

DEENDAYAL PORT AUTHORITY

An ISO 9001 : 2008 & ISO 14001 : 2004 Certified Port



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No.: EL/AC/2879

Date: 14/05/2024

EXPRESSION OF INTEREST [EOI] for

“Design, Supply, Erection/Installation, Testing & Commissioning of HVAC System and Electrical items at SVP Auditorium of DPA at Gopalpuri with Comprehensive Operation and Maintenance for 02 years after 01 year guarantee /warranty period from the date of taken over by DPA.”

Executive Engineer (Electrical), DPA invites Expression of Interest for the work of “Design, Supply, Erection/Installation, Testing & Commissioning of HVAC System and Electrical items at SVP Auditorium of DPA at Gopalpuri with Comprehensive Operation and Maintenance for 02 years after 01 year guarantee /warranty period from the date of taken over by DPA.” Those reputed firms, who have executed similar work in Government/ Public Sectors or in leading private organizations may submit their budgetary offer, in the prescribed format attached herewith with stamp & signature on each page as a token of acceptance of the scope of work, technical specifications, term & conditions etc.

The interested firms are requested to submit their budgetary offers for the said work in the format enclosed at **Annexure - I** the complete EOI (Expression of Interest) shall be submitted to the office of the undersigned on or before 27/05/2024.

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**Executive Engineer (E)
Deendayal Port Authority**

Bill of Quantities

Name of the Work: Design, Supply, Erection/Installation, Testing & Commissioning of HVAC System and Electrical items at SVP Auditorium of DPA at Gopalpuri with Comprehensive Operation and Maintenance for 02 years after 01 year guarantee /warranty period from the date of taken over by DPA.

Part - A HIGH SIDE WORK					
Sr. No.	Description	Qty.	Unit	Rate in Unit Rs.	Amount in Rs.
1.	VRV/VRF Outdoor Unit				
	<p>Supply, Erection/Installation, Testing & Commissioning of Suitable for operating on 42°C Ambient Temperature with Blue Fin treatment to outdoor unit (ODU) Heat Exchanger with Variable Evaporating Temperature Function/Sliding. Temperature Selection Option as per Project Location. Design Condition selection from ODU Control Panel, working on HFC Refrigerant R410A for minimum cooling capacity as mentioned below at designed conditions and suitable for operation in cooling mode complete with inverter scroll compressor of 20HP Single Module with Single Inverter Compressor (multiple compressor will not be allowed) Housed in a separate Protective Enclosure & not in condenser hot airstream, with the following minimum features; Proved design induction Motor, Induction type Heater, Low Pressure Compressor shell, HIC (Heat Inter Change) Circuit. Built in Reverse Phase Protection, internally grooved copper tube with aluminium fins treated with blue fin or equivalent to protect against saline Corrosive weather conditions, air cooled condenser, rotation control to maintain equal working hours when multiple ODUs are connected in common circuit, Pulse width modulation (PWM) over modulation control, condenser fan with BLDC Motor with an adjustable Electronic stability program (ESP) as per site condition, suitable for operating on 415 V ± 10%, 50 Hz. 3 phase power supply (all suitable for high ambient conditions), internal wiring, fully microprocessor based controller etc. All are housed in an attractive, powder coated weather proof cabinet, as per the approved drawings and specifications. The condensing unit shall also be provided with screen/mesh to prevent bird/damage. The outdoor unit shall have low operating noise.</p> <p>Each Outdoor Unit module shall be equipped with 100% single inverter driven scroll hermetic compressor of rating of 20HP or above, Inverters should be protected by in built factory supplied DC Bus Current in order to control the frequency.</p>				
1.1	40 HP Outdoor Unit (cooling only) Make: Daikin, Blue star, LG, Mitsubishi, Carrier, Toshiba, Voltas.	9	Nos.		
2.	VRV/VRF Indoor Unit				

