

2X800 MW LARA TPP STAGE II


TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM

SPECIFICATION No. PE-TS-508-554-A001

REV NO. 0




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

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM	PE-TS-508-554-A001
		Rev. No. 00
		Date : MARCH 2024

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PROJECT INFORMATION			
SL. NO	DESCRIPTION	UOM	DETAILS
1	CUSTOMER	-	NTPC LTD.
2	CUSTOMER CONSULTANT	-	NTPC LTD.
3	LOCATION AND APPROACH	-	The project is located in Raigarh district of Chhattisgarh State. The project is located south-east of Raigarh town near village Lara, bounded by villages Lara, Chhapora & Lohakhan and on the western side of Odisha State boundary.
4	RAIL LINK	-	The project site is approachable from NH-200 (Raigarh–Sarangarh) via Kondatarai through State PWD Road. The nearest rail head Raigarh Railway Station (on South East Central Railway, Howrah-Bilaspur Broad Gauge), is approximately 30 kms from the project site
5	AIRPORT	-	The nearest commercial airport, Raipur is about 250 kms from the project site.
6	METEOROLOGICAL DATA	-	
6.1	SUMMER OUTSIDE DBT	°C	44
6.2	SUMMER OUTSIDE WBT	°C	25.5
6.3	MONSOON OUTSIDE DBT	°C	31
6.4	MONSOON OUTSIDE WBT	°C	27.7
6.5	WINTER OUTSIDE DBT	°C	12.2
6.6	WINTER OUTSIDE WBT	°C	6.6
6.7	SEISMIC ZONE (AS PER IS 1893)	-	III
6.8	HEIGHT ABOVE MSL	m	220

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7	ELECTRICAL DATA			
7.1	AMBIENT TEMPERATURE FOR DESIGN OF ELECTRICAL EQUIPMENT	°C	50	
7.2	RATED FREQUENCY	Hz	50	
7.3	FREQUENCY VARIATION	%	(+) 3 to (-) 5	
7.4	AC VOLTAGE	V	415	
7.5	AC VOLTAGE VARIATION	%	+/-10;	
8	RAW WATER ANALYSIS			
8.1	PH	-	8.0	
8.2	Turbidity	NTU	84	
8.3	P-Alkalinity	mg/l as CaCO ₃	NIL	
8.4	M-Alkalinity	mg/l as CaCO ₃	108	
8.5	Total Hardness	mg/l as CaCO ₃	164	
8.6	Calcium	mg/l as CaCO ₃	100	
8.7	Magnesium	mg/l as CaCO ₃	64	
8.8	Chloride	mg/l as Cl	28	
8.9	Sulphate	mg/l as SO ₄	80	
8.10	Total Silica	mg/l as SiO ₂	14.4	
8.11	Colloidal Silica	mg/l as SiO ₂	6.3	
8.12	Reactive Silica	mg/l as SiO ₂	8.4	
8.13	Sodium + Potassium	mg/l as Na	52	
8.14	Total Organic Carbon (TOC)	mg/l	7.2	
8.15	Chemical Oxygen Demand (COD)	mg/l	12	
8.16	Biological Oxygen Demand (BOD)	mg/l	3.8	
8.17	Equivalent Mineral Acid (EMA)	mg/l	98	
8.18	Total Suspended Solids (TSS)	mg/l	78	
8.19	Total Iron	mg/l as Fe	0.56	
8.20	KMnO ₄ No.	mg/l	1.6	
8.21	Dissolved Oxygen (DO)	mg/l	7	
8.22	Temperature	°C	29	
8.23	TDS	ppm		
8.24	Total cations	mg/l as CaCO ₃	216	
8.25	Total anions	mg/l as CaCO ₃	216	



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SCOPE


SCOPE OF THIS PACKAGE COVERS THE FOLLOWING:

SL.NO	PARAMETERS	REQUIREMENT
1	Supply Including Design, Engineering, Manufacturing Of	
a)	Main Supply	YES
b)	Commissioning Spares	YES
2	Painting	YES
3	Inspection & Testing	YES
4	Packing	YES
5	Transportation & Delivery To Site	YES
6	Erection & Commissioning	YES
7	Supervision of Erection & Commissioning	NO
8	Performance Guarantee (PG) Test	YES
9	Mandatory Spares	YES
10	O & M Service	YES
11	O & M Spares	YES
12	Storage	YES
13	Consumables	YES

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GENERAL TECHNICAL REQUIREMENT		
1	The equipment shall comply with all applicable safety codes and statutory regulations of India as well as of the locality where the equipment is to be installed.	
2	In the event of any conflict between the requirements of two clauses of this specification, documents or requirements of different codes and standards specified, however more stringent requirement as per the interpretation of the owner shall apply	
3	Bidder to note that drawing/document submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Bidder to ensure proper net connectivity at their end.	
4	The first revision drawings/ documents submitted by vendor shall be complete in all respects . Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer's place any number of time as per the requirement for across the table discussions/ finalizations/ submissions of drawings.	
5	Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty eight (28) days prior to date of bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied after approval by the BHEL / customer.	
6	MINIMUM MANPOWER AND T&P REQUIREMENT FOR OVERALL DURATION OF CONTRACT E&C CONTRACT PERIOD	
6.1	Site engineer at least Diploma holder.	
6.2	Mechanical work: Equipment/Piping gang comprising- Piping Gang -01 number for 15 months, Equipment Gang – 01 number for 10 months. Ducting Gang - 2 numbers for 15 months	
6.3	T&P: Welding machine, cutting machine, chain pulley block,----min. 2 nos each for 15 months	
6.4	Manpower and T&P mentioned is minimum requirement and agency to deploy any additional requirement as per mutual agreement with concerned site dealing engineer.	
6.5	In case agency fail to deploy above, BHEL shall engage such manpower/T&P and cost of the same +30% penalty shall be levied on this	

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C&I - GTR		
1	Control of Ventilation System shall be through DCS located in Control Room.	
2	Complete Field Instrumentation for monitoring and operation of Ventilation System shall be provided by Vendor.	
3	The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose.	
4	Instruments to be used for PG test shall be additionally supplied by bidder over and above the instruments shown in tender P&IDs. PG test equipment being supplied, installed and commissioned for each unit, shall be retained by employer after completion of PG test. All PG test process parameters shall be made available in DDCMIS.	
5	The PROFIBUS protocol design shall be further validated by BHEL and approved by NTPC during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by bidder without any implications.	
6	Diaphragm seal shall be provided with Instruments having contact with corrosive media.	
7	Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.	
8	415V AC Power supply shall be provided by BHEL at a single point, All necessary hardware for deriving other power supply from given feeder shall be in Vendor's scope.	
9	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, junction boxes and all other accessories required for erection of local / remote instruments shall be provided by Vendor. Double root valve to be provided where the design pressure is or more than 40kg/cm ² .	
10	The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes.	
11	All instruments other than profibus type shall be terminated on JB/LCP in field. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.	
12	All the outdoor field instruments such as transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipment are protected against rain/ sunlight etc.	
13	All electric actuators, Junction Boxes, Solenoid valves and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.	
14	Bidder to provide Comprehensive Annual Maintenance Services (AMS) for three (03) years after warranty period for profibus instruments of Ventilation System.	
15	For all profibus devices GSD/DD and DTM files are to be provided for configuration/ testing in the DCS for proper interfacing and diagnostics.	
16	Bidder's presence is required for at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic in DCS. Bidder's presence is required in multiple visits at site during commissioning of DDCMIS for assistance related to process correctness. All the expenses like boarding, lodging and travel, air fare etc. shall be in bidder's scope.	

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17	Every panel-mounted instrument requiring power supply shall be provided with easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.	
18	Number of pairs to be selected for Screen/ Control cable a. F-Type: 2P/4P/8P/12P(Size : 0.5 mm ²) b. G-Type: 2P/4P/8P/12P(Size : 0.5 mm ²) c. Core Cable: 3CX2.5sqmm ² / 5CX2.5sqmm ² / 12CX1.5sqmm ²	
19	The design of the control systems and related equipment shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved. 'Fail Safe' operation signifies that the loss of signal, loss of excitation or failure of any component shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips are avoided / minimized.	
20	TYPE TEST GENERAL REQUIREMENT	
20.1	Submission of type test results and certificate shall be acceptable provided:	
20.2	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.	
20.3	There has been no change in the components from the offered equipment & tested equipment.	
20.4	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.	
20.5	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.	
20.6	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.	
20.7	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording, precautions to be taken etc. for the tests to be carried out.	
21	ANNUAL MAINTAINENCE SERVICE (AMS) FOR PROFIBUS INSTRUMENTS	
21.1	The requirements specified below are applicable for warranty (defect liability period) and 3 years AMS period.	
21.2	The Contractor's scope shall also include providing Post Warranty Maintenance for 3 years after completion of warranty period of the offered wireless systems and all associated components as per specification. The AMS shall include tools and tackle as required; travel, boarding & lodging of service engineer. In the event of any malfunction of the system hardware/system software, experienced service engineer shall be made available at site within 48 hours on the receipt of such information from Employer.	
21.3	Employer personnel will work on system day-to-day basis and wherever possible, Employer shall inform the type of failure of hardware/ software to Contractor based on diagnostic available with the system. However Contractor shall be fully responsible to attend and rectify the root cause and the failure within 48 hrs. Contractor may utilize the spares available with Employer, if necessary and available with Employer at site, which are part of mandatory spares supplied with system as per this specification. However, the consumed spares shall be replenished to Employer within 2 months' time.	

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21.4	The services under Post Warranty Maintenance Agreement, shall broadly comprise of the following:	
21.4.1	Periodic Maintenance Site visits, minimum four (4) times in a year (total days expected 16 in a year), schedule of visits to be discussed and finalized jointly between Contractor and client after placement of order/ delivery. It shall include inspection of general healthiness of the system, study and advice on daily maintenance, inspection of Hardware & Software, if any problem is reported, running of test programs, on-line servicing and solving reported problems. System shall be checked online.	
21.4.2	Software Maintenance/ Support Contractor shall maintain the existing operating & application software for any debugging requirements to have consistent performance of the system.	
21.4.3	Emergency Service In the event of any malfunction of the wireless system hardware/system software during this period, Service Engineer must report at site within 48 hrs. of report of failure. The system must be brought back within 48 hours after reporting at site.	
21.4.4	Contractor shall note that while carrying out the Annual Maintenance Contract activities, Employer's engineers shall associate with the Contractor. On-job training of these associated engineers shall be covered under this scope. This shall include all items being supplied by Contractor, including any bought out items but not limited to the following: Labour, at no additional cost, to repair any system devices , to provide tests, and adjustment to system devices.	
22	PLANT CONTROL OF VENTILATION SYSTEM	
22.0.1	Brief scheme of controlling the operation is described below. Detailed description of the control system for safe and efficient operation of the plant shall be elaborated, got approved from Employer.	
22.1	Control Scheme for Ventilation System	
22.1.1	The Ventilation system for main Plant area (excluding roof extraction fans, standalone Air supply and Air Exhaust fans) shall be controlled through DDCMIS (BHEL Scope). This DDCMIS system shall perform all functions such as auto/manual operation of valves, pumps, drives, local/remote selection of operation, status indication, annunciation, interlock and protection of pumps/drives, etc.	
22.2	Air Washer Units (AWU) & Unitary Air Filtration Units (UAF)	
22.2.1	Air washer units shall be started/stopped by initiation from Main DDCMIS based control system of A/C plant for Main plant area and ESP/FGD/AHP control rooms. Starting/stopping of pumps shall be automatic upon such initiation.	
22.2.2	The operation of the pumps shall be interlocked with the low level of water in the sump. High level of the sump shall be alarmed.	
22.3	Miscellaneous control requirements	
22.3.1	Separate emergency local stop push button shall be provided for each pump, fans, etc. of Ventilation system.	
22.3.2	The status of each pump, centrifugal fans, etc. of centralized ventilation system is available on OWS in control room locally.	
22.3.3	All the alarms related to failure of equipments, tripping of equipments, 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 control system	
22.3.4	The fans (both supply and exhaust fans) associated with mechanical ventilation system shall be operated locally.	



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TECHNICAL DATA - PART - A (MECHANICAL)

Air Washer Unit			
S. No.	Description	UOM	DETAIL
1	Components	-	•Double skin Air Washer Units (Containerized modular Type) completely enclosed
		-	• Tank
		-	• Distribution plates.
		-	• Set of metallic/fabric filters at suction.
		-	• Suction louvers.
		-	• Bird screens.
		-	• Water headers.
		-	• Spray nozzle.
		-	• Piping.
		-	• Pumps. (end suction Top discharge)
		-	• Valves.
		-	• Drift eliminators.
		-	• DIDW backward curve Centrifugal Fans Pre filter
-	For air washer units taking suction from C-row side, only metallic pre-filters shall be provided. However, for other air washer units, Contractor may provide fabric or metallic pre-filters.		
2	Cabinet	mm	• 25 thick Double Skin Panels
		Gauge	• 22 pre-painted sheet on outer side
		Gauge	• 20 Galvanized sheet (275 GSM) inside
		kgs/cub mtr	•40 density, fire retardant P.U. insulation injected in between. •panel fixed on Aluminium frame with soft rubber gasket
		-	•rolled formed GSS Channel frame work to mount fan and pump of suitable strength to arrest vibration
3	Tank	-	• Material - MS plate
		mm	• Thickness – 6 (min.)
		mm	• Depth – 600 (min.)
		microns	• Painting - Spray galvanized (minimum 60 DFT) Inside and outside surface
4	Distribution plate	-	Fabricated out of 18G galvanized steel sheets & galvanized steel angle supports with minimum 50% free area.
5	Banks	-	•Two-bank construction (one uni-flow and the other cross flow).
6	Cat Walks	-	• Galvanized header and stand pipes
7	Nozzle	-	Cat Walks of suitable width for maintenance of nozzles
		-	•Material- Brass or bronze with chrome plating.
		-	• Self-cleaning type.
8	Eliminator Plate	Kg/cm2	•Pressure drop through the nozzle -1.4 to 2.4
		-	• Material 24 G thick GS sheets class 275 or from 100% virgin PVC of minimum finished thickness of 2 mm.
		-	• GSS eliminator section to have minimum six bends.
9	Supports	-	• PVC eliminators to be UV stabilized using Titanium di-oxide and to withstand the weathering test as per IS:4892 for 500 hrs. Type test from reputed Laboratory shall be required for approval.
		-	All supports, tie rods and space bar shall be of galvanized steel and shall be complete with suitable drip tray and drain pipe.
10	Inspection door	-	Air tight inspection door of 600mm X 700mm size and a water marine light be provided for each air washer unit.
11	Screens	-	•Suitable number of brass screens to be provided in the to arrest the dirt entering the circulating water pump suction.
		-	•Suitable GI grid shall be used inside the screen for reinforcement
12	Saturation efficiency	%	90 (min.)
UAF Unit			
S. No.	Description	UOM	DETAIL
1	Components	-	•Double skin (Containerized modular Type) completely enclosed
		-	• Tank with screen type suction strainer
		-	• Distribution plates.
		-	• Set of metallic/fabric filters at suction.
		-	• Suction louvers.
		-	• Bird screens.
		-	• Water headers.
		-	• Spray and flooding type nozzle.
		-	• Header and Piping with support
		-	• Pumps. (end suction Top discharge)
		-	• Valves.
		-	• Moisture eliminators.
		-	• water repellant type nylon filter with frame and support
2	Cabinet	mm	• (25±2) thick Double Skin Panels
		mm	•0.80 pre-painted sheet on outer side
		mm	• 0.80 Galvanized sheet (275 GSM) inside
		kgs/cub mtr	•38 density, fire retardant P.U. insulation injected in between. •panel fixed on Aluminium frame with soft rubber gasket
		-	•rolled formed GSS Channel frame work to mount fan and pump of suitable strength to arrest vibration
-	• Material - MS plate		



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3	Tank	mm	• Thickness – 6 (min.)
		mm	• Depth – 600 (min.)
		microns	• Painting - Spray galvanized (minimum 60 DFT) Inside and outside surface
4	Distribution plate	-	Fabricated out of 18G galvanized steel sheets & galvanized steel angle supports with minimum 50% free area.
5	Banks	-	•one-bank construction
6	Cat Walks	-	• Galvanized header and stand pipes
		-	Cat Walks of suitable width for maintenance of nozzles
7	Nozzle	-	•Material- Brass or bronze with chrome plating.
		-	• Self-cleaning type.
		Kg/cm2	•Pressure drop through the nozzle -1.4 to 2.4
8	Eliminator Plate	-	• Material 24 G thick GS sheets class 275 or from 100% virgin PVC of minimum finished thickness of 2 mm.
		-	• GSS eliminator section to have minimum six bends.
		-	• PVC eliminators to be UV stabilized using Titanium di-oxide and to withstand the weathering test as per IS:4892 for 500 hrs. Type test from reputed Laboratory shall be required for approval.
9	Supports	-	All supports, tie rods and space bar shall be of galvanized steel and shall be complete with suitable drip tray and drain pipe.
10	Inspection door	-	Air tight inspection door of 600mm X 700mm size and a water marine light be provided for each UAF unit.
11	Screens	-	•Suitable number of brass screens to be provided in the to arrest the dirt entering the circulating water pump suction.
		-	•Suitable GI grid shall be used inside the screen for reinforcement
12	Saturation efficiency	%	60 (min.)

