MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE: 02.11.2020
	CUSTOMER :		QP NO.: PE-QP-999-509-E001, R2.	
	PROJECT:		PO NO.:	
	ITEM: ABOVE GROUND EARTHING MATERIALS	SYSTEM: EARTHING	SECTION: II	SHEET 4 OF 5

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
		4.MASS OF ZINC COATING	MA	CHEM. TEST	REFER REMARKS	REFER REMARKS	IS-6745 /APP. DATA SHEET	APP. DATA SHEET	INSP. REPORT	✓	P	W	-	10001 and above: 50: 5
		5.UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-4759	IS-2633	IS-2633	INSP. REPORT	✓	P	W	-	Note:- If the number of defective units in a lot exceeds the acceptance number as specified in col (3) of the table, the lot shall be rejected, else accepted.
		6. THICKNESS OF ZINC COATING	MA	MEASUREMENT	IS-4759	IS-4759	APP. DATA SHEET	APP. DATA SHEET	INSP. REPORT	✓	P	W	-	
		7. ADHESION	MA	MECH. TEST	IS-4759	IS-4759	IS 2629	IS 2629	INSP. REPORT	✓	P	W	-	
	Note: Items like Pipes/ Flexible Copper Braid/ GI wire/ GS Rod/ Shielding Mast/ Test link will be cleared based on COC (certificate of Compliance)													
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-5

NOTES:
1. BHEL reserves the right to perform repeat test, if required.
2. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/ verified by supplier's TPI.

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		VIKAS KUMAR SINGH	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE: 02.11.2020
	CUSTOMER :		QP NO.: PE-QP-999-509-E001, R2.	
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	ITEM: ABOVE GROUND EARTHING MATERIALS	SYSTEM: EARTHING	SECTION: II	SHEET 5 OF 5

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	

3. Photographs of items duly placed inside the box just before the final packing and Photographs of the box just before dispatch to be sent to BHEL purchase group for review before issuing MDCC.
4. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
5. Project specific QP to be developed based on customer requirement.
6. For export job, BHEL technical specification for seaworthy packing for export job to be followed.
7. Material shall be packed suitably in order to avoid damage during transit and also during storage at site in tropical climate conditions. Packing shall be suitable for storage at site in tropical climate conditions.
8. Latest revision/ year of issue of all the standards (IS/ASME/IEC etc.) indicated in QP shall be referred.

LEGENDS:

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

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		VIKAS KUMAR SINGH	Checked by:		KUNAL GANDHI		
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR JAISWAL		

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

CABLING EARTHING & LIGHTNING PROTECTION

CABLING,EARTHING,LIGHTNINGPROTECTION

ATTRIBUTES/ CHARACTERISTICS / ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV&IR	Galvanise Test (If Applicable)	Functional	Bought out item/ Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per EMPLOYER
Wall Mounted-Lighting Panel(IS-513,IS:5,IS:2629,2633,6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629,2633,6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands (BS-6121)	Y											Y		
Cable lug (IS-8309)	Y											Y		
Lighting wire(IS-694)	Y											Y		
Flexible conduits	Y										Y	Y		Y
Conduits(Galvanise &Epoxy)IS-9537&IS-2629,2633,6745	Y		Y								Y	Y		Y
RCC Hume Pipe(IS-458)												Y		

मुख्य अभि. (सी एंड आई), अभियांत्रिकी
Chief Engineer (C & I), Engineering
अभियांत्रिकी विभाग/Engineering Department
दामोदर घाटी निगम/DVC
कोलकाता-54/KOLKATA

Cable termination &straight through joint(VDE-0278)	Y											Y		Y
Cable Trays, Flexible supports system &accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y	Y	Y	Y		Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing &lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire(IS-280)	Y											Y		
Fire Sealing System(BS–476)												Y	Y	Y

Note:
1. This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2.* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the OWNER technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & Crosses.
3. Make of all items will be subject to OWNER approval.

मुख्य अभियंता (सी एंड आई), अभियांत्रिकी
Chief Engineer (C & I), Engineering
अभियांत्रिकी विभाग/Engineering Department
दामोदर घाटी निगम/DVC
कोलकाता-54/KOLKATA-54

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM TECHNICAL SPECIFICATION (C&I PORTION)	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : I	
		SUB-SECTION : C4	
		REV. 00	DATE: MARCH 2022

SECTION: I

SUB-SECTION: C4

TECHNCIAL SPECIFICATION

(C&I PORTION)

TECHNICAL SPECIFICATION
(CONTROL AND INSTRUMENTATION)
FOR AC & VENTILATION SYSTEM

INDEX

C&I SPECIFIC TECHNICAL REQUIREMENT

Specific Technical Requirements (C&I)

1. Air Conditioning & Ventilation System shall be operated from DDCMIS (BHEL's scope) for Area's/Building indicated elsewhere in the specification.
2. Interface of MCC, field Equipment, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in specification.
3. Bidder shall provide Microprocessor based controls of Package AC (PAC) with local display along with facilities to Soft link & Hardwired interface with DDCMIS and to meet the requirement of all system operations and controls. Soft link communication between Microprocessor (MP) based control panels & DDCMIS shall be redundant Bi-directional OPC/Modbus link. Bidder shall include required hardware at MP end.
4. Time synchronization of MP with DCS is to be carried out. Necessary hardware/software for same at MP end to be provided by Bidder.
5. The Bidder shall provide complete Instrumentation for control, monitoring and operation of entire AC & Ventilation. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.
6. 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. 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. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price/time implication.
7. Instrument installation and accessories required for the same shall be in Bidder's scope. Further, any instrument installation not covered in the

specification, same shall be subject to customer and BHEL approval during detailed engineering. All instruments required for the package shall be supplied, mounted on the gauge board racks, along with accessories like impulse pipe, fittings & valve manifolds etc.

8. All field instruments enclosure shall be IP65 or better.
9. All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.
10. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication. The make/model of various instruments/items/systems shall be as per customer/BHEL approved vendor list. No commercial and delivery 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.
11. All the instruments/equipments/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.
12. All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant.
13. Material described in the specification (for instrument, equipment, accessories etc.) are the minimum requirements, which shall be complied by bidder. Any other better material shall also be considered to suit the process and environmental conditions at site subject to owner's approval. Material, if found not suitable shall be changed by vendor without any price/time implication.
14. The contacts of equipment mounted instruments; sensors, switches etc. For external connection including spare contacts shall be wired out to suitably located junction boxes by bidder.

15. Drive control philosophy/signal exchange list attached elsewhere in the specification are tentative and shall be finalised during detailed engineering.
16. For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification.
17. Number of pairs to be selected for Screen/ Control cable
    a. F-Type: 2P/4P/8P (Size : 0.5 mm2)
    b. G-Type: 2P/4P/8P (Size : 0.5 mm2)
    c. Core Cable: 3CX2.5sqmm2
18. The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
19. Bidder to furnish electrical load/UPS load data during detailed engineering
20. 415 V AC Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board/change over switch in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.

LIST OF DOCUMENTS/DELIVERABLES

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT			
Sl. No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**
1	PE-V9-XXX-145-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM WITH SET POINTS	A
2	PE-V9-XXX-145-I902	INSTRUMENT SCHEDULE WITH SET POINTS	A
3	PE-V9-XXX-145-I903	FIELD JB SCHEDULE WITH TERMINATIONS	A
4	PE-V9-XXX-145-I904	DATASHEETS FOR INSTRUMENTS, JBs, etc.	A
5	PE-V9-XXX-145-I905	QUALITY PLANS (INSTRUMENTS, etc.)	A

MEASURING INSTRUMENTS

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

Measuring instruments / equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment. The instrumentation vendor shall be subject to BHEL's / customer's approval. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes / numbers as approved by BHEL / customer during detailed engineering.

Every panel-mounted instrument, requiring power supply, shall be provided with a pair of 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.

All local gauges as well as transmitters and sensors for parameters like pressure, temperature etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.

04.00.00 Specification for Field Instrumentation items

04.01.00 Pressure, Differential Pressure, Level (DP Type) and Flow (DP Type) Transmitters (PT, DPT, LT & FT)

Smart Transmitters of the electronic type shall be provided.

Type/Construction	Sealed capacitance / piezo resistive based SMART type
Material	
- Body	Die cast Aluminum or Aluminium alloy with epoxy coating for air & flue gas
- Diaphragm	316 SS or better
- Measurement element	Teflon seal /Capsule/Diaphragm

Output signal	4 to 20 m Amp. DC (Two wires) With HART protocol
Local Indicator	LCD indicator (5 digit) with scale of Engg. unit
Overall Accuracy	± 0.075% or better of FSR ± 0.2% for remote seal type transmitter.
Turn down ratio	10:1 for vacuum / very low pressure / very high pressure applications 25:1 or better for other services
Stability	± 0.2% for 10 years
Power supply	24V DC nominal
Drive capability	600 Ohms nominal
Enclosure Class	IP-65 min. in general Explosion proof for NEC Class-1, Division 1 area
Span Adjustment	Remote or Locally adjustable
Zero Adjustment	Externally adjustable
Zero suppression / elevation	At least 100% of Span
Overpressure	150% of max. operating pressure.
Adjustment/ calibration/ maintenance	Port/provision for Centralised PC based system maintenance
Ambient Temperature	60 Deg. C
Connection	
- Process	1. Half (1/2) inch NPT (F)
	2. Quarter (1/4) inch NPT With /without oval flanges
- Electrical	½" NPT(F), two electrical connections and blind plug
Accessories	
Manifolds	
Type	Non-Integral type
Material of Construction	SS
- For Absolute Pressure Transmitters	Two (2) valve SS316 manifold

- For Gauge & Vacuum pressure Transmitters	Three (3) valve SS316 manifold
For DP, level & flow transmitter	Five (5) valve SS316 manifold
Snubber / Pulsation dampeners	
Application	shall be used where the process media is unstable for measurement such as the discharge of a pump, Compressor, Fan, etc
Material of Construction	SS 316
Protective Diaphragm Seal	
- Application	For oil, corrosive, viscous, solid bearing or slurry type medium
- Type	Flush Type
- Process Connection	½" NPT / Flanged SS316 Class 150
- Material	SS316L
Capillary Length	Minimum 10 m
Mounting bracket	For all transmitters
Drain & vent points	As per requirement

Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures (LIE).

2 No. of universal type hand held/portable HART communicator shall be supplied for calibration / configuration of Transmitters & all HART based instruments.

04.02.00 PRESSURE SWITCHES (PS) & DIFFERENTIAL PRESSURE SWITCHES (DPS)

Applicable Standards	IS3624 - 1966/ISA-RP-8.1 except as modified in spec.
Type/Construction	Bourdon / Sealed Diaphragm Piston Actuated preferable.

	Indicators with contacts are not acceptable.
Material	
- Bellows	316 SS
- Bourdon tube	316 SS
- Movement	316 SS
- Case Material	Die-cast aluminum. Epoxy coating shall be provided for corrosive atmosphere
Accuracy	+/- One (1) percent of span or better
Repeatability	+/- 0.5 percent of span or better
Set Point & Differential	Adjustable
Over range for Pressure / Vacuum Switch	130% of maximum pressure
Contacts	
- Number	1 DPDT / 2 SPDT
- Type	Auto reset with internal Adjustable snap action hermetically sealed micro switch with silver vetted shock & vibration proof
- Rating	5 Amp, 240V AC / 0.2 Amp, 220V DC/ 2 A, 24VDC
Connection	
- Process	Half (1/2) inch NPT Male
- Electrical	Plug in type
Enclosure Class	IP-65 or better for General services and Explosion/Flame proof for NEC Class-1, Division 1 area as applicable
Accessories	
Manifolds	
Pressure Switch	2 valve manifold
Differential Pressure Switch on Steam & water Lines	5 Valve Manifold
Differential Pressure Switch on Air & Flue gas Lines	3 valve manifold

Material	SS 316
Snubber / Pulsation dampeners	
Application	For Pump and compressor suction & discharge lines and pulsating fluid application
Type	Self Cleaning type
Material of Construction	SS 316
Protective Diaphragm Seal	
- Application	For corrosive liquid lines. i) Remote diaphragm seal with SS 316 armoured capillary for typical application. MOC of seal material shall be as per process fluid requirement. ii) Silver coated diaphragm for corrosive services like chlorinated water.
- Type	Flush Type
- Process Connection	NPT / Flanged SS316 Class 150
Mounting	In LIE. Retention ring and screws for surface mounting Mounting bracket / Clamp for 2 '' pipe, bolt & nut.
Tag	Tag Number, service engraved in SS tag plate

04.03.00 PRESSURE & DIFFERENTIAL PRESSURE GAUGES (PG & DPG)

Applicable standard	IS:3602-1966, IS/3624, ASME B 40.1
Type/Construction	
- (-) 760 mm Hg to 1. Kg/cm2	Bellows / Diaphragm
-Above1.Kg/cm2	Bourdon Tube
Suction Side of pumps	Compound gauge
Materials	
- Bourdon tube	316 SS
- Bellows	316 SS
- Movement	316 SS

- Case	SS 304
- Protective Diaphragm	Teflon
Dial	150mm size with toughened shatter proof glass
Scale Details	Graduations in black lines on White dial, 270 Deg. pointer deflection scales provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointers stop for all gauges Anti parallax, glare free.
Accuracy	± 1.0% of Span or better
Connection	
Process	1/2 inch NPT Male Bottom
Enclosure Class	IP-65 or better & Explosion/Flame proof for NEC Class-1, Division 1 area - as applicable
Zero adjustment	For all gauges External Micrometer screw for zero adjustment. Internal micrometer screw for range adjustment.
Safety device	
- Ranges 5 to 20 Kg/cm2	Rubber blow out disc with open front construction
- Ranges above 20 Kg/cm2	Neoprene safety diaphragm at the back with solid front construction
- Over range protection	One thirty (130) percent of full scale
Accessories	
- 3 way gauge Cock	For all gauges
Snubber / Pulsation dampeners	
Application	For Pump and compressor suction & discharge lines and for pulsating fluid applications
Type	Self Cleaning type
Material of Construction	SS 316

Syphon / Pigtail	For all Steam Lines
Protective Diaphragm Seal	
- Application	For oil, corrosive, viscous, solid bearing or slurry type medium SS 316 Flange and Diaphragm, PTFE coated / block, Silicon Oil filling fluid
- Type	Flush Type
- Process Connection	NPT / Flanged SS316 Class 150

04.04.00 TEMPERATURE TRANSMITTERS

Type	Microprocessor type, 2-wire type temperature transmitters and fully compatible with thermocouples & RTDs shall be provided by the bidder. The transmitters shall be field pipe / support mounted type.
Material	
- Body	Die cast Aluminum with epoxy coating
Input	Pt-100 RTD
Output	2-wire with 4-20 mA output with superimposed HART protocol signal. 5-digit LCD display
Power Supply	24 VDC, 2- Wire Loop Power
Enclosure Protection	Weather proof as per IP 65 with corrosion resistance coating. For hazardous area explosion proof enclosure as described in NEC article 500
Composite Accuracy	RTD = <0.25% of 0- 250 deg C
Accessories	Mounting brackets, SS Tag Plate, etc

04.05.00 RESISTANCE TEMPERATURE SENSORS WITH THERMOWELLS

Applicable Standard	ASME PTC 19.3 - Latest Revision
Element	Platinum, R0=100 ohm 3-wire Duplex ungrounded
Sheath Material/ Insulation	316SS / Compacted Magnesium Oxide
Sheath O D	8 MM
Type of the Terminals	Spring loaded Nickel plated brass-screw type/ silver plated
Calibration	As per DIN Standard – 43760, Class A
Material of construction of Head	Die Cast Aluminum (Screwed) with galvanized chain
Response Time	10 Sec bare & 30 Sec. With protective sheath/ thermo well
Accuracy	± 0.35 degree C or Class-A whichever is better
Stability	Zero & span drift within 0.1% of span for a 6 month period
Connection	
Process	½" NPT(M)
Electrical	½" NPT(F) one unused entry with blind plug
Enclosure Class	IP-65
Thermo well	
Applicable Standard	ASME PTC 19.3 TW - 2010
Construction	Tapered drilled from Bar stock With Hex Head & Straight for Air & Gas systems
Material	- 316 SS - water and steam and air services - Inconel for flue gas services For furnace zone, impervious ceramic protecting tube of suitable material along withIncoloy supporting tubes and adjustable flanges.

Process Connection	- M33 x 2 in general - Flanged for Air & Gas systems with mating flanges.
Immersion Length	Within ± 10 mm of centre line of pipe subject to sizing calculations such as frequency ratio, cyclic stress, dynamic stress, pressure limit. Etc. as per PTC 19.3TW 2010
Extension neck length	Minimum 100 mm above insulation of pipe and Minimum 160 mm when there is no insulation on pipe.
Thermo well Sizing Calculation	Bidder shall provide sizing calculations for thermo well as per ASME – PTC-19.3 TW 2010

04.06.00 TEMPERATURE GAUGES (TG)

Applicable standard	IS : 3602,BS:5235 ISA:RP:8.1 except as modified in this specification
Type/Construction	
- Thermometer	Industrial type, Inert Gas Filled type with separable thermo well Bimetallic & all angle tillable
- Thermo well	Bar stock
Material	
Sensing material type	Bimetal strip helix
- Thermo well& Bulb	316 SS
- Capillary	Armoured SS (Applicable or capillary Type)
- Casing	SS 316.Epoxy coating shall be provided for corrosive atmosphere
Dial Size	150mm with toughened/ shatter proof glass

Scale Details	270 degree dial rotation/deflection. Graduations in black lines on white dial provided with glass cover. Smallest scale division shall be 1% of full scale value or smaller. Pointer stop for all gauges Anti parallax heavy gauge aluminium with white matte finish glare free.
Accuracy	± One (1) percent of full scale or better
Response time	Maximum 15 seconds without thermo well, 30 seconds with thermo well
Dampener	Dampening pointer oscillation
Window	Toughened shatter proof glass
Connection	
- Pipe	M33 x 2
-Thermo well	To suit instrument
Other Particulars	
- Capillary length	Minimum 5 meters for local mounting & minimum 10 Meters for panel mounting
- Immersion Length	Within + ten (10) mm of centre line of pipe with adjustable nuts subject to sizing calculations as per PTC 19.3 TW 2010
- Extension neck length	Minimum 50 mm above insulation of pipe/As per approved hook-up drawings.
- Stop or pointer at Maximum value	For all gauges of scale with externally adjustable
	Contact type Temp. gauges are not acceptable for interlock & protection.
- Over range protection	150 percent (%) of full scale
Enclosure Class	IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area)

04.07.00 CONDUCTIVITY TYPE LEVEL SWITCHES

1	Sensing elements	Conductivity type
2	Probe Material	SS 316with high purity ceramic
3	Repeatability	± 0.5 % of full range or better
4	Accuracy	± 0.5 % of full scale or better
5	Working temperature	As per process requirement
6	Probe length	As per requirement
	Probe rating	Max. design pressure of vessel
7	Mounting	Flanged- on external cage
	Input	Four independent channel with selectable switching threshold for water conductivity
	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo
8	No. of contact	2 NO. + 2 NC, 2 SPDT, snap action type dry contact with silver vetted
9	Rating of contacts	5A, 240 V AC / 2A, 24 V DC / 0.25 A,220V DC
	Local Display	Colored LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault
10	Enclosure	IP 65
11	Housing	Cast aluminum epoxy coated weather proof
12	Ambient Temperature	60*C (max.)
13	Electrical Connection	Plug-in type
14	Cable connection	½ " NPT with cable gland
15	Set point	Adjustable
16	Accessories	All mounting accessories, PTFE cable from Probe to electronics, washer & Gasket, etc.

04.08.00 ULTRASONIC LEVEL TRANSMITTER (FOR WATER /OIL SUMP/TANK LEVEL MEASUREMENTS)

Principle of Operation	Detection of reflected ultrasonic pulse
Measuring Ranges	Up to 30 meters (typical)
Signal Processing	Microprocessor Controlled Signal Processing
Operating Frequency	10 KHz to 50 KHz (typical)
Display	Large alpha-numeric back lit LCD / LED
Calibration & Configuration	Accessible from front of panel
Diagnosis	On-line
Status	For power, Hi / Lo / V. Hi / V. Lo- level indication, fault etc.
Construction	Plug-on board
Power supply	240 V AC 50 Hz / 24V DC
Signal Output	4-20 mA DC (isolated) - 600 Ohm load.
Hysteresis	Fully adjustable preferred
Output contacts	2SPDT Potential free changeover contacts @ 8A 230V AC.
Accuracy & Repeatability	0.25% of span or better
Resolution	0.1% of span
Operating temp.	Transmitter-50 Deg.C and Sensor – 80 Deg.C
MOC Sensor	Body- PVC and Face – Polyurethene
Humidity	1% to 95% non condensing.
Enclosure	IP-65 Epoxy painted die cast aluminium or Polycarbonate housing
Cable Connection	3/4" ET
Mounting	2” for sensor and Transmitter on panel.
Accessories	Cable gland, prefab cable, mounting accessories.

04.09.00 LEVEL INDICATORS (LI)

Type/Construction	a) Reflex
	b) Tubular (For tanks open to atmosphere only)
Material:	
a) Glass	Tempered borosilicate resistant to thermal shock
b) Case	Carbon steel
c) Integral cocks and	i) Forged carbon steel with drain valves stainless steel internals
	ii) Rubber lined corrosion resistant 316 stainless steel (for Demineralised and Osmosis water service)
d) Fittings	i) Forged carbon steel
	ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralised and Osmosis water service)
	iii) 304 Stainless Steel for non-corrosive liquids
e) Packing	Teflon
Scale details	Aluminum/SS316 scale Graduated in mmwc
Accuracy	+/- 2 % of full scale
Connection	25 Nb/40 Nb ANSI Flanged
Accessories	a) Integral cocks
	b) Drain valves
	c) Bolts, nuts and gaskets
	d) Illuminating lamps as required
	e) Periscope as required
Tests	Tested at two hundred (200) percent of the maximum process pressure
Other details	For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.

04.10.00 FLOW SWITCH

Type	Vane Type
Materials	
Sensing Element	SS316
Case	Die cast Aluminium
Mounting	Online type
Switch Assembly	
Type	Micro switch with silver vetted
Form	1 DPDT or 2 set of SPDT
Rating	5 Amp 240V AC / 0.2 Amp 220V DC
Enclosure	Weather proof to IP65
Housing	Aluminium alloy
Over range Protection	130% of FSR
Set point	Externally adjustable over full range
Accuracy	± 1% of FSR
Repeatability	± 0.5% of span
Connection	
Instrument	Half (1/2) inch NPT Male Process
Electrical	Suitable for Three fourth (3/4)" gland conduits. Double compression type SS Cable gland shall be included with instruments
Accessories	i) SS tag Plate ii) 1 no. blind Plug for unused electrical connection

11. HUMIDITY SENSOR

Sensor	:	Capacitance type
Accuracy	:	+/-3% R.H
Range	:	0-100% R.H
Output	:	4-20 ma
Time constant	:	2 mins.

Output from the sensor is to be connected to respective control system. Contractor can also provide combined instrument for measurement of humidity and temperature subject to Employer's approval during detailed engineering. In all such cases, 4-20 ma outputs, each for temperature and humidity measurements are to be provided.

12. TEMPERATURE / HUMIDITY INDICATOR

Sensor	:	RTD for(Pt 100) for temperature
	:	Capacitance Type for Humidity (specs for humidity and temperature shall be as mentioned above)
Display	:	Combined enclosure with two three digit seven segments LED display with decimal point after two digits. LED height shall be 4 inches, clearly legible from a distance of at least 10 meters.
Range	:	0-60 Deg C for temperature.
	:	0-95.0 % for Relative Humidity.
Accuracy	:	Better than +/_0.5 % for Temperature
	:	Better than +/_2.5 % for Relative Humidity
Mounting	:	Table Top/ wall mounting.
Power supply	:	240 V AC, 50 Hz.
Output	:	4-20 mA signal each for temperature.

One Set of output signal is to be connected to respective control system. Apart from displaying the temperature/humidity values on indicator.

CLAUSE NO.	TECHNICAL REQUIREMENTS

10.00.00 FIELD MOUNTED LOCAL JUNCTION BOXES

(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
(iii)	Type	Screwed at all four corners for door. Door gasket shall be of synthetic rubber.
(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply.
(v)	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.
(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.
(vii)	Grounding	To be provided.
(viii)	Color	RAL 7035

Electronic Flow-Meter

The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore ultrasonic / electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner.

The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments.

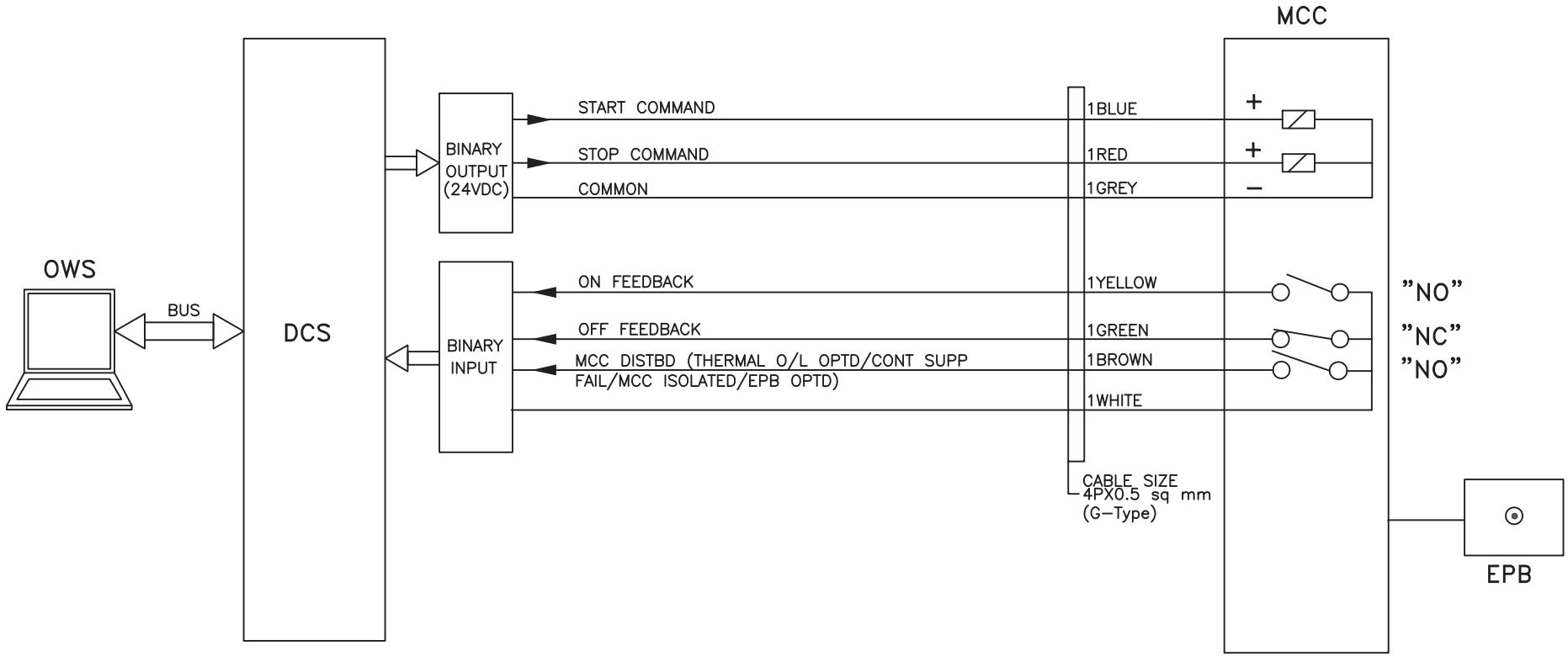
The flow meter shall meet or exceed the following requirement:

(a)	Output	4-20 mA DC Isolated output HART compatible
(b)	Accuracy	± 0.5% of calibrated span or better *
(c)	Repeatability	± 0.2% of calibrated span or better
(d)	Ambient Temp. &	4 deg.C to 55 deg.C.
	Humidity	5% to 100% RH
(e)	Power Supply	UPS 240V AC ± 10%, 50 HZ ± 5%/ 24 V DC, to be arranged by the bidder.
(f)	Protection class	IP-65
(g)	flange material, Measuring tube & electrode material	SS 316
(h)	Liner material.	Teflon.
(i)	Features	zero stability, zero and span field adjustable, suitable for process medium with <= 5 micron Siemens conductivity.

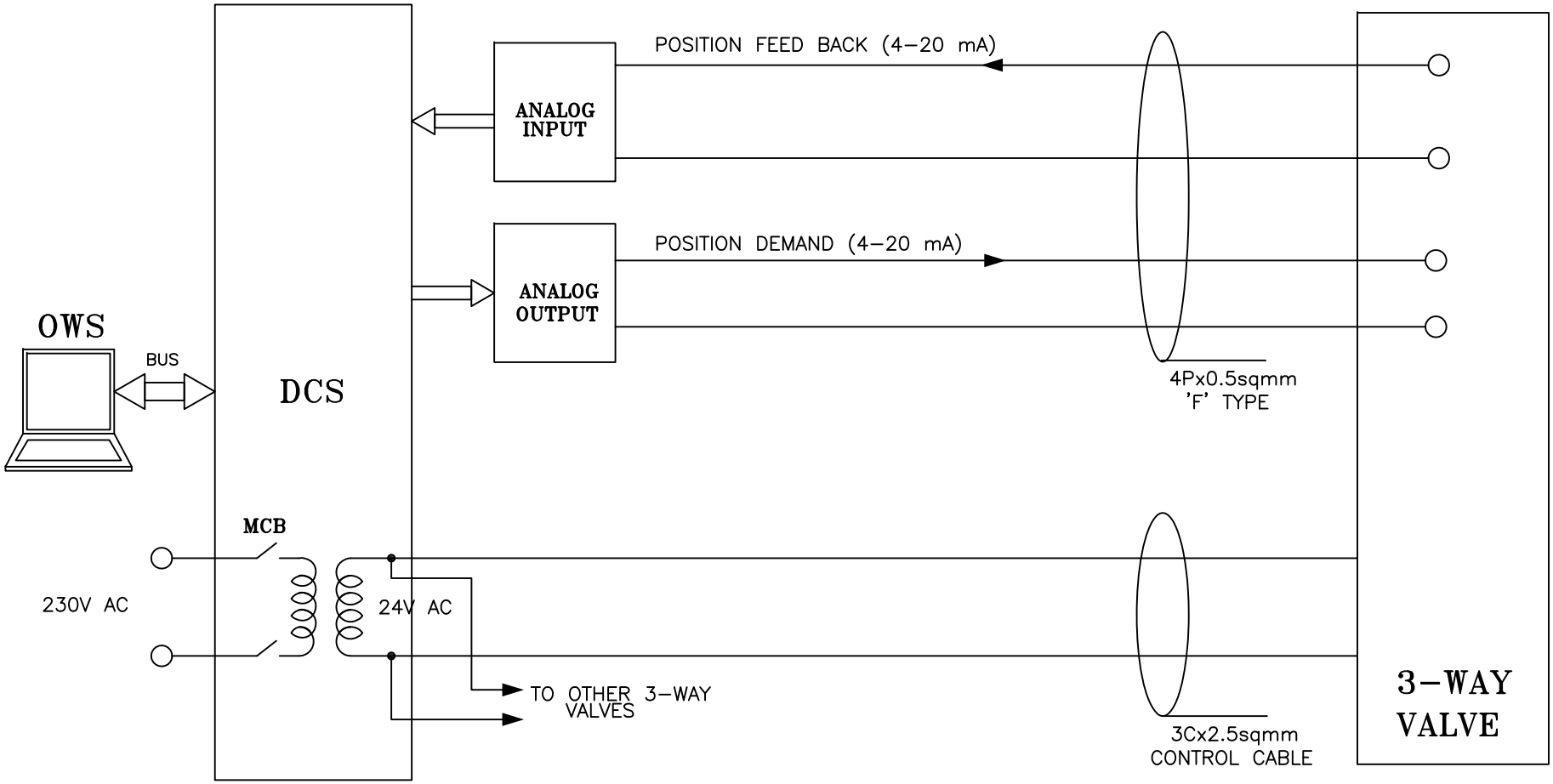
The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser / integrator to get the daily and monthly discharge as stated above.

