
19	AIR FILTERS(PRE FILTERS & FINE FILTERS)	1	SPECTRUM, KOLKATA	Approved
		2	PUROMATIC, OKHLA	Approved
		3	FMI, KOLKATA	Approved
		4	ANFILCO, NEW DELHI	Approved
20	RH SENSOR/TEMP. SENSOR	1	HONEYWELL, TAIWAN	Approved
		2	GENERAL INSTUMENTS, MAHARASHTRA(HQ)	Approved
		3	JOHNSON, SINGAPORE	Approved
		4	SIEMENS, MAHARASHTRA(HQ)	Approved
21	GI SHEET FOR DUCTING	1	TISCO, INDIA	Approved
		2	RASHTRIYA ISPAT NIGAM LTD., INDIA	Approved
		3	ESSAR, INDIA	Approved
		4	JSW STEEL, INDIA	Approved
		5	TATA, INDIA	Approved
		6	SAIL, INDIA	Approved
		7	JINDAL, INDIA	Approved
22	FIRE DAMPER	1	TSC, MUMBAI	Approved
		2	CARRYAIRE, GREATER NOIDA	Approved
		3	SYSTEM AIR(FORMERLY KNOWN AS RAVI STAR), GREATER NOIDA	Approved

Sl. No.	Item Description	SL. No.	Vendor proposed for approval	
23	INSULATION MATERIAL	1	BEARDSELL, FARIDABAD	Approved
		2	K-FLEX, PUNE	Approved
		3	PARAMOUNT, SONIPAT	Approved
		4	ARMAFLEX, PUNE	Approved
		5	SUPREME, MUMBAI	Approved
		6	LLOYDS, SIKANDRABAD	Approved
		7	UP TWIGA, BHILAI	Approved
		8	AEROCELL, GURUGRAM	Approved
24	Y TYPE/POT STRAINER	1	MULTITEX, NEW DELHI	Approved
		2	SANT VALVES, PUNJAB	Approved
		3	DS ENGG, NEW DELHI	Approved
		4	SAROJINI, NEW DELHI	Approved
		5	GRAND PRIX, FARIDABAD	Approved
		6	GUJRAT OTOLIFT, GUJRAT	Approved
		7	BHATIA ENGG, NEW DELHI	Approved
		8	SUNGOV ENGG, CHENNAI	Approved
25	THERMOSTAT/HUMIDSTAT/GEYSERSTAT / AIR STAT	1	HONEYWELL AUTOMATION,USA	Approved
		2	JOHNSON CONTROL, SINGAPORE	Approved
		3	SIEMENS,GERMANY	Approved
26	LEVEL TRANSMITTER (ULTRA SONIC TYPE)	1	ABB, NEW DELHI	Approved
		2	EMERSON PROCESS MANAGEMENT, USA/NAVI MUMBAI	Approved
		3	ENDRESS+HAUSER, GERMANY/INDIA	Approved
		4	FORBES MARSHALL,	Approved
		5	KROHNE MARSHALL	Approved
		6	P&F, INDIA	Approved
		7	SIEMENS MILLTRONICS, CANADA	Approved
		8	VEGA, GERMANY	Approved
27	LEVEL TRANSMITTER (RADAR TYPE)	1	ABB, GERMANY/FARIDABAD	Approved
		2	EMERSON PROCESS, USA/NAVI MUMBAI	Approved
		3	ENDRESS+HAUSER, GERMANY/INDIA	Approved
		4	HONEYWELL, USA/INDIA	Approved

		M&P
		VOLTAS
		BEACON-WEIR
		WORTHINGTON
		Flowmore
		SULZER PUMPS INDIA LTD.
		BHARAT PUMPS & COMPRESSORS LTD
		FLOWSERVE INDIA CONTROL PVT LTD
		V-FLOW PUMPS & SYSTEMS CO
		Kishore pumps
5	LV MOTORS (FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		BHARAT ELECTRIC
		NGEF
		JYOTI
		LHP
6	LV MOTORS (NON FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		BHARAT ELECTRIC
		NGEF
		JYOTI
		LHP
7	AIR FILTER	PUROLATOR
		FMI
		ANFILCO
		TENACITY
		JOHN FOWLER
		SPECTRUM
		AIR TECH
		PUROMATIC
8	INSULTATION MATERIAL	BEARDSHEL
		K-FLEX
		PARAMONT
		ARMAFLEX
		SUPREME

		LLOYDS
		UP TWIGA
		AEROCELL
9	FIRE DAMPER	TSC
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
11	BUTTERFLY VALVES	Audco
		Fouress Engg
		INTER VALVE
		BDK
		WEIR BDK
		TYCO
		CRANE PROCESS
		KEYSTONE
		Fluidline
		INSTRUMENTATION LTD
		R and D MULTIPLES (METAL CAST) PVT LTD
		SURYA VALVES AND INSTRUMENTS MFG CO
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED
		VENUS PUMPS AND ENGG. WORKS
12	NON RETURN VALVE	Leader Valves
		H SARKAR
		Fluidline
		HI-TECH
		CRESCENT VALVES
		A V VALVES
		Bankim
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
		VENUS PUMPS AND ENGINEERING WORKS
13	STEEL GATE/GLOBE/NR VALVES(WATER SYSTEM)	CRESCENT VALVES
		BDK
		Audco
		Fouress Engg
		KIRLOSKAR BROTHERS LTD.
		SANT VALVES

		BOMBAY METAL & ALLOYS
		Bankim
		Leader Valves
		H SARKAR
		AV Valves
		VENUS PUMPS
14	STEEL GATE/GLOBE/NR VALVES(WATER SYSTEM)	Fluidline
		HI –TECH
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
15	Pipes (MS/GI) - ERW	SURYA ROSHNI
		TISCO
		DADU PIPES
		INDUS TUBES
		WELSPUN
		TATA
		BST
		JINDAL
		SAIL
		PSL
		LALIT PROFILE
		SAMSHI PIPE INDUSTRIES
		S MUKUT PIPES
		MANN INDUSTRIES
		SURENDRA ENGINEERING
		PRATIBHA PIPES AND STRUCTURES PVT LTD
		JCO GAS PIPES
		NUKAT TANK AND VESSELS
		GOODLUCK TUBES
		ADVANCE STEEL TUBES
		BIHAR TUBES
		HITECH PIPES
		RATNAMANI
		MAHARASHTRA SEAMLESS
16	GI SHEETS FOR DUCTING	TISCO
		INDIAN IRON & STEEL CO
		RASHTRIYA ISPAT NIGAM LIMITED
		ESSAR
		ISPAT INDUSTRIES

		JSW
		LLOYDS
		Bhushan steels
		TATA
		SAIL
		JINDAL
17	GRILL/DIFFUSER/VOLUME CONTROL DAMPER	AIR FLOW
		TSC
		AIR MASTER
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
18	HUMID STAT	JHONSON CONTROL
		HONEYWELL AUTOMATION
		PENN
19	Y / POT STRAINER	MULTITEX
		GREAVES COTTON
		JAYPEE
		SANT VALVES
		OTOKLIN
		GRAND PRIX
		GUJARAT OTOLIFT
		DS ENGG
		SAROJINI ENTERPRISE
		BHATIA ENGINEERING
		FILTERATION ENGINEERS INDIA PVT LTD
		SUNGOV ENGINEERING
20	LOCAL CONTROL PANEL	INDUSTRIAL CONTROL & APPLIANCE
		Pyrotech Electronics Pvt. Ltd.
		Positronics Pvt. Ltd.
		CONTROL & SWITCHGEAR
		SIEMENS
		L&T
		GE POWER
		RITTAL
		HOFFMAN

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
		7	PARAMOUNT COMMUNICATIONS LTD., NEW DELHI	Approved
		8	POLYCAB WIRES PVT. LTD., MUMBAI	Approved
		9	TORRENT CABLES LTD., GUJARAT	Approved
		10	THERMO CABLES LTD., HYDERABAD	Approved
		11	CRYSTAL CABLE INDUSTRIES LTD., KOLKATA	Approved
		12	SUYOG ELECTRICALS LTD., GUJARAT	Approved
		13	CMI LTD., NEW DELHI	Not Approved
		14	APAR INDUSTRIES LTD., MUMBAI	Not Approved
		15	KEC INTERNATIONAL LIMITED, MUMBAI	Not Approved
		16	TIRUPATI PLASTOMATICS PVT. LTD., RAJASTHAN	Not Approved
		17	DYNAMIC CABLES LIMITED, RAJASTHAN	Not Approved
		18	GUPTA POWER INFRASTRUCTURE LIMITED, GHAZIABAD (UP)	Not Approved
		19	GOVIND CABLE INDUSTRIES, GHAZIABAD (UP)	Not Approved
		20	RAVIN CABLES LIMITED, MUMBAI	Not Approved
		21	SRIRAM CABLES PVT. LTD., NEW DELHI	Not Approved
		22	SPECIAL CABLES PVT. LTD., NEW DELHI	Not Approved
6	**CABLE TRAYS & ACC.**	1	INDIANA GRATINGS PVT. LTD., MUMBAI	Approved
		2	INDUSTRIAL PERFORATION (I) PVT.LTD., KOLKATA	Approved
		3	PREMIER POWER PRODUCTS (CAL) PVT. LTD., KOLKATA	Approved
		4	RUKMANI ELECTRICAL & COMPONENTS PVT LTD., KOLKATA	Approved
		5	RABI ENGINEERING WORKS PVT. LTD., KOLKATA	Approved
		6	UNITECH FABRICATORS AND ENGINEERS PVT	Approved

Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
			LTD., KOLKATA	
		7	INDIA ELECTRICALS SYNDICATE, KOLKATA	Approved
		8	PATNY SYSTEMS PVT. LTD., TELANGANA	Approved
		9	RATAN PROJECTS & ENGINEERING CO. PVT. LTD., KOLKATA	Approved
		10	VINFAB ENGINEERS INDIA PVT. LTD., MUMBAI	Approved
		11	ADVANCE POWER PRODUCTS, KOLKATA	Not Approved
		12	EROS METAL WORKS (P) LTD., MAHARASHTRA	Not Approved
		13	INDMARK FORMTECH PVT. LTD., MAHARASHTRA	Not Approved
		14	MAHESHWARI ELECTRICAL MFRS. PVT. LTD., UP	Not Approved
		15	NAMDHARI INDUSTRIAL TRADERS PVT. LTD, PUNJAB	Not Approved
		16	PARMAR METALS PVT.LTD., RAJKOT	Not Approved
		17	PENTAX FERRO INCORPORATE, MUMBAI	Not Approved
		18	SARAL INDUSTRIES, UP	Not Approved
		19	VATCO ELEC-POWER PVT. LTD., MUMBAI	Not Approved
7	**CABLE TRAY SUPPORT SYSTEM (WELDED TYPE)**	1	ASSOCIATED POWER STRUCTURES PVT. LTD.,	Approved
		2	PATNY SYSTEMS (P) LTD., TELANGANA	Approved
		3	INDUSTRIAL PERFORATION (I) PVT.LTD., KOLKATA	Approved
		4	RATAN PROJECTS & ENGINEERING CO. PVT.LTD., KOLKATA	Approved
		5	TJSV STEEL FABRICATION & GALVANIZING (INDIA) LIMITED, TAMIL NADU	Approved
		6	VINFAB ENGINEERS INDIA PVT. LTD., MUMBAI	Approved
		7	EROS INFRASTRUCTURES PVT. LTD., MAHARASHTRA	Not Approved

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Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
		8	INDMARK FORMTECH PVT. LTD., MAHARASHTRA	Not Approved
		9	JAGANNATHAN ENGINEERING WORKS, TAMIL NADU	Not Approved
		10	NAMDHARI INDUSTRIAL TRADERS PVT. LTD., PUNJAB	Not Approved
		11	PENTAX FERRO INCORPORATE, MUMBAI	Not Approved
		12	PREMIER POWER PRODUCTS (CAL) PVT. LTD., KOLKATA	Not Approved
		13	PARMAR METALS PVT.LTD., RAJKOT	Not Approved
		14	RABI ENGINEERING WORKS PVT. LTD., KOLKATA	Not Approved
		15	RUKMANI ELECTRICAL & COMPONENTS PVT LTD., KOLKATA	Not Approved
		16	SARAL INDUSTRIES, UP	Not Approved
		17	UNITECH FABRICATORS AND ENGINEERS PVT LTD., KOLKATA	Not Approved

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Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
13	**PVC WIRES**	REPUTED BIS MAKES SHALL BE ENSURED		
14	**DISTRIBUTION BOARDS**	1	AMARA RAJA POWER SYSTEMS LIMITED, NEW DELHI	Approved
		2	CHHABI ELECTRICALS PVT.LTD., MAHARASHTRA	Approved
		3	C&S ELECTRIC LIMITED, NEW DELHI	Approved
		4	EMERSON NETWORK POWER, THANE	Approved
		5	HITACHI-HIREL POWER ELECTRONICS, GANDHINAGAR	Approved
		6	HBL POWER SYSTEMS LTD., TELANGANA	Approved
		7	JASPER ENGINEERS PVT. LTD., NOIDA, UP	Approved
		8	JACKSON ENGINEERS LIMITED, NOIDA, UP	Approved
		9	LARSON & TOUBRO LTD., MUMBAI	Approved
		10	NITYA ELECTROCONTROLS PVT. LTD., UP	Approved
		11	RSI SWITCHGEAR PVT. LTD.,RAJASTHAN	Approved
		12	SIEMENS LIMITED,HARYANA	Approved
		13	AVAIDS TECHNOVATORS PVT. LTD., NEW DELHI	Not Approved
		14	BCH ELECTRIC LTD., FARIDABAD	Not Approved
		15	RYB SWITCHGEARS PVT. LTD., NEW DELHI	Not Approved

Chief Engineer/TPC

SUB-VENDOR LIST FOR ELECTRICAL ITEMS

ITEM DESCRIPTION	SL NO.	VENDOR NAME
CABLE GLANDS	1	ALLIED TRADERS & EXPORTERS
	2	ARUP ENGG & FOUNDARY WORKS
	3	BALIGA LIGHTING EQPT.PVT.LTD.
	4	COMMET BRASS PRODUCTS
	5	DOWELLS
	6	ELECTROMAC INDUSTRIES
	7	INCAB
CABLE LUGS	1	DOWELLS
	2	UNIVERSAL MACHINES LTD.
LV MOTORS (NON FLAME PROOF)	1	ABB
	2	BHARAT BIJLEE LTD.
	3	CROMPTON GREAVES
	4	GE-POWER
	5	KIRLOSKAR ELECTRIC CO LTD.
	6	LAXMI HYDRAULICS PVT. LTD
	7	MARATHON
	8	NGEF
	9	RAJINDRA ELECT INDUSTRIES
	10	SIEMENS

VENTILATION SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS

NOTES:

1. *Designed by Hyderabad Pollution Control / SK SYSTEM/ ADVANCE VENTILATION / DRAFT AIR/BLUE STAR/ VOLTAS/ STERLING WILSON/ROOTS COOLING SYSTEM/ C DOCTOR/ TAP/ Pack Plast/ Industrial projects and products & fabricated by their approved fabricator.

2. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

SECTION-I
SUB SECTION -E

ANNEXURE-II

MANDATORY SPARE LIST
(Refer Annexure II of Price Schedule)

SECTION: I

SUB-SECTION: E

ANNEXURE-III

PAINTING AND COLOUR SCHEME

(AS PER SECTION C2C)

SECTION-I

SUB-SECTION-E

ANNEXURE-IV

LIST OF TOOLS & TACKLES

Refer Price Schedule Appendix A

SECTION-II

SUB-SECTION-E

ANNEXURE-V

WATER ANALYSIS

CLARIFIED WATER ANALYSIS

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	$CaCO_3$	121.9 ppm
2.	Magnesium	$CaCO_3$	74.1 ppm
3.	Sodium	$CaCO_3$	184.4 ppm
4.	Potassium	$CaCO_3$	1.1 ppm
5.	Iron in Soln.	Fe	Nil
	TOTAL CATIONS	**$CaCO_3$**	**381.5 ppm**
6.	Bicarbonate	$CaCO_3$	134.8 ppm
7.	Sulphate	$CaCO_3$	80.9 ppm
8.	Chloride	$CaCO_3$	161.0 ppm
9.	Nitrate	$CaCO_3$	3.5 ppm
10.	Phosphate	$CaCO_3$	Nil
11.	Fluoride	$CaCO_3$	1.3 ppm
	TOTAL ANIONS	**$CaCO_3$**	**381.5 ppm**
12.	Reactive Silica	SiO_2	14.1 ppm
13.	Colloidal Silica	SiO_2	Nil
14.	Total Silica	SiO_2	14.1 ppm
15.	Nitrites	NO_2	Nil
16.	Total Hardness	$CaCO_3$	196 ppm
17.	Total Suspended Solid		15 ppm
18.	pH value at 25°C	-	8.0
19.	Turbidity		15 NTU

Note:

The analysis of the clarified water is exhibited here shall be multiplied with 6.5 COC to derive the circulating water analysis.

SECTION-I

SUB-SECTION-E

ANNEXURE-VI

DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE

(AS PER SECTION C2B)

14. 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 OF HVAC SYSTEM 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 CERTIFIED AND TRAINED SERVICE ENGINEERS AND SUPPLY OF GENUINE PARTS AND LUBRICANTS AS PER THE ORIGINAL EQUIPMENT MANUFACTURER'S RECOMMENDATIONS IN A PRO-ACTIVE MANNER.

FOR THE PURPOSE OF OPERATION OF VENT. SYSTEM, ONE-DAY SHALL BE CONSIDERED AS 24 HOURS I.E. 3 SHIFTS OF 8 HOURS EACH. THE VENT. 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 BY BIDDER CAN BE INCREASED OR DECREASED AS PER REQUIREMENT AND PAYMENT IN SUCH CASE SHALL BE MADE ON PRO-RATA BASIS.

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 HVAC SYSTEM REQUIRED TO BE REPLACED DURING WARRANTY PERIOD (AS PART 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 VENT. SYSTEM.

THE VENDOR SHALL DEPLOY FOLLOWING MINIMUM MANPOWER FOR OPERATION OF HVAC SYSTEM.

ONE QUALIFIED AND EXPERIENCED VENT. 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 VENT. SYSTEM. UNDER NORMAL CIRCUMSTANCES ONE SHIFT SHALL NOT BE MORE THAN 8 HOURS.

ONE 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 VENT. SYSTEM OPERATOR IN DAY TO DAY OPERATION OF HVAC SYSTEM AND ACCESSORIES AND SHALL ASSIST HIM FOR KEEPING VENT. SYSTEM EQUIPMENT'S IN NEAT AND TIDY CONDITION. UNDER NORMAL CIRCUMSTANCES ONE SHIFT SHALL NOT BE MORE THAN 8 HOURS.

14.1. Responsibility of VENT. System Operator

I. VENT. SYSTEM OPERATOR SHALL BE RESPONSIBLE FOR PROPER SEQUENTIAL OPERATION OF VENTILATION 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 VENT. 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 HVAC SYSTEM OPERATOR, WHICH SHALL BE SHARED WITH BHEL SITE ENGINEER ON PERIODIC BASIS.

II. VENT. SYSTEM OPERATOR SHALL TAKE HOURLY READINGS OF ALL THE PARAMETERS OF HVAC SYSTEM / EQUIPMENT'S INCLUDING READING ON MAIN ELECTRICAL PANEL OF VENT. 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.

14.2. RESPONSIBILITY OF HELPER

I. THE VENT. SYSTEM HELPER SHALL ASSIST VENT. SYSTEM OPERATOR FOR DAY TO DAY SMOOTH OPERATION OF VENT. SYSTEM, LIKE LEANING OF AWU. FILTERS AND OTHER FILTERS ETC. AS AND WHEN REQUIRED. HE SHALL BE RESPONSIBLE FOR KEEPING ALL THE EQUIPMENT'S OF VENT. SYSTEM INCLUDING AWU/UAF AND ITS PUMPS IN CLEAN AND TIDY CONDITION. HE SHALL ALSO CARRY OUT GENERAL CLEANING OF ALL AC EQUIPMENT'S INCLUDING ELECTRICAL PANELS (PART (VENT. SYSTEM), AWU. ETC. ON REGULAR BASIS.

II. THE HELPER SHALL WORK UNDER THE CONTROL OF VENT. SYSTEM OPERATOR AND SHALL ALWAYS ENSURE THAT UNUSABLE JUNK MATERIALS ARE NOT ALLOWED TO BE KEPT IN VENT. SYSTEM ROOM OR AWU. 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.

14.3. 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.

14.4. ALL THE NECESSARY TOOLS AND OTHER MATERIALS, REQUIRED FOR OPERATION OF HVAC SYSTEM SHALL BE KEPT BY VENDOR UNDER THE CONTROL OF VENT. SYSTEM OPERATOR. REQUIRED TESTING INSTRUMENTS LIKE REFRIGERANT LEAK DETECTOR, MULTI METER (FOR ELECTRICAL PORTION OF VENT. SYSTEM), SLING PSHYCROMETER, LINE TESTER, TOOL KIT, TORCH ETC. SHOULD ALSO BE ALWAYS AVAILABLE WITH PLANT OPERATOR.

14.5. 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 VENT. OPERATOR OR HELPER DOES NOT TURN UP DUE TO ANY REASONS, THE EARLIER DUTY PERSON SHALL CONTINUE TO MAKE SURE THAT HVAC SYSTEM NEVER REMAINS UNATTENDED

15. MAINTENANCE OF VENT. 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 plant at regular interval including cleaning of AWU/UAF AND ITS PUMPS

c) Attending to complaints.

d) Replacement of worn out or defective components

e) Replacing of refrigerant gas and oil as and when required.

No consumable or any other items of VENT. 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 VENT. 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 hours or on public holidays till the VENT. 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 VENT. 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 VENT. 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 AWU/UAF AND ITS PUMPS, PIPING NOZZLES / ducting works, valves etc. shall be done by vendor once in a year.

vi. Painting of all equipment's including base frames & accessories like piping, electrical panel boards etc. shall be done once in two years.

vii. 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.

viii. Vendor shall arrange and maintain separate logbook register for services / maintenance of VENT. 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.

ix. Vendor shall arrange and maintain sufficient stock of spares and consumable at site (VENT. 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.

x. 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.

xi. 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.

xii. 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 VENT. System equipment's etc.

xiii. All the safety controls Plant such as .Tank water level , RH in powerhouse inter locking etc. shall be positively checked at least once a month and same shall be recorded by vendor engineer

xiv. Technicians & helpers engaged by the vendor shall wear uniform with nameplate for easy identification, while being within plant premises

xv. 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 system

xvi. If any damage to the equipment and its accessories has happened due to improper maintenance by bidder shall be recovered from the bidder.
BIDDER IS TO ARRANGE ALL THE SAFETY GEARS LIKE HELMETS, AIR PLUGS, SAFETY SHOES ETC. DURING THE MAINTENANCE FOR THE O&M STAFF.

SECTION-I

SUB-SECTION-E

ANNEXURE-IX

SITE STORAGE AND PRESERVATION

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

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

बीएचईएल
BHEL
Maharatna Company

Golden Jubilee
1964 - 2014
50
Years

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

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

2. PURPOSE OF STORAGE & PRESERVATION

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

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

a) GENERAL STORAGE REQUIREMENTS

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

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

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

b) GENERAL PRESERVATION REQUIREMENTS

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

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
    a. Rust preventive fluid (RPF)
    b. Rust protective paints
    c. Tarpaulin covers, in case of outdoor storage
    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

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

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

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

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

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

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

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

iii Open storage (O)