Centrifugal Fan

1	Type	-	Double Width Double Inlet (DWDI) Centrifugal Type
2	Impeller	-	Backward curved blades
3	Casing material	-	welded construction fabricated with heavy gauge galvanised sheet steel or MS sheet with spray galvanization (minimum 60 micron DFT) with The minimum thickness of 3 mm rigidly reinforced and supported by structural angles.
		-	The seams shall be permanently sealed air-tight.
		-	Split casings shall be provided on larger sizes of fans
		-	Casing drain with valves wherever required
		-	Carbon steel
4	Impeller material	-	die-formed backward-curved blades tie welded to the rim and back plate to have a non overloading characteristic of the fan
		-	Rim shall be spun to have a smooth contour
		-	intermediate stiffening rings
		-	Shaft sleeves based on requirement
		-	The impeller, pulley and shaft sleeves shall be secured to the shaft by key and/or nuts.
5	Shaft	-	EN 8 Steel
6	Fan bearings	-	Self-aligning type, permanently lubricated, heavy duty with a design life of 10,000 operating hours. They shall be easily accessible and lubricated properly from outside
7	Inlet screen	-	galvanised wire mesh of 25 mm square
8	Base plate	-	With suitable number of spring type vibration isolators or ribbed neoprene rubber pad or cushy foot mounting having minimum of 70% efficiency.
9	Critical speed	-	First critical speed of rotating assembly shall be at least 25 % above the operating speed.
10	Drive	-	Fans with V-belts and sheaves
		-	All belts shall be sized for 150% rated HP. All V-belt shall be equipped with removable belt guards that do not impede the air flow to the fan inlet.
		-	removable type belt guard.
		-	Minimum two belts per drive
		-	Motor rating (at 50 deg.C ambient) shall be at least fifteen percent (15%) above the maximum load demand of drives at the design duty point

Gate Valve

S. No.	DESCRIPTION	UOM	DETAIL
1	Size Range	-	50 MM & above, suitable for horizontal and vertical installation
2	Design Code	-	IS: 14846 or BS : 5150
3	Pressure Rating	-	a) PN 1.0 (as per IS:14846) b) PN 10 (as per BS:5150)
4	Construction Features	-	
4.1	Stem	-	Outside screw and yoke type, rising stem
4.2	Ends	-	Flanged, ANSI B16.5 Cl 150 (minimum)
4.3	Bonnet	-	Bolted
4.4	Wedge	-	Solid Wedge
5	Operation	-	by handwheel (Gear reduction unit for valve size 200 NB and above wherever applicable)
6	Seat	-	
a)	Body	-	Renewable
b)	Disc.	-	Renewable
7	Material of Construction	-	
7.1	Body/Bonnet/Handwheel	-	Cast Iron to IS:210 FG-200
7.2	Wedge Gland	-	Cast Iron to IS:210 FG-200
7.3	Stem	-	S.S. 410
7.4	Body Seat	-	GM to IS:318 Gr.-2
7.5	Wedge Seat	-	GM to IS:318 Gr.-2
7.6	Packing	-	Non-Asbestos
7.7	Back Seat Bushing	-	GM to IS:318 Gr.-2
7.8	Bolts, Nuts, & Studs	-	Carbon Steel to IS:1367, CL – 4.6/4.0
8	Accessories	-	• Position Indicator
		-	• Draining arrangement for Valve Seat
		-	•Locking Facility with lock
		-	•Gear reduction unit for valve size 200 NB and above.



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- Companion flanges, nut, bolts, washers
- Limit switch for open and close status of valve at DDCMIS

Globe Valve

S. No.	DESCRIPTION	UOM	DETAIL
1	Size Range	-	50 MM & above, suitable for horizontal and vertical installation
2	Design Code	-	BS : 5152 / Equiv.
3	Pressure Rating	-	PN 10 (as per BS:5152)
4	Construction Features	-	
4.1	Stem	-	Outside screwed & rising spindle
4.2	Ends	-	Flanged, ANSI B16.5 Cl 125 / Cl. 150
4.3	Bonnet	-	Bolted
4.4	Wedge	-	Solid Wedge
5	Operation	-	by handwheel (Gear reduction unit for valve size 200 NB and above wherever applicable)
6	Seat	-	
	a) Body	-	Renewable
	b) Disc.	-	Renewable
7	Material of Construction	-	
7.1	Body/Bonnet/Handwheel	-	Cast Iron to IS:210 FG-200
7.2	Wedge Gland	-	Cast Iron to IS:210 FG-200
7.3	Stem	-	S.S. 410
7.4	Body Seat	-	GM to IS:318 Gr.-2
7.5	Wedge Seat	-	GM to IS:318 Gr.-2
7.6	Packing	-	Non-Asbestos
7.7	Back Seat Bushing	-	GM to IS:318 Gr.-2
7.8	Bolts, Nuts, & Studs	-	Carbon Steel to IS:1367, CL -- 4.6/4.0
8	Accessories	-	• Position Indicator
		-	• Draining arrangement for Valve Seat
		-	• Locking Facility with lock
		-	• Gear reduction unit for valve size 200 NB and above.
		-	• Companion flanges, nut, bolts, washers
-	• Limit switch for open and close status of valve at DDCMIS		

Check Valve (below 50 NB)

S. No.	DESCRIPTION	UOM	DETAIL
1	Size range	-	Below 50 NB
2	Design Code/rating	-	IS : 778
3	Type	-	Swing check type
4	Pressure Rating	-	a) PN 1.0 (as per IS:5312) b) PN 10 (as per BS:5153)
5	End connection	-	Screwed ends ANSI B16.5
6	Material Specifications	-	
	a) Body, cover, flap, hinges	-	GM to IS:318 Gr.2
	b) Hinge pin, door pin	-	HT Brass
	c) Body seat ring, Disc. facing ring	-	As per OEM
	d) Gaskets	-	As per OEM

Check Valve (50 NB and above)

S. No.	DESCRIPTION	UOM	DETAIL
1	Size range	-	50 NB and above
2	Design Code/rating	-	IS : 5312/ BS:5153
3	Type	-	Swing check type
4	Pressure Rating	-	a) PN 1.0 (as per IS:5312) b) PN 10 (as per BS:5153)
5	End connection	-	Flanged to Class 150 min
6	Material Specifications	-	
	a) Body, cover, flap, hinges	-	Cast Iron IS:210 Gr. FG-200
	b) Hinge pin, door pin	-	SS
	c) Body seat ring, Disc. facing ring	-	GM to IS:318, LTB 2
	d) Gaskets	-	Non-Asbestos

Butterfly Valve

S. No.	DESCRIPTION	UOM	DETAIL
1	Size Range	-	50 MM & above, suitable for horizontal and vertical installation
2	Design Code	-	Double flanged or lugged wafer type of low leakage rate confirming to AWWA C-504/BS:EN:593/API 609/equivalent
3	Pressure Rating	-	PN 10
4	End Connection	-	Flanged as per ANSI B.16.5 Class 125 / BS-EN 1092
5	Material of Construction	-	
5.1	Body & Disc	-	Cast Iron
5.2	Shaft	-	SS 410 / SS 420
5.3	Seat Rings	-	EPDM
6	Accessories	-	• Position Indicator
		-	• Locking Facility with lock
		-	• Gear reduction unit for valve size 200 NB and above.
		-	• Nut, bolts, washers
-	• Limit switch for open and close status of valve at DDCMIS		

Balancing/Controller valve (32 mm to 50 mm dia)

S. No.	DESCRIPTION	UOM	DETAIL
1	Material of Construction	-	gun metal / cast iron construction with screwed ends.

Balancing/Controller valve (65 mm and above)

S. No.	DESCRIPTION	UOM	DETAIL
1	Material of Construction	-	cast iron construction with internal parts of SS 410 and EPDM / nitrile seat with flanged ends

Centrifugal Pumps

S. No.	DESCRIPTION	UOM	DETAIL
1	Type	-	End suction top discharge type
2	Configuration	-	As per specific Technical requirement
3	Impeller	-	Closed type
4	Casing MOC	-	2% Ni Cast Iron: IS:210 Gr. FG-260
5	Impeller MOC	-	Bronze IS:318 Gr-2
6	Wearing rings	-	Bronze
7	Shaft	-	SS 316
8	Shaft sleeve	-	SS 316
9	Lantern ring	-	Brass / Bronze



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10	Packing	-	Asbestos free
11	Base Plate	-	Carbon steel as per IS:2062
12	Speed	-	Maximum 1500 rpm
13	Operating Range	%	40 - 120 of the duty point
14	Efficiency	-	Max. efficiency at ± 10% of the rated design
15	Head	-	Minimum shut-off head of about 15% more than the design head.
16	Margin	-	Head of the pumps shall consider min. ten (10) % margin on friction head
17	Motor	-	Continuous Motor rating (at 50 deg.C ambient) shall be at least ten percent (10%) above the maximum load demand of the pump in the entire operating range.
18	Critical Speed	-	Not less than 130% of the rated speed
19	VFD	-	NA
20	Noise level	-	not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment surface
21	Vibration level (peak to peak) at 1500 rpm and below with Antifriction Bearing	micron	75
22	Vibration level (peak to peak) at 1500 - 3000 rpm with Antifriction Bearing	micron	50
23	Vibration level (peak to peak) at 1500 rpm and below with Sleeve Bearing	micron	75
24	Vibration level (peak to peak) at 1500 - 3000 rpm with Sleeve Bearing	micron	65

Piping

S. No.	DESCRIPTION	UOM	DETAIL
1	Chilled and Condenser water lines	-	•Heavy grade-IS:1239 or Equivalent upto150 NB
		-	•Grade 410 of IS:3589 or Equivalent for pipes beyond 200 NB
2	Refrigerant piping	-	• Seamless steel tubes conforming heavy grade IS:1239 or
		-	• Copper tubes as per IS:2501 (copper material as per IS:191 hard copper grade)
3	Drain piping	-	Heavy grade-IS:1239 or Equivalent & galvanized as per IS:4736
		-	• Steel fitting conforming to ASTM A234 Gr. WPB and dimensional standard to ANSI B 16.9/ANSI B16.11 / equivalent for sizes 65 NB and above.
4	Fittings	-	• For sizes 50 NB and below, the material shall conform to ASTM A-105.
		-	• All steel flanges shall be of slip on type and shall conform to ANSI B 16.5.
		-	• For pipe sizes above 350 NB, dimensions shall be as per BS:2633/BS:534.
		-	• Fittings, flanges and pipe joints of refrigerant piping shall conform to ANSI B31.5

Filter

S. No.	DESCRIPTION	UOM	DETAIL
1	Pre Filter		
1.1	Type	-	Flange / Cassette
1.2	Media	-	a) Fabric Filter: Washable non-woven synthetic fiber or High density Polyethylene (HDPE) media having 18G GSS / 16G Al alloy frame. The filter media shall be supported with HDPE mesh on air inlet side & Aluminium expanded metal on exit side or G.I. wire mesh on both sides.
		-	b) Metallic Filter: Filter medium, aluminium alloy shall be supported on galvanized expanded metal casing. Frame shall be fabricated from aluminium alloy of minimum 16G thickness conforming to IS: 737 or 18 gauge.
1.3	Efficiency	-	Average arrestance of 65 - 80 % when tested in accordance with BS:6540/ASHRAE 52 76 / EN-779
1.4	Minimum thickness	-	50 mm
1.5	Face Velocity	-	Not more than 2.5 m/sec.
1.6	Pressure drop	-	Initial pressure drop - Not to exceed 5.0 mm WC at rated flow.
		-	Final pressure drop - Upto 7.5 mm WC.
1.7	Location	-	• At the suction of each AHUs
		-	• At the discharge of each Fresh air fan
		-	• At discharge of each Supply air fan
1.8	General	-	• Suitable aluminium spacers be provided for uniform air flow;
		-	• Casing shall be provided with neoprene sponge rubber sealing.
		-	• Capable of being cleaned by water flushing.
		-	• Density of filter medium shall increase in the direction of air flow in case of metallic filter.
-	• Filter media shall be fire retardant and resistant to moisture, fungi, bacteria & frost.		
2	Fine Filters (Microvee type)		
2.1	Type	-	Flange / Cassette
2.2	Media	-	•Washable non-woven synthetic fibre or High density Polyethylene (HDPE) media having 18G GSS / 16G Al alloy frame.
		-	•The filter media shall be supported with HDPE mesh on air inlet side & Aluminium expanded metal on exit side or G.I. wire mesh on both sides.
2.3	Efficiency	-	Average arrestance > 90% when tested in accordance with BS:6540/ASHRAE 52-76 / EN-779.
2.4	Minimum thickness	-	150 mm or 300 mm.
2.5	Face Velocity	-	Not more than 1.2 m/sec for 150 mm and not more than 2.4 m/sec. for 300 mm
2.6	Pressure drop	-	Initial pressure drop - Not to exceed 10 mm WC at rated flow ; Final pressure drop-Up to 25 mm WC.
		-	• At the discharge of each Fresh air fan.
2.8	General	-	• At the discharge of each supply air fan having static pressure 30mm wc or more.
		-	• A neoprene sponge rubber sealing shall be provided on either face of the filter frame.
		-	• Capable of being cleaned by air or water flushing.
-	• Filter media shall be fire retardant and resistant to moisture, fungi, bacteria & frost.		