DRIVE CONTROL PHILOSOPHY

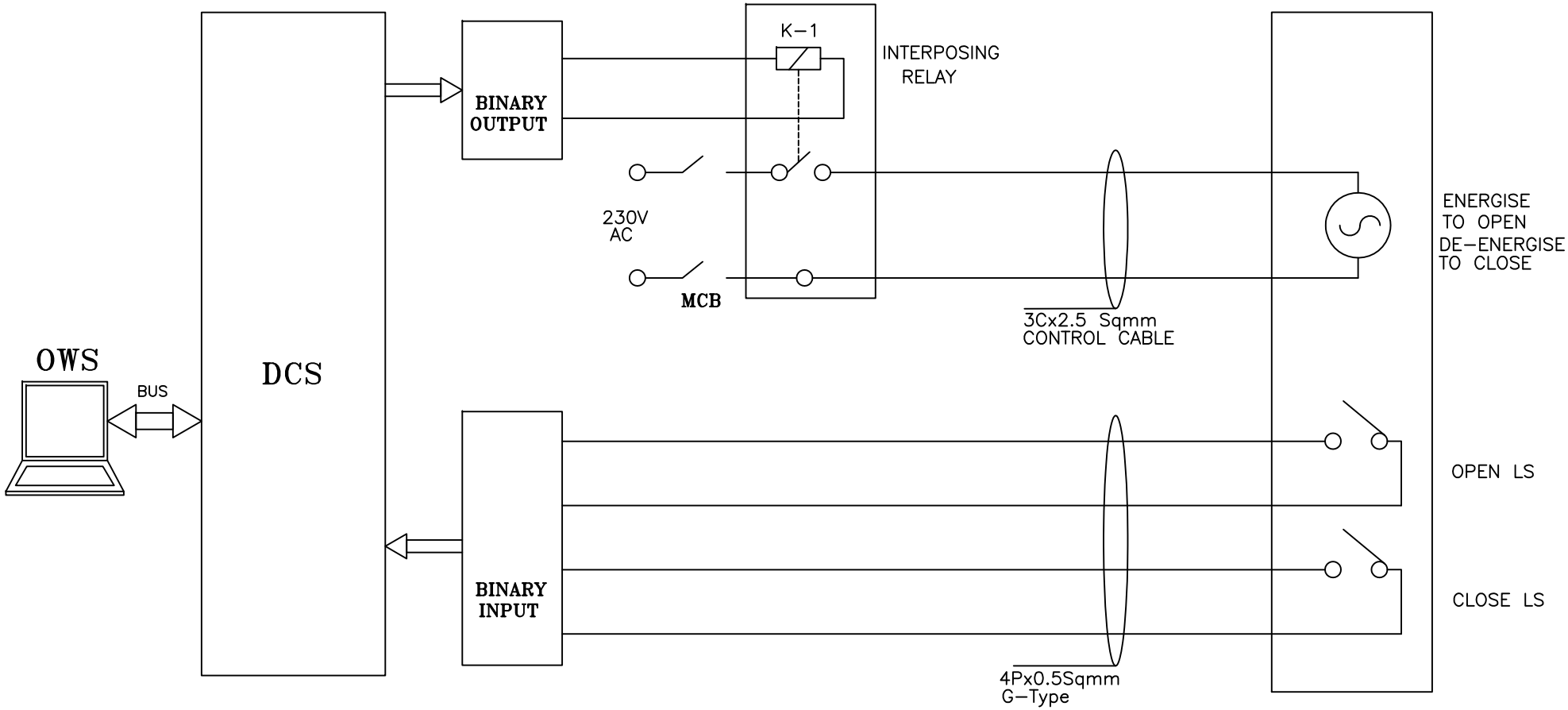
DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR CONTROLLED) (LTUD)



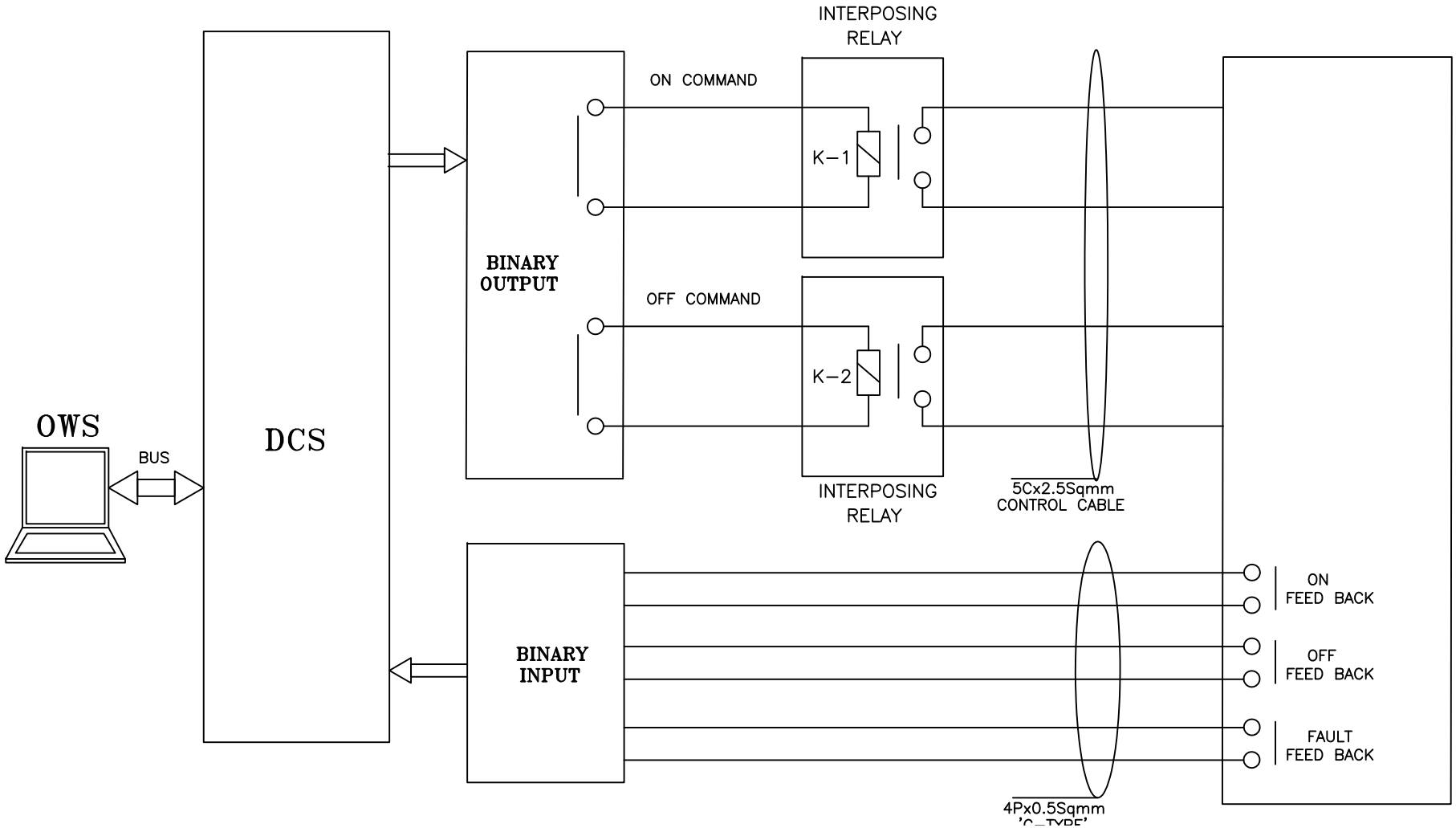
DCS INTERFACE FOR 3–WAY MIXING VALVE (MOD–AC)



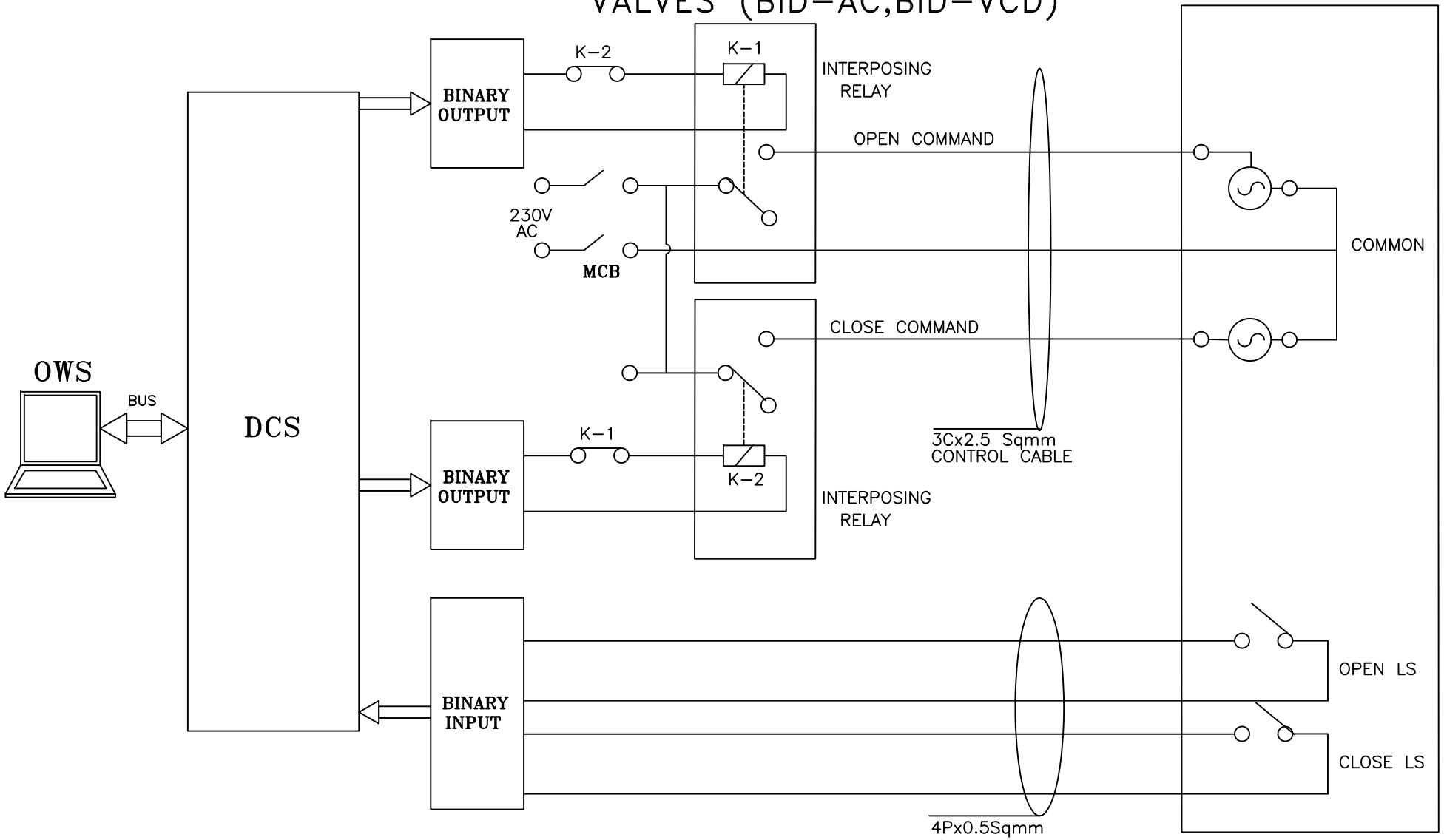
DCS INTERFACE FOR MOTORIZED OPERATED FIRE DAMPER (BID–FD)



HOOK–UP DIAGRAM FOR **PAC**



DCS INTERFACE FOR MOTORIZED OPERATED VALVES (BID-AC,BID-VCD)



QUALITY ASSURANCE

CLAUSE NO.	QUALITY ASSURANCE

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y

R-Routine Test A- Acceptance Test Y – Test applicable

:

CLAUSE NO.	QUALITY ASSURANCE

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Flue Gas analyser	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												

R-Routine Test A- Acceptance Test Y – Test applicable

Note: 1) Detailed procedure of Environmental Stress screening test shall be as per Quality Assurance. Programme in General Technical Conditions

2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

CLAUSE NO.	QUALITY ASSURANCE

PROCESS CONNECTION AND PIPING

TESTS / ITEMS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydrulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y	Y	Y*		Y		Y	Y								
Gauge Board	Y	Y	Y	Y		Y		Y		Y			Y	Y			
Impulse pipes and tubes	Y		Y		Y			Y							Y		
Socket weld fittings ANSI B-16.11	Y		Y					Y							Y		Y
Compression fittings	Y		Y					Y						Y	Y	Y	
Instrument valves & Valve manifolds	Y		Y					Y						Y	Y		
Copper tubings ASTM B75	Y							Y									Y

*-applicable for painted junction boxes.
Note: R-Routine Test A- Acceptance Test Y – Test applicable
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

SUB VENDOR LIST

Package Name	Supplier Name	Supplier Communication Address
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in

PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
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TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in
TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
TEMP. ELEMENT	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com

TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com
TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in
TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com
TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com

TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in
TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com
INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com

INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com
ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com
ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com
ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone-9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone-+91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone-+919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com
LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in

LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com
LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net
LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com

INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,

SECTION: I

SUB-SECTION: D

STANDARD TECHNICAL SPECIFICATIONS

	TECHNICAL SPECIFICATION VENTILATION FANS	SPECIFICATION NO. PES-571-11000-A-03	
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SECTION-D

VENTILATION FANS

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1. GENERAL

This specification covers the design, manufacture, testing of performance at manufacturer's/sub-contractors works, delivery at site, handling at site, erection and commissioning of ventilation fans.

2. CODE AND STANDARDS

The design, manufacture and performance of equipment shall comply with all currently applicable statutes, regulations and safety codes in the locality where it is to be installed. The equipment shall conform to latest edition of applicable Indian Standards or their equivalent standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. In particular the equipment shall conform to the latest editions of the Following standards.

2.1.1 IS:4894 -Centrifugal fans

2.1.2 IS:3588 -Electric Axial Flow fans

2.1.3 IS:2312 -Propeller type A.C. ventilation fans

2.1.4 IS-3963 -Roof extractor units

2.1.5 BS:848 -Method of performance test for fans.

2.1.6 AMCA publication 99 standards handbook

2.1.7 AMCA standard 210, Test code for air moving devices.

3. DESIGN AND CONSTRUCTION

3.1 THE ENCLOSED DATA SHEET A GIVES THE NECESSARY DETAILS FOR CENTRIFUGAL/AXIAL/ROOF EXTRACTOR UNITS ETC.

3.2 WELDING PROCESS AND WELDERS EMPLOYED FOR FABRICATION SHALL BE QUALIFIED AS PER ASME SEC. IX

3.3 CASING

3.3.1 The centrifugal fans casing shall be of welded construction fabricated with heavy gauge material (min 3 mm) with flanges (min. 5 mm) on inlet and out let side for direct connection and shall be rigidly reinforced and supported by structural angles. The seams shall be permanently sealed airtight. Horizontal Split casings shall be provided on large size fans. Casing drain (at bottom) with threaded plug/ with valve shall be provided, as required. All mounting/ connecting holes shall be drilled off centre.

3.3.2 The axial flow casing for supply fans/roof extractors shall be of heavy gauge construction (min 3 mm) properly reinforced for rigidity and shall be complete with suitable supports. Access doors with suitable locking arrangement shall be provided in the casing for easy access to the motor and impeller. External junction box/ Terminal box on casing with IP-55 protection shall be provided, if required. Wiring for motor from external junction box/ Terminal box shall be through flexible conduit.

3.3.3 Suitable motor brackets designed for rigid mounting of motors, shall be provided for roof extractors and wall mounted exhaust/ supply fans.

3.4 IMPELLER

3.4.1 Centrifugal fan impeller shall have die formed, aerofoil or laminar blades welded to the rim and back plate and shall have non-overloading, self cleaning characteristics. Rim shall be spun to have smooth contour. If required, intermediate stiffening rings

shall be provided. Shaft sleeves shall be furnished, if specified. The impeller, pulley and shaft sleeve shall be secured to the shaft by key and/or nuts (threaded opposite to direction of rotation of impeller). The impeller shall be statically and dynamically balanced.

~~3.4.2~~ The axial fan impeller shall be of high efficiency aerofoil design. The blades shall be mounted on a streamlined hub and the impeller shall be mounted directly on the motor shaft. Impeller shall be in one piece however; fabricated blades will be acceptable up to 450 mm impeller diameter.

3.4.3 Roof ventilator impeller may either be centrifugal or axial type. Backward inclined blades shall be provided for centrifugal impellers. Blades may be die-formed or cast. Axial flow impeller shall be directly mounted to motor shaft whereas centrifugal impeller may either be direct-driven or belt-driven. The shaft of belt-driven centrifugal fan shall be solid cold rolled carbon steel, ground and polished. However, direct mounted impellers are preferred.

3.5 BEARINGS:

3.5.1 The centrifugal fan bearing may be ball, roller or sleeve bearings of self-aligning heavy duty type with adequate capacity and life. Make of Bearings to be specified. Bearings shall be oil/grease lubricated and provided with fittings for lubrication from outside and shall be located in easily accessible position to facilitate maintenance.

3.6 INLET CONES AND GUARDS

3.6.1 Centrifugal fans inlet shall be spun to have a smooth contour. Inlet screen, if provided, shall be galvanised wire mesh of 25 mm square with wire thickness of min. 1.5 mm.

3.6.2 Inlet cone, outlet bell and suitably designed guards shall be provided.

3.7 GUIDE VANES:

3.7.1 In case of vane axial fans guide vanes shall be provided on discharge side.

3.8 BASE PLATE AND VIBRATION ISOLATORS

3.8.1 Base plate and vibration isolators, which may be double deflection rubber in shear or rubber in compression type or spring type shall be provided. With each fan rubber bushes, washers wherever needed for vibration isolator in sufficient nos. shall be included, as required, to ensure isolation of foundation from vibration of equipment. For roof ventilators suitable mounting arrangement shall be provided such that there is no ingress of rain water into the building.

3.9 HOOD AND COWL

3.9.1 Roof exhaustors shall be provided with hinge type hood providing easy access to motor and impeller. Weather proof lockable type disconnect switch shall be provided such that hood can open only when the disconnect switch is in'off' position. On larger size of roof ventilators hoods may be of split construction. 15 mm mesh galvanised bird screen shall be provided.

3.9.2 Rain protection cowls shall be designed to suit wall exhausters/supply fans for protecting fans from rain. The cowls shall be provided with bird screen of heavy gauge expanded metal netting.

3.10 SPEED

3.10.1 The speed of axial flow fans/roof ventilators shall not exceed 960 RPM for impeller dia exceeding 450 mm and shall not be greater than 1440 with impeller dia less than 450 mm.

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4. MOTORS

Drive motors shall be of totally enclosed type, suitable for horizontal/vertical mounting as applicable and shall comply with the requirments of the specifications furnished elsewhere for motors.

5. ACCESSORIES

Accessories as specified in Data sheet-A and as required for satisfactory trouble free & safe operation of fans shall be provided.

6. TESTING AND INSPECTION

List of TCs arranged as per Approved Quality Plan shall be furnished along with copy of TCs at the time of inspection by BHEL

- Visual inspection of sheets/plates, angles, channels etc. – Pitting, lamination in sheets/ plates, angles and channels shall be avoided.- visual inspection by main contractor of BHEL.
- Sheets/ Plates - Test certificate shall be furnished for physical and chemical properties for sheets / plates- for review by BHEL
- Shaft: Mechanical and chemical-– review by BHEL
- Motors (of approved make): Routine TC ,FLP TC if applicable
- Workmanship and dimensional check as per manufacturing drg. and approved Drgs.- by main contractor of BHEL.- Shall be checked by BHEL/ Customer during final inspection.
- Balancing of impellers- Dynamic balancing certificates shall be furnished –grade 6.3 or better to ISO-1940. Balancing weights shall be positively locked/ welded to avoid loosening. - witness by manufacturer - TC to be furnished for review by BHEL(consisting of weight of impeller, radius of correction and balancing rpm). For spare impellers Dynamic Balancing shall be witnessed by BHEL.
- Performance test of one Centrifugal fan or Axial Fan /per type/per size as per applicable standard – by BHEL.
- Centrifugal/ Axial fans 100% run tested by main contractor of BHEL. Run test by BHEL/Customer may be at random or 100%- Vibration shall be within satisfactory zone of VDI 2056 (group- G) machines when measured on bearing housing and noise level <85 dbA at 1 metre distance. Max. Temp. on bearing housing- 40 degrees Centigrade + ambient

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7. DRAWINGS/DOCUMENT/DATA REQUIRED AFTER AWARD OF CONTRACT

7.1 GA drawing & data- sheet to be submitted along with technical schedules enclosed in Volume III.

7.2 Drawing including equipment layout, foundation & loading details etc. for civil works. These drawings must cover sufficient details so that design of civil works can be completed.

7.3 Equipment description giving complete design calculations, basis of design, selection criteria etc.

7.4 Test Certificates.

7.5 Performance Test Certificates.

7.6 Final as built documentation i.e. final-version of all drawings, data & information as per the requirement specified elsewhere.

7.7 Installation and erection manual.

7.8 Inspection, operation & Maintenance Manuals.

7.9 Vendor shall also provide soft copy of each drawing in AutoCAD format.

7.10 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

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CENTRIFUGAL FAN **DATA SHEET - A**	VOLUME II-B	
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No.	Particulars	Data
1	**General Information**	
1.1	Fan Designation/application.	Refer schedule of Ventilation system.
1.2	Nos. required/capacity	Refer Section-C of Specific Technical Requirement
1.3	Location	Refer layout drg. Attached.
2.0	**Design Data**	
2.1	Type	DIDW for Ventilation
2.2	Type of blades	backward curved
2.3	Arrangement	To suit application as per layout.
2.4	Discharge direction	To suit application as per layout.
2.5	Duty	Continuous
2.6	Capacity at site (Cubic Meter/hr) & static pressure.	Refer Section-C of Specific Technical Requirement
2.7	Suction pressure (mm Wg)	As per system requirement.
2.8	Fluid	Atmospheric Air.
2.9	Suction Temperature	Refer weather data attached.
2.10	Suction humidity	Refer weather data attached.
3.0	**Materials**	
3.1	Fan Scroll	Heavy Gauge Mild Steet to IS: 2062 with galvanised
3.2	Fan Casing (side plates & stiffeners)	Heavy Gauge Mild Steet to IS: 2062 / IS: 1079 / Eq. Minimum 3 mm thick casing.
3.3	Impeller	Mild Steel/plate to IS: 2062
3.4	Impeller hub	Mild Steet/plate to IS: 2062
3.5	Impeller back plate blade & shroud	Mild Steet to IS: 2062 / IS: 1079 / Eq.
3.6	a) Shaft b) Shaft sleeve	EN-8 or eqv. -do-
3.7	Support frame and structure.	Mild Steet to IS: 2062
3.8	Flexible connection at outlet canvas with MS Flanges and cleats (3mm thick).	Fire resistant type plastic impregnated

PEM-6666-0

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3.9	V Belt	ISI marked (Reinforced rubber section to IS: 4776)
3.10	V Pulley	Cast Iron multi groove to grade FG 20 as per IS: 210. Having taper lock type
3.11	Slide rails	M.S./C.I.
3.12	Connection pieces	G.I. according to supplier's design
3.13	Bolts & nuts	M.S. Galvanized / Epoxy painted.
3.14	Vibration isolating pads, washers and spring if any.	Hard synthetic rubber
4.0	**ACCESSORIES**	
4.1	Common base plate	Required.
4.2	Anchor bolts	-do-
4.3	Vibration Isolators	Hard synthetic rubber
4.4	V-belt pulleys	-do-
4.5	V-belts	Reinforced rubber of appropriate section
4.6	Belt guard	Required.
4.7	Outlet damper	Required(M.S. Heavy Gauge)
4.8	Inlet guard	Required.
4.9	Inlet Vane (variable)	Not required.
4.10	Drain valve	Required.
4.11	Acoustic silencers	Not required.
5.0	**Motor**	
5.1	Motor by	Bidder
5.2	Starter by	Bidder
6.0	Painting of fans including base frame	Galvanized / epoxy painting (as per Section-C & painting specifications)

NOTE:

1) Motors shall have 15 % margin on duty power point.

2) Fan shall be designed to operate with in 9% and 25% of system throttling line.

3) Opposed Multiple louvers damper shall be provided at fan outlet.Louvres shall be of 2 mm thick MS (galvanized). Casing shall be of 3.15 mm thick MS (galvanized).

TITLE	SPECIFICATION NO. PES-571-11000-A-03	
Ventilation Fan (Axial Flow Type)	VOLUME II-B	
DATA SHEET - A	SECTION D	
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No.	Particulars	Data
	General Information	
1)	Designation	Supply/Exhaust Fans.
2)	Nos. required	Refer schedule of Ventilation system in section-C under specific technical requirement.
3)	Service	To exhaust warm air/to supply fresh air.
4)	Location	Wall mounted.
5)	Area	Same as above in 2.
	Design Data	
6)	Type supply	Axial fans suitable for 415V/3 phase for Motor.
7)	Air delivery capacity	As per schedule of ventilation system.
8)	Fluid	Atmospheric Air.
9)	Temperature	Refer Section of specific technical requirement
10)	Static Pressure required	As per Section'C' schedule of ventilation system.
11)	Outlet Air Velocity	Not more than 12 m/sec.
	Materials	
12)	Casing	M.S. (IS-2062)
13)	Impeller	Cast A1uminium. (Alloy A-6M, IS-617)
14)	Hub	Al Alloy.
15)	Support frame and structure. (Galvanized/	M.S. of adequate thickness Painted) IS-2062.
16)	Neoprene rubber pads	As required.
17)	Coned inlet for wall exhausters/supply fans	MS (IS-2062)
18)	Supporting frame for mounting.	Required.
19)	Protective screen at inlet.	Yes (Min 14 SWG Galvanized wire knitted in 1" square mesh.
20)	Rain Protection Cowl	Aluminum or hot dip Galvanized after fabrication from M.S.

TITLE	SPECIFICATION NO. PES-571-11000-A-03	
Ventilation Fan (Axial Flow Type)	VOLUME II-B	
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Motor

21)	Motor by	Bidder
22)	Starter by	Bidder

NOTE:

1) For Battery Room, motor for fan shall be of flame proof type & fan of spark proof construction with Epoxy painting.

2) Gravity type damper shall be provided at the outlet of axial fan for exhaust application.

3) Motor shall have 15% margin over Duty Point.

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SECTION-D

CENTRIFUGAL PUMPS

	TECHNICAL SPECIFICATION CENTRIFUGAL PUMPS	SPECIFICATION NO. PES- 571-11000-A004
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1. GENERAL

1.1 This specification covers the design, material, constructional features, manufacture, assembly, inspection and testing at manufacturer's or his subcontractor's works, suitable painting requirements of centrifugal pumps and drives complete with all accessories as specified hereinafter.

2. CODES AND STANDARDS

2.1 The design, manufacture, inspection, testing & performance of the pumps as specified hereinafter, shall comply with the requirements of the latest revision of the following standards as indicated below (as applicable):

2.1.1 IS-1520 : Horizontal centrifugal pumps for clear, cold and fresh water.

2.1.2 IS-5120 : Technical requirements - Rotodynamic special purpose pump.

2.1.3 IS-1710 : Vertical turbine pumps for clear, cold and fresh water.

2.1.4 BS - 599 : Method of testing Pumps.

2.1.5 PTC - '6' : Centrifugal Pumps Power test code

2.1.6 API - 610

2.1.7 Hydraulic Institute Standards of USA

Wherever standards for certain aspects materials etc., not mentioned, the same shall be as per the applicable Indian or International standards.

2.2 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in this matter, the decision of Purchaser's engineering shall be final and binding.

3. DESIGN REQUIREMENTS

3.1 The pumps shall be of heavy duty suitable for long periods of uninterrupted service and shall be standard product of the manufacturer thoroughly proven for satisfactory performance and reliability.

3.2 The materials of construction of various components shall be as indicated under Data Sheet-A and where not specified to the applicable Indian/British/American standards..

3.3 All pressure containing components including the pump casing, nozzles and stuffing box housing shall be designed, fabricated and tested in accordance with applicable Indian standards if not specified otherwise.

3.4 The pump shall be suitable for handling the fluid as specified in Data Sheet-A.

4. CONSTRUCTION FEATURES:

4.1 **PUMP CASING**

4.1.1 Pump casing may be axially or radially split or barrel type construction as specified in the pump data specification sheet. The casing shall be designed to withstand 1.5 times the maximum pressure developed by the pump at the pumping temperature.

4.1.2 Pump casing shall be provided with adequate number of vent and priming connections with valves, unless the pump is made self venting & priming. Casing drain, as required, shall be provided complete with drain valves or plugged with threaded plugs as required.

4.1.3 Pump shall preferably be of such construction that it is possible to service the internals of the pump without disturbing suction and discharge piping connections.

4.1.4 Under certain conditions, the pump casing nozzles will be subjected to reactions from external piping. Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610

4.2 **IMPELLER**

4.2.1 Unless specifically indicated under Data Sheet-A enclosed, the pump impellers shall be of closed vane type. The impellers shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings. Impellers shall be checked for eccentricity and statically and dynamically balanced individually. The assembled rotor shall be dynamically balanced and checked for eccentricity. Supplier shall ensure during balancing that wall thickness of impeller vane, shroud etc is maintained above the minimum thickness requirement as per design.

4.3 **WEARING RING**

4.3.1 Renewable wearing rings for the casing and/or the impellers and renewable shaft sleeves, shall be provided for all pumps. Length of the shaft sleeves must extend beyond the outer faces of gland packing or seal and plate so as to distinguish between the leakage between shaft & shaft sleeve and that past the seals/gland.

4.4 **SHAFT**

4.4.1 Shaft size selected shall take into consideration the critical speed which shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall also be at least 10% away from runway speed.

4.5 **BEARING**

4.5.1 Bearings and hydraulic devices**,** of approved make, (if provided for balancing axial thrust) of adequate design shall be furnished for taking the entire pump load arising from all probable conditions of continuous operation throughout its Range of Operation and also at the shut off condition. The bearing shall be designed on the basis of 20,000 working hrs minimum for the load corresponding to the duty point. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid being pumped. Where there is a possibility of liquid entering the bearing, suitable arrangement in the form of deflectors or otherwise shall be provided ahead of bearing assembly. Bearings shall be easily accessible without disturbing the pump assembly.

4.6 **STUFFING BOX**

4.6.1 Packed type stuffing boxes of adequate depth with lantern rings shall be provided to minimize the leakage. In all cases where the pump suction is below atmospheric pressure, the shaft packing shall be sealed by the liquid pumped by tapping off from the pump discharge itself and all pipes, valves, fittings etc., required for this shall be furnished by the manufacturer. Tubings used for connections shall be flexible metallic type preferably SS-304/316. PVC/ rubber tubings are not acceptable.