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

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

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

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

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

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

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

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

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

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

5. CONCLUSION

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

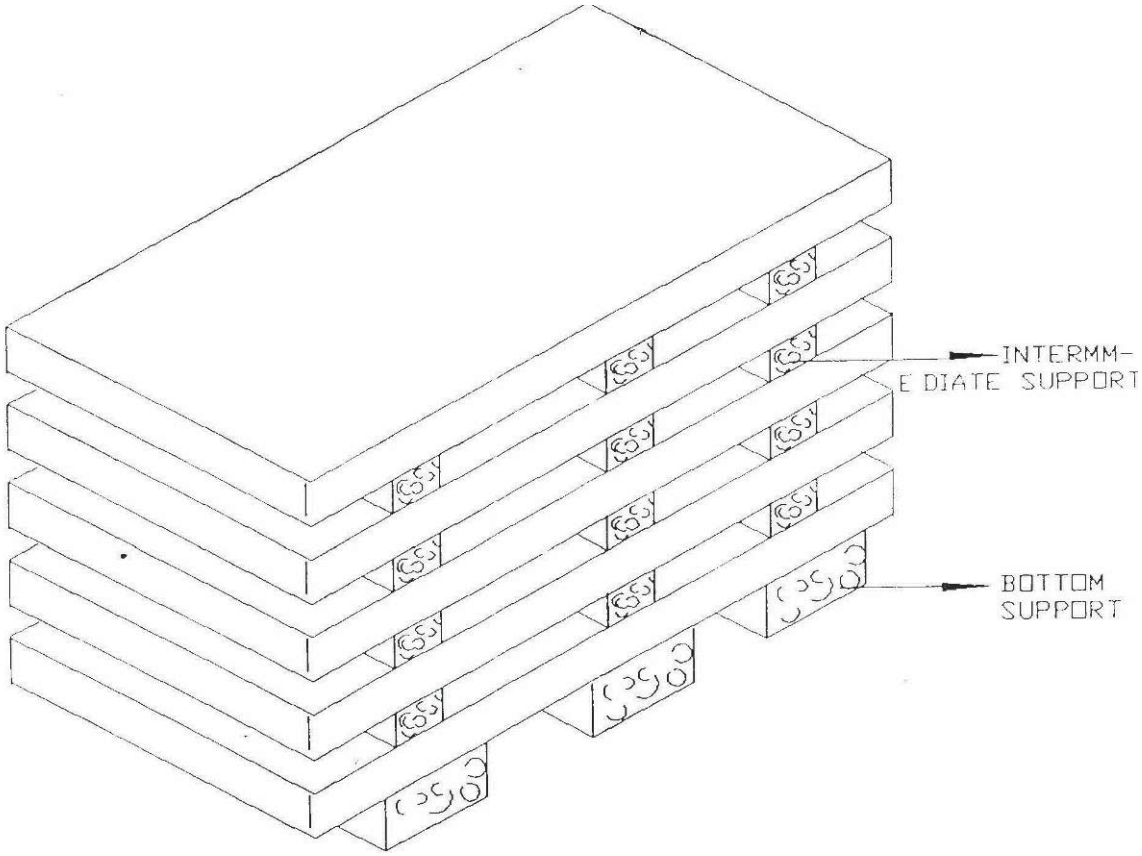


Figure – 1 – PLATE STACKING ARRANGEMENT

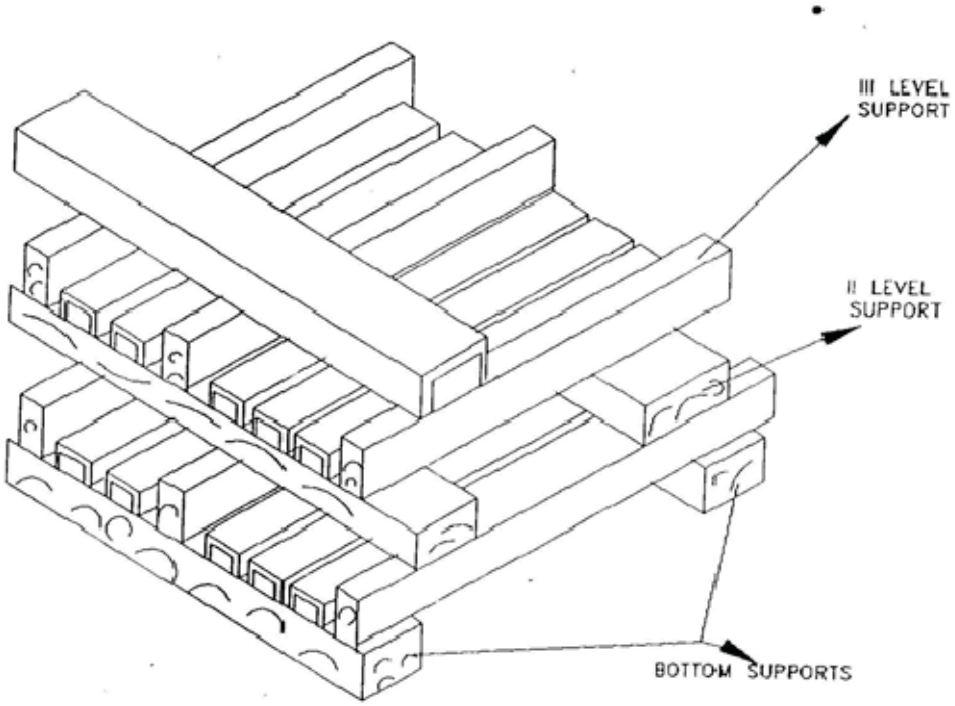


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

SECTION II

	5X800 MW YADADRI TPS VENTILATION SYSTEM LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-417-554-A002	
		SECTION : II	
		SUB-SECTION : 2	
		REV: 00	DATE: AUG 2022
		SHEET 1 OF 1	

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

1. Compliance cum confirmation certificate
2. Un priced format for main package (mentioning quoted against each item)
3. Un priced format for mandatory spare (mentioning quoted against each item)
4. Un priced format for Tools and Tackles (mentioning quoted against each item)
5. Un priced format for Commissioning spare (mentioning quoted against each item)
6. Complete set of technical specification
7. No deviation certificate

COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

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

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

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

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

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

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

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

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

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

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

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

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

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

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

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

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

	5X800 MW YADADRI TPS VENTILATION SYSTEM PRE-BID CLARIFICATION SCHEDULE	SPECIFICATION No: PE-TS-417-554-A002	
		SECTION : II	
		SUB-SECTION : 4	
		REV. NO. 00	DATE: AUG 2022
		SHEET: 1 OF 1	

PRE-BID CLARIFICATION SCHEDULE

S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

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

Signature: _____

Name: _____

Designation: _____

Company: _____

Date: _____

Company Seal

ANNEXURE-II: DEVIATION SHEET (COST OF WITHDRAWAL)

PROJECT:-

PACKAGE:-

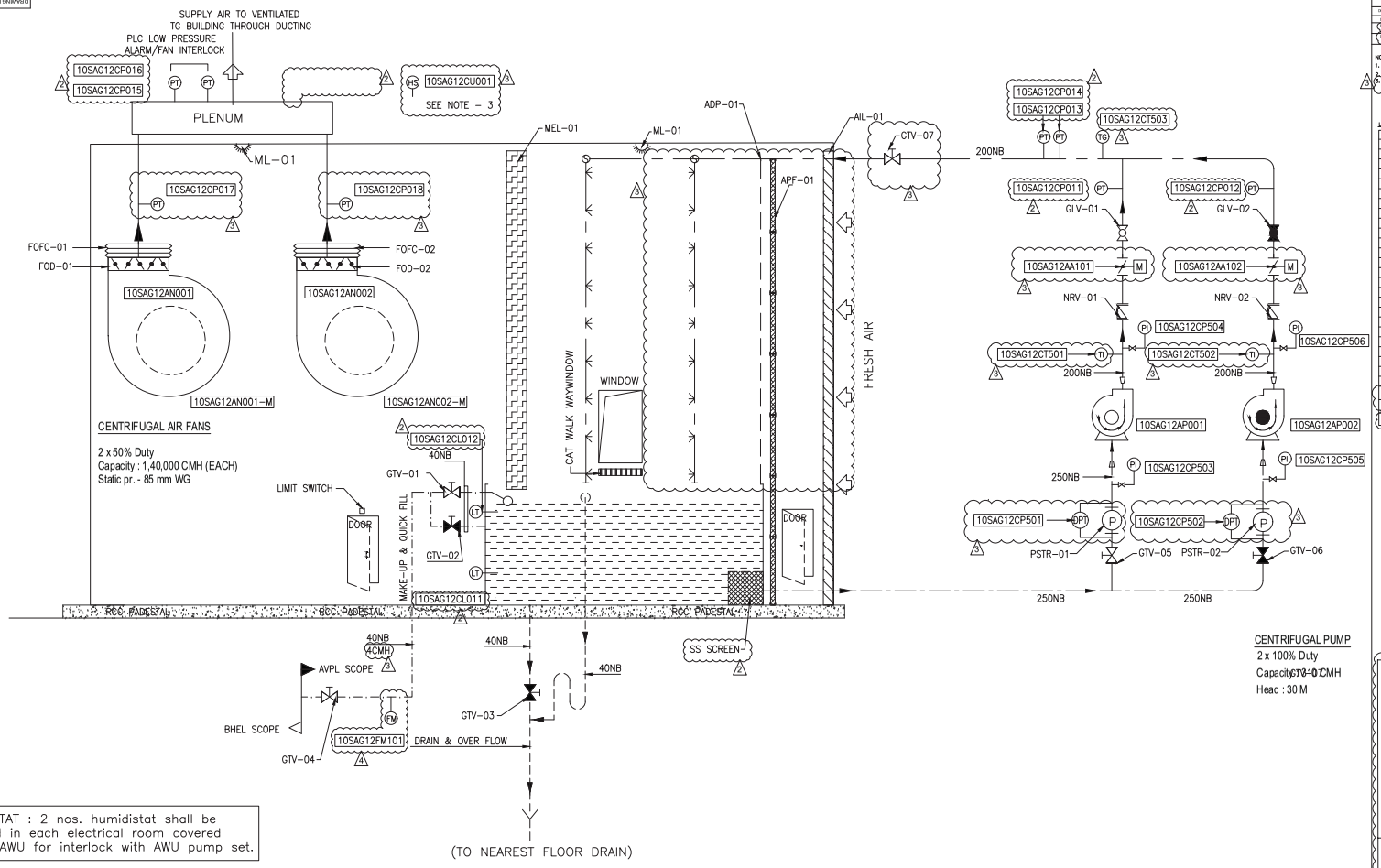
TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME				**DESIGNATIONS**		**SIGN & DATE**			

NOTES:

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

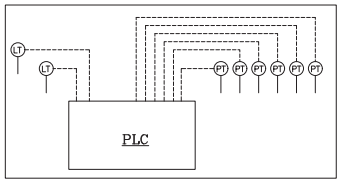


HUMIDISTAT : 2 nos. humidistat shall be provided in each electrical room covered by the AWU for interlock with AWU pump set.

NOTES:

1. LINE SIZE INDICATED ARE IN MILLIMETERS (NOMINAL DIAMETER)
2. ALL DRAIN PIPING UPTO NEAREST DRAIN POINT SHALL BE BY
3. EXCEPT FOR THE MAKE UP WATER PIPING BEYOND TERMINAL POINT AS INDICATED HEREIN, ALL EQUIPMENT, PIPING, VALVES, STRAINER SPECIALITIES AND SHOWN IN THIS DIAGRAM SHALL BE SUPPLIED BY
4. THICKNESS OF THE TANK IS 6.0 MM WITH EPOXY PAINTED INSIDE & OUTSIDE AREA OF THE TANK.
5. SATURATION EFFICIANCY OF THE AIR WASHER SHALL BE 90% MINIMUM.
6. CENTRIFUGAL FAN SHALL BE BACKWORD CURVED BLADE HEAVY DUTY TYPE.
7. GI PIPES HEAVY CLASS FOR AIR WASHER SHALL BE PROVIDED FOR SPRAY SYSTEM.
8. METALLIC FILTERS(SS MESH FILTER WASHABLE TYPE) SHALL BE PROVIDED.
9. GI LOUVER (FIXED TYPE) SHALL BE PROVIDED. COMPLETE WITH GI BIRD SCREEN ETC.
10. THICKNESS OF AWU SHALL BE 2.0MM THICK.
11. TOP SURFACE OF THE AWU SHALL BE THERMALLY INSULATED WITH 13MM THICK ALUMINUM FACED NITRILE RUBBER (QTY: 16 SQ.M ONLY FOR ONE UNIT).

P & ID FOR AIR WASHER UNIT (AWU280)



NOTES :
1. LINE SIZE INDICATED ARE NOMINAL DIAMETER.
2. DRAIN PIPE SHALL BE ROUTED NEARBY DRAIN POINT BY AWPL.
3. HUMIDITY SENSOR SHALL BE PROVIDED IN ALL ELECTRICAL ROOM SUCH AS LV SWITCHGEAR, MV SWITCHGEAR & MCC ETC.

LEGENDS & ABBREVIATIONS:–

SYMBOLE	ABBREVIATION	DESCRIPTION
	GLV	GLOBE VALVE
	NRV	NON RETURN VALVE
	GTV	GATE VALVE
	PSTR	POT STRAINER
	ML	MARINE LIGHT
	AIL	AIR INTAKE LOUVER
	PT	PRESSURE TRANSMITTER
	PI	PRESSURE INDICATOR
	MEL	MOISTURE ELEMINATOR
	FOFC	FAN OUTLET FLEXIBLE CONNECTION
	FOD	FAN OUTLET DAMPER
	SPR	SPRAY NOZZLE
	LT	LEVEL TRANSMITTER
		DP TRANSMITTER
		TEMPERATURE INDICATOR
		LIMIT SWITCH
	TG	TEMPERATURE GAUGE
	HS	HUMIDITY SENSOR
	APF	PRE FILTER (WASHEBLE TYPE)
	ADP	AIR DISTRIBUTION PLATE
		PUMP SUCTION / INLET LINE
		PUMP OUTLET / DELIVERY & BACKWASH LINE
		MAKE UP & QUICK FILL LINE
		DRAIN LINE
	MPH	MAIN POWER HOUSE
	SS	SS SUCTION SCREEN
	BFV–M	MOTORIZED BUTTERFLY VALVE
	FM	TURBINE TYPE FLOW METER

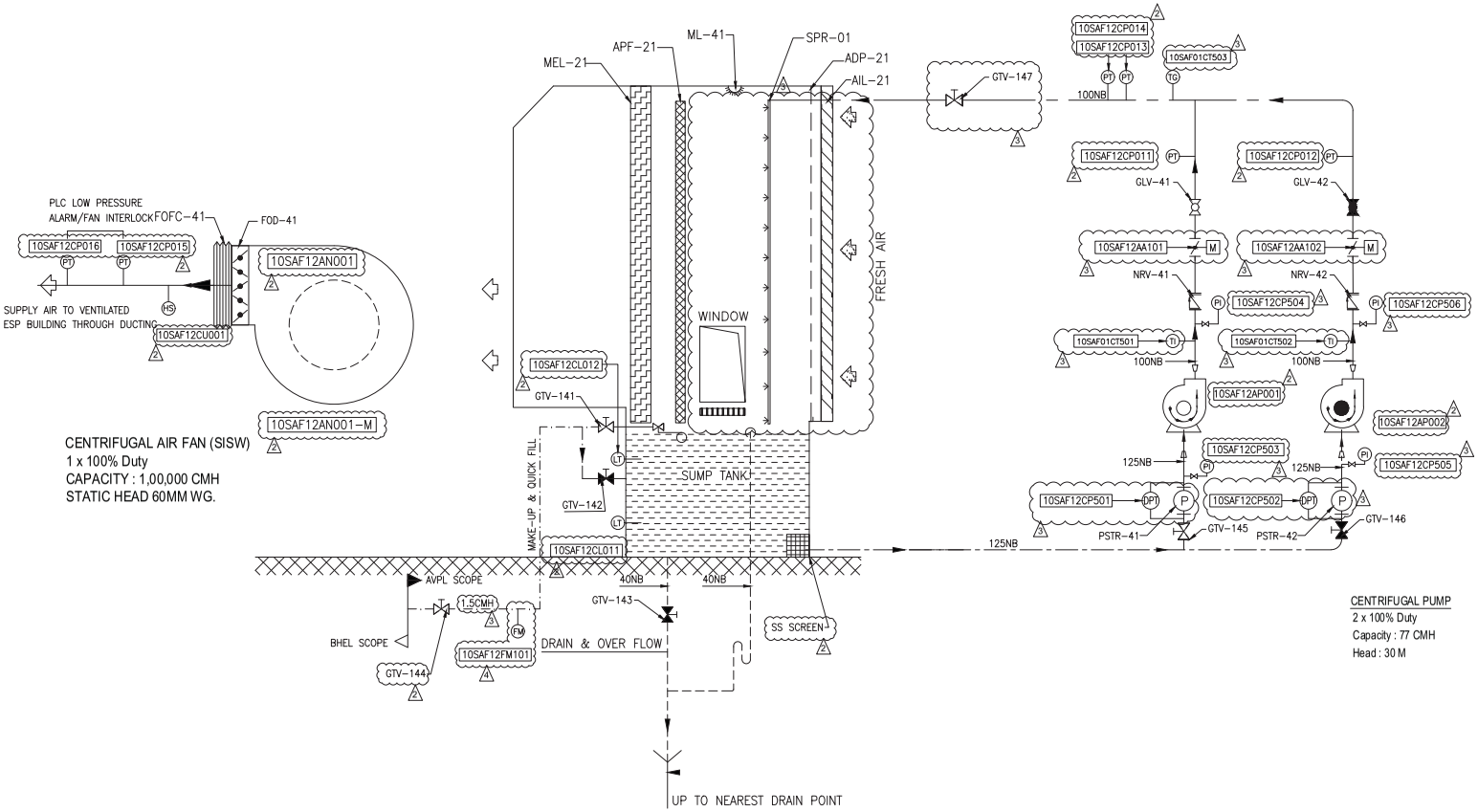
NOTE:- Tagging Philosophy for other units
1. For KKS of unit 2 prefix 20 shall be used instead of 10.
2. For KKS of unit 3 prefix 30 shall be used instead of 10.
3. For KKS of unit 4 prefix 40 shall be used instead of 10.
4. For KKS of unit 5 prefix 50 shall be used instead of 10.