GI Sheet

S. No.	DESCRIPTION	UOM	DETAIL
1	Material	-	Galvanized Steel sheet (GSS)
2	Indian Standard "IS"	-	IS : 277
3	Zinc Coating	GSM	275
4	Thickness	-	As per IS : 655, depending on size of the longer side of duct
		-	•Upto 750: 24 G (0.63 mm)
		-	•751-1500: 22 G (0.8 mm)
		-	•1501-2250: 20 G (1.0 mm)
-	• 2251 & above: 18 G (1.25 mm)		
5	Fabrication	-	Manually fabricated and/ or formed into L Shaped factory fabricated ducts, SMACNA standard to be followed.
6	Support Material	-	* For larger side > 2250 mm - 16mm MS rods and 50x50x3 mm MS double Angles
7	Support distance	-	* For larger side < 2250 mm - 10mm MS Rods and 40x40x3 MS angles at a distance of not more than 2000 mm



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Axial Fans			
S. No.	DESCRIPTION	UOM	DETAIL
1	Axial Fans		
1.1	Blades	-	Fixed / variable pitch cast aluminum blades of aerofoil design.
1.2	Casing	-	Heavy gauge sheet steel construction.
1.3	Accessories	-	•Necessary rain protection cowl.
		-	• Inlet and outlet cones.
		-	• Bird protection screen.
		-	• Adjustable damper.
		-	• Vibration isolators.
1.4	Motor Type	-	• Back draft dampers
1.5	Fan Speed with Static Pressure (mm WC) <30 and Impeller Dia (mm) >450	RPM	• supporting frame and structure Battery room exhaust fans shall be spark proof (with flame proof motor) fans.
1.6	Fan Speed with Static Pressure (mm WC) <30 and Impeller Dia (mm)	RPM	<1000
1.7	Fan Speed with Static Pressure (mm WC) >=30 and Impeller Dia (mm)	RPM	<1500
1.8	Fan Speed with Static Pressure (mm WC) >=30 and Impeller Dia (mm)	RPM	<3000
RE unit Fans			
S. No.	DESCRIPTION	UOM	DETAIL
1	Axial Fans	-	Cowl type
1.1	Blades	-	Fixed / variable pitch cast aluminum blades of aerofoil design.
1.2	Casing	mm	3 Heavy gauge sheet steel construction for impeller dia upto 750 mm
		mm	5 Heavy gauge sheet steel construction for impeller dia above 750 mm
1.3	Impeller	-	access door with locking arrangement Axial flow type , cast Aluminium in one piece and dynamically balanced.
1.4	Accessories	-	•Necessary rain protection cowl.
		-	• Inlet and outlet cones and exhaust hood
		-	• Galvanised bird protection screen of 15 mm square.
		-	• Adjustable damper.
		-	• Vibration isolators.
1.5	Motor Type	-	• Vibration isolators with vibration level as per ISO:14694
1.6	Fan Speed with Static Pressure (mm WC) <30 and Impeller Dia (mm) >450	RPM	• transformation piece to suitably match roof opening with fan opening
1.7	Fan Speed with Static Pressure (mm WC) <30 and Impeller Dia (mm)	RPM	• supporting frame and structure with anticorrosive SS fixing bolts
1.8	Fan Speed with Static Pressure (mm WC) >=30 and Impeller Dia (mm)	RPM	As per Electrical specification
1.9	Fan Speed with Static Pressure (mm WC) >=30 and Impeller Dia (mm)	RPM	<1000
			<1500
			<1500
			<3000
Fire Dampers			
S. No.	DESCRIPTION	UOM	DETAIL
1	Type	-	Motorized
2	Fire rating	minutes	Minimum 90
3	Reference Code/Standard	-	As per UL-555, 1995 (certified by CBR)
4	Actuator	-	Spring return actuator with emergency function
Diffusers, Grills, Dampers & Louvres			
S. No.	DESCRIPTION	UOM	DETAIL
1	Grilles/Diffuser	-	• Supply air diffusers/grills to have factory fitted volume control dampers • Extruded Aluminum of minimum 1.2 mm thick with powder coating for AC system •Mild steel powder coated for Ventilation System
2	Dampers for Grills/diffusers	-	• 20 gauge minimum thickness
3	Splitters and dampers (for equipment/area isolation and for proportional volume control of system	-	• All VCDs shall have key based operations minimum 16 gauge GS sheet of quadrant type with suitable locking device, mounted outside of duct in accessible position
TYPE OF SYSTEM			
1	POWER HOUSE UNIT 1		
1.1	Power house with Electrical area (Except Boiler MCC room)	-	Ten (10) numbers Air washer units each of 1,00,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump and exhaust with back draft damper
1.2	Boiler MCC room	-	One (1) number Air washer units each of 50,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump and exhaust with back draft damper
1.3		-	Roof extractor units - capacity - 60 % of total discharge of Air washer units
2	POWER HOUSE UNIT 2		
2.1	Power house with Electrical area (Except Boiler MCC room)	-	Ten (10) numbers Air washer units each of 1,00,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump and exhaust with back draft damper
2.2	Boiler MCC room	-	One (1) number Air washer units each of 50,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump and exhaust with back draft damper
2.3		-	Roof extractor units - capacity - 60 % of total discharge of Air washer units
3	ESP CONTROL ROOM BUILDING (NON AC AREA)		
3.1		-	One (1) number Unitary Air Filtration (UAF) units each of 75,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump for each unit and exhaust with back draft damper
4	FGD CONTROL ROOM BUILDING (NON AC AREA)		
4.1		-	One (1) number Unitary Air Filtration (UAF) units each of 75,000 cmh capacity each having having 1 no. DIDW centrifugal fan and 1 number circulating water pump for each unit and exhaust with back draft damper
5	AUXILIARY BUILDINGS (NON AC AREA)		
	Area	-	Type of Ventilation system
5.1	General area like pump house, compressor houses, etc.	-	Combination of Supply air fan (with Pre filter) & Exhaust air fans/Roof Extractor Fans
5.2	MCCs and Switchgear room, Cable Vault (other than served by evaporative ventilation system), etc.	-	Supply air fans (with pre and fine filter) & Back draft dampers
5.3	Battery rooms & other fumes/odour generating areas	-	Combination of Air Intake Louvers & Exhaust air fans (with flame proof motor)
5.4	Toilet/pantry etc.	-	propeller type Exhaust air fans
DESIGN CRITERIA			
1	Air change per hour method (ACPH)		
	Area		ACPH
1.1	For all evaporative cooled areas	ACPH	8
1.2	General areas	ACPH	20




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1.3	Hydrogen generation plant/MCC/ Switchgear rooms and Battery rooms & other areas where gaseous fumes/ vapours are generated	ACPH	30
2	Heat load method		
	Area		Inside Temperature (deg. C)
2.1	evaporative cooled	deg. C	3 deg. below summer ambient temperature
2.2	Dry Mechanical ventilation	deg. C	3 deg. above summer ambient temperature
3	Selected Air quantity	-	Higher quantity of air of either of condition (clause no. or 2)
4	Height of AB bay TG hall for air quantity	-	4 M above operating floor
5	Fire damper requirement in Electrical area with evaporative type ventilation	-	Motorised type
		-	90 minutes fire rating
6	Circulating water capacity of Air washer	Cu.M/hr	1 Cu.M/hr per 1000 Cu.M/hr of air flow (min.)
7	Circulating water capacity of UAF	Cu.M/hr	0.7 Cu.M/hr per 1000 Cu.M/hr of air flow (min.)
8	Velocity through pipe	m/sec	2.0 m/sec (max.)
9	Velocity through duct	m/sec	1.5 m/sec (max.) for gravity flow
10	Air washer unit		12.5 m/sec (max.) with constant friction drop along length
10.1	Saturation efficiency	%	90 % (min.)
10.2	Velocity	m/sec	2.7 m/sec (max.)
11	Air washer unit		
11.1	Saturation efficiency	%	60 % (min.)
11.2	Velocity	m/sec	2.7 m/sec (max.)
12	Motor selection criteria		
12.1	For pumps, continuous motor rating (at 50 deg. C ambient)	%	Atleast 10 % above the maximum load demand of the pump in the entire operating range
12.2	For direct driven fans and blowers continuous motor rating (at 50 deg. C ambient)	%	Atleast 10 % above the maximum load demand at degin duty point
12.3	For belt driven fans and blowers continuous motor rating (at 50 deg. C ambient)	%	Atleast 15 % above the maximum load demand at degin duty point


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TECHNICAL DATA - PART - A (ELECTRICAL)


SL.NO	DESCRIPTION	UOM	DETAIL
1.0	DESIGN CODES & STANDARDS		
1.1	Three phase induction motors :	-	IS15999, IEC:60034, IS: 12615, IS: 325
1.2	Single phase AC motors	-	IS:996, IEC:60034
1.3	Energy Efficient motors	-	IS 12615, IEC:60034-30
1.4	Crane duty motors	-	IS:3177, IS/IEC:60034
1.5	Mechanical Vibration of Rotating Electrical Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity	-	IS 12075/IEC 60034-14
1.6	Designation of Methods of Cooling of Rotating Electrical Machines	-	IS 6362
1.7	Designation for types of construction and mounting arrangement of rotating electrical machines	-	IS 2253
2.0	DESIGN /SYSTEM PARAMETERS		
2.1	Rated voltage	V	415
2.2	Frequency	Hz	50
2.3	Permissible variations for		
a)	Voltage	%	+/-10
b)	Frequency	%	(+)3 to (-)5
c)	Combined	%	10 (absolute sum)
2.40	System fault level at rated voltage for 1 sec	kA	50
2.4	Short time rating for terminal boxes for 0.25 sec	kA	50
2.5	Type of motors	-	a) Squirrel cage induction motor suitable for direct-on-line starting (for non- VFD motors). b) Motor operating through VFD shall be suitable for inverter duty with VPI insulation.
2.6	Efficiency class	-	<i>Continuous duty LT motors upto 50 KW Output rating (at 50 deg.C ambient temperature), shall be super Premium Efficiency class-IE4, 50-200 KW shall be of Premium Efficiency class – IE3, conforming to IS 12615, or IEC:60034-30.</i>
2.8	Rating	-	
a)	Motor duty	-	Continuously rated-S1
b)	Design margin over continuous max. demand of the driven equipment (min)	%	10

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3.0	CONSTRUCTION FEATURES		
3.1	Winding	-	Electrolytic grade Copper conductor
3.2	Enclosure Details	-	
a)	Degree of protection	-	
	i) Indoor motors	-	IP 55
	ii) Outdoor motors	-	IP 55
b)	Method of ventilation	-	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
3.3	Insulation	-	Class 'F' with temperature rise limited to class 'B'. Non-hygroscopic, oil resistant, flame resistant Insulation.
3.4	Bearings	-	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined thrust and guide bearing for Vertical motors.
3.5	Main terminal box	-	
a)	Type	-	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
b)	DOP	-	Same as motor
c)	Position when veiwed from the non driving end	-	Left hand side
d)	Rotation	-	90 Deg.
e)	Space heater	-	Motors rated 30KW and above shall have space heater suitable for 240V, 50 Hz single phase AC supply. Separate terminal box for space heaters & RTDs shall be provided.

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f)	Cable glands and lugs	-	-Motor terminal box shall be furnished with Solder less crimping type heavy duty Lugs (aluminium lugs for aluminium cables and copper lugs for copper cables) and double compression Ni-Cr plated brass glands to match with cable used. -Gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.		
3.6	Earthing points suitable for connection	-	Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.		
3.7	Paint shade (Corrosion proof paints of colour shade)	-	RAL 5012 (Blue) The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However, in case electrostatic process of painting is offered. minimum paint thickness of 50 microns shall be acceptable for finish coat. Epoxy based paint with suitable additives shall be used.		
3.8	The spacing between gland plate & centre of bottom terminal stud	-	UP to 3 KW As per manufacturer's practice. Above 3 KW - upto 7 KW 85 Above 7 KW - upto 13 KW 115 Above 13 KW - upto 24 KW 167 Above 24 KW - upto 37 KW 196 Above 37 KW - upto 55 KW 249 Above 55 KW - upto 90 KW 277 Above 90 KW - upto 125 KW 331 Above 125 KW-upto 200 KW 385/203 (For Single core cables only)		
3.9	Minimum inter-phase and phase-earth air clearances with lugs installed	-	UP to 110 KW 10mm Above 110 KW and upto 150 KW 12.5mm Above 150 KW 19mm		
4.0	PERFORMANCE PARAMETERS				
4.1	Starting requirement	-			


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a)	Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	-	a) Up to 85% of rated voltage for ratings below 110 KW b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW	
b)	Maximum locked rotor current	-	as per IS 12615	
c)	Starting duty	-	Two hot starts in succession, with motor initially at normal running temperature.	
d)	The locked rotor withstand time under hot condition at highest voltage limit	-	a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting) b) atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting) c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.	
e)	The ratio of locked rotor KVA at rated voltage to rated KW	-	(a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0	
4.2	Torque (percent of full load torque)	-	1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque.	
4.3	Noise level (max.)	-	85 dB(A)	
4.4	Vibration shall be limited within the limits	-	as per IS:12075	
5.0	INSPECTION/TESTING			
5.1		-	All type & Routine tests shall be as per IS 12615.	
5.2		-	The Contractor shall submit the type tests reports for the tests conducted on the equipment similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than ten (10) years prior to supply under this contract.	


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5.3		-	In case the contractor is not able to submit valid report of the type test(s) or in case type test report(s) are not found to be meeting the specification requirements, or not including all specified tests the contractor shall conduct all such tests under this contract. The cost of such test shall be deemed to be included in the price. The owner shall have right to witness the type tests.
5.4		-	All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.


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TECHNICAL DATA - PART - A (C&I)

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	DESIGN CODES & STANDARDS		
1.1	Impulse pipes, tubes (material, rating)		ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
1.2	Valves (material, pr. Class, size)		ASTM A182/ASTM A105 as per ASME 16.34
1.3	Fittings (size, rating, material)		ANSI B31.1, ANSI B31.1a, ASME B16.11
1.4	Installation schemes		BS 6739-2009, ANSI/ISA 77.70
1.5	Actuator		EN15714-2
1.6	Fieldbus concepts		IEC 61158
1.7	Instruments and apparatus for pressure measurement		ASME PTC19.2
1.8	Electronic transmitters		BS-6447, IEC-60770
1.9	Bourdon tube pressure and vacuum gauges		IS-3624
1.10	Colors for ready mixed paints and enamels.		IS-5
1.11	Annunciator Sequences and Specification		ISA-18.1
1.12	Instrument and apparatus for temperature measurement		ASME PTC 19.3(1974)
1.13	Temperature measurement by electrical Resistance thermometers		IS:2806
1.15	Type of Enclosures		NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13)
1.16	Racks, panels and associated equipment		EIA : RS - 310 C- 1983 (ANSI C83.9 - 1972)
1.17	Protection class for enclosures, cabinets, control panels & desks		IS:2147 -1962
2.0	DESIGN /SYSTEM PARAMETERS		
	SPECIFICATION - PRESSURE TRANSMITTER, DIFFERENTIAL PRESSURE TRANSMITTER, DP BASED FLOW AND LEVEL TRANSMITTER		
	Output		Profibus PA complying to IEC 61158, digital output
	Turndown ratio		50:1
	Accuracy	%	0.06%
	Stability (% of calibrated range)	%	+/-0.25% for 10 year
	Diaphragm seal material		Suitable for process fluid
	Diagram fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for process application.
	Housing		Metallic housing with durable corrosion resistant coating
	Protection		Weather proof IP-67
	Display		Integral digital display
	Diagonstic feature		Required
	Electrical connection		1/2" NPT (f)

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM		PE-TS-508-554-A001
			Rev. No. 00
			Date : MARCH 2024
	Manifold		2/3 valve non integral manifold for PT and 5 valve non integral manifold for DPT
2.2	SPECIFICATION - PRESSURE GAUGE, DIFFERENTIAL PRESSURE GAUGE		
	Sensing element		Bourdon for high pressure, diaphragm/bellow for low pressure
	Sensing element material		SS316
	Movement material		SS316
	Body material		SS316
	Dial size	mm	150mm
	End connection	inch	1/2 inch NPT (m)
	Accuracy		±1% of span
	Scale		Linear, 270° arc graduated in metric units
	Range selection	%	Cover 125% of max. of scale
	Over range test		Test pr. for the assembly shall be 1.5 to the max. Design pr. At 38°C.
	Diaphragm seal material		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for process application
	Housing		IP-55
	Zero/span adjustment		External
	Accessories		Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve
2.4	SPECIFICATION - PRESSURE/ DRAFT SWITCHES/ DP SWITCHES		
	Repeatability		+/-0.5% of full range
	No. of contacts		2 No.+2NC. SPDT snap action dry contact
	Rating of contacts		60 V DC, 6 VA (or more if required by DDCMIS)
	Elect. Connection		Plug in socket.
	Set point adjustment		Provided over full range.
	Dead band adjustment		Adjustable/ fixed as per requirement of application.
	Enclosure		Weather and dust proof as per IP-55, metallic housing.
	Power Supply (where applicable)		As per Contractor's Standard practice.
	Sensing Element		Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum as per suitability to the application.
	Material		316 SS
	End connection		½ inch NPT (F)
	Over range/ proof pressure		150% of maximum operating pr.
	Accessories		Siphon, snubber, chemical seal, pulsation dampeners as required by process
	Mounting		Suitable for enclosure/ rack mounting or direct mounting