4.7 **SHAFT COUPLING**

4.7.1 The pumps shall be directly coupled to their drives through heavy-duty flexible coupling. Suitable sturdy coupling guards of min. 1.5 mm MS sheet/ Aluminium sheet shall be provided along with the coupling. The pump and its drive motor shall be mounted on a common base plate.

4.8 **BASE PLATE AND SOLE PLATE**

4.8.1 Unless otherwise stated the data specification sheet, a common base plate mounting both for the pump and drive shall be furnished. The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust, etc. Suitable drain taps and drip lip shall be provided. The external corners of the base plate shall be rounded to avoid sharp corners. Drilled holes shall have sufficient space around for proper seating of washer with nut. If required in the data specification sheet, steel sole plates shall be provided, below the base plate.

4.9 **PRIME MOVER**

4.9.1 The drive motor selected shall conform to the requirements of the enclosed motor specifications.

4.10 **LIFTING ARRANGEMENT**

4.10.1 Each pump and motor shall incorporate suitable lifting attachments e.g. lifting lugs or eye bolts etc., to facilitate erection and maintenance..

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5. PERFORMANCE REQUIREMENTS

5.1 The pump shall be designed to have best efficiency at the specified duty point. The pump set shall be suitable for continuous operation at any point within the Range of Operation as stipulated in the data specification sheets.

5.2 Pump shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off. Power capacity characteristic will be non-overloading type i.e. 110% of the design flow the power required to drive the pump will be practically the same as that at the design flow.

5.3 Wherever specified in data sheet, pumps of each category shall be suitable for parallel operation. The head vs capacity, input power vs. capacity characteristics, etc., shall match to ensure equal load sharing and trouble free operation throughout the range.

5.4 The pump motor set shall be designed in such a way that there is no damage due to the reverse flow through the pump which may occur due to any malfunction of the system.

6. DRIVE RATING

6.1 The power rating of the drive shall be selected such that a minimum margin of 15% is available over the pump input power required at the rated duty point. However, the drive rating shall not be less than the maximum power requirement at any point within the 'Range of Operation' specified.

6.2 In cases where parallel operation of the pumps are specified the actual drive rating is to be selected by the bidder considering overloading of the pumps in the event of tripping of one of the operating pumps.

6.3 The bidder under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.

7. SCOPE OF INSPECTION AND TESTING

7.1 CASTING

7.1.1 The Witnessing pouring and thereafter physical testing of castings of 'Critical' nature such as casings, impellers, diffusers. Castings shall have 'as cast' heat numbers unless they require overall machining. For partially machined components manufacturer shall ensure availability of as cast heat nos. on unmachined area.

7.1.2 Identification and correlation with test reports for all tests as per the relevant material specifications for castings of 'Major' nature such as suction bell, discharge elbow, stuffing box, gland, wearing rings, shaft sleeves etc.

7.1.3 Foundry's conformity certificate for castings of 'Minor' nature such as base plates, covers etc.

7.1.4 Verification of Heat treatment charts (as applicable)

7.1.5 Castings may be required to meet NDT requirements such as Radiography, Magnetic Particle Testing or Dye-penetrant testing prior to Hydro-test as per requirements specified in Quality Plan.

7.1.6 Surface finish of Steel castings shall meet MSS SP-55.

7.2 **FORGING**

7.2.1 Identification and correlation with mill test certificates for all tests as per the relevant specifications for important forgings like casings, stage bodies, diffusers, shaft material.

7.2.2 Verification of heat treatment charts (time temperature) (as applicable).

7.2.3 Forgings may be required to meet NDT requirements such as Radiography, Magnetic Particle Testing or Dye-penetrant testing prior to Hydro-test as per requirements specified in Quality Plan.

7.3 **FABRICATED ITEMS**

7.3.1 Identification and correlation with mill test certificates for material of items such as discharge bellows, column pipes etc.

7.3.2 Approval of welding procedure specifications and qualifications of weld procedures and personnel as per ASME Sec IX.

7.3.3 Dye penetrant tests of weldment as per ASTM E-165 and acceptance norm as per ASME Sec.VIII, Div.1, Appendix 8

7.3.4 Verification of heat treatment charts (time temperature), (as applicable)

7.3.5 **Note:** For para 7.1.2, 7.2.1 and 7.3.1 above; in case correlating original test certificates are not available, material shall be identified by Main Vendor and test conducted at NABL approved Laboratory.

7.4 **IN PROCESS INSPECTION AND TESTING**

7.4.1 Identification Dye penetrant testing after machining for impellers including vanes, pump shaft, diffusers as per applicable code; in absence of which, as per ASTM E - 165. Permissible defects and acceptance norms need to be specified. On static parts acceptance norms are as per ASME Sec.III NB 2546.

7.4.2 Ultrasonic testing of dynamic duty component, i.e. pump shafts (50mm dia and above) and static duty forgings i.e. Barrel, casting (15mm and above wall thickness) as per applicable code, in absence of which as per ASTM E388 and acceptance norms as stipulated hereunder. Probe shall be of min. 2 MHz frequency.

7.4.3 Acceptance norms for UT for dynamic duty components. the following defects are unacceptable

a) Cracks, flakes, seams and laps

b) Defects giving indications longer than that from a 4mm equivalent flaw.

c) Group of defects with maximum indications less than that from a 4mm equivalent flaw, which cannot be separated at testing sensitivity, if the back echo is reduced to less than 50%.

d) Defects giving indications of 2 to 4mm dia. equivalent flaw separated by distance less than four times the size of the larger of the adjacent flaw.

7.4.4 For static duty components - as per NB 2542.2 of ASME Sec. III

7.4.5 Hydro tests of all pressure parts such as casings, column pipes, discharge elbows etc., at two times duty point pressure or 1.5 time shut off pressure, whichever is higher for 30 min., without any leakage.

Note : In case the pump is required to boost certain pressure, the inlet pressure head shall also be taken into consideration to compute test pressures

7.4.6 Static and dynamic balancing of individual impellers and also assembled rotors as per V.D.I. 2060 Q 6.3 or ISO 1940 G 6.3.

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7.5 **PERFORMANCE TEST**

7.5.1 Pump testing with unit supply motor as per specifications and acceptance norms cited elsewhere, in absence of which as per IS 5120 latest edition. Performance shall be checked for minimum of 7 points (including shut off head and over load) following characteristics shall be checked.

a) Capacity V/s Head

b) Capacity V/s Power absorbed by pump

c) Capacity V/s pump efficiency

Note : For pump of fire protection system, performance test shall be conducted up to 150% of rated capacity.

7.5.2 NPSH test in case specifically mentioned elsewhere.

7.5.3 Vibration, noise level and temperature rise measurement. Noise level shall be within 85dB(A) at 1 metre distance. Vibration within satisfactory zone of VDI 2056 Group G machines. Temperature shall not exceed ambient + 40 deg. C.

7.5.4 Overall dimensions as per GA drawings. One pump/type/size assembly with job motor shall be mounted on base plate, provided the components are ordered on the same manufacturer.

7.5.5 Examination after selective opening up after running for pumps operating at speed over 1800 rpm and capacity exceeding 68M3/hr.

7.5.6 Painting and packing as per technical specification.

7.6 **TEST AT SITE**

7.6.1 The pumps will be tested at site by the purchaser to verify their performance. If the pumps fail to operate smoothly or within the required performance all such deficiencies shall be rectified by the manufacturer by making suitable alternatives in the pump set and additional tests required to show the effect of such alterations shall be performed by him.

7.7 **PERFORMANCE GUARANTEE**

7.7.1 The vendor shall guarantee the material and workmanship of all components as well as the operation of the pump as per requirement of this specification. The vendor shall also guarantee for each pump the total dynamic head at the specified rated capacity and also corresponding efficiency, brake horse power and shut off head

8. CLEANING, PROTECTION , PAINTING & PACKING

8.1 Before shipment of the equipment to be supplied under this specification the necessary cleaning, flushing etc., as per manufacturers standard/ as specified for the contract in Data Sheet A/ elsewhere shall be done to remove all dirts, scales etc. Shop coats of rust inhibiting paints, lacquers etc., shall be applied to various parts as per manufacturers standard/ as specified for the contract in Data Sheet A/ elsewhere. Flanges, inlet and outlet pipe, etc shall be protected. Packing shall be done as per manufacturers standard/ as specified for the contract in Data Sheet A/ elsewhere.

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9. DRAWINGS, TECHNICAL DOCUMENTS AND OTHER INFORMATION REQUIRED WITH THE PROPOSAL

9.1 Fully dimensioned outline GA drawings of the pump motor assembly unit for each type and size offered. This drawing should include:

a) Foundation base plate and sole plate details as applicable

b) Civil foundation and anchor bolts details and loading data

c) Minimum submergence required for the pump (if applicable)

9.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction and/ make with standard applicable codes.

9.3 Performance characteristics (Discharge capacity vs head, BHP and efficiency of the pumps.

9.4 Motor speed torque curve superimposed on pump speed torque curve. Required NPSH of pump.

9.5 Experience list about the supply and successful operation of similar pumps for similar application.

9.6 A comprehensive write up or brochure on the details of manufacturing and testing facilities in the shop of the manufacturer.

9.7 Quality plan for the equipment being offered, in BHEL format as practiced in the manufacturer's works and Field Quality Plan for receipt, storage erection, commissioning & testing at site.

9.8 Data sheet-B with all the particulars filled in.

10. MANUFACTURERS NAME AND TAG. PLATES

10.1 Each pump shall have a permanently attached brass/ Stainless steel tag on the body indicating the following information both in Hindi and English:

a) Manufacturer's name and trade mark.

b) Design Capacity and Head.

c) Design.

d) Purchaser's tag no. as furnished during the contract. The purchaser's tag no. will be indicated by the Purchaser on the drawing submitted for approval by the vendor.

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11. DRAWINGS/DOCUMENT/DATA REQUIRED AFTER AWARD OF CONTRACT

11.1 Certified GA drawings of pump motor assembly weights, crane.

11.2 Detailed cross sectional drawings of the pump and motor assembly and all equipment & accessories supplied under the this specification along with details of material of construction with applicable standard codes.

11.3 Foundation drawings with details of foundation pocket indicating static as well as dynamic load and other data with dimensions.

11.4 Certified characteristics curves (discharge capacity vs. head, BHP and efficiency) of each type of pump and motor.

11.5 Material and other test certificates as required by the application clauses of this specification.

11.6 Motor speed torque curves super imposed on pump speed torque curves.

11.7 Quality plan along with complete details of testing and inspection requirements of centrifugal pumps in BHEL format. Vendor shall also furnish Field Quality Plan.

11.8 Installation , operation and maintenance manual.

11.9 Other drawings and data, if necessary.

11.10 Vendor shall also provide soft copy of each drawing in AutoCAD format.

11.11 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

TITLE

CENTRIFUGAL PUMPS

DATA SHEET - A

SPECIFICATION NO. PE-TS-413-571-11000-A004.

VOLUME II-B

SECTION D

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	DESCRIPTION	DATA
1.	Designation	: Cooling Water pumps for Ventilation plant.
2.	Type	: Horizontal, Centrifugal pump or vertical split type casing pump .
3.	Quantity	: Refer to section-C of Specific Technical Requirements
4.	Installation	: On floating type foundation.
5.	Fluid to be handled	: Water
6.	Temperature of fluid	: To suit.
7.	Capacity M3/hr and TDH at rated	: To suit system requirements but head shall not be less than 25 MWC.
8.	Duty	: Continuous (24 hours / day)
9.	Suction condition	: Flooded
10.	Type of drive	: Direct
11.	Prime Mover	: LV AC motor
12.	Maximum speed	: 1500 RPM
13.	Type of lubrication	: Grease Lubrication
14.	Material	
	a) Impeller	: Refer to section-C of Specific Technical Requirements
	b) Pump shaft	: Refer to section-C of Specific Technical Requirements
	c) Casing	: Refer to section-C of Specific Technical Requirements
	d) Wearing ring	: Refer to section-C of Specific Technical Requirements
	e) Shaft Sleeve	: Refer to section-C of Specific Technical Requirements
	f) Base plate	: Refer to section-C of Specific Technical Requirements
	g) Bolt and nuts.	: Refer to section-C of Specific Technical Requirements
	h) Stuffing Box gland/bush	: Refer to section-C of Specific Technical Requirements

i) Stuffing box Packing. : Refer to section-C of Specific Technical Requirements

j) Pump motor coupling. : Refer to section-C of Specific Technical Requirements

15. **ACCESSORIES REQUIRED:-**

The following accessories shall be provided by the bidder for each pump:

a) Suction & Discharge pressure gauges. : Yes.

b) Vent connection : Yes.

c) Drain piping up to common drain point in plant room. : Yes

d) Companion flanges. : Yes

e) Common base plate. : Yes.

f) Suction strainer. : Yes

g) Isolating valve : Yes

h) NRV at pump outlet at inlet/outlet : Yes

i) Any special requirements : The Cooling Water pumps shall be suitably insulated as per spec.

j) Inspection & Testing : As per specification enclosed elsewhere.

	TECHNICAL SPECIFICATION PACKAGE AIR CONDITIONING UNIT	SPECIFICATION NO. PES-571-11000-A-05	
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SECTION-D

PACKAGE AIR CONDITIONING UNIT

	TECHNICAL SPECIFICATION PACKAGE CONDITIONING UNIT	SPECIFICATION NO. PES-571-11000-A-05	
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1 GENERAL

1.1 This specification covers the design, manufacture, inspection and testing at the manufacturer's works and suitable packing delivery and testing of the packaged air conditioning unit.

2 CODES AND STANDARDS

2.1 The design, manufacture, inspection, testing and performance of the packaged type air conditioning unit shall comply with all statutes, regulations and safety codes currently applicable in the locality where the equipment will be installed. The equipment shall also conform to the latest editions of the codes and standards specified herein under. Nothing in this specification shall be construed to relieve the vendor of this responsibility.

In particular, the packaged air conditioning Unit (max 7.5 TR capacity, ductable or non ductable type) or cassette type (up to 5 TR) shall conform to the latest editions of the following standards:

2.1.1	I.S.660	: Safety code for Mechanical Refrigeration.
2.1.2	I.S.5111	: Code of practice for measurement, and testing of refrigerant compressor.
2.1.3	I.S.659	: Safety code for air conditioning.
2.1.4	I.S.2494	: V Belt for industrial purpose.
2.1.5	I.S.3142	: V grooved pullies for V Belts.
2.1.6	I.S.4503	: Shell and tube type heat exchanger.
2.1.7	ARI 210	: Standard for/unitary air conditioning equipment
2.1.8	ARI 270	: Standard for application installation and servicing of unitary equipment.
2.1.9	ASHRAE-37	: Standard methods of testing for rating unitary air conditioning and heat pump / equipment.
2.1.10	ANSI-B9-1	: Safety code for mechanical refrigeration.

3 DESIGN AND CONSTRUCTIONAL REQUIREMENTS

3.1 Compressor

The compressor shall be hermatic or semi-hermatic or screw rotary type or scroll type. The same shall be suitable for CFC free environment friendly latest refrigerrant e.g. R407C etc. The compressor shall be mounted on anti-vibration spring/rubber pads and shall be positioned in such a way that it is freely accessable with sufficient space all around for easy maintenance. Safety controls like High and Low pressure cut-out overload and single phasing protection for the motors shall be provided. A crankcase heater shall also be provided, if considered necessary by the vendor.

3.2 Condensing unit

Shell and tube type water-cooled condenser or air-cooled condenser with adequate area shall be provided as specified in Data Sheet-A. The condensing unit shall be complete with multipass heads and shall be fitted with the following:

3.2.1 Hot gas inlet and liquid outlet connection with shut off valve for liquid.

3.2.2 Drain plug, air vent and test valve.

3.2.3 Water inlet and outlet connection with thermowell and suitable cocks respectively.

3.2.4 Relief valve and air purge valve (Fusible plug in place of relief valve not acceptable)

3.2.5 Any other accessory as recommended by the manufacturer for proper functioning of the equipment.

3.3 AIR HANDLING FAN

The air handling fan shall be of the centrifugal type and with forward curved blades. This shall be driven by means of a three phase induction motor through V belt drive. The fan static pressure shall be selected for passing air through high efficiency absolute filters, if specified in Data Sheet-A.

3.4 Filters

Filters shall be of dry panel type and shall be cleanable. The velocity of air across the filters shall not exceed 1.75m/sec (350FPM).

3.5 Cooling Coil

The cooling coil shall be of direct expansion type and shall be made of heavy gauge copper with aluminium fins. The fins shall be bonded to the copper tubes under hydraulic pressure. A distributor shall be provided for feeding the refrigerant to different sections of the coil. Rows shall be staggered in the directions of airflow. The velocity of air across coil shall not exceed 2.5M/Sec. (500 FPM).

3.6 Controls

All necessary controls and accessories like thermostatic expansion valve, refrigerant solenoid valve, distributor, filter drier in the liquid lines, shut off valves, HP/LP cut out for compressor, thermostat with adjustable settings, overload and single phasing preventer for motor etc. are to be provided. The microprocessor based control panel shall be provided outside the packaged unit on one side. The control panel shall generally be in line with the specification for control panels given elsewhere.

The control shall be so interlocked that the fan shall be started independently first, and then only the compressor. Tripping of the compressor by the thermostat or compressor cut outs shall not trip the fan. The thermostat setting shall be adjustable

3.7 Refrigerant Piping

The refrigerant piping shall be either heavy gauge copper as furnished in Data Sheet-A. The piping shall be completely factory assembled, pressure tested, dehydrated and initially charged with REFRIGERENT and compressor oil. The line accessories shall include liquid line shutoff valve dehydrator, strainer, flow indicator and distributor etc.

3.8 Cabinet

All the equipments, except control panel, mentioned above shall be provided within a heavy gauge sheet metal cabinet, of floor/ wall mounted type. This shall be given two coats of anti-corrosive and rust proof paint, finished with two coats of final paint . Painting shall be as per manufacturers std unless specified otherwise in data sheet ‘A’. The interior of the cabinet shall be provided with thermal and acoustic insulation of minimum 25mm thick. The insulating material shall be fire proof.

The front and back side of the cabinets shall be easily removable providing maintenance to all the interior parts.

All the electric wires within the cabinet shall run in flexible conduits and carry identification tags. The bottom side of the panel shall be specially ribbed to take care of the transportation.

3.9 Other Accessories

Each packaged air conditioner shall be provided with required number of neoprene rubber isolating pads.

4 CONTROL AND INTERLOCK REQUIREMENTS

The compressor shall have all protective devices like HP/LP cutouts, overload protection for the motor, single phasing preventor for motor etc.

The interlocking requirement shall be as indicated below:

4.1 The compressor shall not start, unless condenser water flow is achieved for water cooled condenser. The condenser flow shall be sensed by means of a flow switch.

4.2 The compressor shall not start unless the evaporator fan is started.

4.3 The tripping of compressor on HP/LP, overload or on thermostat shall not trip the fan.

4.4 Strip heater (if provided in the ducting system) shall not be switched on, unless the evaporator fan is started and airflow is established. For this purpose, an air stat on flow switch shall be used. The heater shall be separately controlled by humidistat/thermostat

4.5 A humidifying package, if specified in data sheet A, shall be controlled by humidistat.

5 TEST AND INPSECTION

5.1 Inspection and Testing at Manufacturer's Works

5.1.1 static and dynamic test for fans

5.1.2 Hydrostatic static test on condenser and cooling coil.

5.1.3 vacuum/pressure test for the complete refrigeration circuit.

5.1.4 Visual and Free running test of the packaged unit on test bed.

5.1.5 Free running test on compressor.

5.1.6 AIR CAPACITY WITH ANEMOMETER.

5.1.7 NOISE LEVEL- <=85 dB(A).

5.1.8 Other tests as per approved qualities plan/scope of inspection.

5.2 Inspection and Testing at Site

5.2.1 Performance testing of the packaged unit for 72 hours in summer / monsoon & 24 hours in winter. Up-to 3 TR (individual M/c capacity) inside room temperature (Dry & wet bulb) will be checked with all machines in the room operating.

The actual days of testing shall be mutually agreed. During the above testing, the following readings shall be taken to compare the same with guaranteed performance data.

5.2.1.1 Condenser inlet and outlet pressure and temperature

5.2.1.2 Entering and leaving air temperature of the cooling coil air filters.

5.2.1.3 Motor current for the compressor and blower.

	TECHNICAL SPECIFICATION PACKAGE CONDITIONING UNIT	SPECIFICATION NO. PES-571-11000-A-05	
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5.2.1.4 Air quantity delivered by the fan. This shall be computed by adding air quantity leaving all the grilles entering the air filters.

Room temperature (Dry & wet bulb)

5.2.1.5 Test to ensure all controls and safety instruments are working properly.

During the above testing, noise level also will be checked to ensure that the same are within acceptable limits. Any undue vibration detected physically will be corrected.

All tools and instruments required for the above testing will be provided by the vendor.

6 PAINTING:

The packaged unit shall be given two coats of primer paint finished with two coats of finish paint as per Manufacturers std. unless specified otherwise elsewhere/ Data sheet 'A'. The colour of finish paint will be as specified in Data Sheet-A.

7 GUARANTEES

The package unit shall be guaranteed for performance measured in terms of the inside temperature maintained.

The packaged unit shall also be free from any manufacturing defects and shall be guaranteed as per contract after the first test as per 5.0 is successfully carried out, and the plant taken over by the purchaser.

8 NAME PLATES

Suitable Name plate as per Data Sheet 'A', depicting the equipment number as designated in Data Sheet A shall be provided for each packaged unit and screwed to a prominent position on the packaged unit.

	TECHNICAL SPECIFICATION PACKAGE CONDITIONING UNIT	SPECIFICATION NO. PES-571-11000-A-05	
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9. DATA TO BE FURNISHED AFTER AWARD OF CONTRACT

9.1 Final technical data as per Data Sheet-A

9.2 G.A. and interior view of packaged unit

9.3 Electrical wiring diagram

9.4 Catalogues for all controls

9.5 O & M Manual

9.6 Erection Manual

9.7 Vendor shall also provide soft copy of each drawing in AutoCAD format.

9.8 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

TITLE	SPECIFICATION NO. PES-571-11000-A-05
PACKAGE AIR -CONDITIONING UNIT	VOLUME II-B
DATA SHEET - A	SECTION D
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	DESCRIPTION	**DATA**
1)	Capacity of the unit at operating conditions.	: As specified
2)	Numbers required	: Refer to Section-C of Specific Technical Requirements
3)	Designation of the unit	: Package AC Unit
4)	Whether air cooled/water cooled	: Refer to Section-C of Specific Technical Requirements
5)	The plant shall be suitable for maximum- - ambient temp.	: Refer outdoor design condition as specified.
6)	Whether a plenum Chamber required	: Units shall be connected to fresh air ducts.
	OR	
	Whether to be connected duct system.	: Yes.
7)	Whether Humidifier required for humidity- -control.	: Refer to Section-C of Specific Technical Requirements
8)	Whether strip heaters required for winter heating.	: Refer to Section-C of Specific Technical Requirements
9)	Whether strip heater required for Humidity control.	: Refer to Section-C of Specific Technical Requirements
10)	Final painting colour shade stage.	: Subject to approval / during detail engineering
11)	Whether fan static pressure is to be designed for filters arrangement shown.	: Yes.
12)	Installation supporting structure/ drain piping, insulation.	: Required. Drain piping with insulation up to the nearest drain point.
13)	Controls & Instruments	: Yes (Lot)
14)	Isolation Switch	: Yes
15)	Electrical feeder requirement	: To be provided by Vendor

	TECHNICAL SPECIFICATION AIR FILTER	SPECIFICATION NO. PES- 571-11000-A-006
		VOLUME II B
		SECTION D
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SECTION-D

AIR FILTER

	TECHNICAL SPECIFICATION AIR FILTER	SPECIFICATION NO. PES- 571-11000-A006
		VOLUME II B
		SECTION D
		REV. 00 | DATE: JAN 2020
		SHEET 2 OF 3

1. GENERAL

This specification covers the design, manufacture, inspection and testing at manufacturer's work or his sub-contractor's works of Air filters to be used for air-conditioning and ventilation system.

2. CODES AND STANDARDS

This design, manufacture and performance of AIR FILTERS shall comply with all currently applicable statutes, regulation and safety codes in the locality where the equipment will be installed. The equipment shall also conform to latest applicable Indian/British/USA standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. The following standards, in particular, shall be applicable for certified ratings of filters and for conducting performance test, if required.

a) BS EN - 779 -Methods of test for air filters used in air conditioning and general ventilation.

3. GENERAL

The enclosed Data sheet A gives the type and other particulars of filters required.

3.1 POLY FIBRE AIR FILTERS

Filtering media shall consist of a suitable fibrous material (e.g. polyethylene extruded sections coir etc.) packed into a 20 gauges GSS framework, complete with handles etc. The filter element shall be supported by galvanised steel wire mesh of 10mm. sq. on either side, Velocity across the filters shall not exceed 2.5 M/sec. Average efficiency Em (%) shall be >/= 80 as per BS EN - 779.

3.2 DRY FABRIC AIR FILTERS

Filter element shall be pressed felt filter fabric or suitable material recommended by the manufacturer, stitched on to galvanised wire gauge support and crimped to form deep folds. Suitable aluminium spacers shall be provided to ensure uniform distribution of air flow through filters. Filter casing shall be provided with neoprene sponge rubber sealing, The filter shall have Average efficiency Em (%) of >/= 95 as per BS EN - 779.

3.3 PANEL TYPE METALLIC FILTERS (DRY/VISCOUS)

Filter shall consist of V-fold galvanised wire mesh interspaced with flat layers of galvanised wire mesh. The density of media shall increase in the direction of air flow. Edges of wire mesh shall be suitably hemmed to prevent abrasion during handling. The media shall be supported on either side by galvanised expanded metal casing. The framework shall be at least 18 gauge GSS. Filter shall be either dry or wetted type as per data sheet=A. The oil shall be mineral oil of approved quality and make. As a the filter frame made of Aluminium alloy conforming to IS:737 can be considered unless use of aluminium is prohibited otherwise due to site conditions being saline/corrosive.

All filters shall be capable of being cleaned of their accumulated dust by tap water flushing. The dry metallic filter shall have Average arrestance Am (%) shall be >/= 90. However oil wetted air filters shall have Average Efficiency Em (%) >/= 90 as per BS EN - 779..

3.4 AUTOMATIC CLEANING FILTERS

This shall consist of a filter mat and drop eliminator, driven by a suitably rated geared

motor unit being supported on a steel framework. The filter mat shall consist of an endless steel wire mat insets of steel mesh held between an upper & a lower shall drop eliminator shall consist of an endles steel wire without insets of steel mesh. The unit shall include a suitable oil pump, gladge raking mechanism and sludge container and tensioning device. Pressure drop shall be limited to 0.5 / mm WG when clean & 10 mm when dirty. Air velocity across filter shall not exceed 3 M/sec.

3.5 ABSOLUTE FILTERS

Filters shall be constructed by pleating a continuous sheet of filter medium into closely spaced pleats separated by heavy corrugated aluminium spacers. They shall be individually tested and certified to have an efficiency of not less than 99.97% when tested with 0.3 micron dioctyphalate smoke as per IS:2831. The clean filter initial static pressure drop shall not be greater than 25mm WC at rated capacity. A neoprene sponge rubber sealing shall be provided on either face of filter frame.

3.6 WATER REPELLANT NYLON FILTERS

This shall be constructed of water repellent nylon fabric with continuous water spraying on it from a header for keeping it clean. Efficiency of this filter shall be 85% down to 10 microns. This filter shall be used for unitary air filtration system only.

4. INSPECTION & TESTING

The scope of inspection for air filters shall be as below:

4.1 Dimensional inspection of frame & filter media.

4.2 Witnessing of type tests on one per type per size air filters for the following properties.

a) Gravimetric efficiency.

b) Pressure drop in clean & dirty (choked - %age to be specified) condition.

c) Efficiency as per BS EN - 779.

4.3 Verification of type test certificates for similar type & size of filters for sodium flame test as per BS-3928 (if applicable- refer data sheet).

5. DATA TO BE FURNISHED BY VENDOR AFTER AWARD OF CONTRACT

5.1 GA Drawing.

5.2 Drawing showing material/construction detail

5.3 Installation and\service manual

5.4 Rating curves/charts

5.5 Test certificates

5.6 Elect. diagrams (when automatic cleaning type)

5.7 Vendor shall also provide soft copy of each drawing in AutoCAD format.

5.8 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

TITLE	SPECIFICATION NO. PES-571-11000-A-06	
AIR FILTER **DATA SHEET - A**	VOLUME II-B	
	SECTION D	
	REV 00	DATE: JAN 2020
	SHEET 1 OF 1	

DESCRIPTION		**DATA**
1)	**General**	
1.1	Service	: Air Conditioning & Ventilation.
1.2	Location	: Ventilation plant, & Ductable Split AC plant, fresh air fan system. Also for split AC.
1.3	Nos.	: Refer Section 'C' of Specification.
1.4	Total air flow/type	: Refer Section 'C' of Specification.
1.5	Temperature	: As per project information.
1.6	Relative Humidity	: 100%
1.7	Gas Composition	: Atmospheric Air (Dusty) as prevalent in power Station.
1.8	Filter Media	: Synthetic non-woven
1.9	Efficiency filters.	: Average arrestance efficiency of 65-80 % for Dry Panel filter (pre-filters) and average arrestance Efficiency of 80 % down to 20 micron for
1.10	Allowable pressue drop	: 2.5 mm & 6.5 mm in clean and dirty condition respectively for dry panel filters(prefilters). 12 mm in clean condition for fine filters.
1.11	Frame Work	: 18 G, GSS.
1.12	Mounting	: Ladder Type M.S Angles (galvanised)
1.13	Size	: 600 x 600 mm

Note:-

1) Face velocity of air across the filters shall not exceed 2.5 m/sec and for absolute filters velocity shall not exceed 1.5 m/sec.

	TECHNICAL SPECIFICATION LOW PRESSURE AIR DISTRIBUTION SYSTEM	SPECIFICATION NO. PES- 571-11000-A-007
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SECTION-D

LOW PRESSURE AIR DISTRIBUTION SYSTEM

	TECHNICAL SPECIFICATION LOW PRESSURE AIR DISTRIBUTION SYSTEM	SPECIFICATION NO. PES- 571-11000-A007
		VOLUME II B
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		SHEET 2 OF 7

1. GENERAL

1.1 This specification covers the design, manufacture, construction features, installation, inspection testing and air balancing of air distribution system upto a total pressure of 95mm w.g. The specification is intended to cover the air distribution for air conditioning system and ventilation system not involving localised exhaust.

2. CODES AND STANDARDS

2.1 The design, construction and performance of complete system shall conform to all currently applicable stuatues, regulations, safety codes in the locality where the equipment are to installed

2.2 Unless specified otherwise the equipments shall generally conform to latest applicable Indian Standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. In particular the equipment shall generally conform to latest editions by the following standards:-

a) IS: 655 - Specifications for metal air ducts.

b) IS:277 - Specifications for galvanised steel sheets.

c) IS:737 - Specification for wrought aluminium and aluminium alloy sheet and strip.

3. MATERIAL

3.1 Metal air ducts shall be either of galvanised steel sheets or aluminium sheets, as indicated in data sheet-A.

3.2 The rolled steel sheets before galvanising shall be properly annealed or normalised so as to allow fabrication of ducts without developing cracks. Zinc coating on the steel shall be as per technical requirement refer to Section-C of Specific Technical Requirements.

3.3 The aluminium sheets shall be of grade S1C or NS3 and shall be suitable for duct fabrication work as per IS-737 latest

4. CONSTRUCTION/FABRICATION

4.1 The thickness of sheets, the type of bracing and other fabrication details shall generally conform to requirements given hereunder unless specified otherwise in data sheet A and/or indicated on drawings.