SYSTEM NO. / SYSTEM / UNIT NO. — INSTRUMENT/ EQUIPMENT CODE / SERIAL NO.
10 SAG 12 xx xxx
FOR AWU

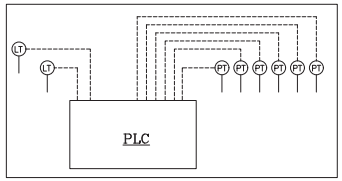
SYSTEM NO. / SYSTEM / UNIT NO. — INSTRUMENT/ EQUIPMENT CODE / SERIAL NO.
10 SAF 12 xx xxx
FOR UAF

JOB NO.	417
STATUS	CONTRACT
DISTRIBUTION	

REV.	DATE	A/D	CHD	APPD



HUMIDISTAT : 2 nos. humidistat shall be provided in each electrical room covered by the UAF for interlock with UAF pump set.



P & ID FOR UAF SYSTEM (UAF100)

NOTES:

1. LINE SIZE INDICATED ARE IN MILLIMETERS (NOMINAL DIAMETER)
2. ALL DRAIN PIPING UPTO NEAREST DRAIN POINT SHALL BE BY
3. EXCEPT FOR THE MAKE UP WATER PIPING BEYOND TERMINAL POINT AS INDICATED HEREIN, ALL EQUIPMENT, PIPING, VALVES, STRAINER SPECIALITIES AND SHOWN IN THIS DIAGRAM SHALL BE SUPPLIED BY
4. THICKNESS OF THE TANK IS 3.0 MM WITH EPOXY PAINTED INSIDE & OUTSIDE AREA OF THE TANK.
5. SATURATION EFFICIENCY OF THE UAF SHALL BE 60% MINIMUM.
6. CENTRIFUGAL FAN SHALL BE BACKWORD CURVED BLADE HEAVY DUTY TYPE.
7. GI PIPES HEAVY CLASS FOR AIR WASHER SHALL BE PROVIDED FOR SPRAY SYSTEM.
8. METALLIC FILTERS(SS MESH FILTER WASHABLE TYPE) SHALL BE PROVIDED.
9. GI LOUVER (FIXED TYPE) SHALL BE PROVIDED. COMPLETE WITH GI BIRD SCREEN ETC.
10. TOP SURFACE OF THE UAF SHALL BE THERMALLY INSULATED WITH 13MM THICK ALUMINUM FACED NITRILE RUBBER (QTY: 10.5 SQ.M. ONLY FOR ONE UNIT).

NOTES :
1. LINE SIZE INDICATED ARE NOMINAL DIAMETER.
2. DRAIN PIPE SHALL BE ROUTED NEAREST DRAIN POINT BY AVPL.

LEGENDS & ABBREVIATIONS:-

SYMBOLE	ABBREVIATION	DESCRIPTION
	GLV	GLOBE VALVE
	NRV	NON RETURN VALVE
	GTV	GATE VALVE
	PSTR	POT STRAINER
	ML	MARINE LIGHT
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	LT	LEVEL TRANSMITTER
		DP TRANSMITTER
		TEMPERATURE INDICATOR
		LIMIT SWITCH
	TG	TEMPERATURE GAUGE
	HS	HUMIDITY SENSOR
	APF	PRE FILTER (WASHEBLE TYPE)
	ADP	AIR DISTRIBUTION PLATE
		PUMP SUCTION / INLET LINE
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		MAKE UP & QUICK FILL LINE
		DRAIN LINE
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	FM	TURBINE TYPE FLOW METER

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SYSTEM NO.
SYSTEM
UNIT NO.
INSTRUMENT/
EQUIPMENT CODE
SERIAL NO.
10 SAG 12 xx xxx
FOR AWU

SYSTEM NO.
SYSTEM
UNIT NO.
INSTRUMENT/
EQUIPMENT CODE
SERIAL NO.
10 SAF 12 xx xxx
FOR UAF

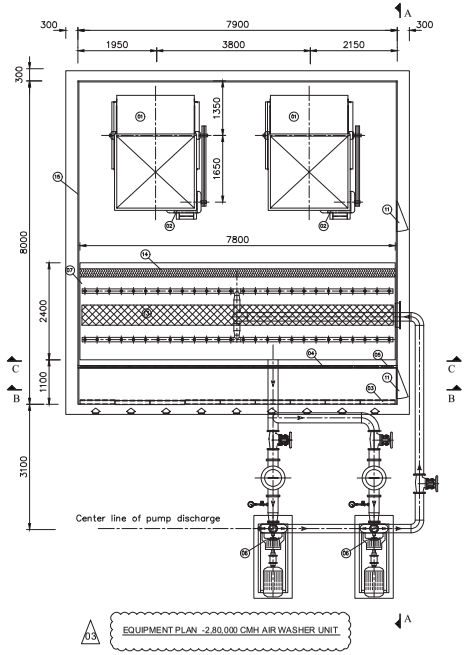
JOB NO.	417
STATUS	CONTRACT
DISTRIBUTION	

REV.	DATE	ALTD	CHD	APPD

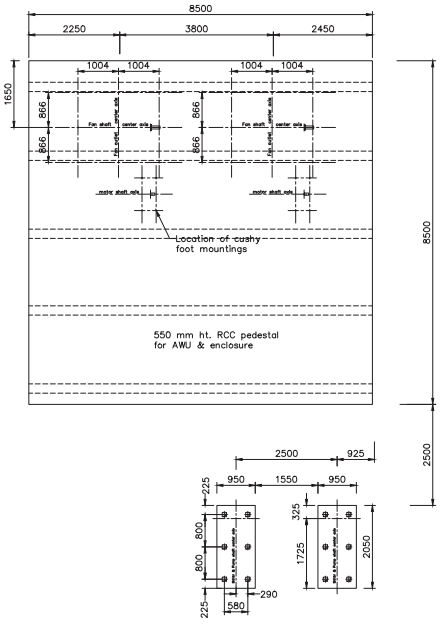
INDEX

3	Model No.	AWU280	
4	KKS Tag of AWU	10SAG12AH001 TO 10SAG12AH004 20SAG12AH001 TO 20SAG12AH004 30SAG12AH001 TO 30SAG12AH004 40SAG12AH001 TO 40SAG12AH004 50SAG12AH001 TO 50SAG12AH004	
5	Type	Double bank spray on filter screen with Mist eliminators, louvers, distribution plate, filters etc.	
6	Air flow Capacity	280000 CMH	
7	Fan Static pressure	85 mm WG	
8	Pressure drop In Air Washer Unit	a. Across air intake louvers	2 mmWC
		b. Across Filter	7.5 mmWC
		c. AWU Chamber / spray section	20 mmWC
		d. Across Eliminators	3 mmWC
		e. Fan outlet Damper	4 mmWC
		f. Duct & Accessories	35 mmWC
		Sub Total	71.5 mmWC
		Margine 10%	7.15 mmWC
		Total	78.65 mmWC
		Fan Selected For	**85 mmWC**
9	Quantity Offered	Total Qty. - Twenty (20)	
		Unit # 1 - 4 nos. (2 nos. A row side & 2 nos. B-C bay side)	
		Unit # 2 - 4 nos. (2 nos. A row side & 2 nos. B-C bay side)	
		Unit # 3 - 4 nos. (2 nos. A row side & 2 nos. B-C bay side)	
		Unit # 4 - 4 nos. (2 nos. A row side & 2 nos. B-C bay side)	
		Unit # 5 - 4 nos. (2 nos. A row side & 2 nos. B-C bay side)	
10	Location	Ten(10) @ 32.5 M in C-D Bay of Power House & Ten(10) @ 0.00M Outside A row of Power House	
11	Overall Dimension	8000x7900x4900 ht.	
12	Operating Weight of AWU	18,750 kg (each)	
13	Saturation Efficiency of AWU	90 % (min.)	
14	Make up water requirement	4 CMH	
15	Pressure Drop across spray section	15 to 20 mm WC	
16	Material of AWU chamber	MS Epoxy Painted	
17	Thickness	2 mm MS	
18	Painting	Epoxy painted from out side & inside	
Item Description			

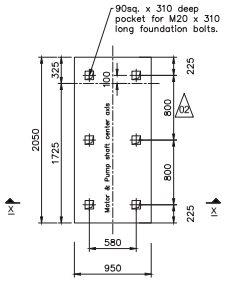
1	Water Tank	MS Epoxy Painted (800 mm ht.)
2	Water Mist Eliminator	100% Virgin PVC, die extruded, 3 bend (7800x4050 ht.)
3	No. of Nozzles	2 Nos. bank x 468 (936 nos. in each AWU)
4	Size of Nozzles	3/8" MPT with 4.5 mm orifice
5	Pressure drop through Nozzle	1.4 to 2.1 kg/cm2
6	Capacity of each Nozzle	5.5 LPM
7	Air Pre filter Type	Washable type, Stainless Steel mesh filter complete with SS / Aluminum frame, Box type.
8	Air Pre filter size	610 x 610 x 50 mm - 72 nos. / 600 x 305 x 50 mm - 18 nos.
9	No. of Air Pre filters	10 x 90 nos; 900 Nos. (90 Nos. for each AWU)
10	Cat walk	600x7800
11	Sump strainer	Yes
12	Inspection Door	Yes
13	Marine Light	Yes;Bulk Head
Material of Construction		
1	Air Intake Louver	20G Galvanized Plain Sheet
2	Air Distribution Plate	18G Galvanized Plain Sheet
3	Air Washer Casing / Enclosure	Double skin panel (inside and outside) shall be fabricated using (24 G) galvanized steel, with 25 mm. thk. Polyurethane insulation in between GSS channels. Outside skin shall be pre plasticized & inside sheet shall be plain GI. Top Surface of the AWU shall be thermally insulated with 13 mm thick thermal insulation made of Aluminium foil faced Nitrile Rubber (of density min. 40 Kg/CuM)
4	Water Eliminator	100% virgin PVC, 2mm thk., 3 bend section with supporting comb.
5	Water Spray Nozzle	Stainless Steel
6	Internal & drain Piping	GI Heavy grade as per IS:1239
7	External piping	Heavy grade as per IS:1239 upto 150 NB and MS as per IS:3589 for sizes above 200 NB
8	Water Tank	6 mm thick MS, Epoxy Painted from inside & outside
9	Support Structure	MS sections as per IS:2062
Inspection & Testing		
1	Inspection & Testing	As per Approved ICP cum sub vendor list for ventilation system, doc. No - Lr No. CE/TPC/SE-3/EME-11/YTPS/F.PEM/CAT PLAN/D NO 26/21 Dt 10.03.2021



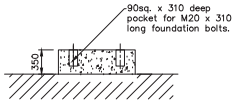
03 EQUIPMENT PLAN -2,80,000 CMH AIR WASHER UNIT



FOUNDATION PLAN -2,80,000 CMH AIR WASHER UNIT



PUMP FOUNDATION PLAN



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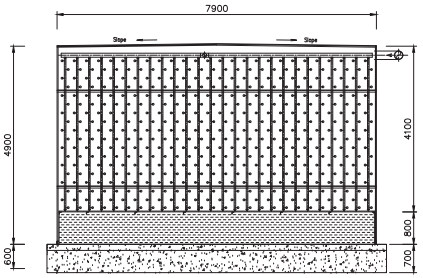
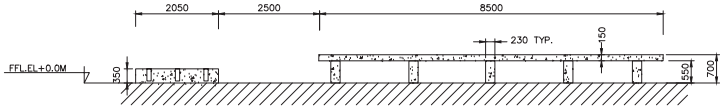
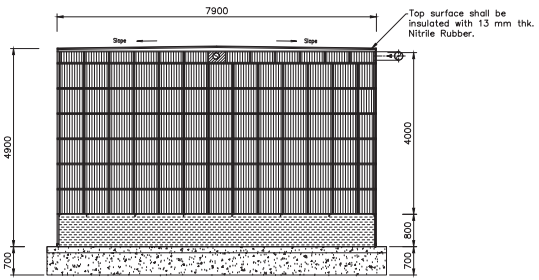