	TECHNICAL SPECIFICATION		PE-TS-508-554-A001
	2X800 MW LARA TPP STAGE II		Rev. No. 00
	VENTILATION SYSTEM		Date : MARCH 2024
2.4	SPECIFICATION - LEVEL GAUGE		
	Sensing element and material		Tempered toughened borosilicate gauge glass steel armoured reflex or transparent type, bicolour type
	Body material		304 SS
	End connection		Process connection as per ASME ptc , 3/4" and drain/vent 15 NB
	Accuracy	%	± 2%
	Scale		Liner vertical
	Housing		304 SS leak proof
	Over range test		Test pr. for the assembly shall be 1.5 to the max. Design pr. At 38°C.
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Accessories		Gasket for all KEL-F shield for transparent type vent and drain valves of steel/SS as per CS /Alloy process
	Length of Gauge glass		Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.
2.4	SPECIFICATIONS - TEMPERATURE GAUGE		
	Body Material		Die-cast aluminium
	Material of bourdon/movement		316SS / 304SS
	End connection		3/4" NPT (M)
	Accuracy	%	± 1% of span
	Dial Size	mm	150 mm
	Scale		Linear, 270° arc graduated in °C
	Range selection	%	Cover 125% of max. of scale
	Over range test		Test pr. for the assembly shall be 1.5 to the max. Design pr. At 38°C.
	Housing		IP-55
	Zero/span adjustment		Required
	Accessories		SS Thermowell
2.17	SPECIFICATION - LIMIT SWITCH		
	Type		Inductive proximity type
	Mounting arrangement		Inside the enclosure
	Operating voltage Range	V	10-40 V DC
	Sensing system		Inductive Proximity type , 2 Wire
	Sensor Contact Type		NO
	Reverse polarity and short circuit protection		Yes
	IP Class-Sensor		IP67
	IP Class-Enclosure(Switch box)		IP67
	Cable entry-Enclosure(Switch box)		2 no-1/2" NPT

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM		PE-TS-508-554-A001
			Rev. No. 00
			Date : MARCH 2024
	Casing material-Sensor		Brass /SS
	Enclosure(Switch box) Housing material		FRP or SS
	Operating Ambient temp(sensors)	DegC	-5 to 70 deg C
	Max allowed Voltage Drop across sensor	V	5 V
	Standard applicable		EN 60947-5-2 or equivalent.
	Applicable for		Manual valves and solenoid operated on-off valves
	Corrosion resistance		Silver plated with high conductivity and non corrosive
	Protection class		IP 55
	Contact rating		shall be sufficient to meet the requirement of DCS subject to a minimum of 60 V, 6 VA rating
2.24	SPECIFICATION - JUNCTION BOX		
	No. of ways		12/24/36/48/64/72/96/128
	Material and Thickness		4mm thick Fiberglass Reinforced Polyester(FRP)
	Type of terminal blocks		Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided.
	Protection Class		IP- 55 min. for indoor & IP-65 min for outdoor applications.
	Grounding		To be provided
	Color		RAL 7035
	Spare Terminals		At least 20% unused terminals
2.13	Impulse piping for water area/equipment		
	Painting color scheme		Grey RAL 9002
	Identification Tag/band color scheme		Sea green, ISC no. 217
3.0	INSPECTION/TESTING		
3.1	Type Test requirement		Yes
	Item-1		Electronic Transmitters
	Test & Standard -1		As per Standard, BS-6447 / IEC-60770
	Test to be specifically conducted		No
	NTPC's approval required. on Test certificate		Yes

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM	PE-TS-508-554-A001
		Rev. No. 00
		Date : MARCH 2024

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT) - MECHANICAL

AIR WASHER

S. No.	Description	Specification	UOM	DETAIL
1	Capacity (CMH)			
2	Saturation efficiency			
3	Weight(kgs)			
4	Overall Dimensions (LxWxH)			
5	Equipment rating (kW)			

UAF

S. No.	Description	Specification	UOM	DETAIL
1	Capacity (CMH)			
2	Saturation efficiency			
3	Weight(kgs)			
4	Overall Dimensions (LxWxH)			
5	Equipment rating (kW)			

AXIAL FAN

S. No.	Description	Specification	UOM	DETAIL
1	Capacity (CMH)			
2	Weight(kgs)			
3	Overall Dimensions (LxWxH)			
4	Equipment rating (kW)			

RE UNIT FAN

S. No.	Description	Specification	UOM	DETAIL
1	Capacity (CMH)			
2	Weight(kgs)			
3	Overall Dimensions (LxWxH)			
4	Equipment rating (kW)			

Centrifugal Pumps

S. No.	Description	Specification	UOM	DETAIL
1	Type			
2	Flow rate (CMH)			
3	Head (m)			
4	Weight(kgs)			
5	Overall Dimensions (LxWxH)			
6	Equipment rating (kW)			



**TECHNICAL SPECIFICATION
2X800 MW LARA TPP STAGE II
VENTILATION SYSTEM**


PE-TS-508-554-A001


Rev. No. 00

Date : MARCH 2024

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT) - ELECTRICAL

SL.NO		UOM	DETAIL
1.0	GENERAL		
i)	Manufacturer & Country of origin.		
ii)	Equipment driven by motor)		
iii)	Motor type		
iv)	Country of origin		
v)	Quantity	nos.	
2.0	DESIGN AND PERFORMANCE DATA		
i)	Frame size		
ii)	Type of duty		
iii)	Type of enclosure and method of cooling		
vi)	Type of mounting		
vii)	Direction of rotation as viewed from DE END		
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard	(KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature	(KW)	
	(B) Rating as specified in load list	(KW)	
xi)	Rated speed at rated voltage and frequency	rpm	
xii)	At rated Voltage and frequency		
	a) Full load current	A	
	b) No load current	A	
xiii)	Power Factor at		
	a) 100% load		
	b) At duty point		
	c) 75% load		
	d) 50% load		
	e) NO load		
xiv)	f) Starting.		
	Efficiency at rated voltage and frequency		
	a) 100% load		
	b) At duty point		
	c) 75% load		
	d) 50% load		
xv)	Starting current(<i>inclusive of IS tolerance</i>) at		
	a. 100 % voltage	A	
	b. Minimum starting voltage	A	
xvi)	Starting time with minimum permissible voltage		

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM		PE-TS-508-554-A001
			Rev. No. 00
			Date : MARCH 2024
	a. Without driven equipment coupled	sec	
	b. With driven equipment coupled	sec	
xvii)	Safe stall time with 110% of rated voltage		
	a. From hot condition	sec	
	b. From cold condition	sec	
xviii)	Torques :		
	a. Starting torque at min. permissible voltage	(kg-mtr.)	
	b. Pull up torque at rated voltage.	(kg-mtr.)	
	c. Pull out torque	(kg-mtr.)	
	d. Min accelerating torque available	(kg-mtr.)	
	e. Rated torque	(kg-mtr.)	
xix)	Stator winding resistance per phase (at 20 Deg.C.)	Ohm	
xx)	GD ² value of motors		
xxi)	Locked rotor KVA input (at rated voltage)		
xxii)	Locked rotor KVA/KW.		
xxiii)	Bearings		
	a. Type		
	b. Manufacturer		
	c. Self Lubricated or forced Lubricated		
	d. Recommended Lubricants		
	e. Guaranteed Life in Hours		
	f. Whether Dial Type thermometer provided		
	g. Oil pressure Gauge/switch		
	i. Range		
	ii. Contact Nos. & ratings		
	iii. Accuracy		
xxiv)	Vibration		
	a) Velocity	mm/s	
	b) Displacement	microns	
xxv)	Noise level	db	
3	CONSTRUCTIONAL FEATURES		
i	Stator winding insulation		
	a. Class & Type		
	b. Tropicalised (Yes/No)		
	c. Temperature rise over specified max.		
	i. Cold water temperature of 38 DEG. C.		
	ii. Ambient Air 50 DEG. C.		
	d. Method of temperature measurement		
	e. Stator winding connection		
	f. Number of terminals brought out		
ii	Type of terminal box for		
	a. stator leads		
	b. space heater		

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM		PE-TS-508-554-A001
			Rev. No. 00
			Date : MARCH 2024
	c. Temperature detectors		
	d. Instrument switch etc.		
iii)	For main terminal box		
	a. Location		
	b. Entry of cables		
	c. Recommended cable size		
	d. Fault level	MVA	
iv)	Temperature detector for stator winding		
	a. Type		
	b. Nos. provided		
	c. Location		
	d. Make		
	e. Resistance value at 0 deg. C	ohms	
vi)	Paint shade		
vii).	Weight of(approx)		
	a. Motor stator (KG)		
	b. Motor Rotor (KG)		
	c. Total weight (KG)		
4	Relevant motor curves		



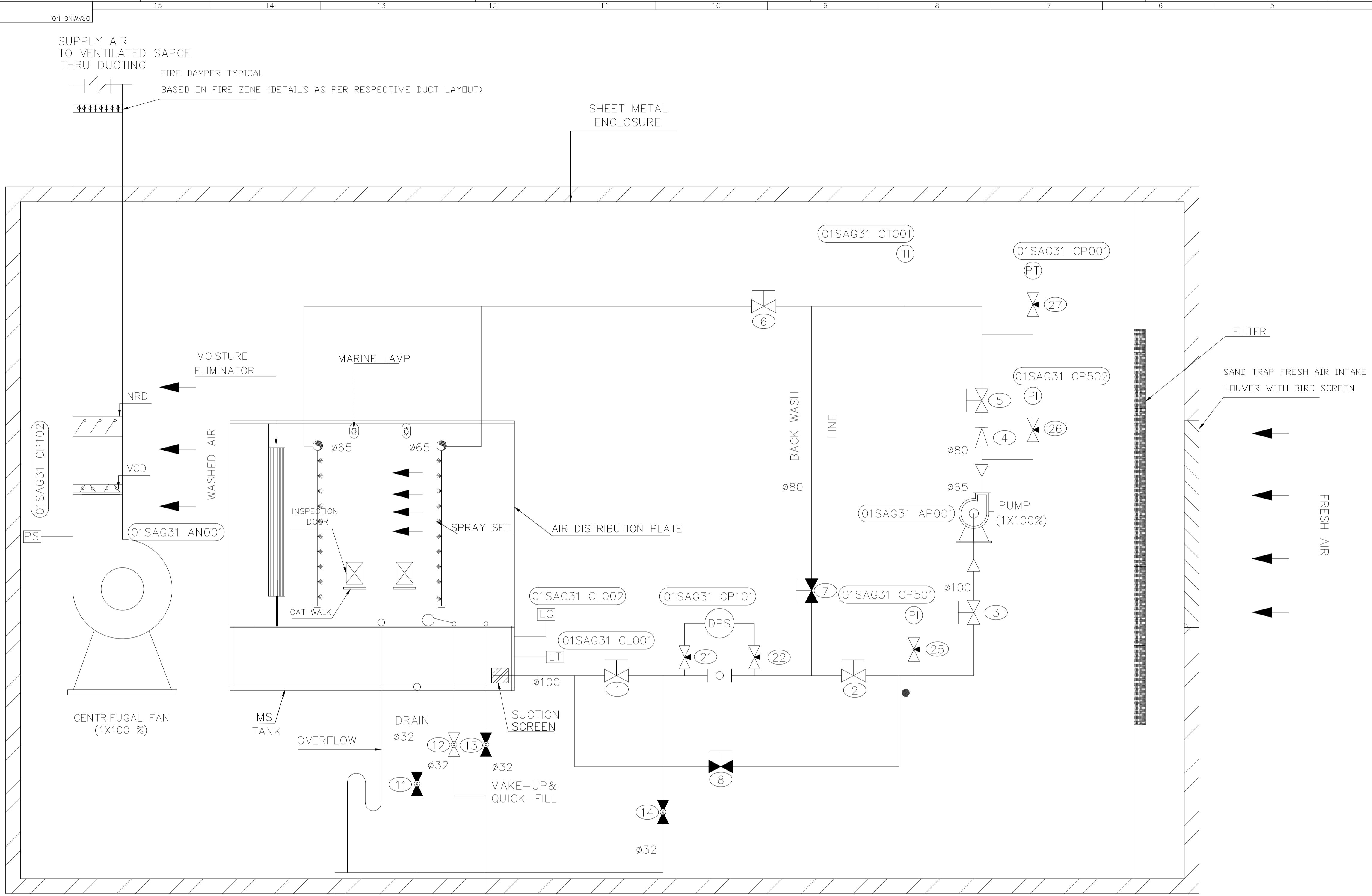
**TECHNICAL SPECIFICATION
2X800 MW LARA TPP STAGE II
VENTILATION SYSTEM**

PE-TS-508-554-A001

Rev. No. 00

Date : MARCH 2024

DRAWINGS



LEGEND		
1	Gate Valve	
2	Gate Valve (Normally Closed)	
3	Check Valve	
4	Ball Valve	
5	Ball Valve (Normally Closed)	
6	Needle Valve	
7	Pot- Strainer	
8	Syphon	
9	Drain	
10	Pressure Indicator	
11	Temperature indicater	
12	Level Transmitter	
13	Suction Screen	
14	Reducer/Expander	
15	Differntial Pressure Switch	
16	Pressure Transmitter	
17	NON RETURN DAMPER	
18	LEVEL GAUGE	
19	VOLUME CONTROL DAMPER	
20	FIRE DAMPER	

DRAIN AND OVERFLOW SHALL BE CONNECTED TO NEAREST DRAIN WHICH IS FURTHER CONNECTED TO 0 M MAKE UP WATER

AIR WASHER UNIT (50,000 CMH)

VALVES KKS NUMBERING		
S. No.	Description	KKS
1.	Gate Valve	01SAG31 AA501
2.	Gate Valve	01SAG31 AA502
3.	Gate Valve	01SAG31 AA503
4.	Non-Return Valve	01SAG31 AA401
5.	Gate Valve	01SAG31 AA504
6.	Gate Valve	01SAG31 AA505
7.	Gate Valve	01SAG31 AA506
8.	Gate Valve	01SAG31 AA507

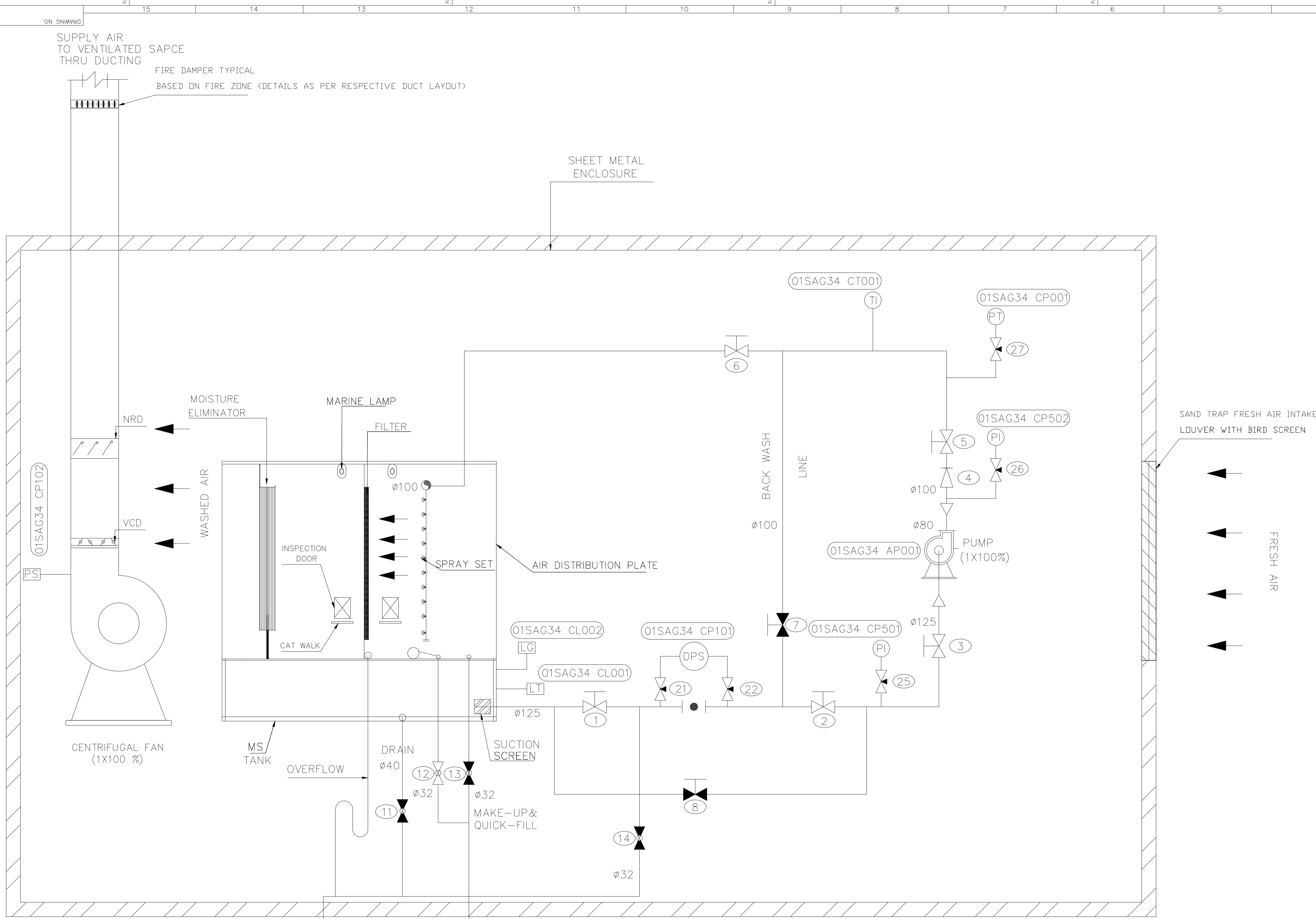
VALVES KKS NUMBERING		
S. No.	Description	KKS
11.	Ball Valve	01SAG31 AA551
12.	Ball Valve	01SAG31 AA552
13.	Ball Valve	01SAG31 AA553
14.	Ball Valve	01SAG31 AA554

VALVES KKS NUMBERING		
S. No.	Description	KKS
21.	Needle Valve	01SAG31 AA601
22.	Needle Valve	01SAG31 AA602
23.	Needle Valve	01SAG31 AA603
24.	Needle Valve	01SAG31 AA604
25.	Needle Valve	01SAG31 AA605
26.	Needle Valve	01SAG31 AA606
27.	Needle Valve	01SAG31 AA607
28.	Needle Valve	01SAG31 AA608

KKS NUMBERING PHILOSOPHY		
01	SAG	31 XX000
01	Indicates Equipment Number	Air Washer Unit No. 21 to 22
31	Indicates TG Unit Number	TG Unit No. 01 to 02

- Note:
- Manual gate valves -1,2,3 and 5 shall be lock-open type.
 - KKS ID indicated are typical and the Digits of the Numbering shall be updated as per table.
 - Approach for Filter shall be provided for regular cleaning.