4.2 **RECTANGULAR DUCTS**

4.2.1

S.No.	Max Side	Sheet Thickness		Type of transverse Joint connections	Bracings
		(mm) GI	(mm) Al		
a)	Up to 600	0.63 (24G)	0.80	S-drive, pocket or bar slips or flanged joints on 2.5m centres	None

b)	601 to 750	0.63 (24G)	0.80	S-drive, 25mm pocket or 25mm bar slips or flanged joints on 2.5m centres	25x25x3 mm MS angles, 1.2m from joints
c)	751 to 1000	0.80 (22G)	1.00	S-drive, 25mm pocket or 25mm bar slips or flanged joints on 2.5m centres	25x25x3 mm MS angles, 1.2m from joints
d)	1001 to1500	0.80 (22G)	1.00	40x40x3mm MS angle, flanged connections or 40mm pocket or40mm bar slips with 35x3mm bar reinforcing on 2.5m centres	40x40x3 mm MS angles, 1.2m from joints
e)	1501 to2250	1.00 (20G)	1.50	40x40x3mm MS angle, flanged connections or 40mm pocket or40mm bar slips, 1M maximum centres, with 35x3mm bar reinforcing	40x40x3 mm diagonal angles or 40x40x3mm angles, 600mm from joints
f)	2251 & above	1.25 (18G)	1.80	50x50x3mm MS angles,connections or 40mm pocket or 40 mm bar slips, 1M maximum centres with 35x3mm bar reinforcing.	50x50x3mm diagonal angles or 50x50x3mm angles 600 mm from joints.
g)	No bracing is required if transverse joints are less than 600mm apart				
h)	For ducts larger than 2250mm, special handling and supporting methods shall be provided as per the approval of Purchaser				

4.2.2 All rectangular ducts having either dimension larger than 450mm shall be cross broken except these ducts which are insulated with sand cement plaster. Air outlet connections on ducts need not be cross broken.

4.2.3 The seams on duct cones shall be of Pittsburgh type. Longitudinal seams shall be smooth inside the ducts.

4.2.4 The flanges used for transverse joints shall be joined together with GI bolts (grade 4.6) and nuts spaced at 125mm centres as per following:

a) Upto 1000mm - 6 mm dia GI bolts
b) 1001 to 1500 - 8 mm dia GI bolts
c) 1501 and above - 10mm dia GI bolts

4.2.5 The MS angle flanges shall be connected to ducts with rivets at approx. 100mm centres. The flanged joints shall have 6mm thick felt packing stuck to flanges with shellac varnish. The holes in the felt packing shall be burnt through. The ducts are to be tapped 6mm across the MS flanges.

4.2.6 MS angles used for bracings shall be tack welded to the ducts or rivetted at 125mm centres, as applicable.

4.3 **ROUND DUCTS**

4.3.1

S.No.	Duct dia-mm	Sheet Thickness		Reinforcing
		(mm) GI	(mm) Al	
a)	Up to 150	0.63 (24G)	0.80	None
b)	151 to 600	0.80 (22G)	1.00	None
c)	601 to 1000	1.00 (20G)	1.50	40x40x3mm girth MS
d)	1001 to1250	1.00 (20G)	1.50	40x40x3mm girth MS angles at 2.0 meter centres
e)	1251 & above	1.25 (18G)	1.80	40x40x3mm girth MS angles at 1.2m centres

4.3.2 The seams on round ducts may be continuously welded or grooved longitudinal seam. In case of welding of GI sheet, zinc rich paint shall be applied on the welded zone.

4.3.3 Round ducts shall either be joined by welding or the ducts shall be swedged 40mm from the ends such that larger end will butt against the swedge and is held in place with sheet metal screws.

4.4 **DUCT SUPPORTS**

Unless specified otherwise on drawings, rectangular ducts with larger side of 2250mm or above shall be supported by 15mm MS rods and 50x50x3mm and MS angles while those below 2250 mm shall be supported by 10mm MS rods and all angles shall be given a coat of primer paint. The duct supports shall be at a distance not exceeding 1800mm. The MS rods shall be fixed to MS angle cleats, which in turn are fixed to ceiling slab by suitable anchor fasteners. All anchor fasteners, MS angle cleats, coach screws, hooks and other supporting material required shall be provided by vendor.

However, If ducts are thermally insulated, the MS angles and supports shall not be in direct contact with ducts, for which purpose wooden pieces/ Resin bonded fibre glass sheets (50 mm thick) shall be used in between.

4.5 **FLEXIBLE CONNECTIONS**

Wherever the sheet metal ducts connects to intake or discharge of fan units a flexible connection of at least 150mm width made by closely woven double layer Fire resistant or canvas shall be provided. The same shall be attached to angle iron frames on equipment and to similar frame on duct or casing by means of a steel band 9r (or) collar fitting over the end of the flexible connection and bolted through angle iron frame so as to clamp securely between the band and the angle frame.

4.6 **TRANSFORMATIONS AND BREACHES**

All curves, bends, offsets and other transformations shall be made for easy and noiseless flow of air. The throat of every branch duct shall be sized to have a velocity not exceeding that in the main duct to which the branch is connected.

4.7 **CAULKING**

Wherever duct passes through wall, the opening between masonary and duct work shall be neatly caulked or sealed to prevent movement of air from one space to adjoin by space with a rated fire resistant material.

4.8 **EASEMENT**

Normally pipe hangers, light fitting rods etc. shall not be allowed to pass through the ducts. Wherever, It becomes absolutely essential to pass these hangers/rods etc. Through the ducts, prior approval of purchaser shall be taken and light streamlines easement around the same shall be provided to maintain smooth air flow.

4.9 **ACCESS DOORS**

Access doors shall be provided in ducts, plenums etc. on both sides to allow access and servicing of equipment viz. pipes, dampers, coils, valves, heaters etc.

All access doors shall be adequately sized and lined suitably with felt to prevent air leakage. The doors shall be of built-up construction, structurally strong and shall have at least two hinges each, and shall be with two rust proof window sash locks of approved type. All doors shall be so set as to flush with outer finish of duct insulation etc.

4.10 **DAMPERS AND SPLITTERS**

4.10.1 Dampers and splitters shall be provided at suitable points for proportional volume control of the system. Splitters and dampers shall be made of minimum 18 gauge GSS of quadrant type with locking device mounted outside the duct at accessible location.

4.10.2 FIRE DAMPERS

Fire dampers shall be provided as specified in Data Sheet -A and shall be installed at locations indicated on drawings and/or as required/approved by purchaser, including all openings in passage of duct work through fire walls and floors etc. The fire damper shall be of electrical type with damper motor actuated by thermal sensor or fusible link type.

4.10.3 VANES

Unless otherwise shown in the drawings all elbows shall be such that the throat radius is 75% of the duct width. In case throat radius is smaller, suitable single thickness vanes of approved details shall be provided.

4.10.4 FLASHING

For the ducts penetrating roofs or outside walls, provision of flashing shall be made by the ducting vendor.

4.11 **DIFFUSERS AND GRILLS**

The type and quantity of diffusers and grills is indicated on enclosed drawings/data sheet A. The size/quantity of diffusers/ grills indicated in the drawing/data sheet is indicative and is for vendor's reference purpose only. Vendor shall ensure that the diffusers/grills offered are of requisite capacity, throw and terminal velocity. The pressure drop and noise levels shall be as per data sheet. A enclosed. The diffusers/grills shall be approved by purchaser.

Unless specified otherwise the diffusers/grills shall be of mild steel land painted with two coats of primer paint. Supply air grills shall be complete with volume control dampers. Supply air grills shall be double deflection type while Return Air grills can be

single deflection type. Ceiling outlets/diffusers shall have volume control dampers, fixed grids and blanking baffles. All volume control dampers shall be operated by a key from the front of grills/diffusers.

Suitable vanes shall be provided in duct collars to have uniform air distribution. Blank-off baffles wherever required, shall also be provided.

4.12 **PLENUMS AND RA BOXING**

All plenum chambers and/or connections to fans, dampers etc. shall be constructed in 18 gauge GI sheet. supported on 40x40x6mm MS angle frames. All vertical angles shall be riveted at appox. 125mm. centres to the casing. Suitable caulking compound (Pecora or equivalent) shall be inserted between the base of the angle and all masonary construction to which angles are fastened.

Return air boxing requirements if any are indicated in data sheet-A and the same shall be provided by vendor. The return air box ~~shall be~~ fabricated out of GI sheets shall be insulated with 25mm thick fibre-glass.

4.13 **ACCOUSTIC LINING**

The ducts shall be lined acoustically from inside as given in data- sheet A and/or section C of the specification.

4.14 **PAINTING**

Wherever specified the ducts shall be painted or lined with suitable anti-corrosive paint/ lining as per approval of purchaser. In particular the ducts coming in contact with acid fumes shall be epoxy coated, inside and outside.

4.15 **THERMAL INSULATION**

Thermal insulation shall be as per data sheet - A and the insulation shall conform to enclosed spec. no. PES-553-08.

5. INSPECTION AND TESTING

5.1 **INSPECTION & TESTING DURING FABRICATION**

5.1.1 Visual inspection of GI sheets and angles, channels etc. – dents, black spots, chipping of zinc coating, white dust on galvanised sheets shall be avoided. Pitting , lamination in angles and channels shall be avoided.

5.1.2 Galvanised sheets - Test certificate shall be furnished for visual check, coating thickness, adhesion test, sheet thickness, uniformity of coating.

5.1.3 Check for dimensions & mass as per latest IS-277.

5.1.4 Check for defect, twists, ungalvanised spots as per IS-2629.

5.1.5 Bend test & wrapping test as per IS-277.

5.1.6 Zinc coating test on samples as per IS-6745.

5.2 **INSPECTION & TESTING AT SITE.**

5.2.1 The duct branches, elbows etc. shall be inspected and the joints and connections etc, are to be checked before they are assembled in position.

5.2.2 After completion, all duct systems shall be checked and tested for air leakage, tightness, velocity, pressure drop, vibration and noise etc.

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6. BALANCING

6.1.1 The entire air distribution system shall be balanced by vendor to supply the air quantities as required in various rooms so as to maintain the requisite temperature and air flow in the conditioned spaces. The final balance of air quantities through each grill/diffuser etc. shall be recorded and submitted to purchaser for approval. Proper steps shall be taken to have a uniform temperature in all enclosures, with utmost care for noise level to be within tolerance limit

6.1.2 All instruments required for testing/balancing etc. of the air distribution system shall be provided by vendor.

7. DATA TO BE FURNISHED BY VENDOR AFTER THE AWARD OF CONTRACT

7.1 Fabrication drawings of ducts and grilles, louvers, dampers, etc, including typical details of grilles dampers etc.

7.2 Test certificates in line with scope of inspection.

7.3 Other dimensional drawings & documents as may be required by purchaser for better understanding of the system & for preparation of operation, maintenance & instruction manual**.**

7.4 Installation instruction manual and air balancing manual.

7.5 Duct air leaking test procedure/smoke test procedure.

7.6 Vendor shall also provide soft copy of each drawing in AutoCAD format.

7.7 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

TITLE	SPECIFICATION NO. PES-571-11000-A-07
LOW PRESSURE AIR DISTRIBUTION SYSTEM	VOLUME II-B
DATA SHEET - A	SECTION D
	REV 00 / DATE: JAN 2020
	SHEET 1 OF 1

Description	**Data**
1. General (List of areas)	: As per Specification/Tender drawing.
2. GSS Duct Work a) Type	: GSS as per IS: 277 (Zinc coating as per Section-C of Specific Technical Requirements.)
b) Size	: As per Section-C of Specific Technical Requirements and bill of quantity.
3. Acoustic lining AC Outlet.	: Up to 5m length from Ductable split
4. Special painting	: Galvanised.
5. Thermal Insulation	: Required in supply air duct in AC entire length.
6. Diffusers (Circular/Square) 300 mm size 350 mm size 450 mm size 550 mm size 600 mm size Any other size	: Bidder to estimate as per drawings./specification. All grille frame and louvers shall be manufactured of at least 16 SWG Aluminium
7. SA grilles (for each size)	: To suit air flow as per System requirements / Tender Drawings.
8. RA grilles (for each size)	: -do-

NOTE:

1. Duct sheet thickness shall be as per IS-655
2. Opposed blade type volume control damper shall be provided at each supply air diffusers/grilles.
3. Bidder to provide suitable gasketing at each duct flange.
4. Fire damper shall be motor operated type, when otherwise specified under Section-C.
5. Access door in ducting system shall be provided as required.
6. MS Angle (painted) shall be used for duct supports etc.
7. Velocity thru duct shall normally not exceed 9.0 M/sec for Air conditioning system and 12 M/sec for Ventilation duct. Maximum velocity (outlet) for supply air diffuser shall not exceed 2.5 m/sec.
8. All Grilles & diffusers shall be supported with frame. Frame etc. shall be supplied by bidder.

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO. PES-571-11000-A-08	
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SECTION-D

THERMAL INSULATION FOR COLD SURFACES

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-553-08	
		VOLUME II B	
		SECTION D	
		REV. 00	DATE: JAN 2020
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1. SCOPE

This specification covers design, manufacture, testing at manufacturers works, supply, application & finishing of insulation for cold piping, air conditioning ducting & equipment for low temperature service.

2. CODES & STANDARDS

The design, manufacture and performance of materials covered under this specification shall comply with all currently applicable statues, regulations & safety codes in the locality where the equipment/material are to be installed. The material shall also conform to the latest applicable Indian/British/American codes & standards. Nothing in this specification shall be construed to relieve the vendor of his responsibility. In particular, the material shall conform to the latest editions of the following standards :-

2.1 IS:3069 : Glossary of terms & symbols & units relating to thermal insulation materials.

2.2 IS:4671 : Expanded polystyrene for thermal insulation purposes.

2.3 IS:3677 : Mineral wool for thermal insulation.

2.4 IS:8183 : Resin bonded mineral wool.

3. DESIGN REQUIREMENTS

3.1 The insulating material as well as protective covering shall be new & unused, non-corrosive, vermin/rodent proof and shall be guaranteed to withstand continuously & without deterioration the maximum/minimum temperatures to which they may be subjected to, under specified site conditions.

3.2 The insulation material must be light weight, strong, free from shots & coarse fibre & shall provide high insulation efficiency at low weight & coat. It should be non-hygroscopic & should not rot. It shall not settle or shake down even when subjected to prolonged vibrations.

3.3 The insulation material, density and thickness etc. Shall be as specified in DATA SHEET A.

4. APPLICATION DETAILS

4.1 The surface to be insulated shall be thoroughly cleaned and allowed to dry. Pressure / hydrostatic tests, if any, shall be carried out before application of insulation.

4.2 A layer of solvent free, anticorrosive paint shall be applied & allowed to dry.

4.3 Hot industrial bitumen of grade 85/40 or 85/25 conforming to latest IS: 702 shall be uniformly applied @ 1.5 kg/sq.m on the surface to be insulated. A similar layer shall also be applied on the inside surface & edges of the insulation. A suitable cold adhesive compound may also be used in place of bitumen.

4.4 Insulation in the form of pipe sections/rolls slabs of specified density & thickness should be stuck to the coated surface with joints staggered & well butted & secured. The adjoining sections shall be tightly pressed together. All the joints shall be sealed

with bitumen/equivalent adhesive. Voids if any shall be packed with suitably cut pieces of insulation material.

4.5 In case of double layer application both circumferential & longitudinal joints shall be suitably staggered.

5. VAPOR SEALING & INSULATION FINISH

The insulation shall be treated for vapor sealing & weather proofing & finished as specified in DATA SHEET A The acceptable types of finishes are outlined below:-

5.1 FINISHING SYSTEM I: EXTERNAL INSULATION WITH PLASTER FINISH

5.1.1 A thick vapor seal of hot bitumen @ 2.5 kg/Sqm shall be applied on the outer surface of insulation & allowed to dry.

5.1.2 The surface shall then be wrapped with 20mm (3/4"_ hexagonal mesh of 24 SWG GI wire, butting all the joints & laced down with 22 SWG GI lacing wire.

5.1.3 12.5mm (1/2 inch) thick sand cement plaster in the ratio of (1:1) shall be applied in two layers, the second layer being brought to a smooth finish. A water proofing compound shall be added to the cement before its application.

5.2 FINISH SYSTEM II: EXTERNAL INSULATION WITH PLASTER FINISH OVER POLYTHENE.

5.2.1 The insulation shall be covered with 500 g polythene/polythene bonded Hessians (PBH) with 50mm overlap on longitudinal & circumferential joints. Overlaps shall be sealed with synthetic adhesive in case o-f polythene & liberal coat of bitumen in case of PBH:

5.2.2 The surface shall then be wrapped with 20mm (3/4") mesh of 24 SWG GI wire butting all the joints & laced down with 22 SWG GI lacing wire.

5.2.3 12.5mm thick (1/2 inch) sand cement plaster in ratio of(4:1) shall be applied in two layers, the second layer being brought to a smooth & even finish similarly as described above.

5.3 FINISH III: EXTERNAL INSULATION WITH SHEET METAL FINISH

5.3.1 The insulation shall be covered with 500g polythene with 50mm overlaps at joints, which shall be sealed with synthetic adhesive or equivalent compound.

5.3.2 The polythene shall be covered with 24 gauge GI/aluminum sheet

5.3.3 25mm wide x 22 SWG GI/aluminum peripheral straps shall be fixed over the GI/aluminum sheet at 300mm centres to secure.

5.4 FINISH IV: EXTERNAL INSULATION WITH PLASTER & WATER PROOFING COMPOUND

For ducts & piping exposed to atmosphere, the finish shall be as follows:

5.4.1 A thick vapor seal of hot bitumen at 2.05 kg/sq.m shall be applied on the outer surface of insulation & allowed to dry.

5.4.2 The surface shall then be wrapped with 20mm (32/4") hexagonal mesh of 24 SWG GI Wire butting all the joints & laced down with 223 SWG GI lacing wire.

5.4.3 12.5mm thick (1/*2 inch) sand cement plaster in ratio of (4:1) shall be applied in two layers, the second layer being brought to a smooth finish with water proofing compound added to the cement.

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-553-08	
		VOLUME II B	
		SECTION D	
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5.4.4 3 mm (1/8") thick coat of water proofing compound shall be applied & wrapped with fibre glass RP tissue. A final coat of 3mm thick water proofing compound shall then be applied over the fiberglass RP tissue & allowed to dry. Alternatively, in place of water proofing as desired above, tar felt type 3 grade 1 of IS 1322 with joints overlapped by 75mm shall be fixed & sealed with bitumen & over this 24 SWG. 25mm hexagonal GI mesh shall be fixed with 22 swig. GI lacing wire & finally bitumen paint shall be applied over wire netting.

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-553-08	
		VOLUME II B	
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		REV. 00	DATE: JAN 2020
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6. INSULATION OF PUMPS & VALVES

6.1 For all inspection covers & hatches on equipment, pump casing & valve bodies, flanges etc. the insulation shall be applied such as to facilitate removal with minimum damage to the insulation. This shall be achieved by encasing the insulation in 22 gauge aluminum sheet metal boxes, which shall be bolted together around the equipment to permit easy removal & replacement. Proper care shall be taken to maintain continuity of vapor seal between the static & removable partitions of the insulation.

6.2 The tenderer may offer thickness of insulation & finishes other than that specified in DATA SHEET A. However, calculations/reasons in support of alternative proposal shall be furnished for purchaser's approval.

7. INSPECTION & TESTING (REFER SPEC. NO - PES-553.00)

7.1 All necessary tests, as required to ensure that the material supplied conform to the requirements of applicable codes & standards, shall be carried out at manufacturer's works & test certificates including these for material/accessories shall be furnished for purchasers approval.

8. PAINTING

8.1 Pipe work having insulation & cladding shall be provided with color identification for the fluids handled and for indicating direction of flow.

8.2 Equipment surfaces having insulation and cladding shall also have identification numbers and any other relevant data provided on the insulated surface.

8.3 All painting for insulated surfaces shall conform to the requirement specified elsewhere.

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-553-08	
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9. DATA TO BE FURNISHED AFTER AWARD OF CONTRACT

9.1 Final version of data sheet 'B' incorporating changes if any along with design data.

9.2 Test certificates/reports giving result of insulation to ensure conformance to applicable codes & standards & in particular the following:-

a) Thermal conductivity test.

b) Sound absorption coefficient test.

c) Corrosion test.

d) Sulphur content, moisture content, shot content, moisture absorption etc.

e) Compressive strength & cross breaking strength test.

9.3 Sketches / technical literature / sectional drgs. indicating insulation materials finish and method of application etc.

9.4 Manual dealing with safety aspects & instructions for combating fire arising out of insulation work.

9.5 Instructions on erection and maintenance of insulation work.

9.6 Vendor shall also provide soft copy of each drawing in AutoCAD format.

9.7 Vendor shall also provide final-version of all drawings in 3-D as per the requirement specified elsewhere.

TITLE	SPECIFICATION NO. PES-571-11000-A-08	
INSULATION	VOLUME II-B	
DATA SHEET - A	SECTION D	
	REV 00	DATE JAN 2020
	SHEET 1 OF 1	

Insulation Material

Insulation	Code	Thermal Conductivity MW/cm ^{0}C	Density Kg/m^3
Resin bonded mineral wool / glass wool	IS:8183	0.49 at 50 ^{0}C	At least 24 for duct insulation and 48 for acoustic lining.
Mineral Wool Pipe Section (min. Gr.2)	IS:9842	0.43 at 50 ^{0}C	At least 81
Expanded Polystyrene	IS:4671	0.37 at 10 ^{0}C	At least 15
Al foiled face Nitrile rubber / XLPE	EN12667	0.037 at 20 ^{0}C	At least 140

Type of Insulation

S.No.	Surface	Insulation Material	Insulation Form	Thickness (mm)
i)	Supply & Return air duct for air-conditioning system	Resin bonded roll Mineral Wool (IS:8183)	Roll/slab	25
		Or AI foiled face Nitrile rubber/XLPE	Roll/slab	25
ii)	Refrigerant Piping	a) Expanded Polystyrene	Pipe Section	75
		or b) Mineral Wool	Pipe Section	75
iii)	AHU drain pipe	a) Expanded Polystyrene	Pipe Section	25
		or b) Mineral Wool	Pipe Section	25
iv)	AHU drain pan coil section and fan section	a) Expanded Polystyrene	Slabs	25
		or b) Mineral Wool	Slabs	25
v)	Chilled water piping, valves & specialties	a) Expanded Polystyrene	Pipe Section	75
		or b) Mineral Wool	Pipe Section	75
vi)	Chiller	a) Expanded Polystyrene	Slabs	100
		or b) Mineral Wool	Slabs	100
vii)	Chilled Water Pumps	a) Expanded Polystyrene	Slabs	50
		or b) Mineral Wool	Slabs	50
viii)	Expansion tank with pipe	a) Expanded Polystyrene	Slabs/Pipe Section	50
		or b) Mineral Wool	Slabs/Pipe Section	50

Insulation shall be fire retardant class.

SECTION: I

SUB-SECTION: E

LIST OF ANNEXURES

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF MAKES-HVAC	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
		SHEET 1 OF 1	

SECTION-I

SUB SECTION E

ANNEXURE-I

LIST OF MAKES-HVAC SYSTEM

13.00 LIST OF PREFERED MAKES

PREAMBLE

This document "PREFERRED MAKES OF EQUIPMENT AND SUPPLIES" is a part of the tender specification for RM&U of Unit#1 of Panchet Hydel Station of DVC at Panchet.

The makes of various equipment and supplies in respect of imported/indigenous equipment/components/materials are listed out in this document. It is essential that the equipment/component/materials to be supplied from imported/indigenous sources by the Tenderer will be of any one of the makes listed against that particular equipment/ component/material in this document. In case of any contradiction in respect of 'Preferred Makes' indicated in this document with the preferred makes indicated in any other tender document, the one indicated in this document shall prevail.

In case the Tenderer/ Contractor intends to substitute any particular make of equipment / components/ materials by a make other than that listed in this document, the Tenderer shall clearly bring out the same in his tender along with justification and indicate the alternative makes offered by him. It will be prerogative of the Purchaser to accept or reject the alternative makes so offered.

a. Mechanical

Sl. No.	EQUIPMENT	Preferred Makes
1.	Horizontal Centrifugal Pumps	Kirloskar Brothers, KSB, Beacon Weir, Khimline, Jyoti, Sintech, Mather & Platt,
2.	Vertical Turbine Pumps	Kirloskar Brothers, Mather & Platt, WPIL, Jyoti, Sintech, Flowserve
3.	Vertical Wet Pit Type Pumps	SU Motors, Kishore Pumps, Kirloskar, Brothers, KSB , Sintech, Mather & Platt, Flowserve.
4.	Submersible Pumps	KSB, SU Motors, Kirloskar Brothers, Kishore Pumps, Darling, Beacon Weir
5.	Slurry Pump	Akay, Sam Engg., MBE, KBL, KSB Pumps, WARMAN. Sintech
6.	Dosing Pump	Shapo Tools, Asia LMI (Madras), Positive Metering Pumps, Toshniwal, Milton Roy India.

Sl. No.	EQUIPMENT	Preferred Makes
7.	Package type FRP Cooling Tower	PCTPL, BDT, GEA, Himgiri
8.	Pressure Filters	Thermax, Ion-Exchange, Resin India, Driplex, VA Tech Wabag
9.	Fire Hydrants	New Age Industries, Steelage Industires, ASCO, Strumech, Vijay Fire, Zenith, Steam & Mining.
10.	Basket Strainers	Filtration Engrs, J.N Marshall, Masturlal Fabrication, Otokiln, Superflo, ARF Engg, Purolator Filters, ABB, Filters Mfd. India
11.	Sluice Gates	Jash Engineering, IVPL Nasik, Steam & Mining
12.	Duplex Strainers	Filteration Engrs., Otokiln, Superflo
13.	Automatic backwash filters	Amiad Filtration, Filteration Engrs., HYDAC (I) Pvt. Ltd., Superflo
14.	Diesel Engine	Cummins/Ashok Layland /Ruston/ Kirloskar
15.	Softening & DM Plant	Resin India / Thermax / Thermax Cullinyan / VA Tech / Ion Exchange / GEA Energy Systems
16.	Surge Tanks	Anup Engg., Zenith Erectors, Haldia., Perfect,Engg., Sakthi Hitech
17.	Electric Actuators	Beacon Rotork, Auma, Marsh Engineers, Keystone, Limitorque, Antrieb, IL, Palghat
18.	Rotory Pneumatic Actuators	AL Saunders, Xomox, EL-O-Matic, Virgo, L&T, Flocon, Precision Processing Equipt. Co.
19.	Thermal insulations	Lloyd insulations (india) limited Polybond insulation pvt ltd ,Dhanbad rockwool insulation pvt ltd , Hyderapad Industries, Rockwool, Thermax Heat Tracers, U.P. Twiga Fibreglass.
20.	C.I. Valves Gate, Globe, Valve	Kirloskar Brothers, Steam & Mining, IVPLNasik, BDK, Fouress, Hawa Engineers, Ahmedabad AUDCO, DEZURIC, TIFLIN, Sakhi international,
21.	CS Valves (gate, NRV)	Audco, Fouress, BHEL, KSB, Steam & Mining, BDK, Kirloskar, Virgo

Sl. No.	EQUIPMENT	Preferred Makes
22.	Duplex filter	OTOKLIN, SUPERFLO, FILTERATION ENGINEERS
23.	Plug valves	Audco- L&T, Vass Ind., Xomox, Virgo, BDK, Steam & Mining , DEZURIC, TUFLIN
24.	Ball Valves	Audco, KSB, AL Saunders, Xomox, Virgo, BDK, Virgo, Akay Industries, Hawa, Tyco valves, Flowchem, Kalpana valves,
25.	GM Valves	Leader, Steam & Mining, NECO, Upadhyay Valves, Bombay Metals & Alloys, Kalpana Valves
26.	Butterfly Valves (Manually & electrically operated)	L&T, Fouress, Kirloskar Brothers, IVPL Nasik, VIRGO, AL Saunders, Steam & Mining, Keystone, BDK, XOMOX, Jash, Audco, Inter Valve , Kalpana valves, R & D Multiples,Durga, Hawa valves, Jupitar, VIP valve, Prime Industrial Valves, Fluid control equipment
27.	Diaphragm Valves	AL Saunders, Fluid System, BDK , Steam & Mining, HAWA, Fluidline valves, Kalpana valves, Expert engineers.
28.	Float Valve	Leader, IVPL Nasik, IM Engineers, Steam & Mining
29.	Control Valve	BHEL, L&T, Fouress, IL, MIL Controls, NECO Scharbet, Darling pumps
30.	Knife Gate Valves	Jash Engineering, Chemtech , Steam & Mining
31.	Pressure Reducing Valve	JNM, Fouress, Bestobell, IL, Mazda, Nirmal Ind., Forbes Marshal
32.	Safety Relief Valve (Pressure relief Valves)	BHEL, Keystone, Bliss Anand, L&T (Audco Div.), Sempell, Fainger, Leser Valves (P) Ltd., IL, Anderson, Kosan, Leader, Hawa, Tyco, Asian,
33.	Hoses	Aeroflox/Markwel/Senior Flexonics, Inalsa, Teksons
34.	MS ERW BLACK Pipes upto DN 150	Good luck steel, Advance Steel, Surya roshni Ltd, Shyam engineering, P.K. Tubes, NEZONE, P.S. Steel, Venktesh udyog.
35.	MS PIPES OF SIZE FROM DN 200 TO DN400 (ERW/SW/SAW)	SAIL, BHEL, TISCO, Jindal, Zenith, Saw Pipes, Welspun, Man Industries, Maharastra Seamless, Indian Seamless,

Sl. No.	EQUIPMENT	Preferred Makes
		BST, Advance Steel, Indus Tubes, Mukat, Lloyds, Surya roshni Ltd., Ratnamani, Shyam, P. K. tubes, Venktesh udyog.
36.	Seamless MS/CS Pipes	Amardeep Steel, Choksy Tubes, MJ Patel, Nagardas Kanji, Poonam Enterprises, Sandulk Asia, MEC Tubes, Nagardas & Kusai, Noble Tubes, Allied Steel, Kamlesh Tube, Menilal & Bro, Uday Tubes, Maharastra Seamless (P) Ltd, Imperial Steel, Soor Neogi Koumar, Jindal, Ratnamani, P.k. Tubes, Reliable steel
37.	SS Pipes / fittings	Heavy Metal Tubes, Nobel Tubes, Rajendra Mech. Ind., Sterling Supply Agency, Vitrag, Poonam Enterprises, N.L.Hazra, M.S.Fittings, Jindal Saw ltd., Ratnamani Metals, Reliable steel
38.	MS/CS Pipe Fittings	EBY Ind., High-Tech, Hydro technic, Hydro-Air Engg., Project Toolings, Shivananda, M.J.Patel, Nagardas & Kusai, MEC Tubes, Nobles Tubes, Amardeep Steel, Allied Steel, Kamlesh Tube, Menilal & Bros, Poonam Enterprises, N.L.Hazra, M.S.Fittings, Sunrise, Prodorite, Tube product incorporate, Gujrat Infra pipes, Modern store, Anil metal, Flash forge, Saradmoni, Sanghvi, Madras Steel, Upadhya valves, Parmar, Strategic Engineering, Sawan, Engineering service enterprise, K.L. parui, Godavari, P.K. tubes, Ferro tubes, Anant extrusion, R.D forge, Venktesh Udyog, Hari udyog.
39.	RCC Pipes & Fittings	SUR Industrial Pipes, Hind Ceramics, Indian Hume Pipes, Daya Cuncrching
40.	HDPE Pipes & Fittings	EMCO, KWH Heliplastic , Astral Polyolefins, Oriplast
41.	PVC Pipes & Fittings	Oriplast, Finolex, Bharat Pipe & Fittings, Supreme Industries.
42.	Compressor	Ingersoll Rand, Atlas Copco, KG Khosla, Kirloskar Pneumatic, Chicago Pneumatic, Mannesman Demag, Eliat, Cooper, Sulzor, Corken (USA)
43.	Air Drying Unit	Chemech, Cleanair, Delair, Indcon, Mellcon, Mirch Gasoenergy System Pune.