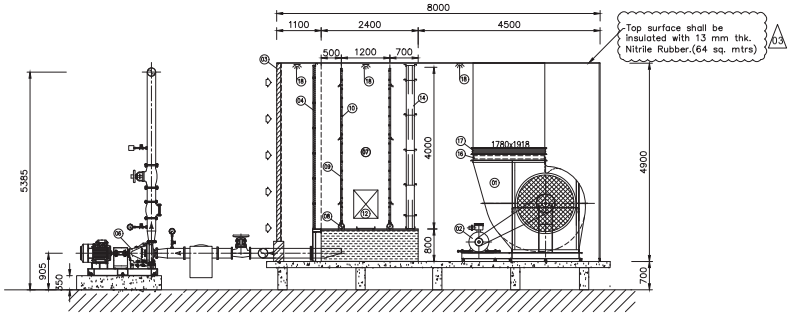
SECTION - B B



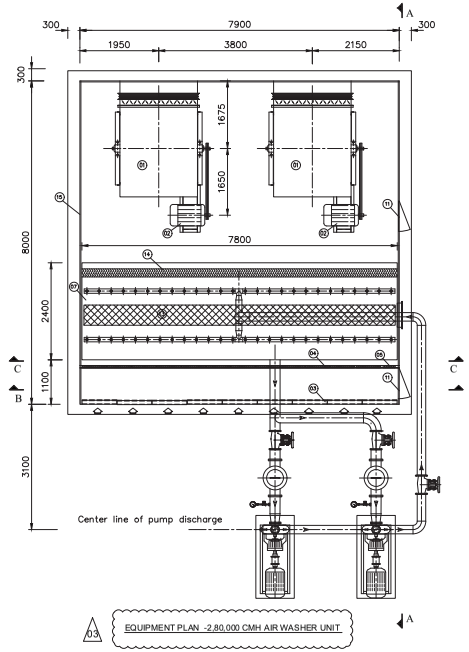
FOUNDATION ELEVATION -2,80,000 CMH AIR WASHER UNIT



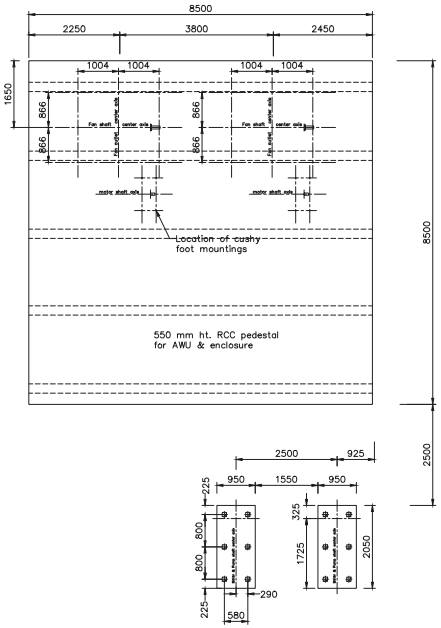
SECTION - C C



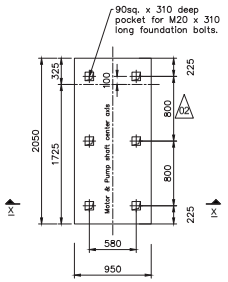
SECTION - A A



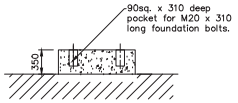
03 EQUIPMENT PLAN -2,80,000 CMH AIR WASHER UNIT



FOUNDATION PLAN -2,80,000 CMH AIR WASHER UNIT



PUMP FOUNDATION PLAN



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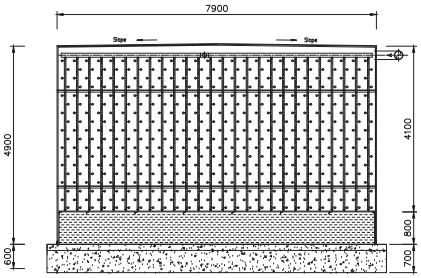
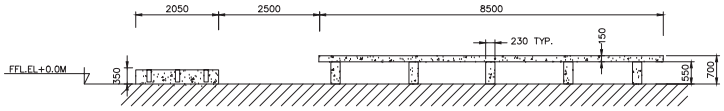
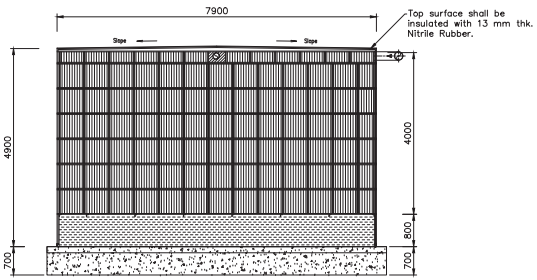


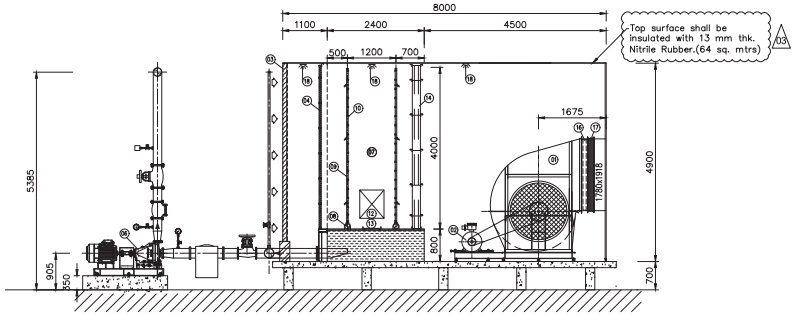
SECTION - B B



FOUNDATION ELEVATION -2,80,000 CMH AIR WASHER UNIT

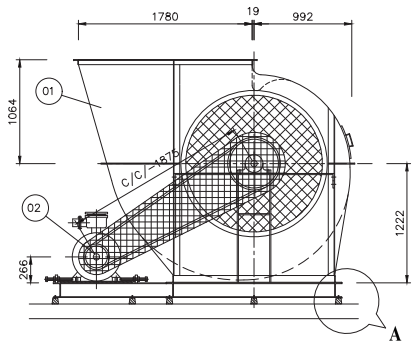


SECTION - C C

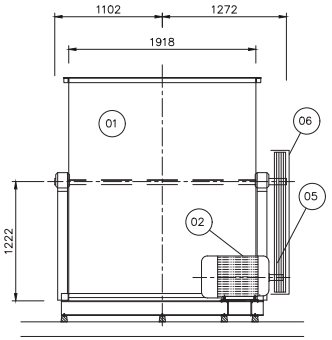


SECTION - A A

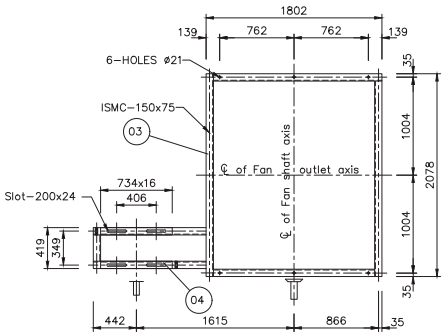
S.No	Item	Unit	Particulars
1	Manufacturer		
2	Model No.		[illegible]
3	Type of fan		Centrifugal (DIDW)
4	Type of fan Blade		Backward Curved/Inclined
5	Quantity	Nos.	Fourty (40)
6	Location		TG Bldg. at El. 32.5 M B-C bay and TG Bldg. at El. 0.00M outside 'A' row
7	Selected Capacity	CMH	140000
8	Static pressure	mmWG	85
9	Impeller Wheel Diameter	mm	1372
10	Rated Speed	RPM	623
11	Critical Speed	RPM	778
12	Class of Construction		Class - I
13	Bearing Type		Double row self aligned Ball/Roller (Bearing life - 100000 Hr. as per IS:3824)
14	Type of fan drive		Belt Drive
15	V - Belts (150% rated power)		SPC-PT5000 mm - 4 nos.
16	Recommended Motor Rating at 50 deg.C	kW	55
17	Motor speed	RPM	1470
18	Vibration Level		As per IS:14694 (2003)
19	Static load of Fan & motor	kg	2200
20	Dynamic load of Fan & motor	kg	3000
21	Material		
	a) Impeller		MS Sheet : IS-2062 (min. 16 swg.)
	b) Casing		3 mm thk. MS
	c) Shaft		EN-8
22	Sound Pressure level at 1 M distance from fan	dBa	≤85
23	Fan Balancing		Dyanamically balanced
24	Painting		Spray Galvanized
25	Direction of Discharge		Refer attached GA drawings
Inspection & Testing			
26	Inspection & Testing		As per Approved ICP cum sub vendor list for ventilation system, doc. No - Lr No. CE/TPC/SE-3/EME-11/YTPS/F.PEM/CAT PLAN/D NO 26/21 Dt 10.03.2021



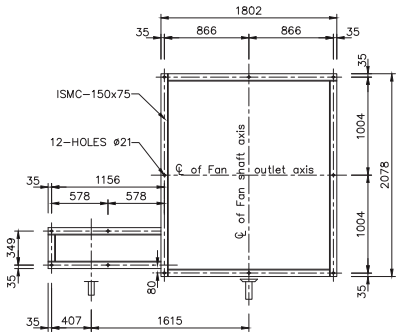
DRIVE END ELEVATION



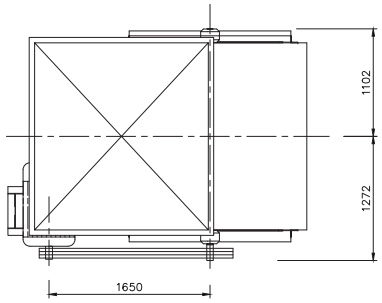
SIDE ELEVATION



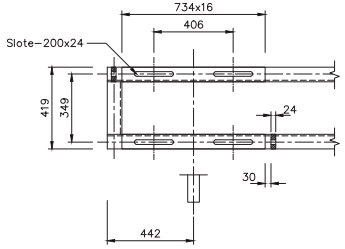
COMMON BASE FRAME (TOP FLANGE)



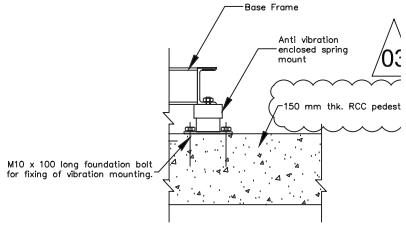
COMMON BASE FRAME (BOTTOM FLANGE)



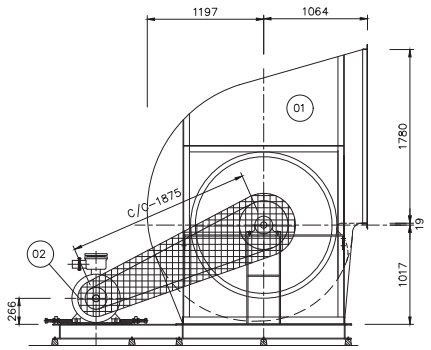
TOP VIEW



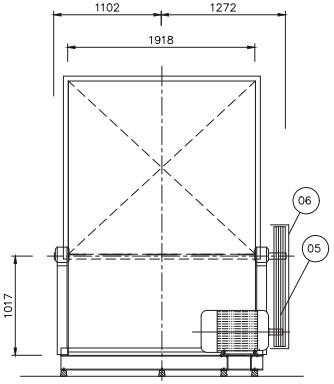
(MOTOR SLIDE RAIL DETAIL)



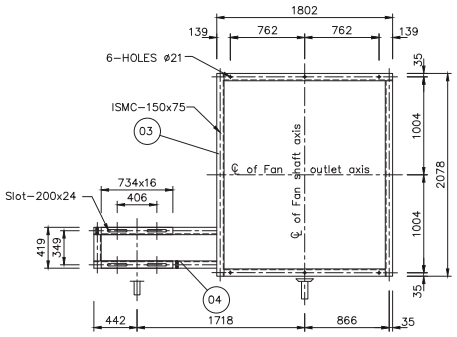
DETAIL - 'A'



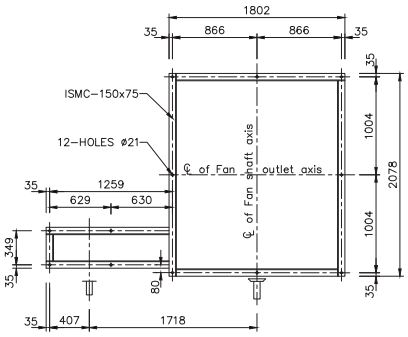
DRIVE END ELEVATION



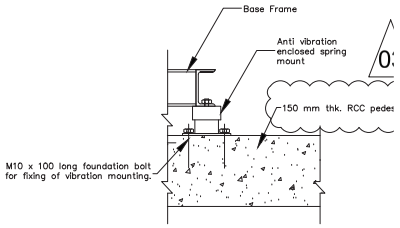
SIDE ELEVATION



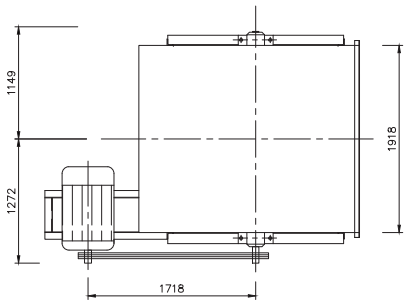
(MOTOR SLIDE RAIL DETAIL)



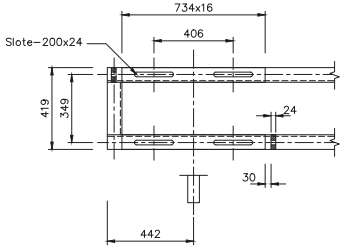
COMMON BASE FRAME (BOTTOM FLANGE)