PACKAGE		VENTILATION SYSTEM	
NEW CUSTOMER		एन टी पी सी लिमिटेड N T P C LIMITED	
PROJECT		2X800 MW LARA THERMAL POWER PROJECT STAGE-II	
DESIGNER		BHARAT HEAVY ELECTRICALS LTD PROJECT ENGINEERING MANAGEMENT NOIDA (U.P.)	
REV.	DATE	CHK	APPD
SINGLE LINE FLOW DIAGRAM FOR AIR WASHER UNIT FOR POWER HOUSE BUILDING AND UNIT UNIT FOR ESP CONTROL BUILDING, FGD CONTROL ROOM BUILDING		REV: 001/2008/02	REV: 00-00-001-0001



LEGEND		
1	Gate Valve	
2	Gate Valve (Normally Closed)	
3	Check Valve	
4	Ball Valve	
5	Ball Valve (Normally Closed)	
6	Needle Valve	
7	Pot- Strainer	
8	Syphon	
9	Drain	
10	Pressure Indicator	
11	Temperature indicator	
12	Level Transmitter	
13	Suction Screen	
14	Reducer/Expander	
15	Differential Pressure Switch	
16	Pressure Transmitter	
17	NON RETURN DAMPER	
18	LEVEL GAUGE	
19	VOLUME CONTROL DAMPER	
20	FIRE DAMPER	

DRAIN AND OVERFLOW SHALL BE CONNECTED TO NEAREST DRAIN WHICH IS FURTHER CONNECTED TO 0 M

MAKE UP WATER

BHEL VENDOR

UNITARY AIR FILTRATION UNIT (75,000 CMH)

VALVES KKS NUMBERING		
S. No.	Description	KKS
1.	Gate Valve	01SAG34 AA501
2.	Gate Valve	01SAG34 AA502
3.	Gate Valve	01SAG34 AA503
4.	Non-Return Valve	01SAG34 AA401
5.	Gate Valve	01SAG34 AA504
6.	Gate Valve	01SAG34 AA505
7.	Gate Valve	01SAG34 AA506
8.	Gate Valve	01SAG34 AA507

VALVES KKS NUMBERING		
S. No.	Description	KKS
11.	Ball Valve	01SAG34 AA551
12.	Ball Valve	01SAG34 AA552
13.	Ball Valve	01SAG34 AA553
14.	Ball Valve	01SAG34 AA554

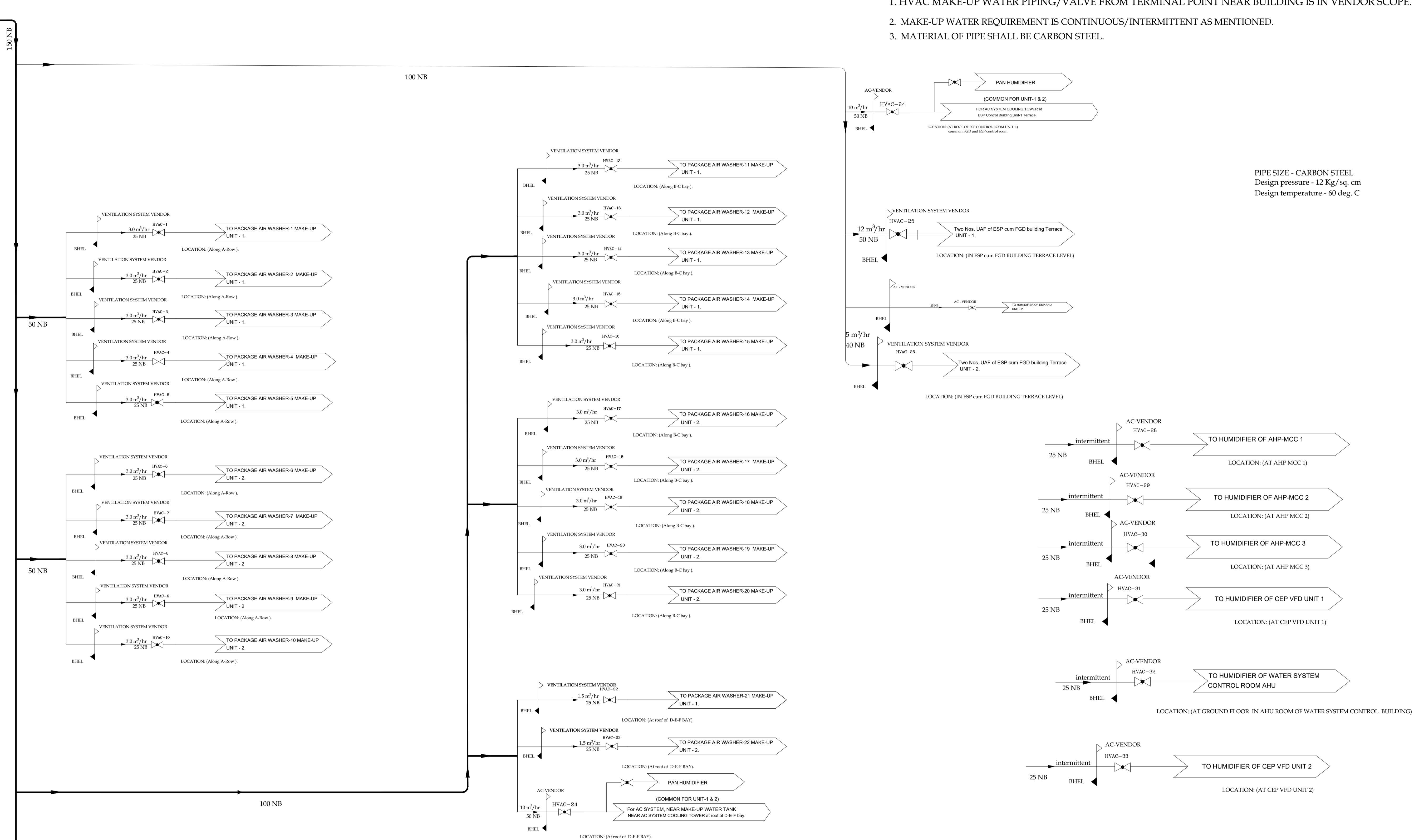
VALVES KKS NUMBERING		
S. No.	Description	KKS
21.	Needle Valve	01SAG34 AA601
22.	Needle Valve	01SAG34 AA602
23.	Needle Valve	01SAG34 AA603
24.	Needle Valve	01SAG34 AA604
25.	Needle Valve	01SAG34 AA605
26.	Needle Valve	01SAG34 AA606
27.	Needle Valve	01SAG34 AA607
28.	Needle Valve	01SAG34 AA608

KKS NUMBERING PHILOSOPHY		
01	SAG	34 XX000
01	Indicates Equipment Number	Unitary Air Filtration Unit No. 23 to 26
SAG	Indicates ESP cum FGD BLDG Unit Number	ESP CUM FGD BLDG Unit No. 01 to 02

- Note:
- Manual gate valves -1,2,3 and 5 shall be lock-open type. 7
 - KKS ID indicated are typical and the Digits of the Numbering shall be updated as per table.
 - Approach for Filter shall be provided for regular cleaning.

PACKAGE		VENTILATION SYSTEM	
NEW CUSTOMER		एन टी पी सी लिमिटेड N T P C LIMITED	
PROJECT		2X600 MW LARA THERMAL POWER PROJECT STAGE-II	
DESIGNER		BHARAT HEAVY ELECTRICALS LTD PROJECT ENGINEERING MANAGEMENT NOIDA (U.P.)	REV. CODE M
DATE		DATE	
REV	DATE	CHK	APPD
SINGLE LINE FLOW DIAGRAM FOR AIR WASHER UNIT FOR POWER HOUSE BUILDING AND LAF UNIT FOR ESP CONTROL BUILDING, FGD CONTROL ROOM BUILDING.		REV: 001/2008/02	REV: 001/2008/02

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

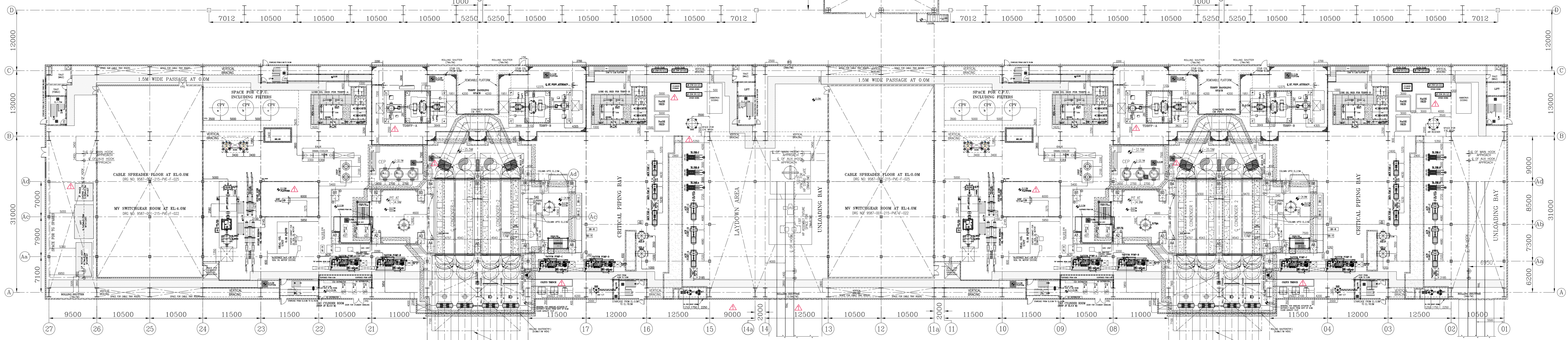
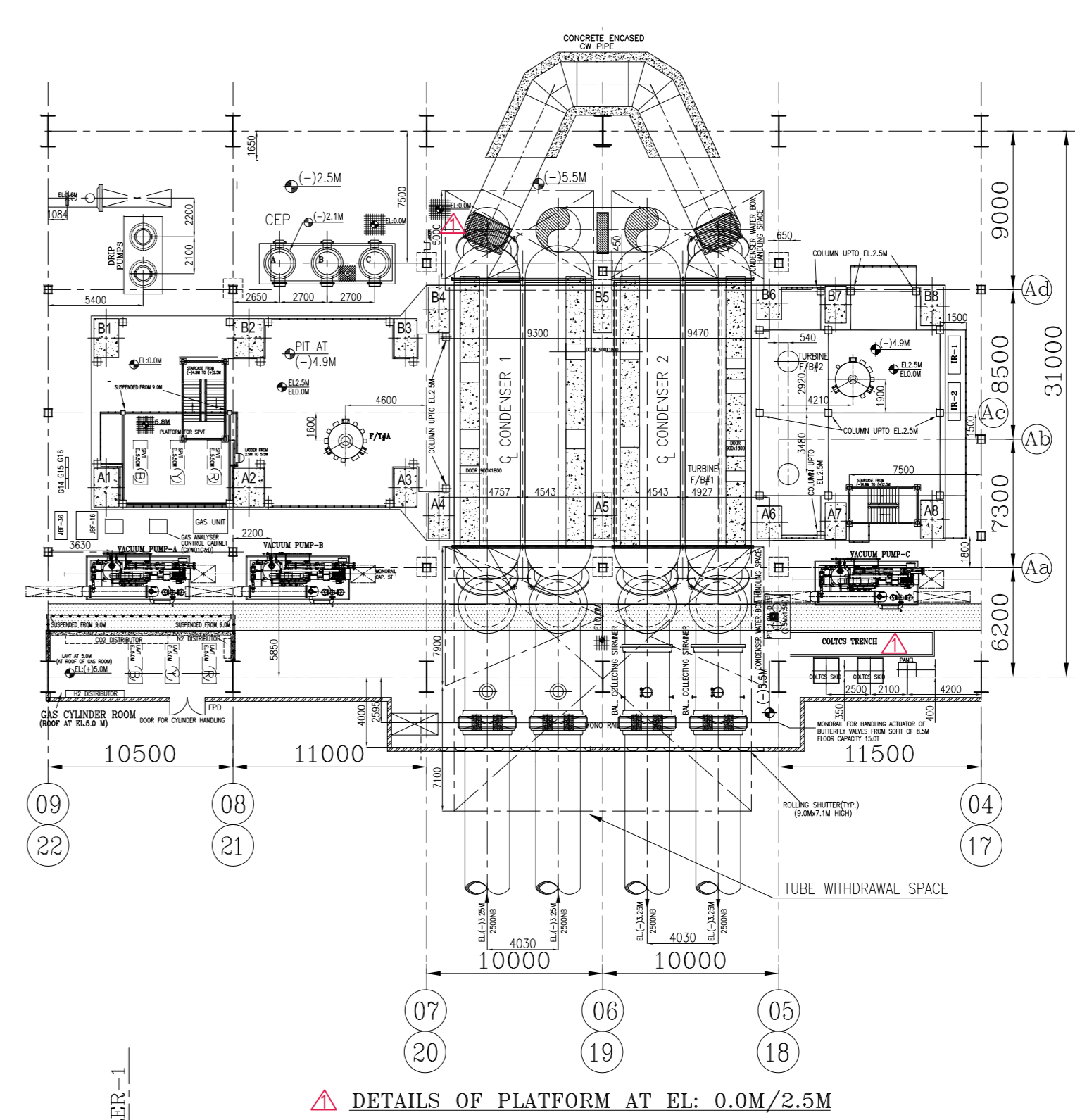
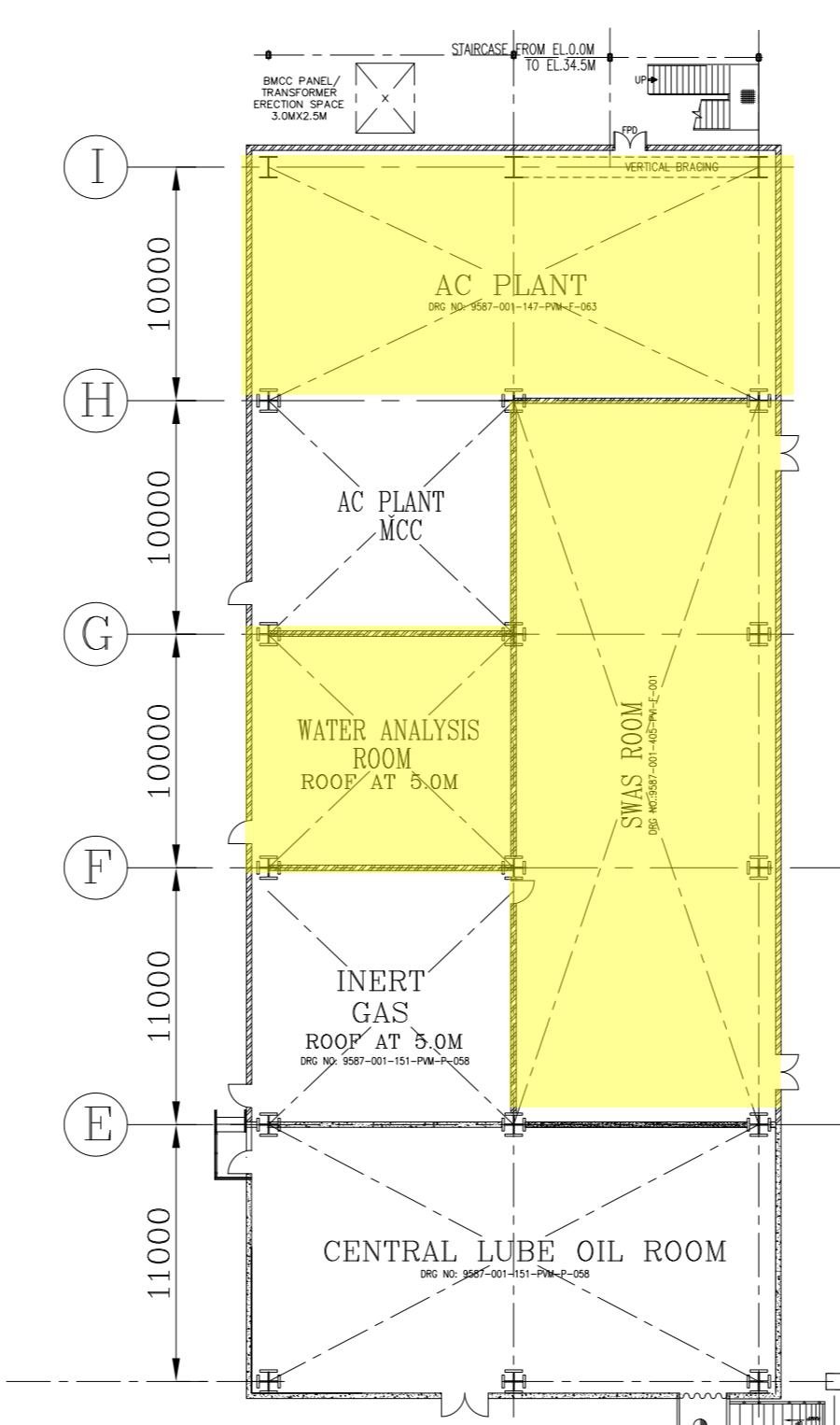
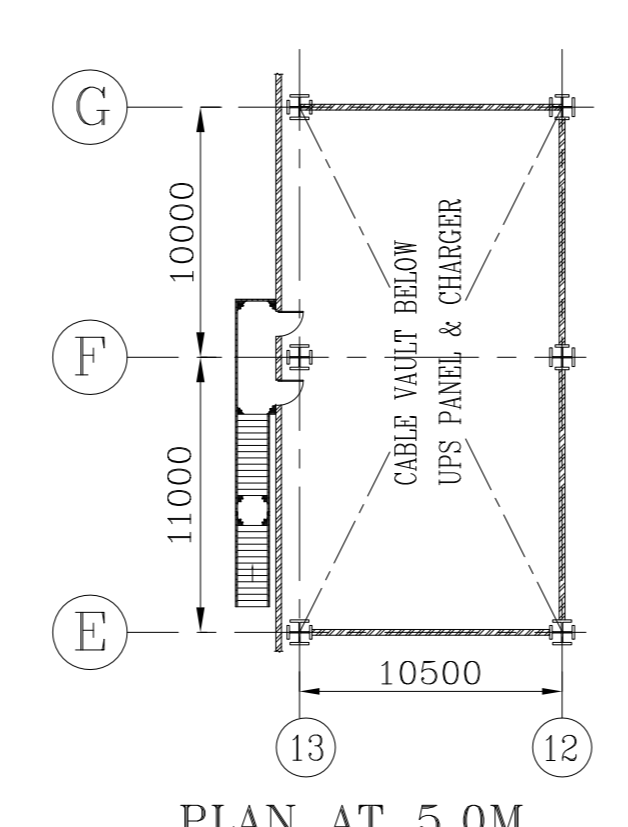