Sl. No.	EQUIPMENT	Preferred Makes
		Ingersoll Rand
44.	Pressure Vessel & Tanks	Beekay Engg., BHPV, ISGEC, Kaveri Engg., TSL, Lloyds Steel, Mukand, Parkair Engg., Grasim Industries, Anup Thermal System, Texmaco, SV Tank, Grasim Industries, Hyderfuel Industries.
45.	Trap & Strainer for Compressed Air & Steam	Uniklinger, ESCO, JNM, Dryton Greaves, Fc Mazda,AIRA EURO AUTOMATION PVT LT

b. Electrical.

Sl. No.	EQUIPMENT	Preferred Makes
1.	HV BUSDUCT	ECC (KOLKATA)/ STAR DRIVE NOW KGS ENGINEERING LIMITED (CHENNAI)/ ENPRO (CHENNAI)/ BEST & CROMPTON/ SIEMENS/ BHEL/ CONTROL & SWITCHGEAR
2.	ISOLATING SWITCH	DP / A BOND STRAND / ESWARI/ GE/ SIEMENS/ L&T
3.	LT TRANSFORMER	BBL/CGL/ALSTOM/ C/EMCO// INDCOIL / VOLTAMP/TR
4.	CURRENT TRANSFORMER	AE /ABB/ JYOTI / KAPPA / WSI/INDCOIL
5.	POTENTIAL TRANSFORMER	AE /ABB/ JYOTI / KAPPA / WSI / INDCOIL
6.	LIGHTNING ARRESTOR	ELPRO / W.S INDUSTRIES LTD / OBLUM INDUSTRIES LTD /RAYCHEM/ SCHNEIDER (AREVA) / SIEMENS AG
7.	415V SWITCHGEAR & MCC	L&T / SIEMENS / CONTROL & SWITCHGEAR /GE (ALSTHOM) / SCHNEIDER

Sl. No.	EQUIPMENT	Preferred Makes
8.	MOTOR CONTROL CENTRES	SIEMENS/BCH/GE-POWER / L&T / C&S/ECC/ SWITCHING CCIRCUIT/ HCE/TECHNOCRATS/TECHNO-COMMERCE/SEN & SINGH/M K Engineers/ POWER & PROTECTION/ SCHNEIDER
9.	LT CIRCUIT BREAKER	SIEMENS/BCH/ DISTRIBUTION BOARD GE(ALSTHOM)/ L&T/ C&S/ SCHNEIDER
9.	BATTERY CHARGER	HBL-NIFE(SABNIFE)/ CHHABI ELECTRICALS /DEBIKAY/CALDYNE / AMAR RAJA/ HCE
10.	UPS	SIEMENS/HIREL/ EMERSON/GE / DB POWER CONTROL
11.	SOLID STATE ANNUNCIATOR	APLAB/ L&T/ ELECMECH/ PROCON/ MINILEC
12.	NUMERICAL PROTECTION RELAYS FOR LT SYSTEM	SIEMENS/ ABB/ AREVA/ SCHNEIDER / L&T(MM30)/ ASIDA
13	NUMERICAL PROTECTION RELAYS FOR HT SYSTEM	AREVA / SIEMENS / ABB / L&T
14.	PROTECTIVE RELAYS	AREVA/SEIMENS/ABB/ER
15.	AUXILIARY RELAYS	AREVA/ EASUN/ ABB/ L&T/ GE/ SCHNEIDER/ SIEMENS BCH/ ROCKWELL
16.	AMMETER/VOLTMETER/ VARMETER/WATTMETER	AEP/ IMP/ MECO AE/GEC// L&T
17	VOLTAGE/ POWER/ CURRENT/ FREQUENCY/ ENERGY TRANSDUCER	ABB/ AEP/ SIEMENS/ ELSTER / ADEPT
18.	INDICATING LAMP/ TECHNIK/	SIEMENS/ VAISHNO/(CLUSTER LED TYPE) /BINAY/ J-AUER

Sl. No.	EQUIPMENT	Preferred Makes
19.	HOOTER/ BUZZER/ BELL	GETCO/ KHERAJ/ EDISON/ KAKKU
20.	HT CABLES	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES/ INDUSTRIAL/ INCAB/ CRYSTAL/ UNIFLEX / ASIAN / CRYSTAL
21.	LT CABLES	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES / INCAB/ CRYSTAL/ UNIFLEX/ POLYCAB/ FINECAB/ INCAB/ RADIANT/ KEI
22.	CONTROL CABLE	RPG/ UNIVERSAL/ CCI/ NICCO/ TORRENT CABLES/ INDUSTRIAL/ INCAB/ CRYSTAL/ UNIFLEX/ POLYCAB/ FINECAB/ INCAB/ RADIANT/ KEI/ SPECIAL/ DELTON/ CORDS/ CAPCAB
23.	LOCAL PUSH BUTTONNS	SIEMENS/ L&T/ BCH/ BHEL/ C&S/ TECHNOCRAT/ B&C/ MEDITRON/ ELECTRO FABRIC/ HCE/ SEN & SINGH /TECHNO COMMERCE/ SWITCHING CIRCUIT/ VIJAY SWITCHGEAR.
24.	Lighting fittings (SV/MV/MH/FLUROESCEN	PHILIPS/ GE/ BAJAJ/ CGL/ WIPRO/ FLOROCRAFT
25.	HT CABLE JOINTING KITS TERMINATION KITS	RAYCHEM/3M / DENSONS/ M – SEAL
26.	CONTACTORS	SIEMENS / ALSTHOM / L&T / CGL / SCHINDIR/BCH/ABB
27.	HT HRC FUSES	AREVA/ DP/ S&S/ COPPER- BUSSMAN
28.	LT FUSE	SIEMENS / STANDARD (INDO ASIAN) / ABB / GE POWER/ ESWARAN
29.	Temperature Scanner	JYOTI/APLAB/SYNTECH/ MASIBUS
30.	MCCB	SCHNEIDER (MG)/ L&T/ ABB/ SIEMENS/ GE POWER/ CONTROL / CONTROL & SWITCHGEAR / BCH /MDS(LEGRAND)
31.	Miniature Circuit Breaker	SIEMENS/ L&T/ GE POWER CONTROL/SCHNEIDER (PROTEC / MG)/ STANDARD/INDOASIAN/ HAVELLS/ MDS (LEGRAND)/ ABB

Sl. No.	EQUIPMENT	Preferred Makes
32.	LT squirrel cage Motor	ABB/ BHARAT BIJLEE/ CGL/ KEC/ LAXMI HYDRAULICS PVT LTD./ MARATHON/SIEMENS/ ELGI/ JYOTI/WEG
33.	TERMINAL BLOCK	EPCC/ ELMEX/ PHOENIX CONTACT/ CONNECT WELL/ ESSEN DEINKI/ WAGO/ LAPP/ S&S/ HANSEL
34.	CONTROL SWITCH	SIEMENS / KAYCEE / AREVA / L&T / VAISHNO / C&S
35.	LIMIT SWITCH	AG SYSTEMS/JAY BALAJI/ TECHNOCRATS / JAYSHREE
36.	MIMIC PANELS & ANNUNCIATION PANELS	L&T / ADVANI OERLIKON / GE POWER CONTROL/ BHEL/ BCH/ TRANSRECT/ MINLEC/ TIRUPATI ELECTRONICS/ ADVANCE POWER CONTOL/ CONTROL DEVICES

c. Control & Instrumentation.(C&I)

Sl. No.	Equipment	Preferred Makes
1.	PLC	• Rockwell Automation Control Logix L73 • GE Fanuc PAC Rx3i • Siemens S7-400H series • ABB 800XA • Schneider(Quantum) or better
2.	DCS	• Yokogawa Centum VP • ABB Simphony Harmony • Honeywell Experion Pks • BHEL METSO DNA • Emersion Ovation
3.	Transmitters (Pressure, Flow & Level)	• YOKOGAWA INDIA LTD., EMERSON., HONEYWELL LTD, FUJI
4.	Digital indicators	• YOKOGAWA LTD.,MASIBUS

Sl. No.	Equipment	Preferred Makes
		ELECTRONICS, RANUTROL LTD.
5.	Pressure/ Temperature Gauges	• WAIKA, WAREE , GIC , A.N. Instruments pvt. LTD, Forbes marshall.
6.	RTDs & Thermocouples	• General instruments, Industrial instrumentation, Instrumentation LTD, Nagman sensors, Toshniwal brothers.
7.	Temperature transmitter	• YOKOGAWA LTD, EMERSON., HONEYWELL LTD.
8.	Digital scanner	• JYOTI, LECTROTEK, PROCON, MASIBUS.
9.	Power cables	• Cable corporation of India ltd., Universal cables ltd., Fort Gloster Industries LTD., Asian cables ltd, Finolex cables ltd., KEI.
10.	Instrumentation screened cables	• Thermopad, Finolex cables ltd., Toshniwal cables, Delton cables, KEI,MEM, Asian cables, Universal Cables.
11.	Compensating cables	• Toshniwal cables, General Instruments, Uday Raj, KEI.
12.	Orifice / Flow nozzle	• Engineering Specialities (pvt) ltd., Micro Precission, GIC
13.	PC	• HP, DELL, COMPAQ
14.	Ethernet switch	• CISCO, SIEMENS.
15.	Control valve	• IL, MIL, Fisher-Xomox, Uniflow, Demla
16.	Pressure switch	• WIKA, SWITZER, WAREE, ORION, INDFOSS
17.	Flow switch	• TRAC, CHEMTROL, D.K.INSTRUMENTATION, LEVCON

d. Fire Fighting:

Sl. No.	Equipment	Preferred Makes
1.	CS Valves (gate, NRV)	Audco, Fouress, BHEL, KSB, BDK, Kirloskar, Leader, Chemtech.
2.	Plug Valves	Audco, Xomox, BDK, Tufiln, Chemtrol Samit, KSB.
3.	Ball Valves	Audco, Xomox, BDK, KSB.
4.	Air Release Valve	IVPL.
5.	Pipe- MS/GI	SAIL, TATA, Jindal, MAN, SAW, Welspun, Prakash, PSL, MSL,
6.	MS/GI Pipe Fittings	Tube bends, Stewards & Lloyds, BST, Jindal.
7.	Fire Hydrants	New Age Industries, Steelage Industires, ASCO, Strucmech, Vijay Fire, Zenith

e. **VENTILATION, AIR CONDITIONING EQUIPMENT.**

Sl. No.	Equipment	Preferred Makes
1.	Centrifugal fans for Ventilation	CBDOCTOR, EFE, FLOW LINK, RIECO, FLAKTWOOD, REITZ, ACCEL, DUSTVEN, F. HARLEY, SUBURBAN INDUSTRIAL WORKS, PATEL AIRFLOW, NADI PASKO ENGG. PVT. LTD., SCINTILLANT PROJECTS, SOIL & ENVIRO INDUSTRIES, FMI, AEROCON CORP, TLT, LAXMI ENGG. *For AHU Fans*: NICOTRA, KRUGER, COMFERÉ
2.	Tube axial fans / Propeller Fans	CBDOCTOR, EFE, FLOW LINK, ALMONARD, ACCEL, KHAITAN, AEROVENT, ISEL, FLAKTWOOD, MARATHON, LM ENGG, F. HARLEY, SUBURBAN INDUSTRIAL WORKS, PATEL AIRFLOW, PASKO ENGG. PVT. LTD., SCINTILLANT PROJECTS, TURBOFLOW, INDVENT FANS, FMI, AEROCON CORP, LAXMI ENGG., AIR TECHNIKO
3.	Man coolers :	CBDOCTOR, VENTURA, LM ENGINEERS, KHAITAN, ALMONARD, DUSTVEN, FLOWLINK, F. HARLEY, PASKO ENGG
4.	Window air conditioners	VOLTAS, BLUE STAR, CARRIER AIRCON, LG, SAMSUNG, HITACHI, ROOS TEMPKOOL LTD.,
5.	Packaged air conditioners	VOLTAS, BLUE STAR, KIRLOSKAR, CARRIER, EMERSON
6.	Packaged chillers	VOLTAS, BLUE STAR, KIRLOSKAR, YORK, DUNHAM-BUSH, CARRIER, TRANE,HITACHI, DAIKIN-MCQUAY‘
7.	Air handling units / Fan coil units:	VOLTAS, BLUE STAR, SUVIDHA, CARRIER, CARYAIRE, ZECO, AIRFLOW.
8.	Cooling towers	PAHARPUR, MIHIR, ADVANCE, GAMMON INDIA, SHRIRAM TOWER TECH., BELL, ROOS TEMPKOOL
9.	Refrigerant compressors	VOLTAS, SHRIRAM, BLUE STAR, ATLAS COPCO, KIRLOSKAR, HITACHI, YORK, DUNHAM BUSH, CARRIER, TRANE, COPELAND, DANFOSS, BITZER
10.	Duct Insulation	U.P.TWIGA, LLOYDS, BAKELITE HYLAM, MALANPUR ENTECH, OWENS CORNING, PARAMOUNT
11.	Vibration isolators	DUNLOP, EMERALD, GERB, GETZNER
12.	Grills / Diffusers /Fire Dampers	RAVISTAR, DYNACRAFT, COSMOS, AIRFLOW, CARYAIRE, AIRMASTER

Sl. No.	Equipment	Preferred Makes
13.	3 / 2 way Control Valve	HONEYWELL, JOHNSON CONTROLS, SIEMENS
14.	Fabricated Duct	ZECO, RADIANT, NUTECH, SPIRO
15	Strip Heater / Pan Humidifier	ALCO HEATING, DAS PASS, RAPID CONTROL
16	Balancing Valve	ADVANCE, CASTLE, FLOWCON
17	Actuators	SIEMENS, BELIMO, HONEYWELL, JOHNSON CONTROLS
18	Cyclones & Multiclones:	THERMAX, RIECO, ALSTOM, C.DOCTOR, F.HARLEY, EFE, BATLIBOI, SCINTILLANT, SOIL & ENVIRO INDUSTRIES, CADILLAC, FMI, HAMON SHRIRAM COTTRELL, SHRIRAM EPC, APC SYSTEMS & PRODUCTS, F.L.SMIDTH,

For items not covered in 'list of preferred makes' specified by customer, bidder to refer to Make List for AC and Ventilation System enclosed in subsequent pages of this section.

AIR CONDITIONING SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLICABLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

LIST OF MAKES OF SUB-VENDOR ITEMS

AIR CONDITIONING SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLICABLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

SI. NO.	ITEM / EQUIPMENT	SUB SUPPLIER
1	SCREW CHILLER	YORK / TRANE / CARRIER / KIRLOSKAR / DUNHAM BUSH / MCQUAY (DAIKIN) / BLUE STAR / VOLTAS
2	VAPOUR ABSORBTION MACHINE	VOLTAS / THERMAX
3	PRECISION PACKAGE UNITS	STULZ / UNIFLAIR / EMERSON / BLUEBOX / CLIMAVENETA
4	PACKAGE UNIT	VOLTAS / BLUE STAR / CARRIER
5	SPLIT AIR CONDITIONER	VOLTAS / BLUE STAR / CARRIER / HITACHI / LG
6	AIR HANDLING UNITS	VOLTAS / BLUE STAR / ZECO / CARRYAIRE(FLAKT) / EDGETECH / ETHOS / SYSTEM AIR / WAVES AIRCON
7	AHU FAN (CENTRIFUGAL FAN)	CB.DOCTOR / FLAKT / KRUGER / NICOTRA / COMEFRI / MARATHON / PATEL AIR
8	CHILLED & CONDENSER WATER PUMP	BEST & CROMPTON / JYOTI / SAM TURBO / KBL / KSB / M&P / VOLTAS / BEACON-WEIR / WORTHINGTON / FLOWMORE / SULZER / BHARAT PUMPS & COMPRESSORS LTD / FLOWSERVE INDIA CONTROL PVT LTD / V-FLOW PUMPS & SYSTEMS CO
9	COOLING TOWER	PAHARPUR / MIHIR / PCT / FLOWTECH / BELL
10	INDUCTION MOTORS (LT)	SIEMENS / ABB / CGL / MARATHON / KEC / BHARAT BIJLEE / NGEF /JYOTI / LHP
11	AIR FILTER	PUROLATOR / FMI / ANFILCO / TENACITY / JOHN FOWLER / SPECTRUM / AIR TECH / PUROMATIC
12	AXIAL FANS / F.A. FANS	FLAKT / KHAITAN / PATEL / NICOTRA / SARLA / KRUGER / MARATHON / C DOCTOR
13	INSULTATION MATERIAL	BEARDSHELL / K-FLEX / PARAMONT/ ARMAFLEX / SUPREME / LLOYDS / UP TWIGA
14	BALANCING VALVE	ADVANCE
15	BUTTERFLY VALVE	AUDCO / FOURESS / INTER VALVE / BDK / WEIR BDK / TYCO / CRANE PROCESS / KEYSTONE / ADVANCE
16	NON RETURN VALVE	LEADER / H.SARKAR / FLUID LINE / HI -TECH / CRESENT / A V VALVES / BANKIM & COMPANY / SHIVADURGA
17	GATE/GLOBE VALVES	CRESENT / BDK / AUDCO / FOURESS / KIRLOSKAR / SANT / BOMBAY METAL & ALLOYS / BANKIM / LEADER / H SARKAR / AV VALVES / VENUS PUMPS AND ENGG
18	3 WAY MIXING VALVE WITH ACTUATING MOTOR	SIEMENS BUILDING TECHNOLOGY /JOHNSON / BELIMO / HONEYWELL / RAPID CONTROL / ALC
19	MOTORIZED BUTTERFLY VALVE	ANERGY / / BELIMO / JOHNSON / HONEYWELL / SIEMENS
20	Y / POT STRAINER	MULTITEX / GREAVES COTTON / JAYPEE / SANT / OTOKLIN / GRAND PRIX / GUJARAT OTOLIFT / DS ENGG / SAROJINI ENTERPRISE / BHATIA ENGINEERING / FILTERATION ENGINEERS INDIA

AIR CONDITIONING SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLICABLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

SI. NO.	ITEM / EQUIPMENT	SUB SUPPLIER
		PVT LTD / SUNGOV ENGINEERING
21	PIPING - ERW	SURYA ROSHNI / TISCO / DADU PIPES / INDUS TUBE / WELSPUN / TATA / BST / JINDAL / SAIL
22	PIPING - CS SEAMLESS (ASTM A 106)	ISMT / MAHARASHTRA SEAMLESS
23	GI SHEETS FOR DUCTING	TISCO / INDIAN IRON & STEEL CO LTD. / RASHITRYA ISPAT NIGAM LTD. / ESSAR/ ISPAT INDUSTRIES / JSW STEEL / LLOYDS STEEL / BHUSHAN / TATA / SAIL / JINDAL
24	FIRE DAMPER	TSC / CARRYAIRE / RAVISTAR (SYSTEM AIR)
25	GRILL/DIFFUSER/VOLUME CONTROL DAMPER	AIR FLOW/ TSC /AIR MASTER/ CARYAIRE/RAVI STAR (SYSTEM AIR)
26	STRIP HEATER	ESCORTS / RACOLD / DASPASS/ ALCO/ HEATCO / HOTSET
27	PAN HUMIDIFIER	RAPID COOL/ HOTSET /ALCO
28	RELIEF / PURGE VALVE	BRASSOMATIC
29	THERMOSTATS	HONEYWELL / RANCO / PENN / DANFOSS / INDFOSS / JHONSON CONTROL /RANUTROL
30	HUMID STAT	JHONSON CONTROL / HONEYWELL / PENN
31	ANTI FREEZE THERMOSTAT	RANCO / HONEYWELL / PENN / DANFOSS / INDFOSS
32	PRESSURE GAUGE	GENERAL INST CONSORTIUM / BELL / H.GURU INST P. LTD. / WAAREE INSTRUMENTS / H. GURU IND / FORBES MARSHALL / MANOMETER / A.N. INST / GAUGES BOURDON / GLUCK / WIKA / ASHCROFT / BAUMER TECHNOLOGIES/ PRECISION MASS PRODUCTS PVT. LTD. / BOSE PANDA INSTT. PVT. LTD.
33	TEMPERATURE GAUGE	H. GURU IND/ H.GURU INST/ FORBES MARSHALL/DETRIVE INST & ELECTRONICS / PYRO ELECTRIC /TOSHNIWAL BROSS / WAREE INSTRUMENTS / A.N.INST / GOA INSTRUMENTS / WIKA/ ASHCROFT / H GURU (SI)/ BAUMER TECHNOLOGIES/ GOA THERMOSTATIC/ GAUGE BOURDON/ BUDENBERG GAUGE/ PRECISION MASS PRODUCTS
34	LEVEL GAUGE	GENERAL INSTRUMENTS / CHEMTROLS / SBEM, PUNE/ AUTOMAT MUMBAI /SIGMA / TOSHNIWAL / TECHNOMATIC / TELACO /LEVCON / D K INSTRUMENTS / PUNE TECHTROL / FLOW STAR/ BLISS ANAND
35	PRESSURE SWITCH / DP SWITCHES	BELLS / DANFOSS / DK INSTRUMENTS/ DRESSER / SOR INC / VASU / SWITZER / INDFOSS / TRAFAG / GIC / ASHCROFT/ KASTURBA UDYOG/ BARKSDALE/ PRECISION MASS PRODUCTS/ MITTAL REFRIGERATION
36	TEMPERATURE SWITCH	INDFOSS/ SEIMENS / DANFOSS/ DK INSTRUMENTS/ SOR INC / VASU / DRESSER / TOSHNIWAL / SWITZER
37	FLOW SWITCH	SWITZER / LEVCON / DK INSTRUMENT / SBEM / V. AUTOMATE/ SIEMENS

AIR CONDITIONING SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLICABLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

SI. NO.	ITEM / EQUIPMENT	SUB SUPPLIER
38	LEVEL SWITCH	SBEM / BLISS ANAND / HI TECH / RAMAN INST / SIGMA / SOR INC / WAREE INST / LEVCON / DK INSTURMENT / V ATUOMATE /CHEMTROLS / SIMENS / FLOW STAR / TRAC/ FLOW TECH/ NIVO CONTROLS/ PUNE TECHTROL/ SAPCON/ BAUMER TECHNOLOGIES/ GIC/ SBEM
39	TRANSMITTERS	TAYLOR / ABB/BRISTOL BABCOCK / BIRLA KENT TAYLOR / BLISS ANAND /SBEM/ SMART INST / V AUTOMATION & INST / FISHER-ROSEMOUNT/ SIEMENS/ TATA HONEYWELL/ PUNE TECHTROL/ NIVO CONTROLS/ PANAM ENGINEERS/ EMERSON/ MOORE INDUSTRIES/ TOSHINIWAL INDUSTRIES/ YOKOGAWA/ E&H/ ABB
40	SIGHT FLOW INDICATORS	SIGMA / LEVCON /V AUTOMAT / TELLACE /EUREKA / TATA HONEYWELL/BLISS ANAND/ SCIENTIFIC DEVICES/ BK EQUIPMENTS/ INSTRUMENTATION ENGINEERS
41	FLOW ELEMENT	BRISTOL BABCOCK / BALIGA /LIGHTING EQUIP /ENGINEERING SPECIALITIES /IL / MINCO/ MICRO PRECISION / STAR MECH
42	TEMPERATURE ELEMENT	GENERAL INST CONSORTIUM/ PYRO ELECTRIC /WAAREE INSTRUMENTS/ DETRIVE INST & ELECTRONICS / TOSHNIWAL/ GOA INSTRUMENTS/ GAUGE BOURDON/ TECHNO INSTRUMENTS/ TEMPSENS INSTRUMENTS/ THERMAL INSTRUMENTS/ TM TECHNOMATIC/ BAUMER TECHNOLOGIES
43	FLOW METER	EUREKA / INSTRUMENTATION ENGINEERS PVT LTD / PLACKA /TRAC / FLOW STAR/ SCIENTIFIC DEVICE
44	RH SENSOR/TEMP SENSOR	HONEY WELL /JOHNSON /SIEMENS / GENERAL INSTRUMENTS
45	PLC BASED PANEL	SIEMENS / SCHENIEDER / ROCKWELL / GE INTELLIGENT / HONEYWELL AUTOMATION / ABB/ MITSUBISHI ELECTRIC
46	OWS / PC	HP / COMPAQ / DELL / HCL / IBM / LENOVO
47	PRINTER	HP / CANON / EPSON / XEROX / IBM / LEXMARK
48	UPS	HITACHI-HIREL / APC / DELTA / EMERSON / DB POWER / APLAB
49	FIBRE OPTIC CABLE	BIRLA ERICSON / FINOLEX / AKSH FIBRE
50	ANNUNCIATOR FOR PANEL	ICC / PECON/ PROCON
51	LT ADAPTER BOX FOR AL TO CU CABLE CONVERTOR	CONTROL DEVICE / SYSTEM POWER CONTROL / JACKSON / UNILEC / ELECTRIC ALLIED PRODUCT
52	METERING PUMP	SHAPO TOOLS / VK PUMPS
53	WATER SOFTENING PLANT	THERMAX / ION EXCHANGE / DOSI ION
54	PRESSURE TRANSMITTER	ABB / ENDRESS + HAUSER (INDIA) / MOORE / SIEMENS / SMART INSTRUMENT BRAZIL / SBEM / TOSHNIWAL / V. AUTOMAT / EMERSON / YOKOGAWA / HONEYWELL / FUJI
55	TEMPERATURE TRANSMITTER	ABB / ENDRESS + HAUSER (INDIA) / MOORE / SIEMENS / SMART INSTRUMENT BRAZIL / SBEM / TOSHNIWAL / V. AUTOMAT / EMERSON / YOKOGAWA / HONEYWELL
56	ROTAMETER	CHEMTROLS SAMIL / EUREKA IND / IL / TRANSDUCERS AND CONTROL

AIR CONDITIONING SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLICABLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

SI. NO.	ITEM / EQUIPMENT	SUB SUPPLIER
57	BATTERY CHARGER	AMARARAJA/ CHHABI ELECTRICAL / DUBAS ENGG. / HBL POWER SYSTEM / STATCON / CALDYNE
58	BATTERY (NI -Cd)	HBL POWER / AMCO SAFT / SAFT
NOTE		
	1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. LIST OF SUB-VENDOR SHALL BE FINALIZED WITH THE FINALLY SELECTED L-1 VENDOR BUT PRIOR TO ORDER FINALIZATION ON L-1 VENDOR BY THE BHEL. 2. 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. 3. PLEASE ALSO REFER RESPECTIVE SUB-SECTION C-3 & C-4 FOR ELECTRICAL AND C&I RELATED EQUIPMENT LIST OF MAKE.	

VENTILATION SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLIACBLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

LIST OF MAKES OF SUB-VENDOR ITEMS

VENTILATION SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLIACBLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

S.No.	Description	Makes
1.	**AIR WASHER & UAF* / FFU**	HYDERABAD POLUTION CONTROL / SK SYSTEM / ADVANCE VENTILATION / DRAFT AIR / BLUE STAR / VOLTAS / STERLING WILSON & ROOTS COOLING SYSTEM / C.DOCTOR
2.	**AIR HANDLING UNITS**	
3.	**CENTRIFUGAL FAN**	FLAKT / KRUGGER / DRAFT AIR / HYDERABAD POLUTION CONTROL / ADVANCE VENTILATION / PATEL AIR / NICOTRA/ SK SYSTEM / MARATHON / CB DOCTOR / SARLA
4.	**AXIAL FLOW FANS/RE UNITS**	HYDERABAD POLLUTION/ SK SYSTEM / ADVANCE VENTILATION / KRUGER / NICOTRA / MARATHON / FLAKT / CB DOCTOR/ PATEL AIR /SITAL
5.	**FAN**	FLAKT WOODS/ KRUGER/ ANDREW YULE/ AEROTHERM/ DUVENT/ SIWENT (SARLA)/ S.R PRAYAVARAN/ GEC(Alstom)
6.	**CENTRIFUGAL WATER PUMP**	BEST & CROMPTON / JYOTI / SAM TURBO / KBL / KSB / M&P / VOLTAS / BEACON-WEIR / WORTHINGTON / FLOWMORE / SULZER / BHARAT PUMPS & COMPRESSORS LTD / FLOWSERVE INDIA CONTROL PVT LTD / V-FLOW PUMPS & SYSTEMS CO
7.	**INDUCTION MOTORS (LT)**	SIEMENS / ABB / CGL / MARATHON / KEC / BHARAT BIJLEE / NGEF /JYOTI / LHP/ KIRLOSKAR/ G.E.C.
8.	**AIR FILTER**	PUROLATOR / FMI / ANFILCO / TENACITY / JOHN FOWLER /SPECTRUM / AIR TECH / PUROMATIC/ CHEMFARM/ KIRLOAKAR/ CLEAR AIR PUROFIL/ DYNA
9.	**INSULTATION MATERIAL**	BEARDSHELL / K-FLEX / PARAMONT/ ARMAFLEX / SUPREME / LLOYDS / UP TWIGA
10.	**RESIN BOUNDED FIBRE GLASS**	UP TWIGA/ CLYOL/ COOLINE
11.	**FIRE DAMPER**	TSC / CARRYAIRE / RAVISTAR (SYSTEM AIR)
12.	**BUTTERFLY VALVE**	AUDCO / FOURESS / INTER VALVE / BDK / WEIR BDK / TYCO / CRANE PROCESS / KEYSTONE
13.	**NON RETURN VALVE**	LEADER / H.SARKAR / FLUID LINE / HI -TECH / CRESENT / A V VALVES / BANKIM & COMPANY / SHIVADURGA
14.	**GATE/GLOBE VALVES**	CRESENT / BDK / AUDCO / FOURESS / KIRLOSKAR / SANT / BOMBAY METAL & ALLOYS / BANKIM / LEADER / H SARKAR / AV VALVES / VENUS PUMPS AND ENGG
15.	**PIPING - ERW**	SURYA ROSHNI / TISCO / DADU PIPES / INDUS TUBE / WELSPUN / TATA / BST / JINDAL / SAIL
16.	**GI SHEETS FOR DUCTING**	TISCO / INDIAN IRON & STEEL CO LTD. / RASHITRYA ISPAT NIGAM LTD. / ESSAR/ ISPAT INDUSTRIES / JSW STEEL / LLOYDS STEEL / BHUSHAN / TATA / SAIL / JINDAL/ NIPPON
17.	**HUMID STAT**	JHONSON CONTROL / HONEYWELL / PENN
18.	**GRILLES/ DIFFUSERS**	MOOSA HAJI/ NUTECH/ COSMOS/ OPELLA/ CARYAIRE
19.	**PRESSURE GAUGE**	GENERAL INST CONSORTIUM / BELL / H.GURU INST / WAAREE INSTRUMENTS / H. GURU IND / FORBES MARSHALL / MANOMETER / A.N. INST / GAUGES BOURDON / GLUCK / WIKA / ASHCROFT / BAUMER TECHNOLOGIES/PRECISION MASS PRODUCTS/ BOSE PANDA/ FIEBIG/ JAPSIN/ MICA
20.	**THERMOSTATS**	H.GURU/ FIEBIG/ JAPSIN/ MICA/ PENN/ HONEYWELL

VENTILATION SYSTEM
LIST OF MAKES OF SUB-VENDOR ITEMS-AS APPLIACBLE
(R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW))

21.	**TEMPERATURE GAUGE**	H. GURU IND/ H.GURU INST/ FORBES MARSHALL/DETRIVE INST & ELECTRONICS / PYRO ELECTRIC /TOSHNIWAL BROSS / WAREE INSTRUMENTS / A.N.INST / GOA INSTRUMENTS / WIKA/ ASHCROFT / H GURU (SI)/ BAUMER TECHNOLOGIES/ GAUGE BOURDON/ GOA THERMOSTAT/ BUDENBERG GAUGE/ PRECISION MASS PRODUCTS
22.	**LEVEL GAUGE**	GENERAL INSTRUMENTS / CHEMTROLS / SBEM, PUNE/ AUTOMAT MUMBAI /SIGMA / TOSHNIWAL / TECHNOMATIC / TELACO /LEVCON / D K INSTRUMENTS / PUNE TECHTROL / FLOW STAR/ BLISS ANAND
23.	**PRESSURE SWITCH / DP SWITCHES**	BELLS / DANFOSS / DK INSTRUMENTS/ DRESSER / SOR INC / VASU / SWITZER / INDFOSS / TRAFAG / GIC / ASHCROFT/ KASTURBA UDYOG/ BARKSDALE/ PRECISION MASS/ MITTAL REFRIGERATION
24.	**LEVEL SWITCH**	SBEM / BLISS ANAND / HI TECH / RAMAN INST / SIGMA / SOR INC / WAREE INST / LEVCON / DK INSTURMENT / V AUTOMAT /CHEMTROLS / SIMENS / FLOW STAR / TRAC/ NIVO CONTROLS/ PUNE TECHTROLS/ SAPCON INSTRUMENTS/ BAUMER TECHNOLOGIES/ GIC
25.	**Y / POT STRAINER**	MULTITEX / GREAVES COTTON / JAYPEE / SANT / OTOKLIN / GRAND PRIX / GUJARAT OTOLIFT / DS ENGG / SAROJINI ENTERPRISE / BHATIA ENGINEERING / FILTERATION ENGINEERS INDIA PVT LTD / SUNGOV ENGINEERING
26.	**CONTROL PANEL**	INDUSTRIAL CONTROL & APPLIANCE/ PYROTECH /POSITRONICS / CONTROL & SWITCHGEAR /SIEMENS / L&T /GE POWER /RITTAL / HOFFMAN
27.	**SWITCHGEAR**	(MCCB, CROMPTON/ SIEMENS/ ABB/ L&T CONTRACTORS ETC.)
28.	**CABLES**	FINOLEX/ NICCO/ UNIVERSAL CABLES/ GRANDLEY/ CCI/ POLYCAB/ FORT GLOSTER
NOTE		
	* Designed by C. Doctor / Blue Star / Voltas / Hyderabad Pollution Controls / SK System /Advance Ventilation / Draft Air / Sterling & Wilson / Roots cooling and fabricated by their approved fabricators.	
	1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. LIST OF SUB-VENDOR SHALL BE FINALIZED WITH THE FINALLY SELECTED L-1 VENDOR BUT PRIOR TO ORDER FINALIZATION ON L-1 VENDOR BY THE BHEL. 2. 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. 3. PLEASE ALSO REFER RESPECTIVE SUB-SECTION C-3 & C-4 FOR ELECTRICAL AND C&I RELATED EQUIPMENT LIST OF MAKE.	