DETAIL - 'A'



TOP VIEW



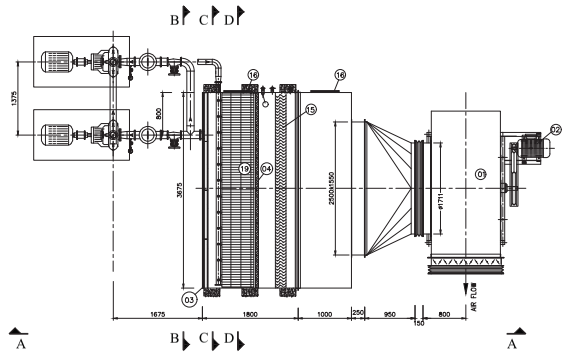
(MOTOR SLIDE RAIL DETAIL)

Outlet Velocity m/sec	Capacity, m^3/h	Static Pressure, Milli Metre of Water Column																		Limit Load	
		6.25		10		12.5		15		20		21.9		25		31.25		37.5			
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
4	40922	181	1.40	206	1.98	229	2.60	250	3.24	270	3.94	288	4.66	306	5.41	338	6.99	368	8.64	160	1.05
4.5	46038	191	1.67	216	2.30	236	2.96	256	3.64	276	4.37	294	5.14	311	5.93	342	7.60	374	9.34	180	1.49
5	51153	201	1.99	224	2.66	245	3.37	264	4.11	282	4.86	299	5.66	316	6.50	347	8.26	376	10.10	200	2.04
5.5	56268	212	2.35	234	3.06	254	3.82	272	4.61	289	5.42	306	6.26	322	7.13	352	8.94	380	10.87	220	2.72
6	61384	224	2.77	244	3.52	263	4.33	281	5.17	297	6.03	313	6.91	328	7.81	358	9.72	386	11.70	240	3.52
6.5	66499	235	3.25	254	4.05	272	4.90	290	5.77	306	6.69	322	7.63	336	8.58	365	10.50	392	12.60	260	4.50
7	71614	247	3.81	266	4.64	283	5.52	299	6.45	315	7.41	331	8.40	345	9.41	372	11.50	398	13.60	280	5.60
7.5	76730	260	4.44	277	5.30	294	6.25	309	7.20	325	8.20	339	9.24	354	10.30	380	12.50	405	14.70	300	6.88
8	81845	273	5.16	288	6.03	306	7.01	320	8.01	335	9.08	349	10.10	362	11.20	388	13.50	412	15.80	320	8.36
8.5	86960	286	5.94	301	6.86	316	7.85	331	8.94	345	10.0	359	11.10	372	12.30	397	14.60	421	17.10	340	10.00
9	92075	299	6.82	314	7.77	328	8.81	342	9.90	355	11.00	369	12.20	382	13.40	406	15.80	430	18.40	360	11.90
9.5	97191	313	7.81	326	8.80	339	9.87	354	11.00	366	12.20	379	13.40	392	14.50	416	17.20	438	19.80	380	14.0
10	102306	328	8.85	339	9.89	352	11.00	365	12.20	378	13.40	390	14.70	402	15.90	425	18.50	448	21.20	400	16.40
11	112537	355	11.30	366	12.40	378	13.60	389	14.8	401	16.10	412	17.50	424	18.80	446	21.60	467	24.50	420	18.90
12	122767	383	14.20	394	15.50	404	16.70	415	18.10	425	19.30	435	20.70	446	22.20	467	25.10	488	28.20	440	21.80
13	132998	412	17.50	422	19.00	431	20.40	441	21.60	451	23.0	461	24.50	471	26.0	489	29.20	509	32.40	460	24.80
14	143228	441	21.60	449	23.10	459	24.40	468	26.0	477	27.30	485	28.80	494	30.50	512	33.60	531	37.10	480	28.20
15	153459	469	26.20	478	27.60	486	29.20	494	30.80	503	32.20	512	33.90	519	35.50	537	38.80	554	42.30	500	31.90

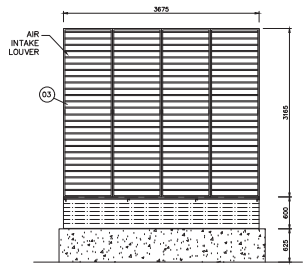
Outlet Velocity m/sec	Capacity, m^3/h	Static Pressure, Milli Metre of Water Column																		Limit Load	
		50		62.5		75		87.5		100		112.5		125		137		150			
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
7	71614	445	18.20	490	23.10	531	28.40	569	33.80	604	39.30	638	46.40	670	51.20	700	57.40	730	64.20	520	35.80
7.5	76730	452	19.40	495	24.50	536	29.80	574	35.50	608	41.20	644	47.20	674	53.50	706	60.30	735	66.60	540	40.10
8	81845	458	20.70	499	26.00	540	31.50	576	37.30	612	43.30	646	49.50	677	55.80	707	62.60	736	69.30	560	44.90
8.5	86960	465	22.20	506	27.30	545	33.20	581	39.20	616	45.30	650	51.80	682	58.40	711	65.00	738	71.80	580	49.70
9	92075	472	23.70	512	29.20	551	35.00	588	41.10	621	47.40	656	54.00	685	60.60	718	67.70	747	75.00	600	55.00
9.5	97191	481	25.30	519	31.00	557	36.90	593	43.30	626	49.70	659	55.10	690	63.40	720	70.70	748	77.80	620	60.60
10	102306	489	26.90	527	32.80	563	38.80	598	45.30	631	52.00	664	58.60	695	66.00	724	73.70	752	80.80	640	66.80
11	112537	507	30.60	544	36.90	578	43.30	612	50.00	644	57.00	672	64.40	705	71.40	734	79.20	761	86.90	660	73.20
12	122767	525	34.60	561	41.30	595	48.20	626	55.40	657	62.40	687	70.30	717	77.60	744	85.80	771	93.70	680	80.20
13	132998	545	39.20	579	47.00	612	53.40	644	61.00	672	68.60	700	76.50	729	84.30	755	92.50	784	101.00	700	87.50
14	**143228**	565	44.10	599	51.60	630	59.20	**662**	**67.10**	690	75.30	718	83.50	744	91.70	770	100.30	796	109.00	720	95.20
15	153459	587	49.90	619	57.50	650	65.50	678	73.90	708	82.10	735	91.00	761	99.60	787	108.20	810	117.60	740	103.40
16	163690	609	56.10	639	64.10	670	72.60	698	80.90	725	89.80	752	99.00	777	108.00	801	117.20	824	126.50	760	112.10
17	173920	632	62.80	661	71.50	690	79.90	718	88.80	744	97.90	769	107.80	796	116.80	823	126.20	842	137.00	780	121.40
18	184151	655	70.50	684	79.20	711	88.40	738	97.70	764	107.20	789	114.80	812	126.60	840	137.00	860	147.00	800	131.00
19	194381	679	79.00	706	87.70	732	97.50	758	107.20	784	116.90	808	128.10	831	137.00	852	147.80	876	158.50	820	141.00
20	204612	704	88.00	730	97.50	756	107.00	780	117.70	805	124.80	828	137.30	851	148.10	875	159.00	896	170.00	840	151.80
21	214846	730	98.00	755	107.50	780	117.00	804	128.10	827	139.00	849	148.80	873	161.00	894	171.20	916	182.50	860	162.70

S.No	Item	Particulars	
3	Model No.	UAF-100	
4	KKS Tag of UAF	10SAF12AH001 20SAF12AH001 30SAF12AH001 40SAF12AH001 50SAF12AH001	
5	Type	Single bank spray nozzles with Mist eliminators, louvers, filters etc.	
6	Air flow Capacity	1,00,000 CMH	
7	Fan Static pressure	60 mm WG	
8	Pressure drop In Air Washer Unit	a. Across air intake louvers	2 mmWC
		b. Across Filter	12 mmWC
		c. AWU Chamber / spray section	15 mmWC
		d. Across Eliminators	3 mmWC
		e. Fan outlet Damper	4 mmWC
		f. Duct & Accessories	15 mmWC
		Sub Total	51 mmWC
		Margine 10%	5.1 mmWC
		Total	56.1 mmWC
		Fan Selected For	**60 mmWC**
9	Quantity Offered	Five (5); each of 1,00,000 CMH	
		ESP Building Unit # 1 - 1 no.	
		ESP Building Unit # 2 - 1 no.	
		ESP Building Unit # 3 - 1 no.	
		ESP Building Unit # 4 - 1 no.	
		ESP Building Unit # 5 - 1 no.	
10	Location	On to the Roof of ESP Building @ 8.50M LVL.	
11	Overall Dimension	As per GA drawing of UAF, enclosed	
12	Operating Weight of UAF	5650 kg.	
13	Saturation Efficiency of AWU	60%	
14	Make up water requirement	1.5 CMH	
15	Pressure Drop across spray section	12 to 15 mm WC	
16	Material of UAF chamber	2 mm thk. MS, Epoxy painted, Top Surface of the UAF shall be thermally insulated with 13 mm thick thermal insulation made of Aluminium foil faced closed cell elastomeric Nitrile Rubber (of density min. 40 Kg/CuM) / XLPE (of density min. 33 Kg/CUM) or equalvent.	

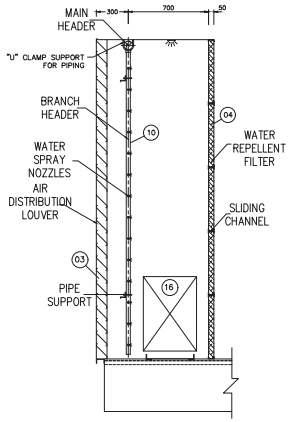
S.No	Item	Particulars
17	Thickness	2 mm thk. MS
18	Painting	Epoxy painted from outside & inside
Item Description		
	Water Tank	MS Epoxy painted (600 mm ht.)
1	Water Mist Eliminator	100% Virgin PVC, die extruded, 3 bend (3675x3165 ht.)
2	No. of Nozzles	1 No. bank x 168 nos. in each UAF
3	Size of Nozzles	3/8" MPT X 4.5 mm orfice
4	Pressure drop through Nozzle	1.4 to 2.1 kg/cm2
5	Capacity of each Nozzle	5.5 LPM
6	Air Pre filter Type	Washable type, Stainless Steel mesh filter complete with SS / Aluminum frame, Box type.
7	Air Pre filter size	610 x 610 x 50 mm-30 nos.
9	Cat walk	600x3600
10	Sump strainer	Yes
11	Inspection Door	Yes
12	Marine Light	Yes; Bulk Head
Material of Construction		
1	Air Intake Louver	20G GI sheet
2	UAF Chember	2 mm thk. MS, Epoxy painted, Top Surface of the UAF shall be thermally insulated with 13 mm thick thermal insulation made of Aluminium foil faced closed cell elastomeric Nitrile Rubber (of density min. 40 Kg/CuM) / XLPE (of density min. 33 Kg/CUM) or equalvent.
3	Water tank	3 mm thk. MS, Inside & outside Epoxy Painted
4	Water Mist Eliminator	100% virgin PVC, 2mm thk., 3 bend section with supporting comb.
5	Water Spray Nozzle	Stainless Steel
6	Internal & drain Piping	GI Heavy grade as per IS:1239
7	External piping	Heavy grade as per IS:1239 upto 150 NB and MS as per IS:3589 for sizes above 200 NB
8	Support Structure	MS sections as per IS:2062;with galvanizing
Inspection & Testing		
1	Inspection & Testing	As per Approved ICP cum sub vendor list for ventilation system, doc. No - Lr No. CE/TPC/SE-3/EME-11/YTPS/F.PEM/CAT PLAN/D NO 26/21 Dt 10.03.2021