	<p>Supply, Erection/Installation, Testing & Commissioning of Indoor Units shall be made of Galvanised Steel Plate Casing, insulated with Sound Absorbing Material, Drainage arrangements, Fan, Refrigerant Liquid and Gas Piping and Fresh Airport etc. complete in all respects and as per Specifications. All the Motors shall work on 3 Phase AC LT Power Supply.</p> <p>The Unit shall consist of Cooling Coil, one or more Centrifugal Fans, Electric Motor, Condensate Drain Pan, Galvanized Steel Casing and Electric Junction Box. The Condensate Drain Pan shall be constructed with Heavy Gauge Galvanized Steel adequately treated against Corrosion & shall be Insulated. The Unit shall be provided with Washable Filter or as recommended by the Manufacturer. The Fans shall be Statically & Dynamically Balanced and Specially Designed for quiet operation. The Motor shall be provided with three in-built speeds and Resiliently Mounted with adjustable mounting and shall be Direct Driven.</p>				
2.1	8.0 TR Ductable Unit	2	Nos.		
2.2	Cordless remote receiver for ductable unit	2	Nos.		
2.3	Drain pump for ductable unit	10	Nos.		
2.4	SITC of AHU kits	16	Nos.		
2.5	Branch distribution joints for refrigerant piping	12	Nos.		
3.	Floor mounted air handling unit with dx type condenser				
3.1	<p>Supply, Erection/Installation, Testing & Commissioning of floor mounted direct expansion (dx) type air handling unit (thermal break profile) double skin type horizontal air handling units made of 50 mm thick panels consisting of pre coated casing of thickness 0.8 mm outside layer and 0.8 mm inside layer with polyurethane foam (puf) insulation having density 43 ± 2 kg/m³ factory injected between them by injection moulding machine, consisting of plug fans with VFD suitable for static pressure as per required class suitable for $415 \pm 10\%$ V, 50hz, 3 phase ac supply, cooling coil section dx type with aluminium finned copper tubes, cooling coil of 6 row deep and prefilter-10 micron , pre filter should be washable synthetic type, fine filter –3 micron, hepa filter - 0.3 micron, drain connections stainless steel drain pan with insulation, wherever required, necessary vibration isolation arrangement.</p>				
	Note : cost should be inclusive for VFD, Local Electrical Control Panel (starter panel) with cabling from panel to AHU Outdoor units etc. as required.				
3.2	<p>Supply, Erection/Installation, Testing & Commissioning of 13000 CFM AHU Unit of SP-75 mm. wg Filtration –up to 0.3 micron- 30.5 tr along with proved design Motor of 3 Phase, 50HZ, 415VAC. Make: Daikin, Blue star, LG, Zeco Aircon , Citizen Industries, Edge tech air system.</p>	8	Nos.		
Total Basic Amount for the High Side Work of Part –A					

Part - B LOW SIDE WORK

Sr. No.	Description	Qty.	Unit	Rate in Unit Rs.	Amount in Rs.
1.	Copper Piping				
1.1	Copper piping with its accessories between IDU to ODU as per proved design with insulation sleeve and proper supporting for VRV/VRF hard copper pipe for header & soft pipe for drain after refrigerator joint with 19mm nitrile class O insulation	1500	RFT		
1.2	GI Cable tray with its accessories for exposed copper piping on terrace/hanging with support (200 x 50 x 1.2mm), length 2.5 mtr.	1500	RFT		
2	Transmission cabling - IDU to ODU (1.0sqmm 2core shielded)	3000	RFT		
3	Insulated 50MM PVC Drain piping with 6 mm nitrile class 1 insulation	500	RFT		
4	Factory/site fabricated rectangular GI ducting				
4.1	24 G	15000	SQ.FT		
4.2	22 G	20000	SQ.FT		
5	Duct Insulation				
5.1	19 mm Duct thermal nitrile Insulation class o	20000	SQ.FT		
5.2	50 mm Glass Wool Insulation	4200	SQ.FT		
6	ADP Unit				
6.1	Aluminium powder coated sq. diffuser with volume control damper for supply air & return air	500	SQ.FT		
6.2	Duct Damper	250	SQ.FT		
6.3	White Cotton Fabric Canvas for connection AHU/DUCTABLE	20	Nos.		
7	Additional refrigerant charging				
7.1	Additional refrigerant charging for VRV/VRF unit SVP hall	1	LOT		
8	Supply, Installation ODU M S stand				
8.1	Outdoor unit with heavy duty M S stand - simple type for VRV/VRF condensor unit	630	KG		
9	Cables and Cables termination				
	Supply & Laying Testing and Commissioning of following sizes of LT Cable XLPE Insulated PVC sheathed copper conductor Armoured Cable on existing cable tray /surface including saddle, clamp as required. This also includes termination with copper lugs and bimetallic shims.				
9.1	4.0 C x 2.5 sq mm. copper armoured xlpe cable	1000	Mtr.		
9.2	4.0 C x 10 sq mm. copper armoured xlpe cable	1000	Mtr.		
9.3	4C x 2.5 sq mm copper un armoured flexible cable	700	Mtr.		
9.4	3C x 1.5 sq mm copper un armoured flexible cable	1000	Mtr.		
10	Supply, Erection/Installation of Earthing				
10.1	25 x 6 mm GI strip	250	Mtr.		
10.2	6 SWG GI wire	250	Mtr.		
10.3	Copper Earthing rod 50 mm diameter & 2-meter length with filling compound complete work with labour and material at				