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM MANDATORY SPARE LIST	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
		SHEET	

SECTION-I

SUB SECTION -E

ANNEXURE-II

MANDATORY SPARE LIST

ANNEXURE - II LIST OF MANDATORY SPARES R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW)		
S. No.	**Description**	**UNIT & QTY**
A	**HVAC Spares**	
1	AC Motors	
a	Valve drive	1 of each type
b	Bearings	3 set of each type
c	Fans	3 nos. each type
2	Measuring Instruments/Field instruments.	10% of total Temperature & Pressure gauges of each type & model or a minimum of one of each type and model which ever is more.
3	Measuring Instruments/Field instruments.	10% of total temperature elements with thermowells for RTD/TC or a minimum of one of each range & model which ever is more
4	Electronic smart transmitters	10%of total electronic transmitters of each type range andmodel orminimum of one number of each type, range & model whichever is more.
5	Process Actuated switch devices	10% of total pressure switches, limit switches, differential switches, temperature switches, flow switches of each type & model or minimum of one number of each type & model whichever is more.
6	Local Instrument	10 % of each type of Push buttons, indicating lamps, colour caps & control sation for each type.
7	Local Instrument	10% or minimum 1 nos of each instrument not covered in the list but used in the system.
8	Alarm Annunciator	10% of total electronic cards of each type & model or minimum of 2nos of each type & model . This shall include all types of cards.
9	Cable & Accessories	
a	Special Cable	20% of total quantity for each type & size
b	Signal / Communication Cable	20% of total quantity for each type & size
c	Cable Gland and Lugs	20% of each type, size & rating
d	Cable termination kits	20% of each type, size & rating
e	Cable Jointing kits	20% of each type, size & rating
f	Trefoil Clamps (each type & size)	20% of each type, size
g	Cable Route Markers, if applicable	10% of each type

Notes:	
a)	Spares listed in Price Schedule is bare minimum requirement. In case any additional mandatory spares required for 5 years of successful operation of the system or those covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidder’s scope of supply.
b)	Wherever "set" is indicated, it shall mean complete replacement for one main equipment.
c)	All Spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is “not applicable” for particular equipment, then suitable applicable alternate spare has been offered / shall be supplied by the bidder without any financial implication."
d)	Any item which is quoted as “not applicable” by the bidder in the above list and is found to be “applicable” at a later date shall be supplied by the bidder without any commercial and delivery implication.
e)	Any cell left blank in the unpriced schedule shall be treated as “Quoted” and is included in total price.
f)	If percentage comes at fraction next higher integer should be considered for the purpose of quantity required.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF TOOLS & TACKLES AND LIST OF COMMISSIONING SPARES	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION: I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
		SHEET 1 OF 3	

SECTION-I

SUB-SECTION-E

ANNEXURE-III

LIST OF TOOLS & TACKLES
AND
LIST OF COMMISSIONING SPARES

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF TOOLS & TACKLES AND LIST OF COMMISSIONING SPARES	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION: I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
		SHEET 2 OF 3	

LIST OF TOOLS & TACKLES

SL NO	ITEM DESCRIPTION	UNIT	QTY
1	FLAT D WRENCH - 6 MM TO 32 MM (12 Pcs)	SET	1
2	BOX WRENCHES - 6 MM TO 22 MM (14 Pcs)	SET	1
3	RING SPANNER - 6 MM TO 32 MM (12 Pcs)	SET	1
4	ALLEN KEYS - 2 MM TO 10 MM	SET	1
5	CRESCENT SCREW SPANNER	NO.	1
6	SCREW DRIVER	NO.	1
7	OFFSET SCREW DRIVER	NO.	1
8	INSULATED PLIER	NO.	1
9	TORCH LIGHT FOR 2 CELL	NO.	1
10	HAMMER 1 LB	NO.	1
11	OIL CAN	NO.	1
12	POCKET THERMOMETER - 0 TO 50 DEG. C)	NO.	1
13	INSULATION TAPE ROLL	NO.	1
14	STEEL FOOT RULE - 12"	NO.	1
15	FEELER GAUGE 9 BLADES	NO.	1
16	PIPE WRENCH	NO.	1
17	FLARE NUT (1/4")	NOS.	6
18	FLARING TOOL	NO.	1
19	TUBE CUTTER	NO.	1
20	GAS CHARGING PIPE	NO.	1
21	NITOGEN CHARGING ADAPTER	NO.	1
22	FREON PRESSURE GAUGE (2 1/2" DIA DIAL)) 0 - 300 MM PSI	NO.	1
23	FREON PRESSURE GAUGE (2 1/2" DIA DIAL)) 30 - 150 MM PSI	NO.	1
24	PSYCHRO METER	NO.	1
25	LOCK WITH KEY FOR TOOL BOX	NO.	1
26	RATCHET 1/4"	NO.	1
27	MS TOOL BOX	NO.	1
28	LOCK WITH KEY FOR TOOL BOX	NO.	1
29	HAND LAMP	NO.	1
30	Grease Gun	NO.	1

NOTE:-

Above is the minimum list. Any other Tools and tackles required for HVAC system w.r.t. Mechanical, Electrical and C&I part shall also be provided by the vendor as per system / customer requirement without any commercial & Delivery implication to BHEL.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF TOOLS & TACKLES AND LIST OF COMMISSIONING SPARES	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION: I	
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LIST OF COMMISSIONING SPARES

SL NO	ITEM DESCRIPTION	UNIT	QTY
1	FAN BELTS (each type & size)	SET	1
2	PRESSURE GAUGE (for each type and range)	NO.	1
3	TEMPERATURE GAUGE (for each type and range)	NO.	1
4	FILTER (each size)	SET	1
5	COMPRESSOR OIL	Ltr.	1 Lot
6	REFRIGERANT GAS OF EACH TYPE IN A NON-RETURNABLE CYLINDERS	Kg	1 Lot

NOTE:-

Above is the minimum list. Any other commissioning spare required for HVAC system w.r.t. Mechanical, Electrical and C&I part shall also be provided by the vendor as per system / customer requirement without any commercial & Delivery implication to BHEL.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE	SPECIFICATION No: PE-TS-495-571-11000A-A001
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		SUB-SECTION : E
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SECTION-I

SUB-SECTION-E

ANNEXURE-IV

DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE

REFER CUSTOMER TECHNICAL SPECIFICATION C2-A

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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SECTION-I

SUB-SECTION-E

ANNEXURE-V

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SPECIFICATION No: PE-TS-495-571-11000A-A001
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SL. NO	DVC DOCUMENT NO	BHEL DOCUMENT NO	DOCUMENT TITLE	SCH. WEEK (FROM DATE OF LOI)
1	2201-114-PVM-W-001	PE-V0-495-571-11000-A-A001	SUB-VENDOR LIST ALONG WITH INSPECTION CATEGORISATION PLAN FOR HVAC SYSTEM	2
2	2201-114-QVM-Q-001	PE-V0-495-571-11000-A-A002	QUALITY PLAN OF COOLING TOWER FOR HVAC SYSTEM	4
3	2201-114-QVM-Q-002	PE-V0-495-571-11000-A-A003	QUALITY PLAN OF PUMPS FOR HVAC SYSTEM	5
4	2201-114-QVM-Q-003	PE-V0-495-571-11000-A-A004	QUALITY PLAN OF PACKAGE AC	6
5	2201-114-QVM-Q-004	PE-V0-495-571-11000-A-A005	QUALITY PLAN OF CENTRIFUGAL FANS FOR HVAC SYSTEM	6
6	2201-114-QVM-Q-005	PE-V0-495-571-11000-A-A006	QUALITY PLAN OF AXIAL FANS FOR HVAC SYSTEM	4
7	2201-114-QVE-Q-001	PE-V0-495-571-11000-A-A007	QUALITY PLAN OF MOTOR FOR HVAC SYSTEM	7
8	2201-114-PVM-U-002	PE-V0-495-571-11000-A-A101	HEAT LOAD CALCULATION FOR AC AREAS	2
9	2201-114-PVM-G-001	PE-V0-495-571-11000-A-A102	OPERATION AND CONTROL PHILOSOPHY FOR HVAC SYSTEM	2
10	2201-114-PVM-U-003	PE-V0-495-571-11000-A-A103	VENTILATION FAN CALULATION & SCHEDULE.	4
11	2201-114-PVM-U-004	PE-V0-495-571-11000-A-A104	SPLIT AC SCHEDULE ALONG WITH HEAT LOAD CALCULATION FOR AUXILIARY BUILDING OF AC SYSTEM	4
12	2201-114-PVM-Y-001	PE-V0-495-571-11000-A-A201	TDS OF COOLING TOWER FOR HVAC SYSTEM	4
13	2201-114-PVM-Y-002	PE-V0-495-571-11000-A-A202	TDS OF PUMPS FOR HVAC SYSTEM	5
14	2201-114-PVM-Y-003	PE-V0-495-571-11000-A-A203	TDS OF TANKS FOR AC SYSTEM	3
15	2201-114-PVM-Y-004	PE-V0-495-571-11000-A-A204	DATA SHEET & GA FOR SPLIT AC	4
16	2201-114-PVM-Y-005	PE-V0-495-571-11000-A-A205	DATA SHEET & GA FOR PACKAGE AC	5
17	2201-114-PVM-Y-006	PE-V0-495-571-11000-A-A206	DATA SHEET & GA FOR CENTRIFUGAL FANS	6
18	2201-114-PVM-Y-007	PE-V0-495-571-11000-A-A207	DATA SHEET & GA FOR AXIAL AND PROPELLER FANS FOR HVAC SYSTEM	6
19	2201-114-PVM-Y-008	PE-V0-495-571-11000-A-A208	DATA SHEET OF VALVES & STRAINER FOR HVAC SYSTEM	7
20	2201-114-PVM-Y-009	PE-V0-495-571-11000-A-A209	DATA SHEET OF INSULATION FOR HVAC SYSTEM	5
21	2201-114-PVM-Y-010	PE-V0-495-571-11000-A-A210	DATA SHEET OF PIPES AND FITTINGS FOR HVAC SYSTEM	2
22	2201-114-PVM-Y-011	PE-V0-495-571-11000-A-A211	DATA SHEET OF GI AND MS SHEET FOR HVAC SYSTEM	2
23	2201-114-PVM-Y-012	PE-V0-495-571-11000-A-A212	DATA SHEET & GA FOR PRE AND FINE FILTERS.	4
24	2201-114-PVM-Y-013	PE-V0-495-571-11000-A-A213	GA OF AIR TERMINALS LIKE SUPPLY/RETURN AIR DIFFUSER / GRILL / BACK DRAFT DAMPER / INTAKE LOUVER ETC FOR HVAC SYSTEM	6
25	2201-114-PVM-Y-014	PE-V0-495-571-11000-A-A214	DATA SHEET & GA FIRE DAMPER WITH	5

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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			ACTUATOR FOR HVAC SYSTEM	
26	2201-114-PVE-Y-001	PE-V0-495-571-11000-A-A215	DATA SHEET & GA FOR MOTORS (FAN, SUPPLY AND EXHAUST AXIAL FANS)	7
27	2201-114-PVI-Y-001	PE-V0-495-571-11000-A-A216	DATA SHEET FOR INSTRUMENTS (PRESSURE GAUGE, TEMP GAUGE, LEVEL GAUGE, PRESSURE SWITCH, LEVEL SWITCH)	8
28	2201-114-PVM-F-001	PE-V0-495-571-11000-A-A401	PID FOR AC SYSTEM	2
29	2201-114-PVM-F-002	PE-V0-495-571-11000-A-A402	SCHEME FOR AIR DISTRIBUTION IN POWER HOUSE	2
30	2201-114-PVM-F-003	PE-V0-495-571-11000-A-A403	PID FOR VENTILATION SYSTEM	2
31	2201-114-PVM-F-004	PE-V0-495-571-11000-A-A501	PAC ROOM LAYOUT AND DUCT LAYOUT FOR CONTROL ROOM INCLUDING CIVIL DETAILS	5
32	2201-114-PVM-F-005	PE-V0-495-571-11000-A-A502	AC PLANT ROOM & COOLING TOWER AREA LAYOUT INCLUDING CIVIL DETAILS	7
33	2201-114-PVM-F-006	PE-V0-495-571-11000-A-A503	VENTILATION ROOM & VENTILATION DUCT LAYOUT FOR ALL THE FLOOR FOR POWER HOUSE INCLUDING CIVIL DETAILS	8
34	2201-114-PVM-F-007	PE-V0-495-571-11000-A-A504	VENT. ARRANGEMENT FOR BATTERY / AUXILIARY ROOMS OF POWER HOUSE	10
35	2201-114-PVM-E-001	PE-V0-495-571-11000-A-A505	TYPICAL DETAILS OF DUCT FABRICATION DRAWING / SUPPORT / ERECTION.	8
36	2201-114-PVG-X-001	PE-V0-495-571-11000-A-A901	DEMONSTRATION TEST PROCEDURE FOR HVAC SYSTEM	10
37	2201-114-PVM-X-001	PE-V0-495-571-11000-A-A902	O & M MANUAL FOR HVAC SYSTEM	20
38	IGP DOCUMENT	PE-V0-495-571-11000-A-A703	ELECTRICAL FEEDER LIST FOR HVAC SYSTEM	8
39	IGP DOCUMENT	PE-V0-495-571-11000-A-A704	CABLE SCHEDULE WITH BOQ FOR HVAC SYSTEM	10
40	IGP DOCUMENT	PE-V0-495-571-11000-A-A705	TDS FOR POWER AND CONTROL CABLES-TYPE TEST CERTIFICATE FOR CALES, TYPE TEST PROCEDUE, CROSS SECTION	12
41	IGP DOCUMENT	PE-V0-495-571-11000-A-A707	TDS FOR CABLING-CABLE TRAY, CABLE SUPPORT, TYPE TEST CERTIFICATE, JOINTING KITS, TRIFOIL CLAMPS, ABOVE GROUND EARTHING	12
42	IGP DOCUMENT	PE-V0-495-571-11000-A708	DRIVE LIST FOR HVAC SYSTEM	10
43	IGP DOCUMENT	PE-V0-495-571-11000-A709	I/O LIST FOR HVAC SYSTEM	10
44	IGP DOCUMENT	PE-V0-495-571-11000-A710	LOGIC DRAWING FOR HVAC SYSTEM	12
45	IGP DOCUMENT	PE-V0-495-571-11000-A711	TECHNICAL DATASHEET & GA , TYPE TEST OF JUNCTION BOX FOR HVAC SYSTEM	12
46	IGP DOCUMENT	PE-V0-495-571-11000-A712	INSTRUMENT SCHEDULE WITH TAG NUMBER FOR HVAC SYSTEM	10
47	IGP DOCUMENT	PE-V0-495-571-11000-A713	INTERCONNECTION OF FIELD	10

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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			INSTRUMENTS UPTO JUNCTION BOX FOR HVAC SYSTEM	

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in auto-cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.:-

a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.
c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
e) Drawings/ documents to be submitted for purchasers review/ approval shall be under revision a, b, c… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under r-0, 1, 2, 3 ….etc.
f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS no., technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
h) All drawings shall be prepared as per BHEL'S title block and shall bear BHEL'S drawing no.
i) 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.
j) Bidder to follow the following the drawing submission schedule:
k) 1st submission of drawings from date of LOI as per the submission schedule (week).
l) Every revised submission incorporating comments – within 7 days.
m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM FORMAT FOR OPERATION AND MAINTENANCE MANUAL	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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SECTION-I

SUB-SECTION-E

ANNEXURE-VI

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM FORMAT FOR OPERATION AND MAINTENANCE MANUAL	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

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

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM FORMAT FOR OPERATION AND MAINTENANCE MANUAL	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
3.8	Control philosophy /control write-ups				
4.0	**COMMISSIONING ACTIVITIES (IF NOT COVERED IN SEPARATE DOCUMENT I.E. ERECTION MANUAL, COMMISSIONING MANUAL)**				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**OPERATION GUIDELINES FOR PLANT PERSONAL/USER/OPERATOR**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**MAINTENANCE GUIDELINES FOR PLANT**				

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM FORMAT FOR OPERATION AND MAINTENANCE MANUAL	SPECIFICATION No: PE-TS-495-571-11000A-A001
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Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
	PERSONAL				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM SITE STORAGE AND PRESERVATION	SPECIFICATION No: PE-TS-495-571-11000A-A001	
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SECTION-I

SUB-SECTION-E

ANNEXURE-VII

SITE STORAGE AND PRESERVATION

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

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

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

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.

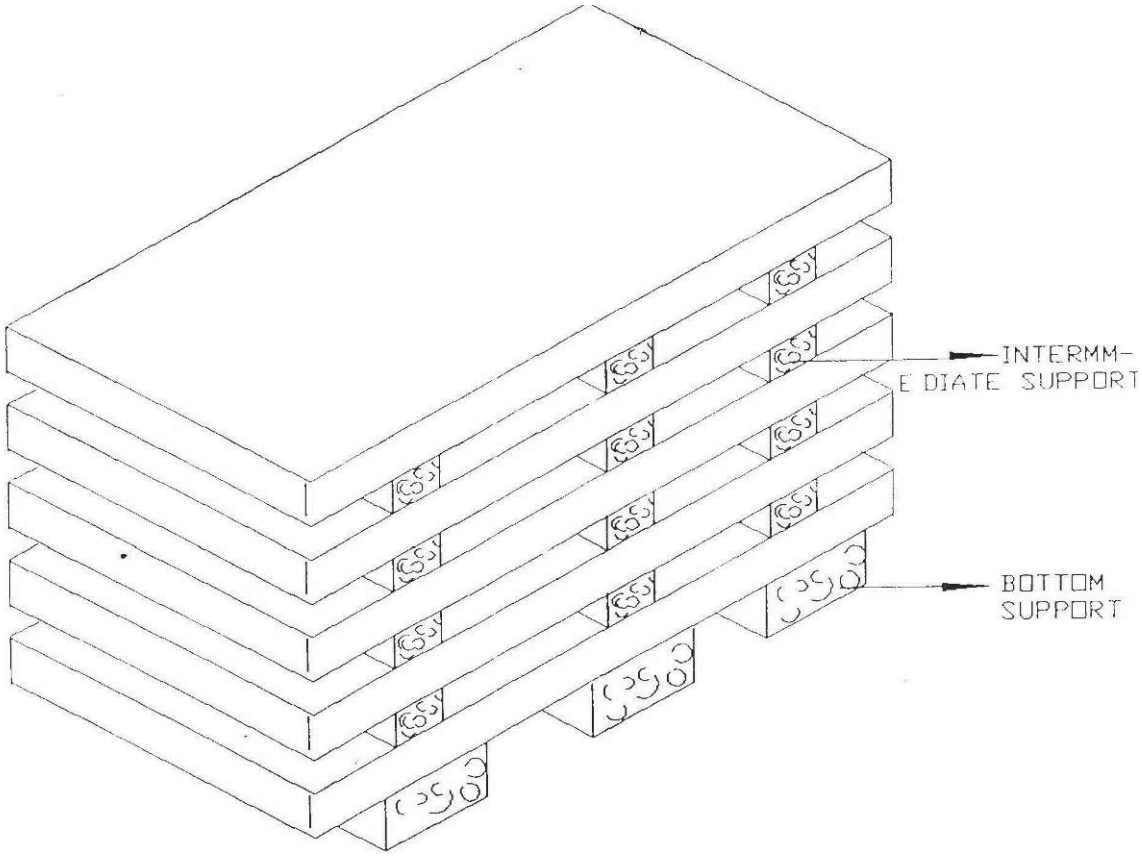

Figure – 1 – PLATE STACKING ARRANGEMENT

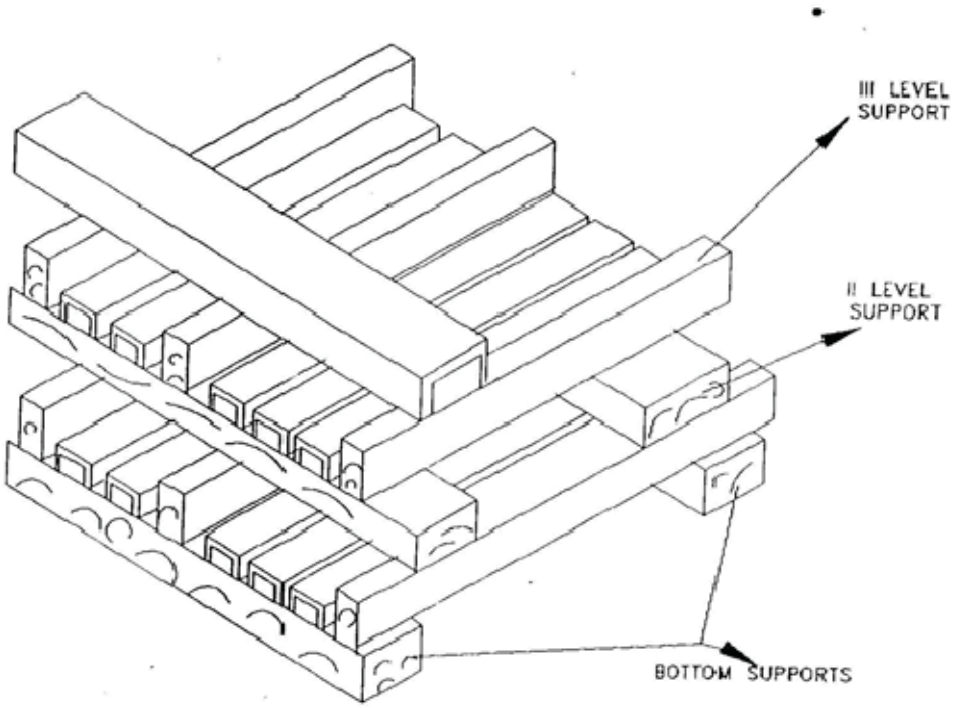

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM PAINTING SPECIFICATION & COLOUR SCHEME	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
		SHEET 1 OF 1	

SECTION-I

SUB SECTION E

ANNEXURE-VIII

PAINTING SPECIFICATION & COLOUR SCHEME (COVERED UNDER SECTION C2-B)

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM PACKING PROCEDURE	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : I	
		SUB-SECTION : E	
		REV 00	DATE: AUGUST 2022
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SECTION-I

SUB SECTION E

ANNEXURE-IX

PACKING PROCEDURE
(COVERED UNDER SECTION C2-B)

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION: II	
		REV. 00	DATE: AUGUST 2022

SECTION-II

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM INSPECTION AND TESTING	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 1	
		REV 00	DATE: AUGUST 2022
		SHEET 1 OF 4	

SECTION-II

SUB-SECTION-1

INSPECTION AND TESTING

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM INSPECTION AND TESTING	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 1	
		REV 00	DATE: AUGUST 2022
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1.01.00 Inspection and Tests during Manufacture.

1.01.01 The method and techniques to be used by the Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner.

1.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

1.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

1.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The owner's representative shall have at all reasonable times access to bidder's or his sub-vendor's premises and shall have power to inspect/ examine materials and workmanship or equipment under manufacture.

The Bidder shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Further nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere.

For electrical equipment, routine tests as per relevant IS spec are to be carried out on all equipment. Type tests are also to be carried out on selected equipment as detailed in the specs of concerned electrical equipment.

1.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

1.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.
Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.

1.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material. Equipment or parts coming under any statutory

Regulations shall be certified by a Competent Authority under the regulations in the specified format.

1.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.

1.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

1.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major but welding joints shall be radiographed unless otherwise stipulated.

Statutory payments in respect of IBR approvals including inspection shall be made by the bidder. Bidder's scope shall include to preparation of all necessary documents, co-ordination and follow-up for above approval. Owner shall only forward assistance/endorsement of documents /design /drawings /reports/records to be submitted for approval as stipulated/ required by Statutory Authorities till registration of the unit and clearance for commercial operation.

1.02.00 Performance Tests at Site

1.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Bidder on site under normal operating conditions. The Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

1.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

1.02.03 The Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

1.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

All Statutory testing / clearance is in Bidder's scope including payment of all fees, etc. as required

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM INSPECTION AND TESTING	SPECIFICATION No: PE-TS-495-571-11000A-A001
		SECTION : II
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QAP FORMAT

BHARAT HEAVY ELECTRICALS LIMITED

CORPORATE QUALITY ASSURANCE

PROJECT: SYSTEM :

VENDOR : ITEM :

SL NO	COMPONENT /OPERATION OPERATIONS	CHARACTERISTICS CHECKED	CATEGORY	TYPE /METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

Legend: 1. BHEL 2. Vendor 3. Sub-Vendor

QP No	CQS/SQP/31	Signature	Date			
	Rev		Name			
Page No	1 of 1		Party	Customer/Consultant	Bhel	Vendor

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 2	
		REV: 00	DATE: AUGUST 2022
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SECTION: II

SUB SECTION: 2

LIST OF DOCUMENTS TO BE SUBMITTED WITH BID

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 2	
		REV: 00	DATE: AUGUST 2022
		SHEET 2 OF 2	

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

1. Compliance cum confirmation certificate
2. Un priced format for HVAC package
    a. Unpriced format for Main package, mandatory spares, tools and tackles and commissioning spares on BHEL e-procurement portal.
3. Deviation schedule /No deviation certificate in attached format ‘Deviation sheet (Cost of withdrawal)’.
4. Pre-bid clarification schedule and signed copy of technical corrigenda, if any.