NOTE:-

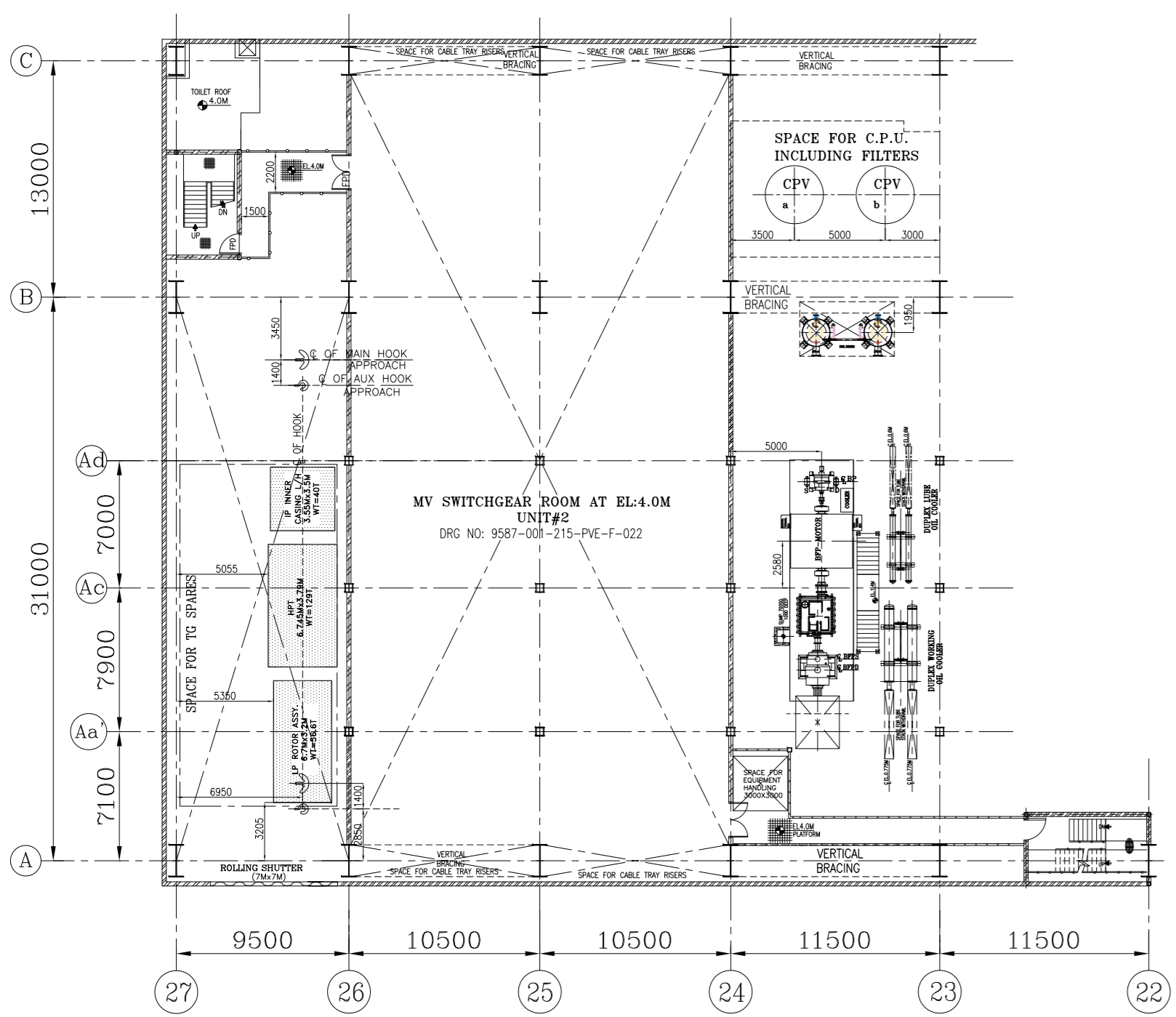
1. HVAC MAKE-UP WATER PIPING/VALVE FROM TERMINAL POINT NEAR BUILDING IS IN VENDOR SCOPE.
2. MAKE-UP WATER REQUIREMENT IS CONTINUOUS/INTERMITTENT AS MENTIONED.
3. MATERIAL OF PIPE SHALL BE CARBON STEEL.

PIPE SIZE - CARBON STEEL
Design pressure - 12 Kg/sq. cm
Design temperature - 60 deg. C

CUSTOMER:		NATIONAL THERMAL POWER CORPORATION (NTPC)	
JOB No.: 508		2X800 MW LARA STPP STAGE II	
STATUS: TENDER		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI BLDG. PLOT NO. 25, SECTOR-16A, NOIDA	
DISTRIBUTION		TITLE: SCHEMATIC DIAGRAM FOR HVAC MAKE UP	
REV. DATE DRAWN CHD APPD		MFL C MSH I MAX E SWPT SCALE-N.T.S. 78-05-508-503-0004 SHN DATE SHEET 1 OF 155 REV 00	

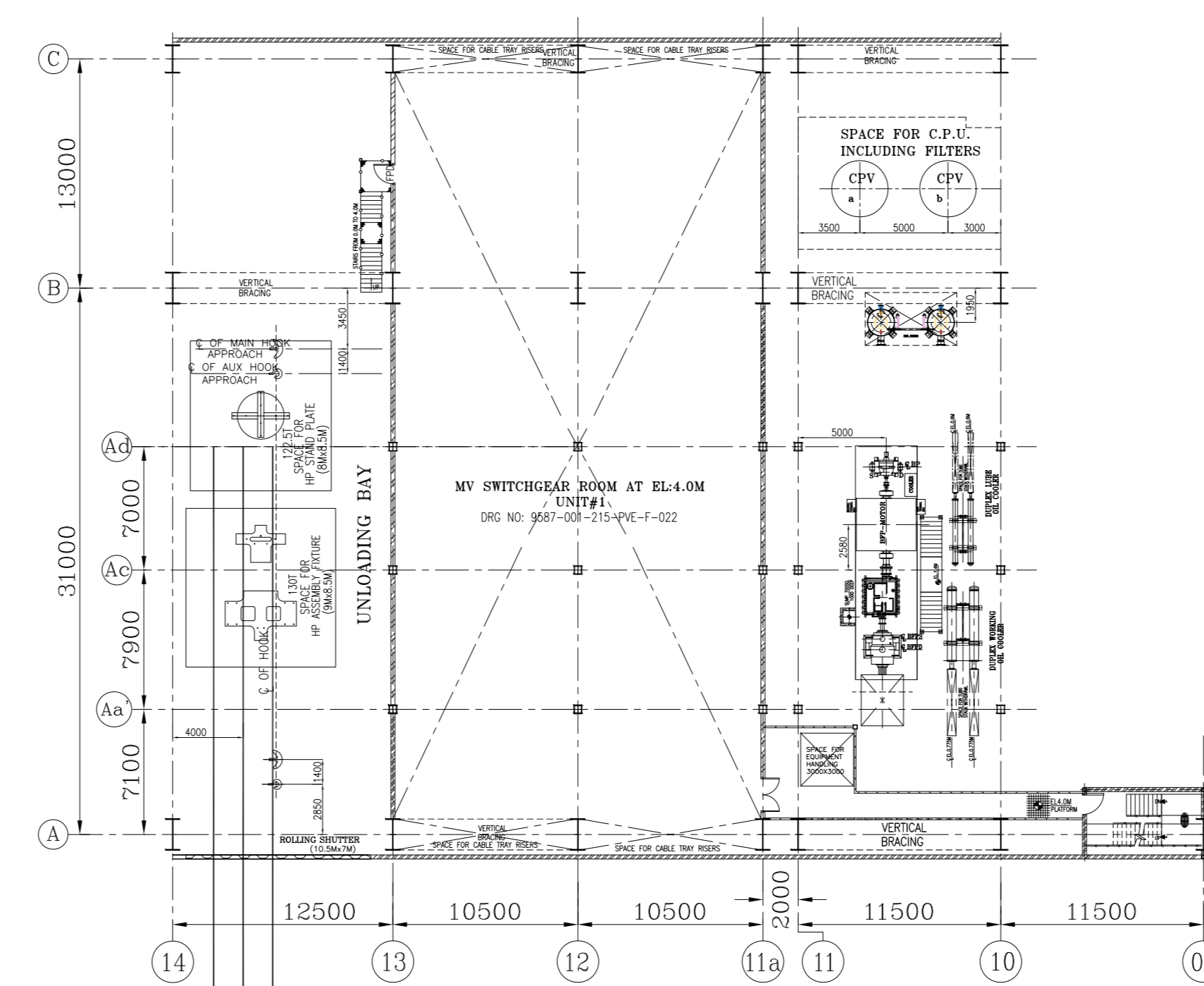


TG EQUIPMENT PLAN LAYOUT AT 0.0M



PLAN AT EL. 4.0M

SL. NO	TITLE	NUMBER	NTPC DRG. NUMBER	UNIT
1	TO EQUIPMENT PLAN AT EL. 0.5 M	PC-10-508-100-M004	9587-001-110-PW-F-050	FW
2	TO EQUIPMENT PLAN AT EL. 0.5 M	PC-10-508-100-M005	9587-001-110-PW-F-051	FW
3	TO EQUIPMENT PLAN AT MISCELLANEOUS FLOORS	PC-10-508-100-M006	9587-001-110-PW-F-052	FW
4	T.G. HALL CROSS SECTION	PC-10-508-100-M007	9587-001-110-PW-F-053	FW
5	GA OF UNIT AND RECEIVER		9587-001-110-PW-F-053	FW
6	CONDENSER	01467070703238		HW
7	GA OF BRIN COOLER			HW
8	GENERAL ARRANGEMENT F/71-A			SPL
9	GENERAL ARRANGEMENT F/71-B			SPL
10	GENERAL ARRANGEMENT UFT			SPL
11	FOUNDATION DETAILS OF CONDENSER AUXILIARY EQUIPMENTS			HW
12	TDBPP AUXILIARY EQUIPMENT FOUNDATIONS			HW
13	BRIP PUMPS GA			HW
14	GA OF AIR PUMPS			FW
15	GA OF TO FINE			FW
16	GA DUCK PUMP			FW
17	LEAKAGE OIL TANK AND PUMP			FW
18	GA WASTE OIL TANK			FW
19	GA VACUUM PUMPS			FW
20	EQUIPMENT LAYOUT FOR CPU SV			FW
21	GA HIGH DRAINING SKD			FW
22	GA AIRWASH DRAINING SKD			FW
23	GA OF BRINEN DRAINING			FW
24	GA OF COND STEAM CONDENSER			FW
25	GA OF TDBPP			HW
26	GA OF WDRPP			HW
27	FOUNDATION BARR. OF TDBPP			HW
28	FOUNDATION ARR. OF WDRPP			HW



PLAN AT EL. 4.0M

DETAIL OF LAYDOWN SPACE FOR TDBPP COMPONENTS (HOLD)

S.No.	DESCRIPTION	LENGTH	BREADTH	HEIGHT
01	MAXIMUM OF OUTER CASING + EXH. HOOD	3510	4850	4090
02	ROTOR	4400	1400	1400
03	FRONT BEARING PEDESTAL (UP)	860	1100	370
04	REAR BEARING HOUSING (UP)	1000	1120	520
05	GUIDE BLADE CARRIER-I (LP)	390	1130	520
06	GUIDE BLADE CARRIER-I (LP)	390	1300	620
07	GUIDE BLADE CARRIER-I (LP)	960	1970	990
08	GUIDE BLADE CARRIER-I (LP)	990	1970	990
09	STEAM CHAMBER (LP)	440	1240	620
10	STEAM CHAMBER (LP)	440	1240	620

LEGEND

- PIPE HATCH
- VERTICAL BRACING
- FIRE PROOF DOOR
- GRATING
- CHEQUERED PLATE
- REMOVABLE
- HAND RAILING
- CABLE TRAY
- FIRE BARRIER WALL
- INDICATES PIPES/CABLE TRESTLE
- ROLLING SHUTTER
- RAIL TRACK
- PIPE TRENCH WITH RCC COVERED SAND FILLED
- BRICK WALL
- BUS DUCT
- WALK BAY
- CONCRETE
- CHAIN PULLEY BLOCK
- FIRE WALL
- CLADDING

SPACE FOR MANDATORY SPARES AT 0.0M:-

- IF INNER CASING LOWER HALF
- HP TURBINE
- LP ROTOR ASSEMBLY

NOTES:-

- ALL DIMENSION ARE IN MM AND LEVELS ARE IN METRES.
- ALL ELEVATION MARKED ARE W.R.T. TO HALL FINISHED FLOOR ELEVATION OF EL. 0.0M WHICH CORRESPONDS TO RL 209.50 M.
- FOR CABLE TRAY/BUS DUCT/TRENCH/SPLIT LAYOUT, ELECTRICAL DRAWING TO BE REFERRED.