	various location for Transformer and DG Set	08	Nos.		
11	Supply and fixing of Cable tray galvanized steel perforated of length 2.5 mtr. along with all accessories as per site requirement complete with labour and materials.				
11.1	300 mm Wide x 50 mm Depth x 1.6 mm Thickness, length 2.5 mtr.	700	Mtr.		
11.2	150 mm Wide x 50 mm Depth x 1.6 mm Thickness, length 2.5 mtr.	700	Mtr.		
	Total Basic Amount for the Low Side Work of Part –B				

Part -C Balance Electrical Work

Sr. No.	Description	Qty.	Unit	Rate	Amount
1.	Supply at site of 3C X 120 Sq. mm. XLPE 11KV Insulated Armoured Aluminium Conductor HT Cable (E) as per Technical Specification No.01	1000	Mtr.		
2.	Laying of 3C X 120 Sq. mm. (E) XLPE Cable through below details as per Technical Specification No. 02 a. Existing trench by fixing cable tray b. By trench cleaning and fixing cable tray c. Excavation in hard/soft soil as per IS	400 400 200	Mtr. Mtr. Mtr.		
3.	Supply, Installation, Testing and Commissioning of 3 Way Gas Insulated Maintenance free RMU IP-54, 12 KV 630 A 21 KA for 3 sec. with Robotically Welded SS-304 Tank having one as incomer with CT & PT Compartment and electrical charging and mechanical isolation of electrical power and two number outgoing Manufactured according to ISO 9001,14001 and OHSAS 18001 as per Technical Specification No.03 a. Supply b. Erection/Installation, Testing & Commissioning	1 1	Set. Set.		
4.	Supply, Installation, Testing and Commissioning of 800 KVA 11/0.415 KV distribution Transformer level -1 Oil Cooled Outdoor Type along with Protection and Metering Device etc. Off Load Tap Changer in a suitable enclosure with IP-54 as per Technical Specification No.04 a. Supply b. Erection/Installation, Testing & Commissioning with Civil Work as directed	1 1	Nos. Nos.		
5.	Supply, fixing and testing of Indoor/Outdoor Cable Termination Kit for 11 KV 120 Sq. mm. HT XLPE Cable as per Technical Specification No.05 a. Supply b. Fixing, testing & Commissioning	6 6	Nos. Nos.		
6.	Supply, Laying, Testing, Termination & Commissioning of 4 Core X 185 Sq. mm. aluminium LT XLPE Cable 415V as per IS: 7098 (Part – II) with up to date amendment complete with gladding, lugging, etc. with labour and materials. a. Supply b. Laying in Hard/Soft Soil, Saddling breaking RCC/ PCC floor and fixing cable tray in existing trench & laying of cable trough	500 500	Mtr. Mtr.		