SECTION: II

SUB SECTION: 3

COMPLIANCE CUM CONFIRMATION CERTIFICATE

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM COMPLIANCE CUM CONFIRMATION CERTIFICATE	SPECIFICATION No: PE-TS-495-571-11000A-A001
		SECTION : II
		SUB-SECTION : 3
		REV. NO. 00 | DATE: AUGUST 2022
		SHEET: 2 OF 3

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.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM PRE-BID CLARIFICATION SCHEDULE	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 4	
		REV. NO. 00	DATE: AUGUST 2022
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SECTION: II

SUB SECTION: 4

PRE-BID CLARIFICATION SCHEDULE

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM PRE-BID CLARIFICATION SCHEDULE	SPECIFICATION No: PE-TS-495-571-11000A-A001
		SECTION : II
		SUB-SECTION : 4
		REV. NO. 00 | DATE: AUGUST 2022
		SHEET: 2 OF 2

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

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM NO DEVIATION CERTIFICATE	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		SUB-SECTION : 5	
		REV: 00	DATE: AUGUST 2022
		SHEET 1 OF 3	

SECTION: II

SUB SECTION: 5

NO DEVIATION CERTIFICATE
(REFER ANNEXURE-II OF GCC REV 07)

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM NO DEVIATION CERTIFICATE	SPECIFICATION No: PE-TS-495-571-11000A-A001
		SECTION : II
		SUB-SECTION : 5
		REV: 00 / DATE: AUGUST 2022
		SHEET 2 OF 3

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL 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 of 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 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

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM NO DEVIATION CERTIFICATE	SPECIFICATION No: PE-TS-495-571-11000A-A001
		SECTION : II
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		SHEET 3 OF 3

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 club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

	R M & U OF PANCHET HYDEL STATION UNIT # 1 (46 MW) HVAC SYSTEM TENDER DRAWINGS	SPECIFICATION No: PE-TS-495-571-11000A-A001	
		SECTION : II	
		Sub Section : 6	
		REV. 00	DATE: AUGUST 2022

SECTION: II

SUB SECTION: 6

TENDER DRAWINGS

DRAWING No. PE-DG-495-571-11000A-A101

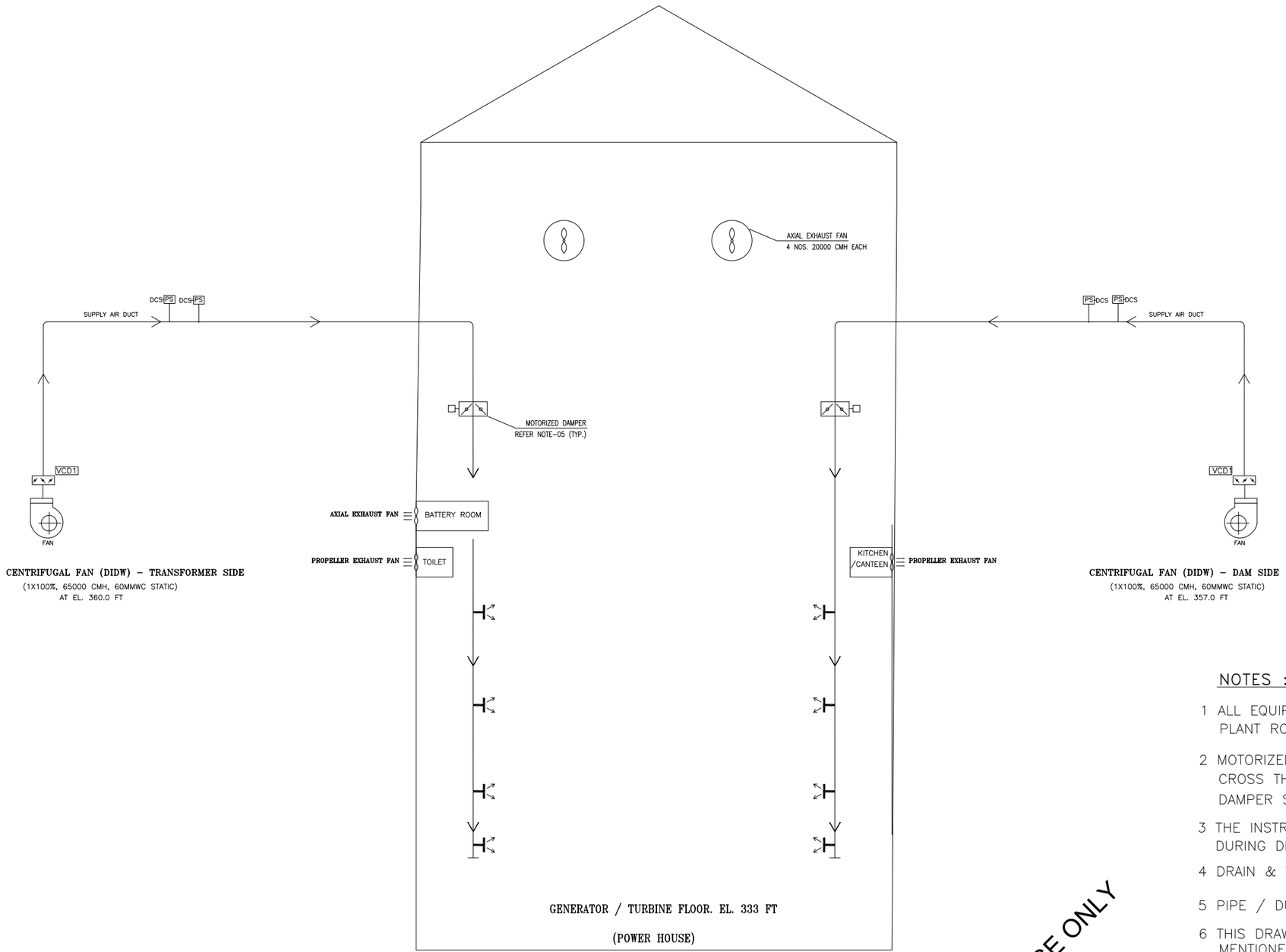
CUSTOMER'S DRAWING No.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

LEGEND :-

TT	TEMPERATURE TRANSMITTER
PT	PRESSURE TRANSMITTER
PS	PRESSURE SWITCH
	DUCT
	FIRE DAMPER(M)
	PRE FILTER
VCD	VOLUME CONTROLDAMPER
MD	MOTORIZED DAMPER
	FLOW METER WITH ORIFICE PLATE
	PIPE
TG	TEMP.GAUGE.
PG	PRESSURE GAUGE.



CENTRIFUGAL FAN (DIDW) – TRANSFORMER SIDE
(1X100%, 65000 CMH, 60MMWC STATIC)
AT EL. 360.0 FT

CENTRIFUGAL FAN (DIDW) – DAM SIDE
(1X100%, 65000 CMH, 60MMWC STATIC)
AT EL. 357.0 FT

NOTES :-

1 ALL EQUIPMENT DRAIN SHALL BE CONNECTED TO NEAREST BUILDING/ PLANT ROOM DRAIN (BY HVAC SUPPLIER)

2 MOTORIZED DAMPERS SHALL BE PROVIDED IN THE DUCT WHERE IT WILL CROSS THE WALL/FLOOR. FURTHER IN BRANCH DUCT, VOLUME CONTROL DAMPER SHALL BE PROVIDED

3 THE INSTRUMENTATION & CONTROL / MONITORING SHALL BE FINALIZED DURING DETAILED ENGINEERING.

4 DRAIN & VENT VALVE SHALL BE PROVIDED AS PER LAYOUT REQUIREMENT.

5 PIPE / DUCT INSULATION SHALL BE PROVIDED WHEREVER IF REQUIRED.

6 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH OTHER REQUIREMENTS MENTIONED IN SPECIFICATION.

7 INSTRUMENT PHILOSOPHY FOR TURBINE EXHAUST & DRAINAGE GALLARY FAN SHALL BE SAME AS INDICATED IN PID.

CUSTOMER	DAMODAR VALLEY CORPORATION (DVC)
CONSULTANT	MECON
PACKAGE:	HVAC SYSTEM FOR HYDRO
PROJECT	R M & U FOR PANCHET HYDEL STATION 1X46 MW

BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA.

DEPT CODE		NAME	SIGN	DATE
M	DRN	VS	Sd/-	05.05.2025
	DSGN	VS	Sd/-	05.05.2025
	CHD	LJ	Sd/-	05.05.2025
	APPD	SG	Sd/-	05.05.2025

TITLE: PROCESS & INSTRUMENTAION DIAGRAM FOR HVAC SYSTEM

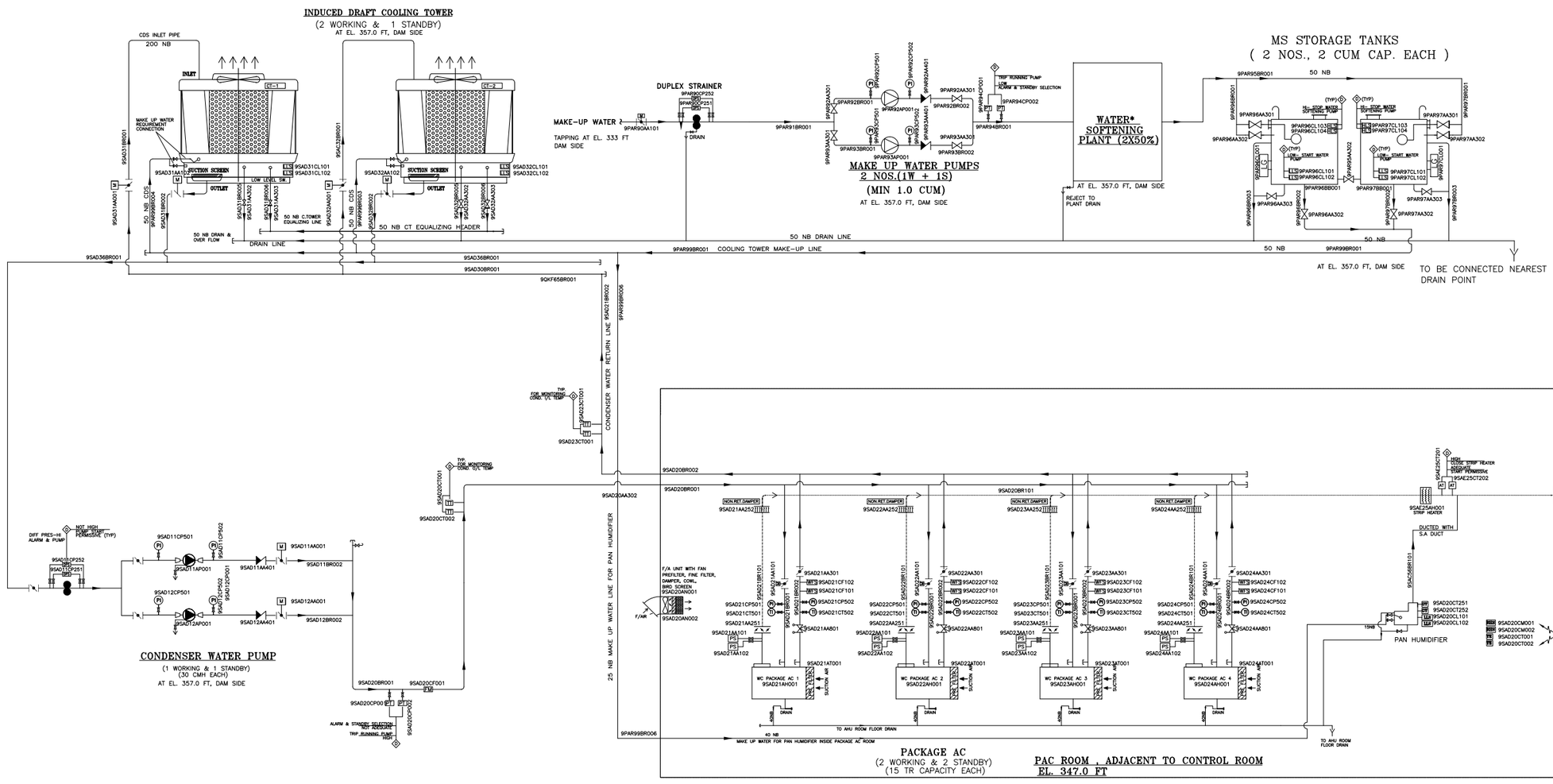
DEPT | SCALE | DRAWING No. PE-DG-495-571-11000A-A101
SIGN
DATE
SHEET 01 OF 01 | REV 00

SIZE-A1

DRAWING No. PE-DG-495-571-11000A-A101

CUSTOMER'S DRAWING No.

P & I DIAGRAM FOR AC SYSTEM
WATER COOLED PACKAGE AC FOR CONTROL ROOM FOR PANCHET HEP



LEGEND					
SYMBOL	DESCRIPTION	TAG	SYMBOL	DESCRIPTION	TAG
T	TEMPERATURE GAUGE	TI		NON RETURN VALVE	NRV
P	PRESSURE GAUGE	PI		Y-STRAINER	YSTR
	BALANCING VALVE	BV		GATE VALVE	GV
M	MOTORISED BUTTERFLY VALVE	MBF		NON RETURN DAMPER	NRD
M	3-WAY MOTORISED MIXING VALVE	3MV		FIRE DAMPER (MOTOR OPERATED)	FD
	PUMP	P		VOLUME CONTROL DAMPER.	VCD
	VENT VALVE	–		LEVEL SWITCH (LOW/HIGH)	LS
	PURGE VALVE.	–		DESCALING TEE	–
WFS	WATER FLOW SWITCH	WFS	AT	AIRSTAT	AT
	PRE FILTER	–		FIRE DAMPER (MOTOR OPERATED)	FD
	DUPLEX STRAINER	DST		FINNED TYPE STRIP HEATER	–
		–	GT	GEYSER THERMOSTAT	GT
–E–	ELECTRICAL LINE	E	HLS	HIGH LEVEL SWITCH	HLS
PH	PAN HUMIDIFIER	PH	PX	PRESSURE TEST POINT	PX
LLS	LOW LEVEL SWITCH	LLS	TT	TEMPERATURE TRANSMITTER	TT
TX	TEMP. TEST POINT	TX	RHS	HUMIDITY SENSOR	RHS
DPS	DIFFERENTIAL PRESSURE SWITCH	DPS	WPS	WATER LINE PRESSURE SWITCH	WPS
TS	TEMPERATURE SENSOR	TS	PS	AIR LINE PRESSURE SWITCH	PS
	POT STRAINER	–	HLS	HIGH LEVEL SWITCH	HLS
PT	PRESSURE TRANSMITTER	PT	D	SIGNAL TO DCS	D
TE	TEMPERATURE ELEMENT	TE	–	NON CHEMICAL WATER TREAT. EQ	–
FM	FLOW METER	FM			
	ORIFICE PLATE	–			
				CONDENSER WATER LINE	
				CHILLED WATER LINE	
				SUPPLY AND RETURN AIR DUCT	

KKH NOMENALATURE

9	SAD	10	AA	001

- EQ / INSTRUMENT NUMBER KEY
- EQUIPMENT/INSTRUMENT KEY
- AREA KEY
- FUNCTION KEY
- UNIT NUMBER IDENTIFIER

NOTES:
1. ALL SUPPLY & RETURN DUCT SHALL BE INSULATED AS PER SPECIFICATION.
2. ALL PIPING AND VALVES OF SIZE 50NB & BELOW SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT
3. ALL PRESSURE GAUGES, PRESSURE SWITCHES, DIFFERENTIAL PRESSURE SWITCHES SHALL BE PROVIDED WITH ISOLATION VALVE.
4. TEMPERATURE SENSOR (TE) & RELATIVE HUMIDITY SENSOR (RHS) SHALL BE PROVIDED IN EACH PAC ROOM.
5. ALL INSTRUMENT AND TEST POINTS SHALL BE PROVIDED WITH ISOLATING ROOT VALVE
6. MOTORIZED VALVES SHALL BE PROVIDED WITH SPECTACLE BLIND WITH COUNTER FLANGE FOR LINE ISOLATION.
7. VENT AND DRAIN SHALL BE PROVIDED AT THE HIGHEST AND LOWESH POINT RESPECTIVELY AS PER SYSTEM REQUIREMENT.
8. ALL EQUIPMENT DRAIN SHALL BE CONNECTED TO NEAREST BUILDING / PLANT ROOM DRAIN.
9. MAKE UP WATER TAPPING SHALL BE PROVIDED AT ONE POINT AT EL. 333 FT NEAR DAM SIDE. FURTHER, DISTRIBUTION OF SAME TO INDIVIDUAL EQUIPMENT SHALL BE IN AC SUPPLIER SCOPE.
10. ONE NO. DRY BULB & WET BULB THERMOMETER WITH PSYCHOMETRIC CHART SHALL BE PROVIDED IN EACH AIR CONDITIONED ROOM.
11. ALL VALVES SHALL BE LOCATED AT GRADE / MAN APPROACHABLE HEIGHT. METALLIC STOOL / LADDER TO BE PROVIDED BY AC SUPPLIER FOR ACCESSING VALVES / EQUIPMENTS.
12. APPLICABILITY OF WATER SOFTENING PLANT SHALL BE DECIDED DURING DETAIL ENGINEERING.
13. THE QUANTITY SHOWN IN THE DRAWING FOR VALVES, INSTRUMENTS ARE INDICATIVE MINIMUM. ANY INSTRUMENTS & VALVES REQUIREMENT FOR SYSTEM REQUIREMENT / COMPLETION, THE SAME SHALL BE PROVIDED WITHOUT ANY PRICE IMPLICATION.
14. REQUIREMENT OF CT SHALL BE ASSESSED DURING DETAIL ENGINEERING. IN CASE OF ITS NON-APPLICABILITY, PACS SHALL BE WATER COOLED WITH ONCE THROUGH SYSTEM WITH COOLING WATER INTAKE FROM DESIGNATED TAP-OFF POINT TILL PAC THROUGH CYCLONE SEPARATOR AND/OR STRAINER AND DISCHARGE TO TAIL RACE.

FOR TENDER PURPOSE ONLY

CUSTOMER	DAMODAR VALLEY CORPORATION (DVC)
CONSULTANT	MECON
PACKAGE:	HVAC SYSTEM FOR HYDRO
PROJECT	R M & U FOR PANCHET HYDEL STATION 1X46 MW

BHARAT HEAVY ELECTRICALS LTD, POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA.

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	Sd/-	08.08.2022
	DSGN	VK	Sd/-	08.08.2022
	CHD	LJ	Sd/-	08.08.2022
	APPD	SG	Sd/-	08.08.2022

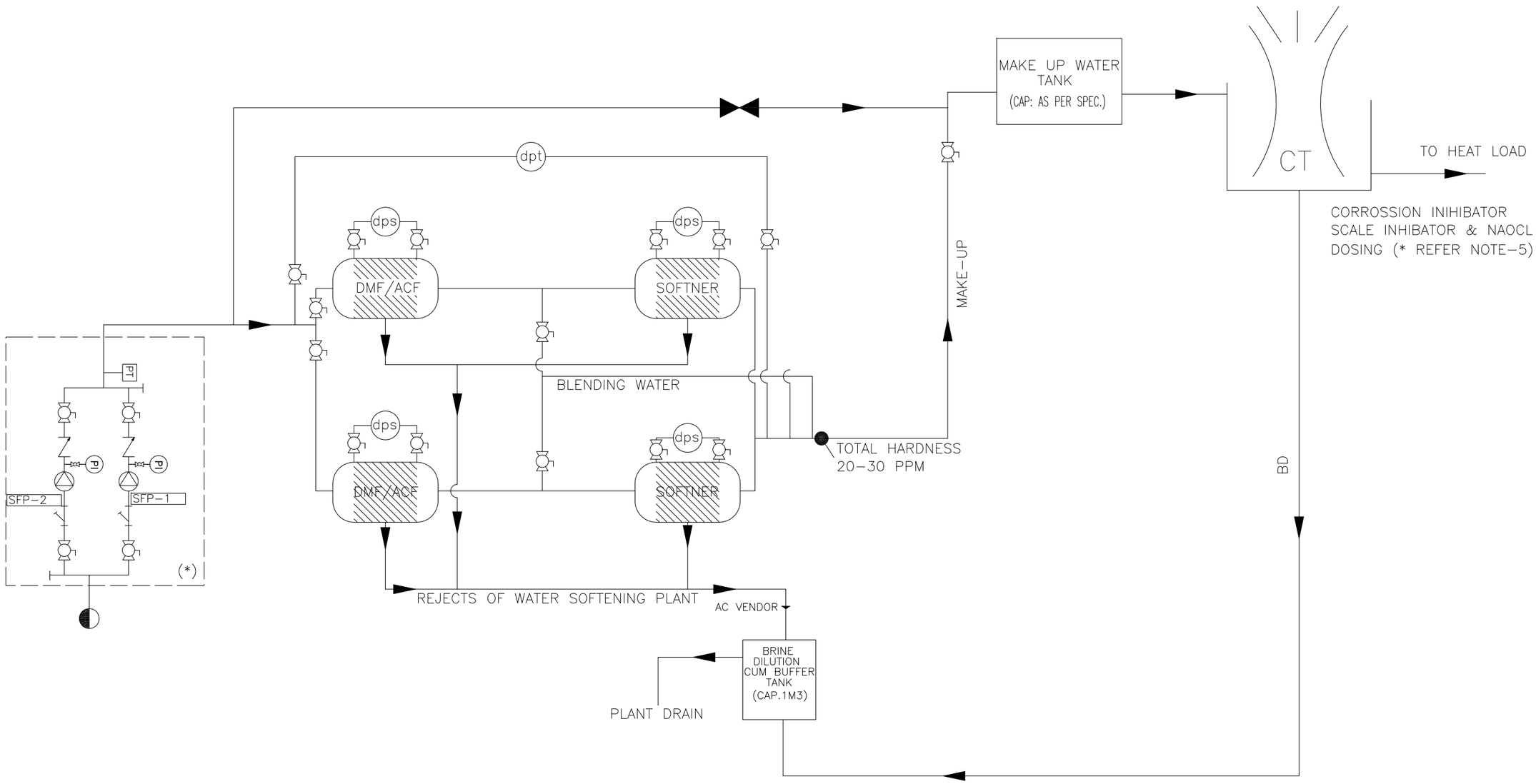
TITLE: PROCESS & INSTRUMENTAION DIAGRAM FOR HVAC SYSTEM

DEPT. | SCALE | DRAWING No. PE-DG-495-571-11000A-A101 | SHEET 01 OF 01 | REV 00

SIZE-A1

DRAWING No. PE-DG-495-571-11000A-A101

CUSTOMER'S DRAWING No.



SKID MOUNTED WATER SOFTENING PLANT

SFP- SOFTENING FEED PUMP
ACF- ACTIVATED CARBON FILTER
DMF- DUAL MEDIA FILTER
BD - BLOW-DOWN
CT - COOLING TOWER
(FT) FLOW TRANSMITTER
(DPS) DIFF. PRESS. SWITCH

NOTES:

1. KKS TAGGING SHALL BE PROVIDED FOR ALL INSTRUMENTS & EQPT.
2. BD BLOW DOWN TO BE CONTROLLED TO ENSURE A CYCLE OF CONCENTRATION OF 05
3. INSTRUMENTS WHICH ARE USED FOR PROTECTION / CLCS SHALL BE TRIPLE REDUNDANT, USED FOR INTERLOCK& PERMISSIVE SHALL BE DUAL REDUNDANT AND USED FOR ONLY ALARM OR INDICATION SHALL BE SINGLE.
4. VALVES & INSTRUMENTS SHOWN ARE MINIMUM. THE SAME SHALL BE PROVIDED IN LINE WITH THE MAIN PLANT PHILOSOPHY TECHNICAL SPECIFICATION.
5. DMF/ACF FILTER MEDIA SHALL CONSIST OF GRADED QUARTZ SAND INCLUDING GRAVELS & PEBBLES (FREE FROM CARBONATES AND OTHER FOREIGN MATTER) AND ANTHRACITE AS PER REQUIREMENT.
5. SUITABLE COOLING WATER TREATMENT PROGRAM (Viz SCALE INHIBITOR/ CORROSION CORROSION INHIBITOR/BIO DISPERSANT/NAOCL ETC.) MUST TO DOSED TO MAINTAIN A CORROSION, SCALE & MICROBIOLOGICAL FOULING FREE WATER CHEMISTRY IN THE COOLING WATER CIRCUIT FOR EFFICIENT OPERATION OF AC SYSTEM.
6. MOC SHOULD BE AS PER TECHNICAL SPECIFICATION AND SHALL BE COMPATIBLE WITH THE PROCESS REQMT. & FLUID BEING HANDLED. BIDDER TO GIVE DETAILS OF IN IN SUPPORT OF THE MOC THUS SELECTED FOR SUITABILITIES OF THE MATERIAL WHEREVER NOT SPECIFIED IN THE TENDER.
7. SKID MOUNTED SOFTENING PLANT (2 X 100 %) WITH INSTRUMENTS, SOFTENING FEED PUMPS, REGENERATION PUMPS, VESSELS, BUFFER TANK , ASSOCIATED PIPING & VALVES UPTO MAKE-UP WATER TANK AND FROM MAKE-UP WATER TANK UPTO COOLING TOWER SHALL BE CONSIDERED AS A SINGLE PACKAGE. FURTHER PRICES SHALL BE QUOTED AGAINST " SKID MOUNTED SOFTENING PLANT..." MENTIONED IN PRICE SCHEDULE FOR RESPECTIVE AC PLANTS.
8. TECHNICAL GRADE OF SALT SUITABLE FOR INDUSTRIAL USE SHALL BE USED.

CUSTOMER	DAMODAR VALLEY CORPORATION (DVC)
CONSULTANT	MECON
PACKAGE:	HVAC SYSTEM FOR HYDRO
PROJECT	R M & U FOR PANCHET HYDEL STATION 1X46 MW

BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR, PROJECT ENGINEERING MANAGEMENT, NOIDA.

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	Sd/-	08.09.2022
	DSGN	VK	Sd/-	08.09.2022
	CHD	LJ	Sd/-	08.09.2022
	APPD	SG	Sd/-	08.09.2022

TITLE: SCHEME FOR WATER SOFTENING PLANT

DEPT. | SCALE | DRAWING No. PE-DG-495-571-11000A-A102 | SHEET 01 OF 01 | REV 00

SIZE-A1

DRG.No.DRG.No.MEC/53/11/076P/TS/M/01

LOCATION OF CONTROL ROOM IN POWER HOUSE EL. 347.0 FT

LOCATION OF COOLING TOWER, MAKE UP WATER TANK, CONDENSER WATER PUMPS EL. 357.0 FT

RESERVIOR ROAD (TOP OF DAM.)

SLOP

SLOP

OPERATING FLOOR

SPIL WAY GATE

SLOP

SLOP

SLOP

SLOP

SLOP

UNIT # 1

UNIT # 2

POWER HOUSE

ELECTRICAL PANNEL

VENTILATION ROOM 1 (DAM SIDE) EL. 357.0 FT

VENTILATION ROOM 2 (TRANSFORMER SIDE) EL. 360 FT

TER OUTLET FROM SPILWAY

ENTERANCE

TRANSFORMAR

TRANSFORMAR

LOCATION OF PAC ROOM (ADJACENT TO CONTROL ROOM) EL. 347.7FT

GANTRY CRANE

SLOP

SLOP

MAIN GATE

RCC ROAD

CISF

DG ROOM

CANTEEN

SPACE FOR PUMP HOUSE SUMP.

WATER OUTLET FROM POWER HOUSE

TENDER PURPOSE ONLY

DAMODAR VALLEY CORPORATION (DVC)

मैकॉन लिमिटेड

MECON LIMITED

PANCHET HYDEL STATION

LAYOUT DRAWING OF PANCHET HYDEL STATION

SECTION	PP&EE
LOCATION	RANCHI
DESIGNED	A CHATTERJEE
DRAWN	SATISH
CHECKED AND VERIFIED	J K SINGH
APPROVED	
SIG.	
DATE	
SCALE:– NTS.	
SHEET	1 OF 1
REV.	0
DRG.No.MEC/53/11/070P/TS/M/02	

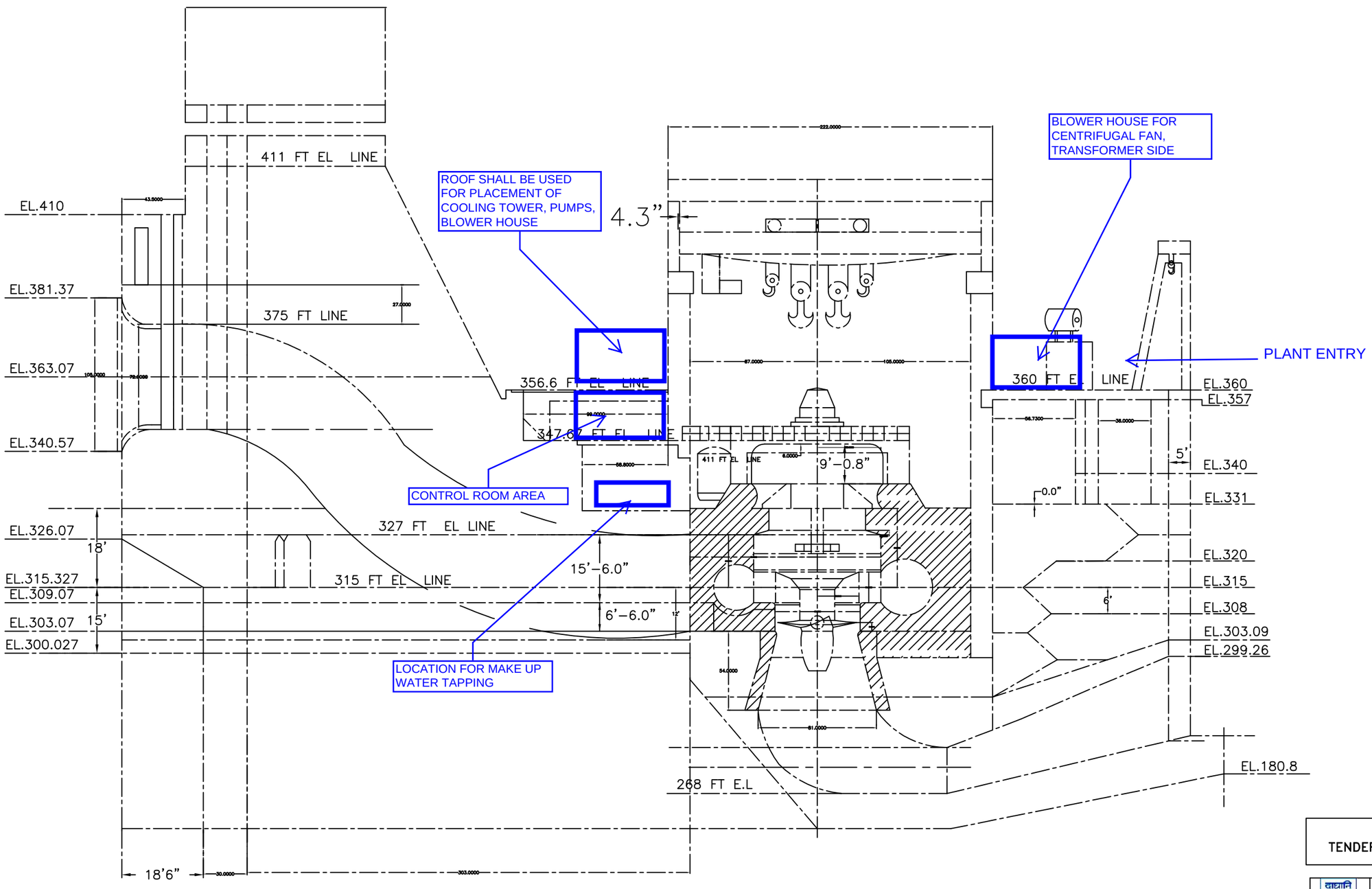
NOTES:–
1. ALL DIMENSIONS & LEVELS ARE IN METRES AND ONLY FIGURED DIMENSIONS SHALL BE FOLLOWED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG. NO. MEC/11/11/Q670/DE/RF/35/7421 SHEET 2 OF 2.

REFERENCES DRG. NO.

REVISIONS: REV.NO. | DATE | ZONE | DESCRIPTION | BY | VERIFIED

REV/SEC | GL.& T. | M.H. SEC. | B.F. | S.M.S. | CONCURRED BY

DRG.No.DRG.No.MEC/53/11/070P/TS/M/01



TENDER PURPOSE ONLY

DAMODAR VALLEY CORPORATION (DVC)

मैकॉन लिमिटेड

MECON LIMITED

NOTES:-
1. ALL DIMENSIONS & LEVELS ARE IN METRES AND ONLY FIGURED DIMENSIONS SHALL BE FOLLOWED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG. NO. MEC/11/11/Q670/DE/RF/35/7421 SHEET 2 OF 2.

REV./SEC.	GL.& T.	M.H. SEC.	B.F.	S.M.S.
	CONCURRED BY			

REV.NO.	DATE	ZONE	DESCRIPTION	BY	VERIFIED
			REVISIONS		

REFERENCES — DRG. NO.

THIS DRAWING IS THE PROPERTY OF MECON AND IS ISSUED FOR THE SPECIFIC PROJECT MENTIONED THEREIN. THIS IS NOT TO BE COPIED OR USED FOR OTHER PROJECTS UNLESS EXPRESSLY PERMITTED BY MECON.