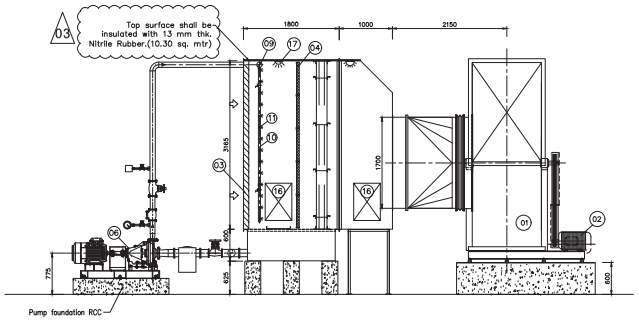
EQUIPMENT PLAN - 1,00,000 CMH UAF UNIT



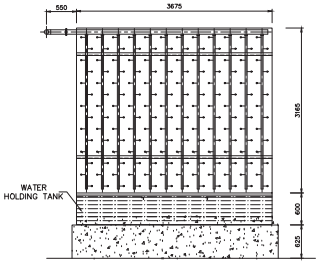
SECTION - B B



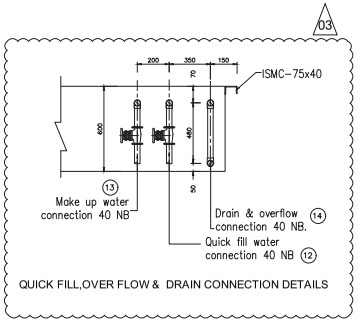
DETAIL FOR FILTER & NOZZLES



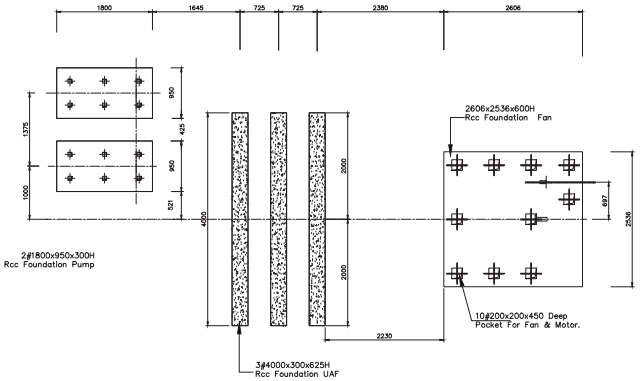
SECTION - A A - 1,00,000 CMH UAF UNIT



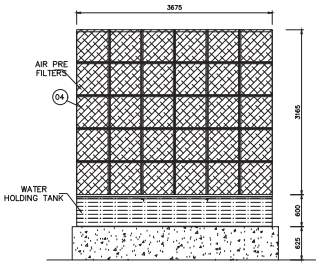
SECTION - CC



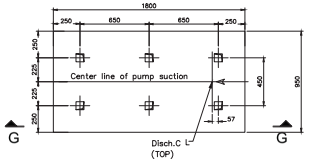
QUICK FILL,OVER FLOW & DRAIN CONNECTION DETAILS



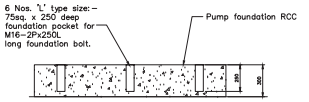
FOUNDATION PLAN - 1,00,000 CMH UAF UNIT



SECTION - D D



PLAN FOR PUMP FOUNDATION



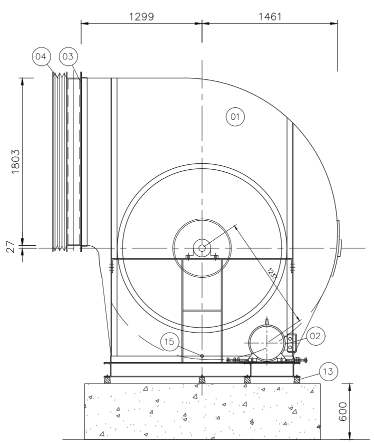
SECTION - G-G

S.No	Item	Unit	Particulars
1	Manufacturer		
2	Model No.		
3	Type of fan		Centrifugal (SISW)
4	Type of fan Blade		Backward Curved/Inclined
5	Quantity	Nos.	Five (5)
6	Location		At the Roof of ESP Building
7	Selected Capacity	CMH	1,00,000
8	Static pressure	mmWG	60
9	Impeller Wheel Diameter	mm	1130
10	Rated Speed	RPM	470
11	Critical Speed	RPM	587
12	Class of Construction		Class - I
13	Bearing Type		Double row self aligned Ball/Roller (Bearing life - 100000 Hr. as per IS:3824)
14	Type of fan drive		Belt Drive
15	V - Belts (250% rated power)		SPB-PT4060 mm - 3 nos.
16	Recommended Motor Rating at 50 deg.C	kW	30
17	Motor speed	RPM	1470
18	Vibration Level		As per IS:14694 (2003)
19	Static load of Fan & motor	Kg.	1840
20	Dynamic load of Fan & motor	Kg.	2760
21	Material		
	a) Impeller		MS Sheet : IS-2062 (min. 16 swg.)
	b) Casing		3 mm thk. MS
	c) Shaft		EN-8
22	Sound Pressure level at 1 M distance from fan	dBa	≤85
23	Fan Balancing		Dyanamically balanced
24	Painting		Spray Galvanized
25	Direction of Discharge		Refer Attached GA drawing
Inspection & Testing			
26	Inspection & Testing		As per Approved ICP cum sub vendor list for ventilation system, doc. No - Lr No. CE/TPC/SE-3/EME-11/YTPS/F.PEM/CAT PLAN/D NO 26/21 Dt 10.03.2021

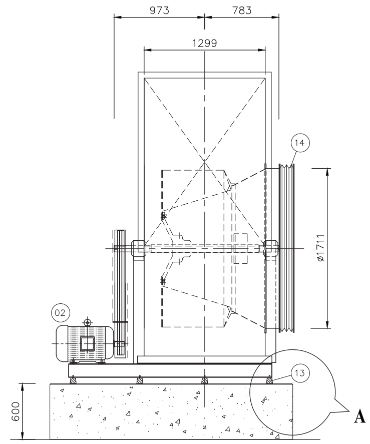
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

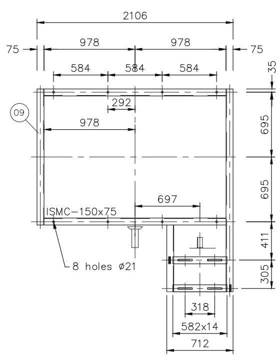
DRAWING No. PE-VD-417-554-A009



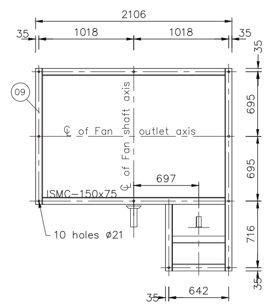
FAN DRIVE END ELEVATION



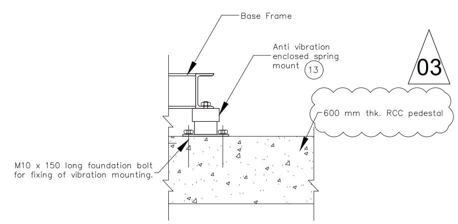
SIDE ELEVATION



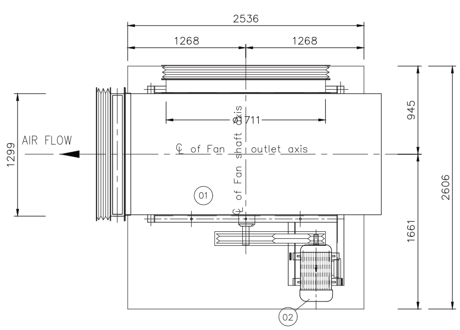
COMMON BASE FRAME (TOP FLANGE)



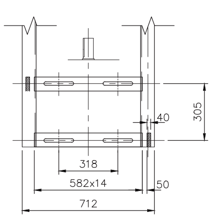
COMMON BASE FRAME (BOTTOM FLANGE)



DETAIL - 'A'



PLAN OF FAN & MOTOR ASSEMBLY



(MOTOR SLIDE RAIL DETAIL)

ELECTRONIC FILE NAME :

SINGLE INLET SINGLE WIDTH CENTRIFUGAL LIMIT LOAD FAN

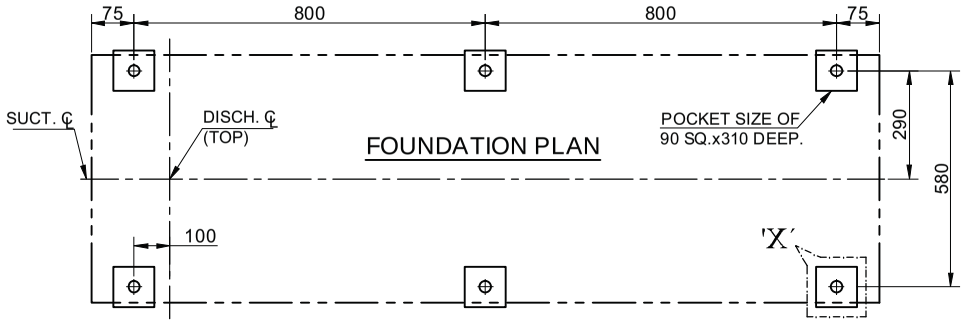
MODEL
AdLL-168

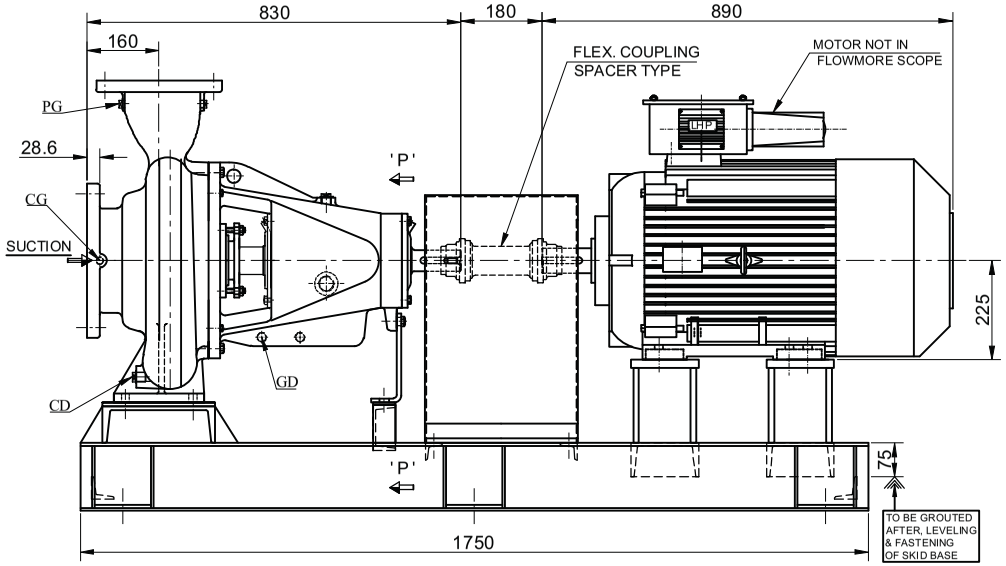
Wheel Diameter : 1676 mm Overall wheel Width : 759 mm Outlet Area : 2.320 Sqm

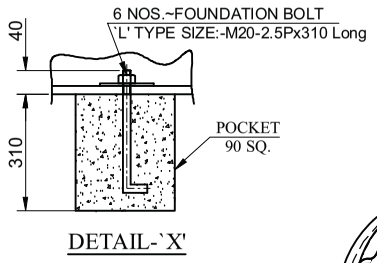
Outlet Velocity m/sec	Capacity, m³/h	Static Pressure, Milli Metre of Water Column																		Limit Load	
		6.25		10		12.5		15		20		21.9		25		31.25		37.5			
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
4	33963	154	1.20	174	1.66	191	2.14	208	2.64	224	3.19	239	3.76	253	4.34	279	5.56	303	6.85	150	1.17
4.5	38208	163	1.44	182	1.94	199	2.47	214	3.02	230	3.58	244	4.17	258	4.80	283	6.11	307	7.46	170	1.71
5	42452	172	1.73	190	2.26	206	2.82	222	3.41	236	4.03	250	4.65	263	5.30	288	6.67	311	8.12	190	2.39
5.5	46699	182	2.07	199	2.63	215	3.25	230	3.86	243	4.52	256	5.19	269	5.86	292	7.29	316	8.81	210	3.23
6	50942	193	2.46	209	3.95	224	3.70	238	4.38	251	5.05	263	5.77	276	6.50	299	7.98	320	9.55	230	4.24
6.5	55189	204	2.93	219	3.53	233	4.22	246	4.93	259	5.65	272	6.40	283	7.16	305	8.75	326	10.36	250	5.43
7	59434	216	3.48	228	4.10	242	4.80	255	5.54	268	6.30	279	7.10	291	7.90	312	9.56	333	11.27	270	6.85
7.5	63679	227	4.07	239	4.73	252	5.46	264	6.23	276	7.02	288	7.86	299	8.70	321	10.40	340	12.21	290	8.50
8	67924	239	4.74	251	5.46	262	6.20	274	6.99	285	7.82	297	8.68	307	9.58	328	11.38	347	13.25	310	10.38
8.5	72167	252	5.56	262	6.25	273	7.00	284	7.82	295	8.65	306	9.65	316	10.50	336	12.40	355	14.33	330	12.51
9	76412	264	6.36	274	7.15	284	7.90	294	8.76	305	9.64	315	10.55	325	11.52	345	13.50	363	15.50	350	14.90
9.5	80658	276	7.30	287	8.10	296	8.96	305	9.77	315	10.65	325	11.65	335	12.63	354	14.65	372	16.80	370	17.70
10	84903	289	8.35	298	9.21	307	10.08	316	10.90	326	11.85	335	12.83	344	13.83	363	15.90	380	18.10	390	20.60
11	93395	314	10.69	322	11.61	331	12.56	339	13.58	348	14.50	356	15.50	364	16.55	382	18.70	398	21.10	410	24.00
12	101886	340	13.20	347	14.40	355	15.55	363	16.55	370	17.65	378	18.70	386	19.70	402	22.00	417	24.50	430	27.60
13	110376	365	16.50	372	17.94	380	19.00	387	20.20	394	21.20	401	22.40	408	23.60	422	25.80	437	28.40	450	31.60
14	118864	391	20.50	398	21.60	405	23.10	411	24.10	418	25.40	425	26.65	432	27.80	444	30.20	457	32.80	470	36.20
15	127356	417	24.90	424	25.60	430	27.60	436	28.70	442	30.00	449	31.30	455	32.60	467	35.20	478	37.80	490	41.00