	it complete with labour and materials Termination and Commissioning				
7.	Supply, fixing and testing of Indoor/Outdoor Cable Termination Kit for 4Core X 185 Sq. mm. aluminium LT XLPE Cable a. Supply b. Fixing, testing & Commissioning	16 16	Nos. Nos.		
8.	Preparation and installation of Earth Station of GI flat in pipe in which flat size is of 50 X 6 mm with pipe length 2 meter complete with its compound along with labour and material as per Technical Specification No.06 a. Supply b. Installation, Testing & Commissioning	24 24	Nos. Nos.		
9.	Supply, laying, fixing including termination/connection of Hot Dip Galvanised Earth Strip of 50 X 6 mm. size as per Technical Specification No.07 a. Supply b. Laying, Testing & Commissioning	350 350	Mtr. Mtr.		
10.	Supply, laying, fixing including termination/connection of GI Earth Strip of 25 X 3 mm. size as per Technical Specification No.08 a. Supply b. Laying, Testing & Commissioning	500 500	Mtr. Mtr.		
11.	Supply and laying of 1C X 35 Sq. mm. Cu Flexible Cable for Transformer Neutral Earthing as directed. a. Supply b. Laying, Testing & Commissioning	100 100	Mtr. Mtr.		
12.	Supply, Installation, Testing and Commissioning of a 750 KVA Three Phase Oil Cooled Servo Controlled Voltage Stabiliser provided with 10 KV Surge Suppressor as per make as directed and Technical Specification No.09 a. Supply b. Installation, Testing & Commissioning	1 1	Nos. Nos.		
13.	Supply, Installation, Testing and Commissioning of a 500 KVA DG Set Outdoor type with AMF Panel per make as directed and Technical Specification No.10 a. Supply b. Installation, Testing & Commissioning	1 1	Nos. Nos.		
14.	Supply, Installation, Testing and Commissioning of a 500 Kvar APFC Panel 3PH, 415VAC, 50HZ (10 stages) IGBT based Operating with Latest Microprocessor power controller with Auto/ Manual System working as per Technical Specification No.11 a. Supply b. Installation, Testing & Commissioning	1 1	Nos. Nos.		
15.	Supply, Installation, Testing and Commissioning of Indoor type LT Panel with following incomer and outgoing switchgear front type operation this also, includes 1 nos. multifunction meter of 96 x 96 mm along with 3 phase LED indication lamps, this also, includes 3 phase CT Operate Energy meter. 1) Incomer switch gear: ACB of 1250 Amp. 415V, 50 Hz draw out type with frame size 2000 Amp. Nos. 01				

	<p>2) Outgoing switch gear:</p> <p>I. 4P MCCB 250Amp. 415V, 50Hz, C curve, Nos. 02 For Main Incomer Indoor unit & lighting purpose</p> <p>II. 4P MCCB 300Amp. 415V, 50Hz, C curve, Nos.02 For Main Incomer outdoor unit</p> <p>III. 10HP Motor, DOL starter, Nos.08 for 13000 CFM AHU unit sp-75 mm wg filtration – up to 0.3 micron</p> <p>IV. 4P MCCB 63Amp. C curve, Nos.20 For outdoor unit 20HP & 8.0Tr. Ductable unit</p> <p>V. 4P MCB 32 Amp. Nos. 06 4P MCB 16 Amp. Nos.06 For lighting & spare purpose</p> <p>As per Technical Specification No.12</p> <p>a. Supply</p> <p>b. Installation, Testing & Commissioning</p>	1	Nos.		
		1	Nos.		
16.	<p>Supply, Installation, Testing and Commissioning of flush mount LED light ceiling fixture 200W in round size single phase Supply with inbuilt driver, cool white, LED lighting mount in SVP Hall top ceiling with aluminium die casting material with latest specification as per Technical Specification No.13</p> <p>a. Supply</p> <p>b. Installation, Testing & Commissioning</p>	35	Nos.		
		35	Nos.		
17.	<p>Supply, Installation, Testing and Commissioning of Flood light LED fixture 200W in rectangular size single phase Supply with inbuilt driver, cool white, LED lighting mount at SVP Hall outside with aluminium die casting material with latest specification.</p> <p>a. Supply</p> <p>b. Installation, Testing & Commissioning</p>	15	Nos.		
		15	Nos.		
18.	<p>Dismantling/ removal of all electrical unwanted item likes old panel, conventional lighting, junction box, fans, cabling which are not required as per direction of engineer in charge at SVP auditorium hall.</p>	1	Comp. Job		
19.	<p>Providing and Fixing re-wiring in existing concealed/surface for light/tube/bell point with PVC insulated single core standard 1.5 Sq.mm. FRLS copper conductor wire with modular switch and plate complete with labour and material.</p>	70	Nos.		
20.	<p>Providing and fixing re-wiring in existing concealed/surface for 15/16A X 230 Voltage Power point with PVC insulated single core standard 2.5 Sq.mm. FRLS copper conductor wire with modular switch and plate complete with labour and material.</p>	20	Nos.		
21.	<p>Supply, Installation of Fire Extinguisher dry powder type Cylinder Capacity 10 Kg. with stand as per latest IS.</p>	10	Nos.		
22.	<p>Shock proof electrical rubber mat sheet for HV applications.</p>	15	sq. mtr.		
23.	<p>Liasoning work for electrical additions installation from consult authority.</p>	1	Comp. Job		