SECTION	PP&EE
LOCATION	RANCHI
DESIGNED	A CHATTERJEE
DRAWN	SATISH
CHECKED AND VERIFIED	J K SINGH
APPROVED	
SIG.	
DATE	

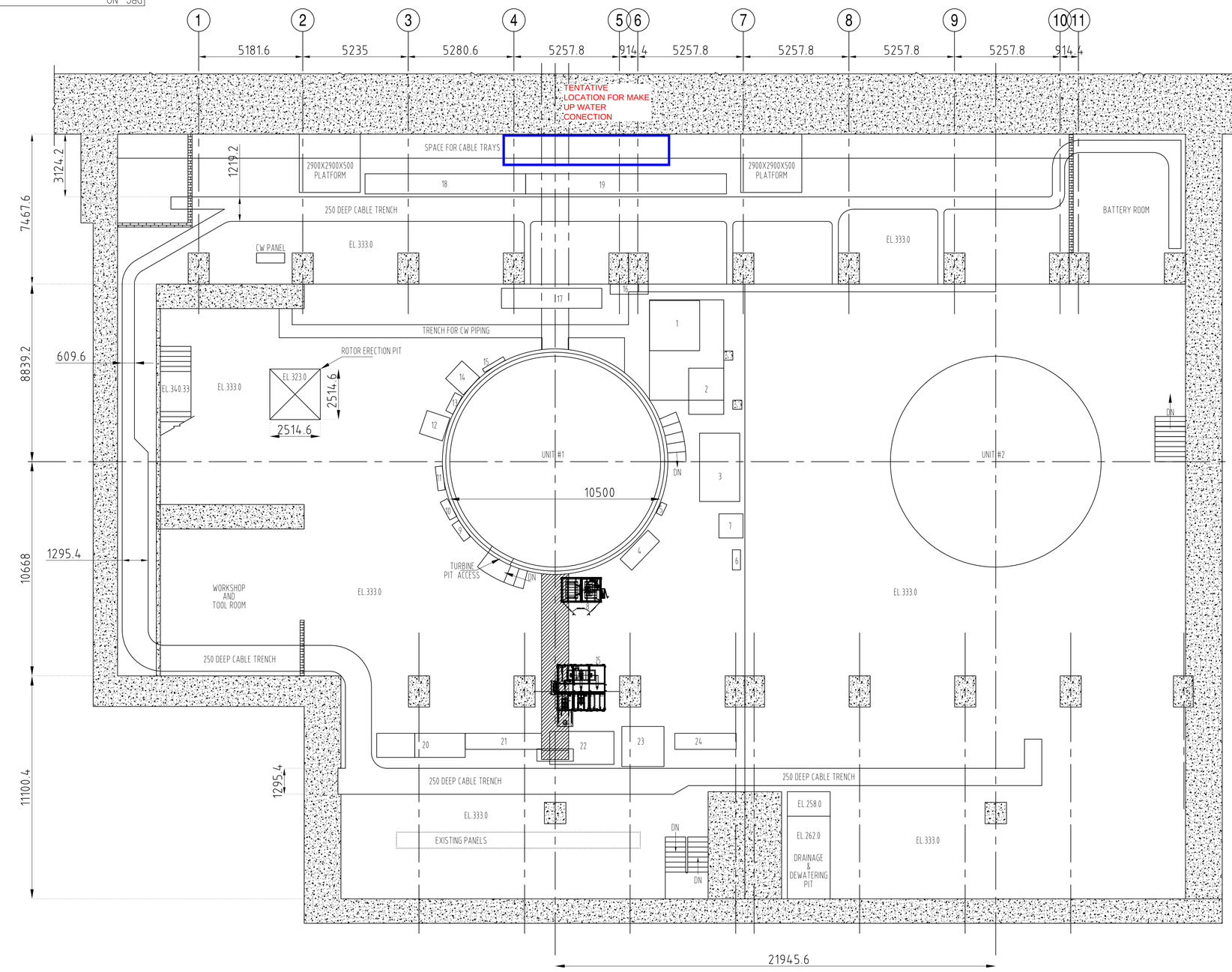
PANCHET HYDEL STATION

CROSS SECTION DRAWING OF UNIT#1

SCALE:- NTS.

SHEET	REV.
1 OF 1	0

DRG.No.MEC/53/11/070P/TS/M/01



PLAN AT EL 333.0 ft

TABLE FOR DIMENSION OF EQUIPMENTS(TENTATIVE)

ITEM NO	DESCRIPTION	WIDTH	DEPTH	HEIGHT	QTY/UNIT	TOTAL QTY	WT.(KG)	SUPPLYING UNIT
1	PP SET	2500	2500	2300	1	1	-	HPE GOV
2	PISTON TYPE PRESSURE ACCUMULATOR	1750	2300	2400	1	1	-	HPE GOV
3	N2 BOTTLE BANK	3400	2000	1800	1	1	-	HPE GOV
4	HS LUBRICATION SYSTEM	2000	800	800	1	1	-	HGE
5	H.S LUB. STARTER PANEL(AC)	1000	400	1400	1	1	-	HPE ELEC
6	H.S LUB. STARTER PANEL(DC)	1000	400	1400	1	1	-	HPE ELEC
7	MOTORISED POWER PACK	1200	1200	1800	1	1	-	HGE
8	NG CUBICLE	2000	1250	2100	1	1	-	RUDRAPUR
9	TOP COVER DRAINAGE PUMP STARTER PANEL	1000	400	1400	1	1	-	HPE ELEC
10	GENERATOR SPACE HEATER PANEL	1000	400	1200	1	1	-	HPE ELEC
11	BRAKE & JACK PANEL	1100	350	1200	1	1		HGE
12	CARBON DUST COLLECTOR(CDC)	1200	1200	2300	1	1	-	HGE
13	CDC & BDC STARTER PANEL	1000	400	1200	1	1	-	HPE ELEC
14	BRAKE DUST COLLECTOR(BDC)	1200	1200	2300	1	1	-	HGE
15	MARSHALLING BOX	1500	200	1200	1	1	-	HGE
16	STARTER PANEL FOR PP SET	1900	500	2200	1	1	-	HPE ELEC
17	CO2 FIRE FIGHTING SYSTEM FOR GEN.	5000	1000	2300	1	1	-	HGE GOVC.
18	UAB	8000	1000	2600	1	1	-	HPE GOVC.
19	SAB	11000	800	2600	1	1	-	HPE ELEC.
20	EXCITATION PANELS	4410	1200	2295	1	1	-	EDN
21	UCB	3804	800	2300	1	1	-	EDN
22	GDS	2800	1640	3200	1	1	-	SWGR
23	ET	3000	1500	2295	1	1	-	JHANSI
24	LCB FOR COMMON SERVICES	3804	800	2300	1	1	-	EDN
25	LAVT	2400	2250	1900	1	1	-	RUDRAPUR

NOTES:
1. ALL ELEVATIONS ARE IN FEET AND DIMENSIONS IN MM.

ADDITIONAL INFORMATION		PROJECT	2X40 MW PANCHET HEP (R&M)	
STATUS OF DRAWING	U	CUSTOMER	DVC LTD.	
DISTRIBUTION OF PRINTS		CONSULTANT	-	
		DVC DWG NO	2203 121 P V M F 002	
NAME / SIGN / DATE / NO. OF VAR.		CONTRACTOR	भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भोपाल Bharat Heavy Electricals Limited, Bhopal	
DRWN B SINGH 23.07.22				
CHKD B SINGH 23.07.22				
APPD R SINGH 23.07.22				
SUB-SUPPLIER / VENDOR		DEPT HSE / CODE 415	UNTOL. DIMS. GR. / ANGLE / SCALE -- / WEIGHT(kg) / REF.TO ASSY.DRG. / ITEM NO. / NO.OF ITEMS	
		TITLE	STATION LAYOUT PLAN AT EL 333 FT	
		DRAWING NO.	1-200-00-219 52	REV. 00
		SHEET NO. 01	NO. OF SHEETS. 01	

REV. / DATE / ALTERED / CHECKED / APPROVED / ZONE

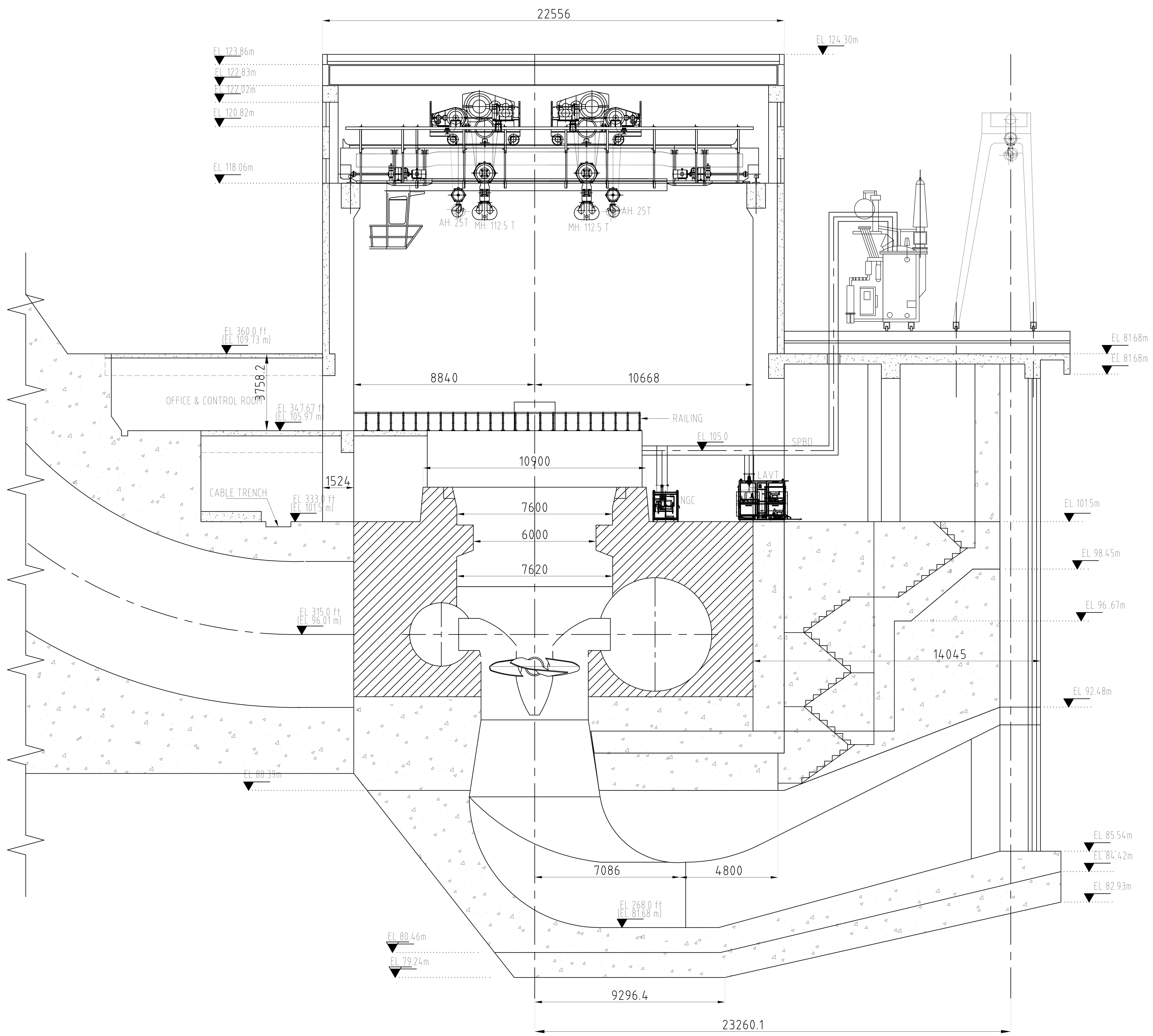
REF. DRG. NO. / SIGN. & DATE / INVENTORY NO.

A1 SIZE

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN "mm")

DRG. NO. 1 200 00 204 52 REV. 06



NOTES:
1. ALL ELEVATIONS ARE IN FEET AND DIMENSIONS IN MM.

ADDITIONAL INFORMATION	
STATUS OF DRAWING	U
DISTRIBUTION OF PRINTS	
PROJECT	2X40 MW PANCHET HEP (R&M)
CUSTOMER	DVC LTD.
CONSULTANT	-
DVC DWG NO	2201 121 P V M F 001
CONTRACTOR	भारत हेवी इलेक्ट्रिकल्स लिमिटेड, भोपाल Bharat Heavy Electricals Limited, Bhopal

	NAME	SIGN	DATE	NO. OF VAR.
DRWN	B SINGH		23.07.22	
CHKD	B SINGH		23.07.22	
APPD	R SINGH		23.07.22	

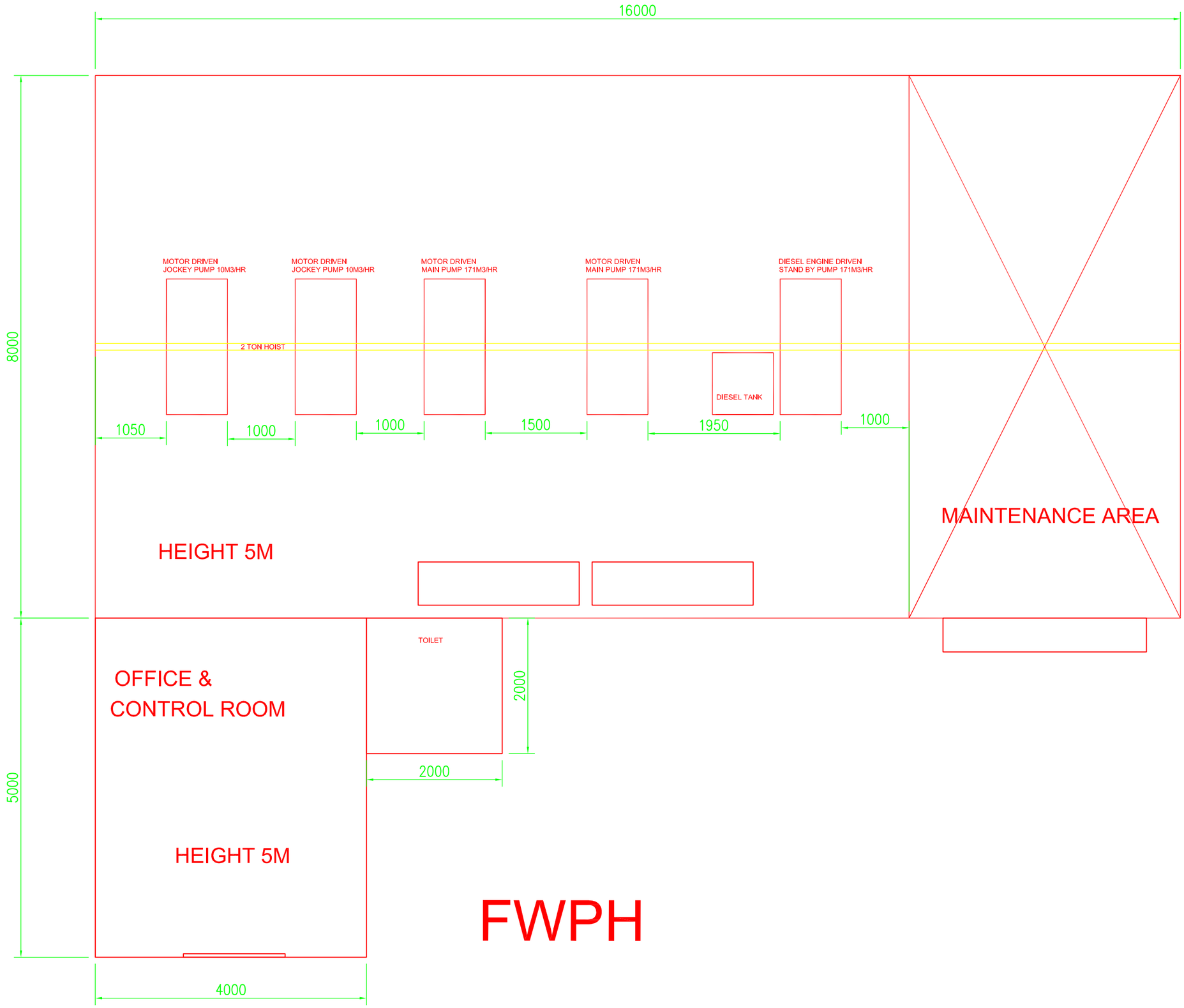
DEPT	CODE	UNTOL. DIMS. GR.	ANGLE	SCALE	WEIGHT(kg)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEMS
HSE	415			1:80				

SUB-SUPPLIER / VENDOR

TITLE	POWER HOUSE CROSS SECTION	DRAWING NO. 1-200-00-219 51	REV. 00
		SHEET NO. 01	NO. OF SHEETS. 01

REV. | DATE | ALTERED CHECKED APPROVED | ZONE

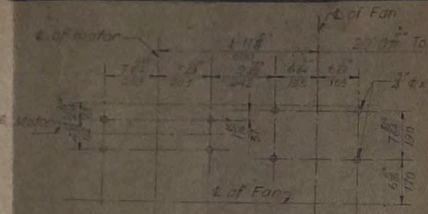
A1 SIZE


16000
8000
MOTOR DRIVEN
JOCKEY PUMP 10M3/HR
MOTOR DRIVEN
JOCKEY PUMP 10M3/HR
MOTOR DRIVEN
MAIN PUMP 171M3/HR
MOTOR DRIVEN
MAIN PUMP 171M3/HR
DIESEL ENGINE DRIVEN
STAND BY PUMP 171M3/HR
2 TON HOIST
DIESEL TANK
1050
1000
1000
1500
1950
1000
MAINTENANCE AREA
HEIGHT 5M
TOILET
2000
OFFICE &
CONTROL ROOM
2000
5000
HEIGHT 5M
FWPH
4000

PLAN - EL 354.0
KEY PLAN
SECTION A-A (Only ductwork shown)
PLAN El 360.0
(Concrete in column not shown)
PLAN EL 347.67
(Ref. PPC 729)
NOTE:-
1. Mounting details of fan and air filters are to be furnished by the suppliers
2. Grilles 1 & 2 shall be of straight vanes set at an angle of 45°
3. Grille 1 size 2'-6" x 2'-6" and capacity 1500 cfm.
4. Grille 2 size 2'-0" x 3'-2" and capacity 1500 cfm
REFERENCE DRAWINGS:-
SYMBOL:-
PRINTS
20/13
SL. NO. 90.
DAMODAR VALLEY CORPORATION
PANCHET HILL
POWER HOUSE
VENTILATION SHEET-1
LAYOUT OF DUCTS
22.6.56


SECTION C-C
(PPM-822)
SECTION B-B
(Pent house not shown)
(PPM-821 & PPM 822)
SECTION G-G
DETAIL-H
DETAIL-K
SECTION M-M
SECTION L-L
(PPM 822)
VIEW X-X
SECTION Q-Q
SECTION P-P
Detail-N
Kitchen roof ventilator F5
Office washroom roof ventilator F4
Power roof ventilator F6
Carrier equipment room
Office
Contraction Jt.
Reducer
Duct 3'-0"x5'-3"
Duct 8'x8"
Duct 3'-3"x3'-0"
El. 360.0
El. 347.67
El. 344.50
El. 335.0
El. 333.0
El. 356.50
El. 405.48
El. 400.0
Slab
Purlin
℄ Exhaust Fan F2
℄ Units
℄ Supply Fan F1
℄ Fan F1
℄ Fan F7
Gallery roof El. 297.0
Generator bus duct by AEG
Handrailing
Screen
Louver
Angle
Cork
Fan mounting plate
℄ exhaust fan F8
Powerhouse left wall
Anchor the duct to the wall through angle cleats on either side of the duct
Duct 1'-3"x1'-3" for ventilating non-conditioned space in El. 347.67 floor (upstream)
Lead gasket
Braze or weld to duct
NOTE:-
1. Mounting details of fan and air filters are to be furnished by the suppliers.
2. All bend and abrupt connection shall be provided with guide vanes.
REFERENCE DRAWINGS:-
Work this drawing with Dwg 118C59, 118C62, 118C73, 118C77, PPM-821, PPM-822
SYMBOLS:-
1. Direction of air flow in duct
2. Placement of grille in the longitudinal direction of the duct
S.L.NO.95
DAMODAR VALLEY CORPORATION
PANCHET HILL POWER HOUSE
VENTILATION SHEET-3
SECTIONS
PRINTS
22.5.58

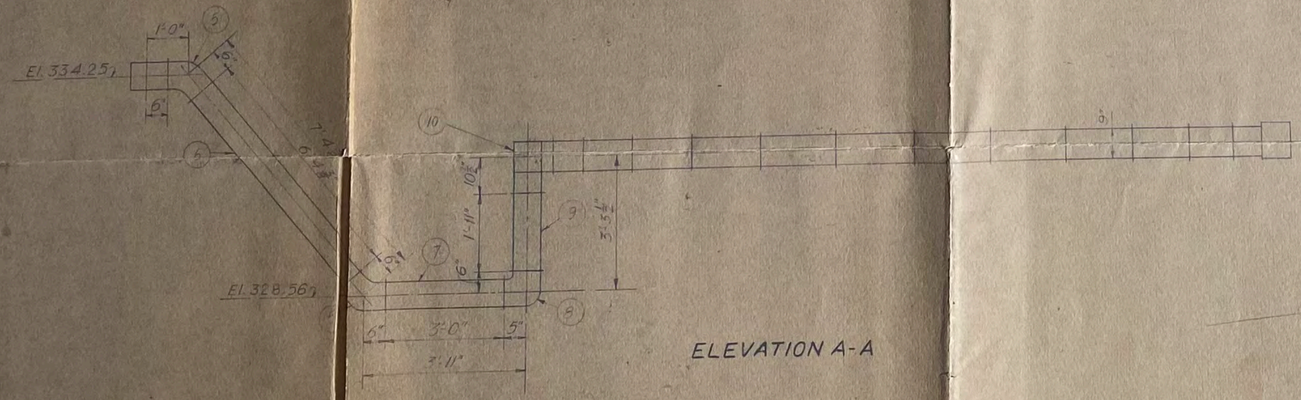
Block 3
Block 4
Block 5
Block 6
B (PPM-823)
Bottom of duct El. 342.5
Bottom of duct El. 341.50
Contraction Jt.
Sewage treatment area
Battery room
Penstock expansion joint access well.
℄ Unit-1
℄ Unit-2
Duct 8'x 8'
Hand rail
Fan F.7
PLAN-EL 344.0
KEY PLAN
Axis of dam
DETAIL-D
SECTION F-F
(Typical for 14"φ concrete opening)
SECTION E-E
Transition fitting square to round
15"x 15" square duct from battery room
NOTE :-
1. Mounting details of fan and air filters are to be furnished by the suppliers.
2. Grilles 4 & 6 will be of diverging vanes type with the end vanes set at an angle of 45°.
REFERENCE DRAWINGS :-
SYMBOLS :-
1. Direction of air flow in ducts
2. Direction of grille in ducts
HOLD
Penthouse
Spillway
Air filters
Detail-D
14"φ conc. opening for kitchen roof ventilator
14"φ concrete opening for P.H. washroom roof ventilator
PLAN-EL.360.0
SL. NO. 92.
DAMODAR VALLEY CORPORATION
PANCHET HILL POWER HOUSE
VENTILATION SHEET-2
LAYOUT OF DUCTS
PRINTS
REV. NO. DATE NATURE OF REVISION
PPM-822



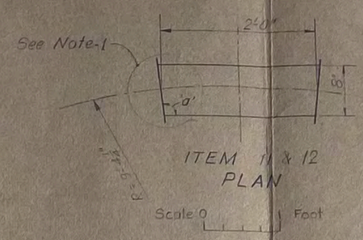
FOUNDATION PLAN OF FAN & MOTOR AT FLOOR EL. 333.00

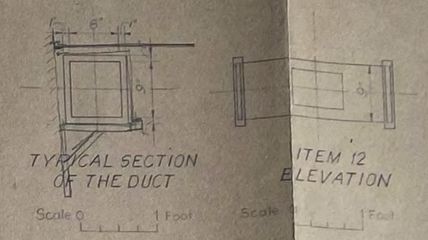
Scale 0 1 Foot

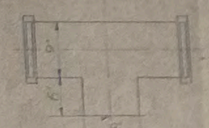
PLAN

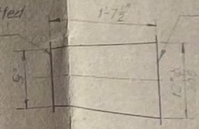


ELEVATION A-A





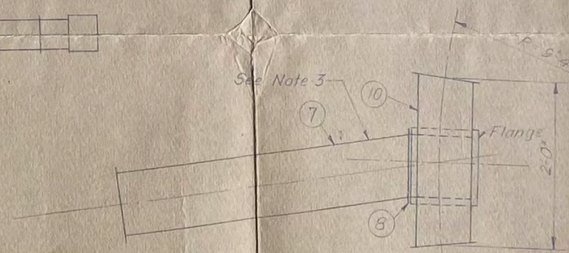




ITEM 1
PLAN

Scale 0 1 Foot

SCHEDULE OF PARTS		
Item No	Description	Reqd. Nos
1	Reducer, circular to rectangular (as shown)	1
2	40° Elbow	1
3	8"x9" Straight duct	1
4	84° Elbow	1
5	30° Elbow	2
6	8"x9" Straight duct	1
7	8"x9" " "	1
8	90° Elbow	1
9	8"x9" Straight duct	1
10	Tee	1
11	8"x9"x2'-0" Long straight duct (as shown)	17
12	8"x9"x2'-0" " " " with grille	4
13	10"x11" Plate for closing the duct	2



DETAIL-A

Scale 0 1 Foot

NOTES:

1. The angle marked 'a' will be determined by the manufacturer in the workshop by actual plotting on the floor.
2. The bolt holes on the duct flanges are not shown. The number of bolts will be determined by the manufacturer.
3. The duct No. 7 is to be made 3'-6" long and the flange (for fixing with Elbow 8) will be fitted at an angle at site to suit.

REFERENCE DRAWINGS:

1. Foundation plan of Centrifugal Fan Type L4230 Arrn. 3 Forth V2 with Kirloskar Motor ¼ H.P. 1420 R.P.M. Frame Size B100 Dwg. No. C-229786 of SF Products India Ltd.

Scale 0 2 4 6 Feet
Except as noted

DAMODAR VALLEY CORPORATION

PANCHET HYDEL STATION

ASSEMBLY OF DUCTS FOR TURBINE PIT VENTILATION

DESIGNED		
CHECKED	DATES CHANGE IN RECORDS	
DRAWN	DATE 16.11.64	DWG NO. PH/GEN 157

1X46 MW PANCHET HEP - (RMU-RENOVATION, MODERNIZATION & UP GRADATION WORKS)

(SITE PHOTOGRAPHS-HVAC SYSTEM)

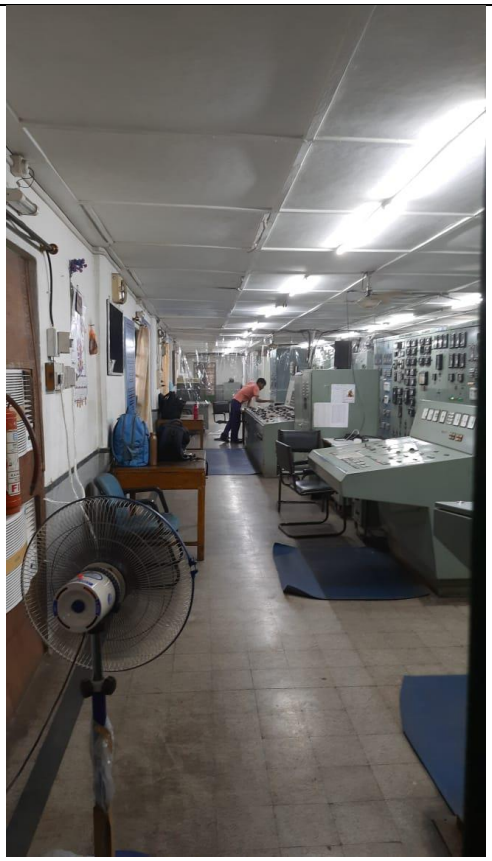
ANNEXURE-I

Site Photographs for HVAC System are attached for bidder reference. However, bidders, in their own interest, are advised to visit the site and assess the work requirements in line with scope of HVAC covered in this specification, before quoting for this tender.

Fresh Air Blower with Motor and Duct	
Duct Routed below Control Room	
Panoramic view of Area above Control Room where Condenser Water Pump, Cooling Tower and Make up water tank is planned	

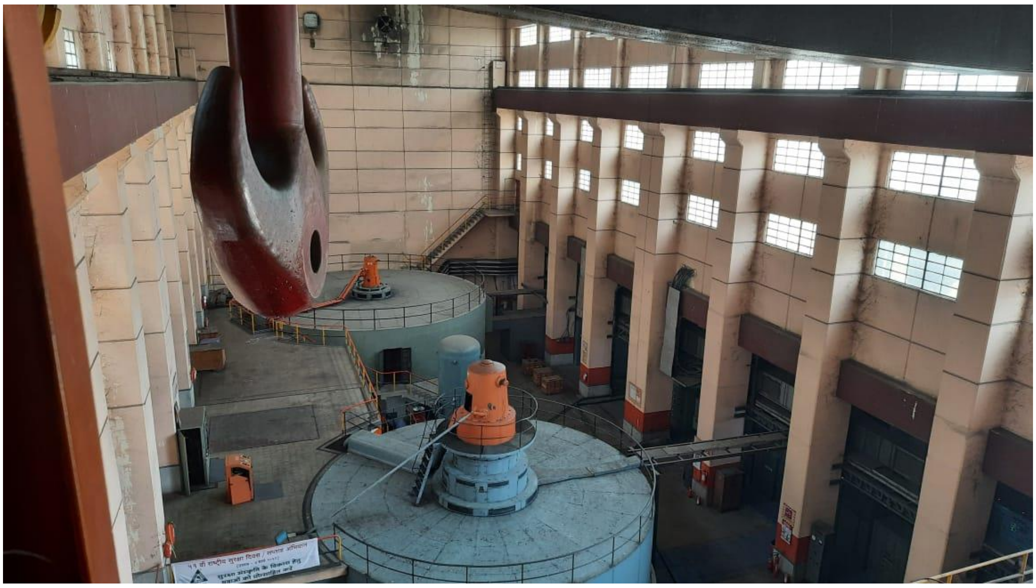
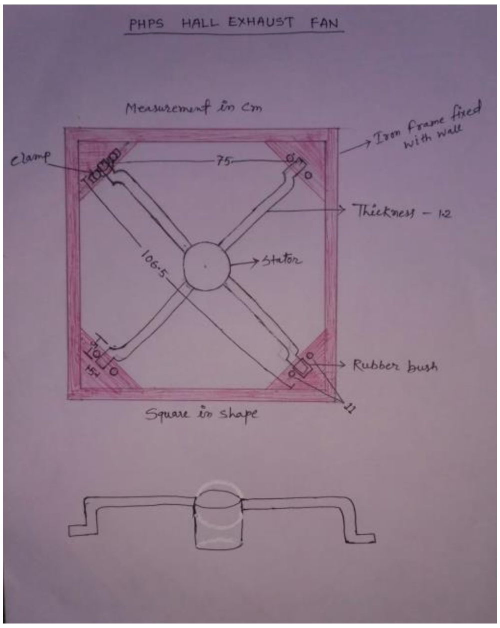
1X46 MW PANCHET HEP - (RMU-RENOVATION, MODERNIZATION & UP GRADATION WORKS)

(SITE PHOTOGRAPHS-HVAC SYSTEM)

Control Room	
Centrifugal Exhaust Fan with Duct for Ventilation of Turbine pit	
Tube Axial Fan along with Duct for Supplying air to Power house basement	

1X46 MW PANCHET HEP - (RMU-RENOVATION, MODERNIZATION & UP GRADATION WORKS)

(SITE PHOTOGRAPHS-HVAC SYSTEM)

Birds Eye View of Power house. Ventilation Duct is routed below control room which is on left side at EL. 347.67 Ft (Generator Planform) and between column located on right side of Generator (Part of Duct Visible) **Ventilation Exhaust Fan opening is visible at Gable end**	
Fan Opening Dimension (Exhaust Fan)	
Ventilation Duct routed to Mechanical workshop at El. 333 Ft	

977050/2022/PS-PEM-MAX

1X46 MW PANCHET HEP - (RMU-RENOVATION, MODERNIZATION & UP GRADATION WORKS)

(SITE PHOTOGRAPHS-HVAC SYSTEM)

Ventilation Duct Dropping from Blower Room at Transformer Area