ELECTRONIC FILE NAME : 9587-001-110-PW-F-049-01

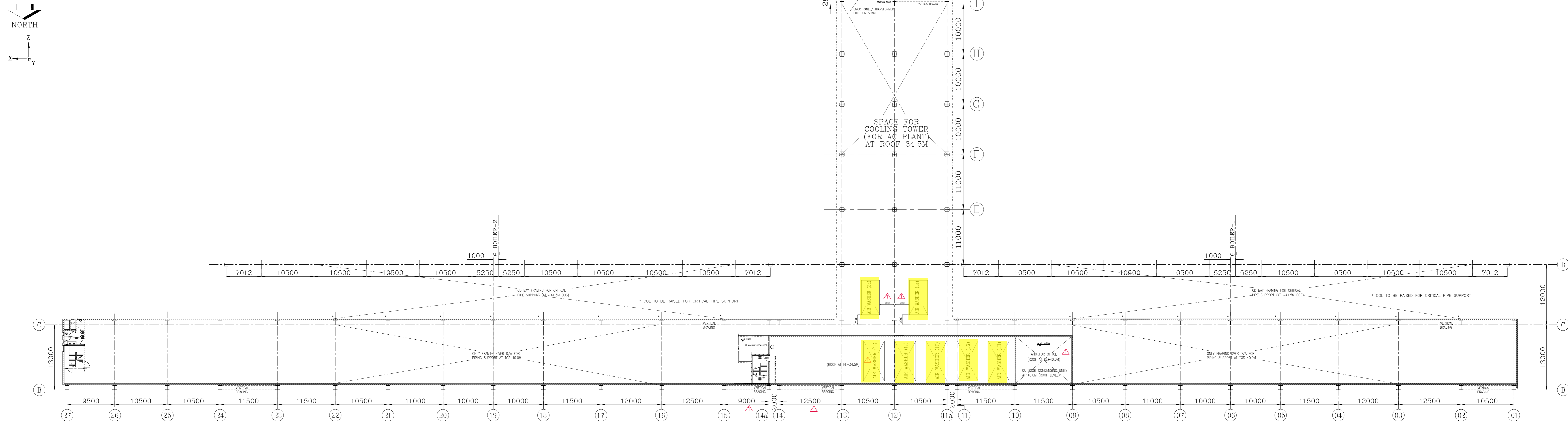
<p>NOTE: SCAN QR CODE FOR CHECKING THE LATEST REV STATUS OF DRAWING.</p>	<p>9587-001-110-PW-F-049</p> <p>CUSTOMER DRAWING NO.</p>	<p>भारत हेवी इलेक्ट्रिकल्स लिमिटेड NTPC LIMITED</p>
<p>508</p> <p>PROJECT CONTRACT</p>	<p>परियोजना PROJECT</p>	<p>एन टी पी सी लिमिटेड N T P C LIMITED</p>
<p>भारत हेवी इलेक्ट्रिकल्स लिमिटेड भारत हेवी इलेक्ट्रिकल्स लिमिटेड भारत हेवी इलेक्ट्रिकल्स लिमिटेड</p>	<p>2x800 मेगावाट लगर सुपर थर्मल पावर परियोजना चरण-II 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE-II</p>	<p>भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD</p>
<p>08.02.24</p> <p>AA</p> <p>CSF</p> <p>SK</p>	<p>01</p> <p>01</p> <p>01</p>	<p>01</p> <p>01</p> <p>01</p>

TG EQUIPMENT LAYOUT DRAWING AT 0.0 M

SCALE: 1:300

PE-DG-508-100-M003

01



TG EQUIPMENT PLAN LAYOUT AT 34.5M/40.0M

LEGEND

- PIPE HATCH
- VERTICAL BRACING
- FIRE PROOF DOOR
- GRATING
- CHEQUERED PLATE
- REMOVABLE HAND RAILING
- CABLE TRAY
- FIRE BARRIER WALL
- INDICATES PIPES/CABLE TRUSTLE
- ROLLING SHUTTER
- RAIL TRACK
- PIPE TRENCH WITH PCC COVERED SAND FILLED
- BRICK WALL
- BUS DUCT
- WALK WAY
- CONCRETE
- CHAIN PULLEY BLOCK
- FIRE WALL
- CLADDING

DETAIL OF Air Washer Layout AT 34.5 M FLOOR UNIT-1			
S.No.	DESCRIPTION	LOCATION	AREA TO BE CATERED
01	Air Washer -1J	BC Bay grid 11a-12	0 Mtr floor, Mezzanine floor, Operating Floor of Unit 1
02	Air Washer -1F	BC Bay grid 11a-12	
03	Air Washer -1G	BC Bay grid 10-11	
04	Air Washer -1H	BC Bay grid 10-11	
05	Air Washer -1I	BC Bay grid 12-13	

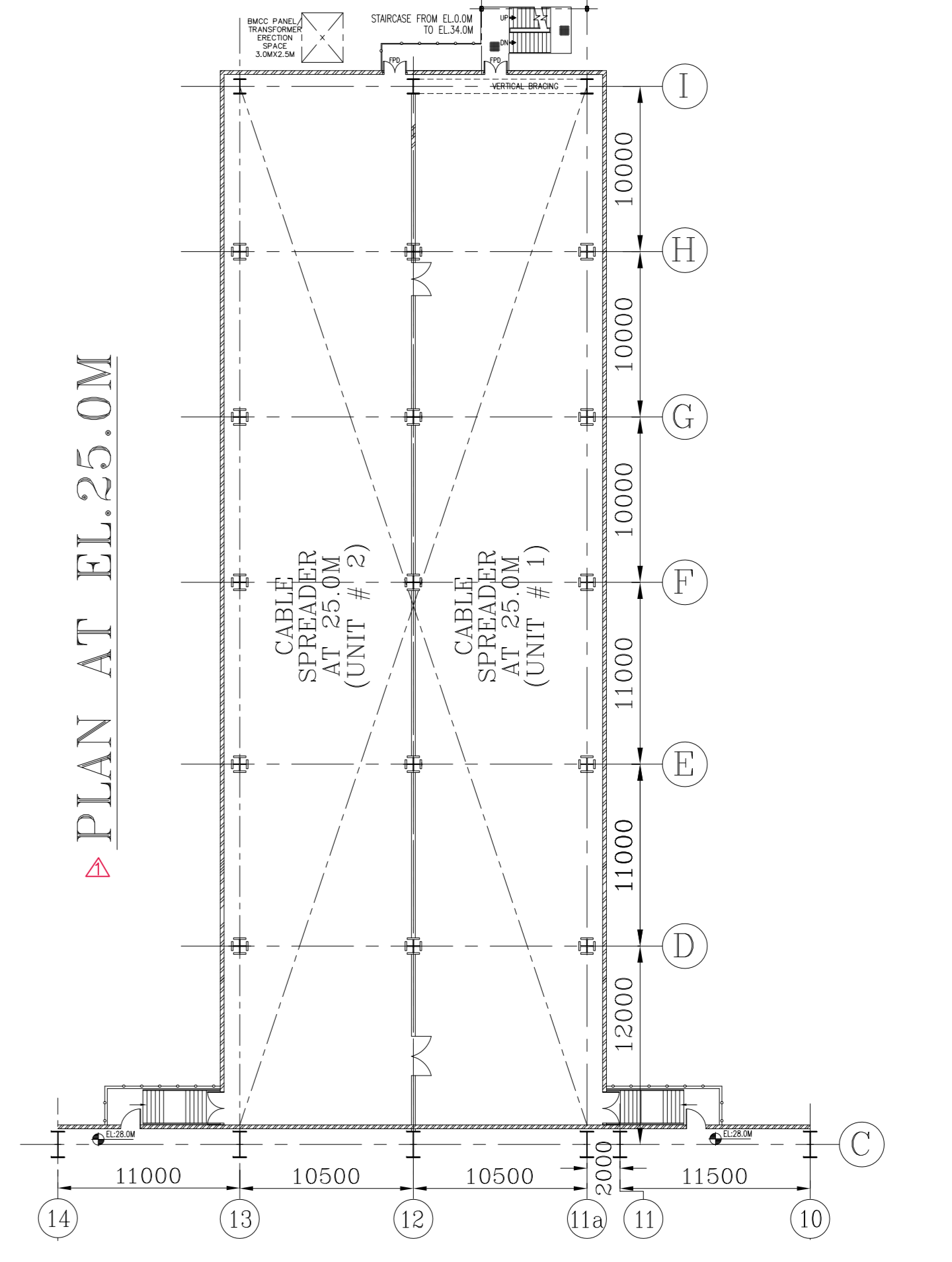
DETAIL OF Air Washer Layout AT 28.0 M FLOOR UNIT-2			
S.No.	DESCRIPTION	LOCATION	AREA TO BE CATERED
01	Air Washer -2J	BC Bay grid 24-25	0 Mtr floor, Mezzanine floor, Operating Floor of Unit 2
02	Air Washer -2F	BC Bay grid 23-24	
03	Air Washer -2G	BC Bay grid 23-24	
04	Air Washer -2H	BC Bay grid 22-23	
05	Air Washer -2I	BC Bay grid 22-23	

DETAIL OF Air Washer Layout AT 34.5 M FLOOR UNIT-1			
S.No.	DESCRIPTION	LOCATION	AREA TO BE CATERED
01	Air Washer -1a	CD Bay grid 11a-12	Boiler MCC & its Cable vault, COR cable vault, UPS cable vault of Unit 1

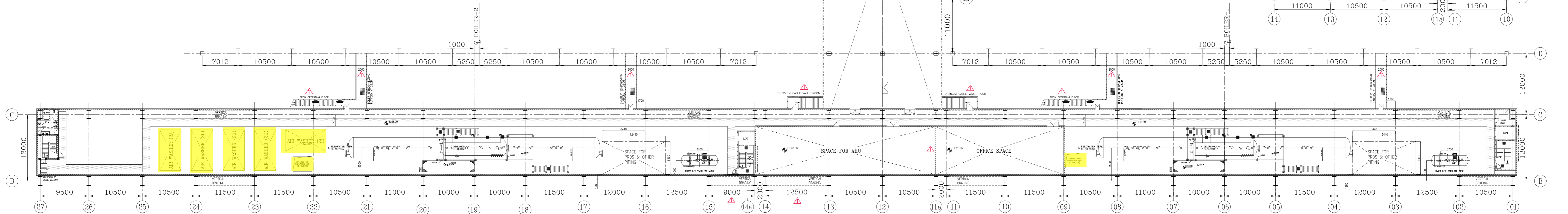
DETAIL OF Air Washer Layout AT 34.5 M FLOOR UNIT-2			
S.No.	DESCRIPTION	LOCATION	AREA TO BE CATERED
01	Air Washer -2a	CD Bay grid 12-13	Boiler MCC & its Cable vault, COR cable vault, UPS cable vault of Unit 2

REFERENCE DRAWINGS:

SL NO	TITLE	DRG. NUMBER	NTPC DRG. NUMBER	UNIT
1	TG EQUIPMENT PLAN AT EL. 0.0 M	PE-DG-508-100-M003	9587-001-110-PVM-F-049	PEM
2	TG EQUIPMENT PLAN AT EL. 8.5 M	PE-DG-508-100-M004	9587-001-110-PVM-F-050	PEM
3	TG EQUIPMENT PLAN AT 18.0 M	PE-DG-508-100-M005	9587-001-110-PVM-F-051	PEM
4	T.G. HALL CROSS SECTION	PE-DG-508-100-M007	9587-001-110-PVM-F-053	PEM
5	GA OF DEGENERATOR	HY-DG-1-26310-04301	9587-001-110-PVM-B-040	HYD
6	GA OF DRAIN TANK			SPR
7	GA D/A PLATFORM			HYD



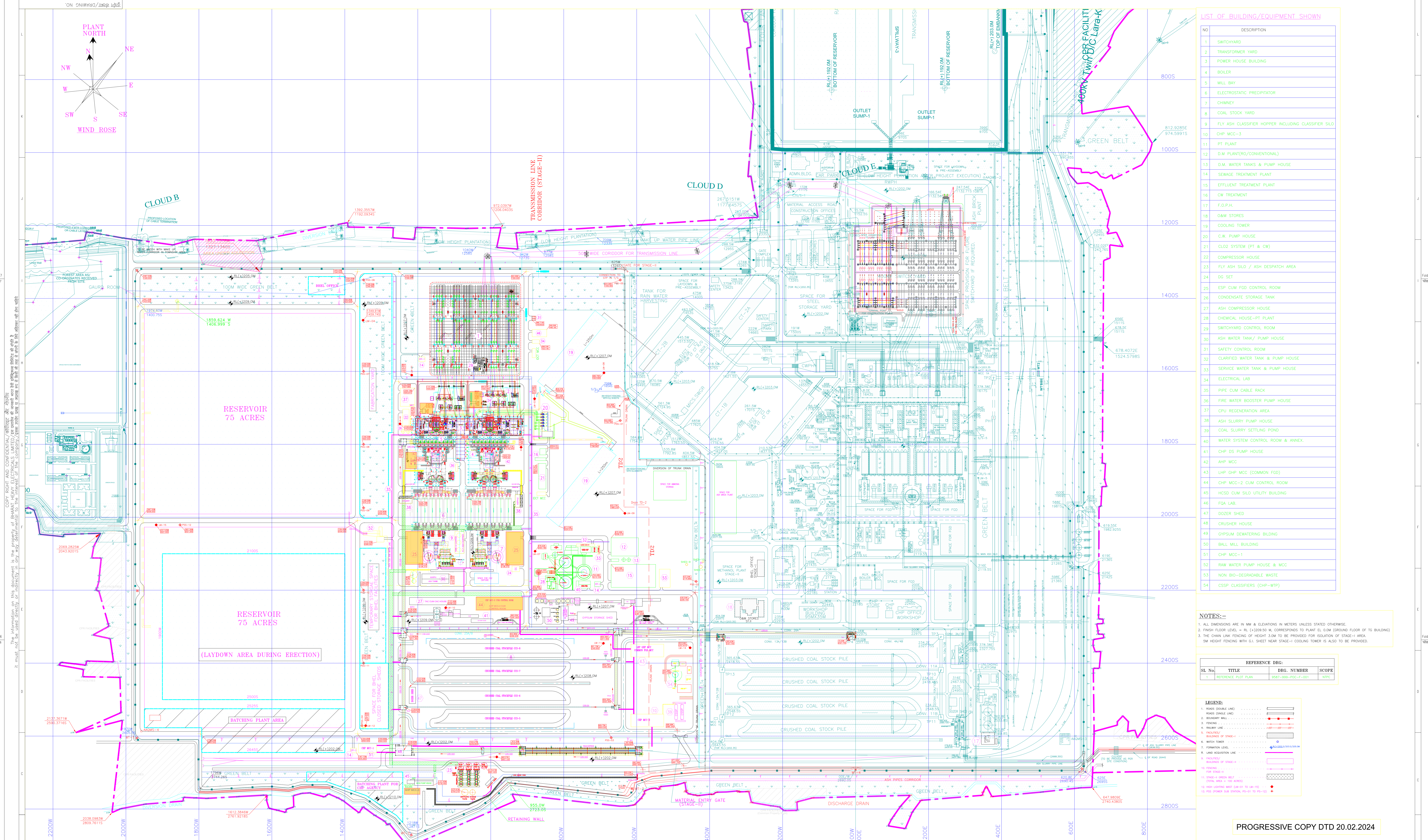
PLAN AT EL.25.0M



TG EQUIPMENT PLAN LAYOUT AT 28.0M/28.5M

- NOTES:-**
- ALL DIMENSION ARE IN MM AND LEVELS ARE IN METRES.
 - ALL ELEVATION MARKED ARE W.R.T. TG HALL FINISHED FLOOR ELEVATION OF 0.0M WHICH CORRESPONDS TO RL 209.50 M.
 - FOR CABLE TRAY/BUS DUCT/TRENCH/SPLIT LAYOUT, ELECTRICAL DRAWING TO BE REFERRED.