Outlet Velocity m/sec	Capacity, m³/h	Static Pressure, Milli Metre of Water Column																		Limit Load	
		50		62.5		75		87.5		100		112.5		125		137		150			
		RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP	RPM	HP
7	59434	370	14.80	406	18.70	439	22.80	470	27.00	498	31.30	525	35.90	551	40.50	577	45.50	601	50.60	510	46.20
7.5	63679	376	16.00	411	19.90	443	24.20	474	28.60	502	32.60	529	37.70	555	42.50	581	47.60	604	52.60	530	51.80
8	67924	383	17.10	416	21.20	448	25.60	478	30.10	506	34.80	534	39.60	559	44.50	584	49.70	607	54.90	550	57.80
8.5	72167	390	18.40	422	22.60	452	27.20	483	31.70	511	36.50	538	41.60	561	46.60	587	51.90	610	57.40	570	64.60
9	76412	397	19.70	429	24.20	459	28.60	488	33.50	515	38.30	542	43.60	566	48.90	590	54.30	614	59.70	590	71.70
9.5	80658	405	21.10	436	25.80	465	30.40	493	35.30	520	40.40	547	45.70	570	51.10	594	56.60	618	62.40	610	78.90
10	84903	413	22.60	443	27.40	471	32.30	499	37.30	525	42.30	551	47.80	575	53.40	599	59.20	622	65.00	630	87.00
11	93395	429	26.00	459	30.90	486	36.20	514	41.70	538	46.90	561	52.60	586	58.30	609	64.40	631	70.50	650	95.50
12	**101886**	448	29.60	**475**	**34.90**	503	40.40	528	46.20	550	52.10	575	58.00	597	63.90	619	70.10	641	76.30	670	104.60
13	110376	465	33.80	493	39.50	518	45.30	543	51.20	566	57.20	589	63.60	611	70.10	633	76.40	652	82.90	690	114.40
14	118864	485	38.50	510	44.40	536	50.60	560	56.80	581	63.00	605	69.70	625	76.00	646	83.60	666	90.20	710	124.60
15	127356	504	43.60	529	49.90	554	56.00	576	63.00	597	69.50	621	76.30	641	83.20	661	90.70	680	96.90	730	135.80
16	135847	525	49.50	548	56.00	570	62.40	594	69.50	615	76.50	636	83.80	655	90.90	676	98.40	695	106.0	750	146.00
17	144335	546	56.00	568	62.50	590	69.40	614	76.60	632	83.90	654	91.80	671	99.00	692	106.8	711	114.7	770	159.00
18	152825	569	63.40	589	70.20	610	77.00	630	84.50	650	92.00	671	100.00	689	108.0	708	116.3	727	124.2	790	170.80
19	161316	592	71.50	610	78.40	630	85.60	651	93.30	669	101.0	689	109.00	708	117.0	726	126.0	744	134.6	810	184.30
20	169806	614	80.70	632	87.50	652	94.60	670	102.8	689	110.7	708	119.00	726	127.0	744	136.0	760	145.0	830	199.00
21	178298	638	90.5	655	97.60	672	105.00	690	113.3	708	121.5	728	129.20	742	138.0	759	147.0	779	156.1	850	214.00

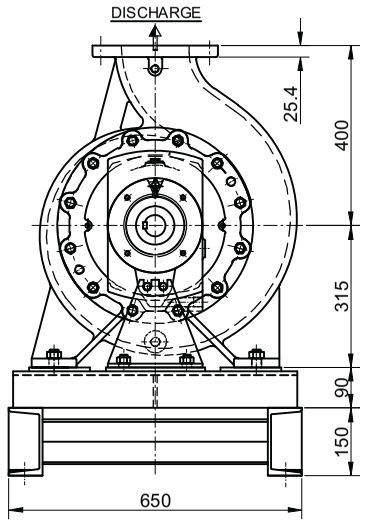
TECHNICAL DATA SHEET AIR WASHER PUMPS		
1	**Pump Details**	**Air washer Pumps**
2	Liquid	WATER
3	Make	Flow More
4	KKS Tag For Pump	For Unit #1:- 10SAG12AP001 to 008 For Unit #2:- 20SAG12AP001 to 008 For Unit #3:- 30SAG12AP001 to 008 For Unit #4:- 40SAG12AP001 to 008 For Unit #5:- 50SAG12AP001 to 008
3	Qty. (Nos)	40
4	Capacity(M3/Hr)	310
5	Head(m)	30
6	Sp.Gr.	1
7	Temp.	Amb
	PUMP SPECIFICATIONS	
8	Pump Model	5625
9	Succ.X Del(mm)	200X150
10	Pump Type	ENDSUCTION
11	Shut of Head	34
12	Effeciency(%)	80
13	Pump Input(kw)	31.65
14	Required Motor(kw)	45
15	RPM	1475
16	Nozzle Orientation	Side Suc X Top Discharge
17	Coupling Type	Spacer
18	NPSHr (M)	2.5
	Motor Specifications	
19	Make	LHP
20	Type	Totally Enclosed Fan Cooled Squirrel Cage
21	Insulation	Class F With Temp. rise limited to class B
22	Power Supply	AC 3 Phase,415 Volt+/-10%,50Hz+/-5%
23	Performance	Confirming to IS 325
24	Protection	IP-55(IS;2148)
	Material Of Construction	
25	Pump Casing	CI IS 210 GR FG 260
26	Impeller	Bronze IS 318 Gr-2
27	Impeller wearing	Bronze IS 318 Gr-2
28	Shaft	EN-8
29	Shaft Sleeve	Bronze as per IS 318
30	Gland Packing	PTFE
31	Base Plate	MS IS2062







DETAIL-`X'



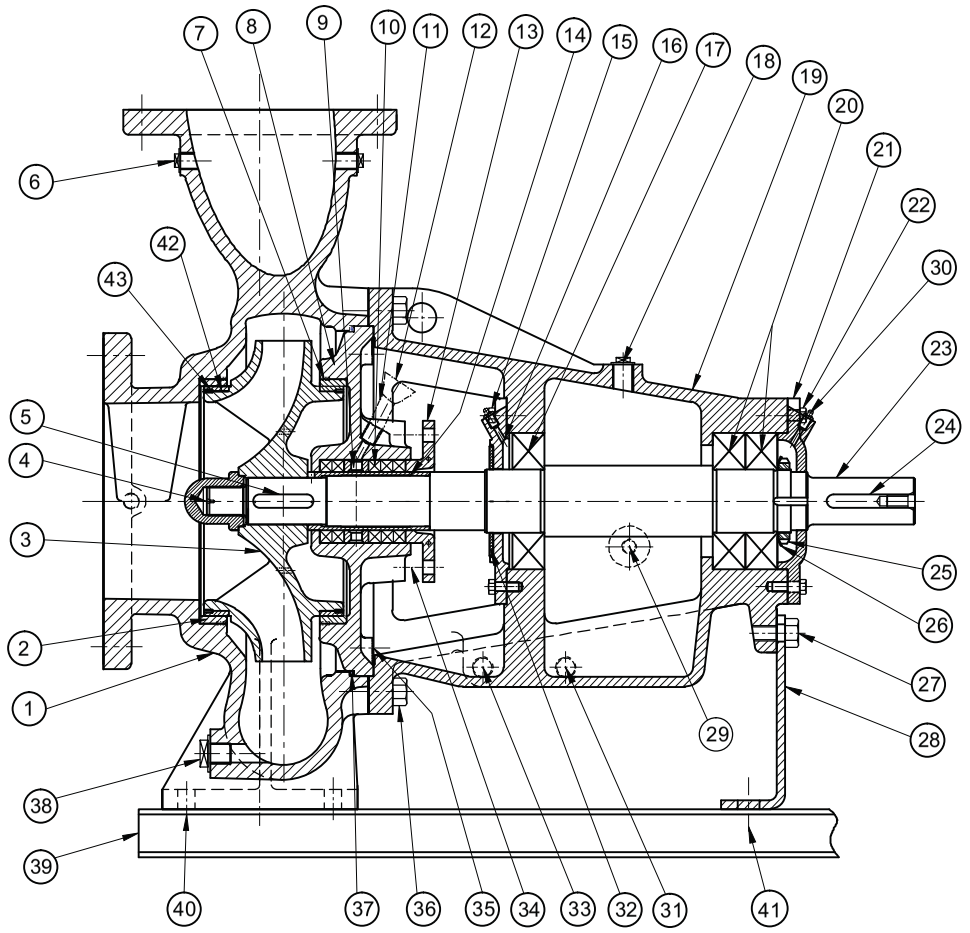
VIEW -'P'-'P'

FLANGE DETAIL AS PER ANSI B16.5, 150 LBS.			
SUCTION:------	200 N.B.	DISCHARGE:----	150 N.B.
FLANGE O.D.:---	343	FLANGE O.D.:---	279.4
P.C.D.:--------	298.4	P.C.D.:---------	241.3
NO. OF. HOLES:-	8	NO. OF. HOLES:-	8
DIA OF BOLTS:-	M20	DIA OF BOLTS:-	M20

PG	PRESSURE GAUGE	3/8" B.S.P
CG	COMPOUND GAUGE	3/8" B.S.P
CD	CASING DRAIN	3/4" B.S.P
GD	GLAND DRAIN	1/2" B.S.P

NOTE:-
1. DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. DIRECTION OF PUMP ROTATION:-COUNTER CLOCKWISE WHEN LOOKING FROM DF
3. STATIC LOAD (Pump Set With Motor) = 860 Kgs. (Approx.),
4. DYNMIC LOAD (Pump Set With Motor) = 1060 Kgs. (Approx.)

MOTOR PARTICULARS		PUMP PARTICULARS (QTY.:- 40 Nos)	
MAKE	-- LHP	FIG.	-- 5625
FRAME	-- 225 S/M	SIZE	-- 200 x150 (8"x6")
POWER	-- 45 K.W.	STAGE	-- SINGLE
SPEED	-- 1475 R.P.M.	SPEED	-- 1475 R.P.M.
VOLTS	-- 415±10%	CAPACITY	-- 310 Cu M /Hr.
PHASES	-- THREE	HEAD	-- 30 Mtrs.
FREQUENCY	-- 50 Hz.±5%	PUMP INPUT (Sp. Gr. 1.0)	-- 31.65 K.W.
TYPE OF CONS.	-- H.S.S.	EFFICIENCY	-- 80%



S. NO.	DESCRIPTION	QTY.	MATERIAL
45	COUPLING GUARD	01	M.S. (FAB.)
44	FLEXIBLE COUPLING (SPACER TYPE)	01	C.I.
43	DOWEL PIN (For Impeller Wearing ring)	04	S.S.-304
42	IMPELLER WEARING RING (Front & Back)	02	BRONZE (IS-318, LTB-II)
41	HEX. HD. BOLT WITH NUT & WASHER	02	M.S. (IS.-1367,Gr.-4.6)
40	HEX. HD. BOLT WITH NUT & WASHER	04	M.S. (IS.-1367,Gr.-4.6)
39	SKID BASE	01	M.S. (Fab.)(IS-2062)
38	PIPE PLUG	01	M.I.
37	`O' RING	01	NITRILE RUBBER
36	HEX. HD. CAP SCREW	12	M.S. (IS.-1367,Gr.-4.6)
35	STUD BOLT WITH NUT	02	M.S. (IS.-1367,Gr.-4.6)
34	STUD BOLT WITH NUT	02	S.S.-316
33	PIPE NIPPLE (Gland Drain)	01	STEEL
32	WATER SLINGER	01	RUBBER
31	PIPE PLUG	01	M.I.
30	GREASE RELEASE FITTING	02	STEEL
29	PIPE PLUG	01	M.I.
28	SUPPORT FOOT	01	M.S. (Plate)
27	HEX. HD. CAP SCREW WITH WASHER	02	M.S. (IS.-1367,Gr.-4.6)
26	BRG. LOCK WASHER	01	STEEL
25	BRG. LOCK NUT	01	STEEL
24	KEY FOR COUPLING	01	EN-9
23	PUMP SHAFT	01	EN-8
22	HEX. HD. CAP SCREW	04	M.S. (IS.-1367,Gr.-4.6)
21	BEARING COVER (D.E.)	01	C.I. (IS-210, FG 260)
20	ANTIFRICTION BEARING (D.E.) (6313 Z-C3)	02	BRG. STEEL (SKF /FAG)
19	FRAME/BEARING HOUSING	01	C.I. (IS-210, FG 260)
18	PIPE PLUG	01	M.I.
17	ANTIFRICTION BEARING (N.D.E.) (6313 Z-C3)	01	BRG. STEEL (SKF/ FAG)
16	BEARING COVER (N.D.E.)	01	C.I. (IS-210, FG 260)
15	HEX. HD. CAP SCREW	04	M.S. (IS.-1367,Gr.-4.6)
14	SHAFT SLEEVE	01	ASTM A276, S.S.-410 (H) (250-300 BHN
13	GLAND HALF	02	CI.(IS-210, FG-260)
12	GREASE CUP WITH N.R.V.	01	STEEL
11	PIPE NIPPLE WITH COUPLING	01	G.I.
10	PACKING PCS.(Champion Make,Style No:- 6094)	05	P.T.F.E IMP. (Non Asbestos)
09	WATER SEAL RING	01	BRONZE (IS-318, LTB-II)
08	BACK COVER/BACK HEAD	01	CI.(IS-210, FG-260)
07	DOWEL PIN (W/Ring to Casing / Back cover)	04	En-8/En-9
06	PIPE PLUG	04	M.I.
05	KEY FOR IMPELLER	01	EN-9
04	IMPELLER NUT	01	STEEL
03	IMPELLER	01	BRONZE (IS-318, LTB-II)
02	WEARING RING CASING (Front & Back Side)	02	CI.(IS-210, FG-260)
01	CASING (VOLUTE)	01	CI.(IS-210, FG-260)

NOTE:-

DIRECTION OF PUMP ROTATION:- COUNTER CLOCK WISE WHEN LOOKING FROM DRIVING

❋ THESE ITEM ARE NOT SHOWN IN THIS DRAWING.

PUMP PARTICULARS (QTY		
FIG.	--	5625
SIZE	--	200x150 (8")
STAGE	--	SINGLE
LUB.	--	GREASE