<p>NOTE: SCAN QR CODE FOR CHECKING THE LATEST REV STATUS OF DRAWING.</p>	<p>9587-001-110-PVM-F-052</p> <p>CUSTOMER DRAWING NO.</p>
<p>508</p> <p>CONTRACT</p>	<p>परियोजना PROJECT</p> <p>एन टी पी सी लिमिटेड N T P C LIMITED</p>
<p>भारत हेवी इलेक्ट्रिकल्स लिमिटेड</p> <p>BHARAT HEAVY ELECTRICALS LTD</p> <p>पॉवर सेक्टर/POWER SECTOR</p> <p>प्रोजेक्ट इंजीनियरिंग मैनेजमेंट</p> <p>प्रोजेक्ट (3-र) /NOIDA (U.P.)</p>	<p>2x800 मेगावाट लार सुपर थर्मल पावर परियोजना चरण-II</p> <p>2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE-II</p>
<p>08.02.24</p> <p>AA</p> <p>CSF</p> <p>SK</p>	<p>ड्राइंग संख्या / DRAWING NO.</p> <p>PE-DG-508-100-M006</p> <p>शीट 1 OF 1</p>



NO	DESCRIPTION
1	SWITCHYARD
2	TRANSFORMER YARD
3	POWER HOUSE BUILDING
4	BOILER
5	MILL BAY
6	ELECTROSTATIC PRECIPITATOR
7	CHIMNEY
8	COAL STOCK YARD
9	FLY ASH CLASSIFIER HOPPER INCLUDING CLASSIFIER SILO
10	CHP MCC-3
11	PT PLANT
12	D.M PLANT(RO/CONVENTIONAL)
13	D.M. WATER TANKS & PUMP HOUSE
14	SEWAGE TREATMENT PLANT
15	EFFLUENT TREATMENT PLANT
16	CW TREATMENT
17	F.O.P.H.
18	QAM STORES
19	COOLING TOWER
20	C.W. PUMP HOUSE
21	CLO2 SYSTEM (PT & CW)
22	COMPRESSOR HOUSE
23	FLY ASH SILO / ASH DESPATCH AREA
24	DG SET
25	ESP CUM FGD CONTROL ROOM
26	CONDENSATE STORAGE TANK
27	ASH COMPRESSOR HOUSE
28	CHEMICAL HOUSE-PT PLANT
29	SWITCHYARD CONTROL ROOM
30	ASH WATER TANK/ PUMP HOUSE
31	SAFETY CONTROL ROOM
32	CLARIFIED WATER TANK & PUMP HOUSE
33	SERVICE WATER TANK & PUMP HOUSE
34	ELECTRICAL LAB
35	PIPE CUM CABLE RACK
36	FIRE WATER BOOSTER PUMP HOUSE
37	CRU REGENERATION AREA
38	ASH SLURRY PUMP HOUSE
39	COAL SLURRY SETTLING POND
40	WATER SYSTEM CONTROL ROOM & ANNEX.
41	CHP DS PUMP HOUSE
42	AHP MCC
43	LHP CHP MCC (COMMON FGD)
44	CHP MCC-2 CUM CONTROL ROOM
45	HCSO CUM SILO UTILITY BUILDING
46	FOA LAB.
47	DOZER SHED
48	CRUSHER HOUSE
49	GYPSUM DEWATERING BUILDING
50	BALL MILL BUILDING
51	CHP MCC-1
52	RAW WATER PUMP HOUSE & MCC
53	NON BIO-DEGRADABLE WASTE
54	CSSP CLASSIFIERS (CHP-WTP)

NOTES:-

- ALL DIMENSIONS ARE IN MM & ELEVATIONS IN METERS UNLESS STATED OTHERWISE.
- FINISH FLOOR LEVEL = RL (+200.00) M. CORRESPONDS TO PLANT RL CUM GROUND FLOOR OF TO BUILDING
- THE CHAIN LINK FENCING OF HEIGHT 2.0M TO BE PROVIDED FOR ISOLATION OF STAGE-I AREA. 5M HEIGHT FENCING WITH G.I. SHEET NEAR STAGE-I COOLING TOWER IS ALSO TO BE PROVIDED.

SL. No.	TITLE	DRG. NUMBER	SCOPE
1	REFERENCE PLOT PLAN	9587-001-301-POC-F-001	NTPC

NO	DESCRIPTION
1	BOUNDARY WALL
2	ROAD
3	MAINTENANCE LINE
4	PROPERTY LINE
5	BOUNDARY OF STAGE-I
6	WITH TOWER
7	FORMATION LEVEL
8	LAND ACQUISITION LINE
9	PROPERTY LINE
10	BOUNDARY OF STAGE-II
11	FORMING
12	STAGE-I GREEN BELT (TOTAL AREA = 700 ACRES)
13	100% GREEN BELT (TOTAL AREA = 100 ACRES)
14	100% GREEN BELT (TOTAL AREA = 100 ACRES)
15	10% GREEN BELT (TOTAL AREA = 100 ACRES)
16	10% GREEN BELT (TOTAL AREA = 100 ACRES)

PROGRESSIVE COPY DTD 20.02.2024

SCALE: 1:1000

DATE: 09.02.24

PROJECT: 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE-II

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

NTPC LIMITED

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

9587-001-301-POC-F-001

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

PROJECT: 2x800 MW LARA SUPER THERMAL POWER PROJECT STAGE-II


भारत हेवी इलेक्ट्रिकल्स लिमिटेड


भारत हेवी इलेक्ट्रिकल्स लिमिटेड


REV.	DATE	BY	CHKD.	DESCRIPTION
01	09.02.24	VKS/AA	GSF/SK	BKA

1. Dwg. REVISED IN LINE WITH NTPC COMMENTS NO.10. LETTER NO. CC-ENG-9587-001-301-POC-F-001 R.O.D. DTD. 13/12/2023.

ANNEXURE 1

		TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM		PE-TS-508-554-A001	
				Rev. No. 00	
				Date : MARCH 2024	
THERMAL INSULATION					
	Insulation Material	Code	Thermal conductivity (w/m/°c)	Density Kg/m3	
1	Resin bonded glass wool	IS:8183	0.049 at 50oC 0.043 at 50oC	i) 24 (For Glass wool) ii) 48 (For Rockwool) iii) 48(For acoustic insulation)	
2	Mineral wool pipe section. Min.Gr.2	IS:9842	0.043 at 50oC	144	
3	Closed Cell Elastomeric Nitrile Rubber		0.036 at 20oC	40 – 60	
4	Polyurethane Foam		0.03 at 50 oC	34 + 2	
5	Polyisocyanurate Foam	IS12436	0.03 at 50 oC	34 + 2	
6	All insilation shall be CFC/HCFC free				
THERMAL INSULATION TYPE AND FINISH FOR DIFFERENT APPLICATION					
	Surface	Insulation Material	Insulation Form	Thick (mm) / Finish	
1	Acoustic insulation of duct	Resin bonded Glass wool	Slab	25 / All ducts up to a distance of 5 meters from AHU , Air washer unit fan, UAF fan and other centrifugal fan outlet shall be acoustically lined from inside with 25 mm thick resin bonded glass wool of 48 Kg/Cu.M. density and 30 gauge perforated aluminium sheet having 5 mm dia perforation at 8 to 10 mm centre-to-centre distance. Insulation shall be fixed on wooden frame of 600 x 600 mm dimension Fibre glass tissue sheet shall be applied over the outer surface of insulation before applying perforated aluminium sheet	
2	Exposed air duct	Resin bonded Glass wool/Rockwool	Roll/Slab	50 / F-4	
		or Polyisocyanurate Foam	Slab	F-4 (a)	

	TECHNICAL SPECIFICATION		PE-TS-508-554-A001
	2X800 MW LARA TPP STAGE II		Rev. No. 00
	VENTILATION SYSTEM		Date : MARCH 2024
DETAILS FOR FINISH OF THERMAL INSULATION			
a)	Finish F-1 (with Resin Bonded Glass Wool/Resin Bonded Mineral Wool)		
	Step-1	Wrapping of Poly-Bonded Hessain (PBH – to act as vapour seal) on outer surface of insulation with 50 mm overlap stitching and sealing of overlap with synthetic adhesive like CPRX or Equivalent compound.	
	Step-2	The surface then shall be wrapped with 19 mm mesh 24 SWG GI wire netting, butting all the joints and laced down with 22 SWG lacing wire.	
	Step-3	Sand cement (4:1) plaster shall be applied in two layers totalling to 12.5 mm thick, the second layer being brought to a smooth finish. A water proofing compound shall be added to the cement before its application	
aa)	Finish F-1(a) (With Polyurethane Foam & Polyisocyanurate Foam)		
		Wrapping of two layers of 7 mil 10 x 10 mesh glass cloth dipped in suitable adhesive such as SR 998 or Loid Bond 130 equivalent	
b)	Finish F-2		
	Step-1	Insulation shall be covered with 500g polythene with 50mm overlap and sealing of overlap with synthetic adhesive like CPRX/ Loid Bond 83 or Equivalent compound.	
	Step-2	Same as Step-2 of Finish F-1 above.	
	Step-3	Same as Step-3 of Finish F-1 above.	
c)	Finish F-3		
	Step-1	Same as Step-1 of Finish F-2 above	
	Step-2	The polythene shall be covered with 26 gauge Aluminium sheet and locking of joints with self-locking screws at a pitch of minimum 100 mm.	
d)	Finish F-4		
	Step-1	Same as Step-1 of Finish F-1 above.	
	Step-2	Same as Step-2 of Finish F-1 above.	
	Step-3	Same as Step-3 of Finish F-1 above.	
	Step-4	Application of 3 mm thick coat of suitable water proofing compound and wrapped with fibre glass RP tissue followed by final coat of 3 mm thick water proofing compound over the RP tissue.	
	Step-5	After the above treatment, 22G Aluminium sheet cladding, properly stiched at all joints shall be provided over the external surface	
dd)	Finish F-4(a) (With FR Closed Cell Chemically Cross Linked Polyethylene)		
		Application of aluminium sheet 22G cladding to be provided over the XLPE insulating material. Cladding sheet is held in position with SDST screws @ 150 mm C/c over tongue-in-groove joints applied with a felt for sealing joint against water ingress. All sheet joints to be done in a manner to shed water.	

	TECHNICAL SPECIFICATION 2X800 MW LARA TPP STAGE II VENTILATION SYSTEM	PE-TS-508-554-A001
		Rev. No. 00
		Date : MARCH 2024
DETAILS FOR APPLICATION OF THERMAL INSULATION		
1	Application with Glass Wool	
a)	All surfaces to be insulated both thermally and acoustically shall be thoroughly cleaned, dried and an adhesive (CPRX compound of Shalimar Tar Products or Equivalent) be applied @ 1.5 Kg /Sqm on the surface.	
b)	Insulation material (either expanded polystyrene foam or Glass Wool/ Glass fiber or Equivalent) shall be struck to the surface. All the joints shall be sealed with bitumen.	
c)	Insulation mass to be covered with 500 gauge polythene sheet with 50 mm overlaps and sealing all joints on hot side	
d)	Insulation Finish of types specified under shall be provided thereafter.	
2	Application with Nitrile Rubber:	
a)	All surfaces to be insulated shall be properly cleaned.	
b)	A suitable adhesive such as SR 998 or equivalent shall be applied over the surfaces to be insulated and insulation material surfaces.	
c)	Insulating material shall than be pasted onto the surfaces in a manner to avoid stretching and any air entrapment within.	
d)	Two layers of Glass Cloth with a suitable adhesive as SR 998 or equivalent shall be then applied over the insulating material to avoid surface weathering.	
3	Application with Polyurethane Foam & Polyisocyanurate Foam	
a)	All surfaces to be insulated shall be cleaned.	
b)	A suitable adhesive such as CPRX or Loid Bond 83 or equivalent shall be applied over the surface to be insulated and insulation material surfaces	
c)	Insulating material with aluminum foil lamination shall then be pasted onto the surface in a manner to avoid stretching and any air entrapment within.	
d)	Two layers of Glass Cloth with a suitable adhesive as Loid Bond 130 shall be then applied over the insulating material, to avoid surface weathering.	
e)	Insulation Finish of types specified under shall be provided thereafter.	
4	Application with FR Closed Cell Chemically Cross Linked Polyethylene Material (XLPE)	
a)	All surfaces to be insulated shall be properly cleaned of any dust, grease and moisture	
b)	A suitable adhesive, normally, a pressure sensitive acrylic base, such as SR 998/STAR Glue R242 or Neosole AA 900 or equivalent shall be used to paste the insulating material over the cleaned surface	
c)	XLPE cut to size for each surface, with overlaps provided for two faces shall be stuck to the surfaces in a manner to avoid air entrapment. The extent of over-lap shall be equivalent to the thickness of the material to be applied. The adhesive is applied on both the surfaces to be insulated and the insulation foam material.	
d)	Application of the insulating material to surfaces should preferably be carried out at ground level, in a clean dust free area	
e)	All joints- lateral & longitudinal, shall be taped with self adhesive aluminium foil tape 75 mm wide. The insulation over the surface shall be then held in position with 12mm wide PVC straps at every 600mm, to provide a neat & clean finish.	

ANNEXURE 2

REV-00, DATE: 20.02.2024

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: VENTILATION SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 2X800 MW LARA STP STAGE II

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	<p>a) 240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL as per load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract.</p> <p>b) Emergency supply feeder provided (if required) shall be 3 phase 3 wire only. Any other voltage level (AC/DC/Single ph emergency AC) required will be derived by the vendor.</p> <p>c) 230 V AC UPS Power supply shall be provided by BHEL at a single point, All necessary hardware for deriving other power supply from given feeder shall be in Vendor's scope.</p>
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	<p>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.</p> <p>2. Termination at BHEL equipment terminals by BHEL.</p> <p>3. Termination at Vendor equipment terminals by Vendor.</p>
5	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL BHEL	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.
6	Cable glands ,lugs and bimetallic washers for equipment supplied by Vendor	Vendor	Vendor	Bimetallic washers shall be used for bimetallic connections.
7	Conduit and conduit accessories for cabling between equipment supplied by vendor	BHEL	Vendor	
8	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES: VENTILATION SYSTEM****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 2X800 MW LARA STP STAGE II**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	
13	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	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

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
 (dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

- B = 6.6KV (Power cables)
- C = 3.3KV (Power cables)
- D = 1.1KV (LV & DC system power & control cables)
- E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

- A = Armoured FRLS
- B = Armoured Non-FRLS
- C = unarmoured FRLS
- D = Unarmoured Non-FRLS

PVC Aluminium

- E = Armoured FRLS
- F = Armoured Non-FRLS
- G = unarmoured FRLS
- H = Unarmoured Non-FRLS

XLPE Copper


- J = Armoured FRLS
- K = Armoured Non-FRLS
- L = unarmoured FRLS
- M = Unarmoured Non-FRLS

XLPE Aluminium

- N = Armoured FRLS
- P = Armoured Non-FRLS
- Q = unarmoured FRLS
- R = Unarmoured Non-FRLS

- S = FIRE SURVIVAL CABLES
- T = TOUGH RUBBER SHEATH
- U = OVERALL SCREENED
- V = PAIRED OVERALL SCREENED
- W = PAIRED INDIVIDUAL SCREENED
- Y = COMPENSATING CABLES
- I = PRE-FABRICATED CABLES
- Z = JELLY FILLED CABLES

ANNEXURE 5

	TECHNICAL SPECIFICATION FOR LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW)	SPECIFICATION NO. PE-TS-XXX-XXX-XXX VOLUME II B REV 010 DATE 06.02.2024 PAGE 1 OF 1
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TECHNICAL SPECIFICATION OF CABLE GLANDS AND LUGS

Cable glands shall conform to BS:6121. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and Hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene or better synthetic material and of tested quality.

Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections

DCS INTERFACE FOR MOTORIZED OPERATED FIRE DAMPER (BID-FD)