	Total Basic Amount for the Electrical Work of Part –C	
Part - D Comprehensive CMC Work for 02 Years		
1.	Comprehensive Operation & Maintenance Contract of the entire electro/mechanical work for period of 02 years after completion of the work for 01 year guarantee/ warranty their after handing over to DPA.	
	a) First Year	
	b) Second Year	
Grand Total of Part – (A + B + C + D) Rs. _____		

(In Words: Rupees _____ only.)

(NOTE:

- I. The rates should be inclusive of all taxes, duties, fees, cess, transportation etc. and all incidental charges; but exclusive of GST).
- II. All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standard.)
- III. The above electro/mechanical work is to be complete with kind consent of our civil department

**Signature & Seal
of Contractor**

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**Executive Engineer (E)
Deendayal Port Authority**

SCOPE OF WORK

Deendayal Port Authority (DPA) is one of the Major Port in India. At Gopalpuri colony cultural program and indoor games are conducted in SVP auditorium hall as the same hall was non AC & looking to the climatic condition the temperature is about 42 degree Celsius plus. There by the players coming for practices and cultural activity feels unrest resulting to which the utilization of hall is very minimum. Hence, it is propose to convert to hall by installing air conditions. The scope of work consists of Supply, installation, testing & commissioning of Variable Refrigerant Flow(VRF)/ Variable Refrigerant Volume (VRV) type Air Conditioning system and Electrical items with materials at SVP Auditorium, Gopalpuri Colony, Gandhidham of size L*W*H 37.27*35.73*35.33 Approx. (Metre).The Contractor shall carry out the total work as per the direction of Executive Engineer (Electrical). Supply, Installation, Testing, Commissioning, Transportation of all the materials/ accessories, required for execution of the work at his/her own cost and arrangement.

The detailed scope of work the followings:

VRV/VRV WORK:

- 1) The Contractor shall supply & installation, testing & commissioning top discharge type Variable Refrigerant Flow(VRF)/ Variable Refrigerant Volume(VRV) System having 9 Nos. of 40 HP Outdoor Unit, Inverter Controlled Scroll Compressors suitable for operation with R-410A refrigerant comprising of all Inverter Driven Air-Cooled Condenser along with Protective Coated Fins, Propeller type Fan with BLDC Motor, Electronic Expansion Valve along with microprocessor based Panel, Refrigerant Cooled PCB and other required accessories. The system shall be capable to operate at Ambient Temperature ranging from 15 to 42°C (Cooling Mode) and Power Source of 3 Phase, 380 - 415 Volts, 50 Hz for Non-Stop Cooling.
- 2) The Contractor has to supply, install, testing & commissioning factory assembled 2 Nos. 8.0 Tr. Ductable Indoor type unit 3 Phase 415 VAC supply with Multi speed fan motor, DX Cooling Coil, Solenoid Valve/Electronic Expansion Valve & other standard accessories. They shall also supply & installation, testing of the AHU Kit suitable for the above Air Conditioning System.
- 3) Floor mounted direct expansion (dx) type air handling unit (AHU) 13000 CFM Nos.08 double skin type horizontal mount made of 50 mm thick panels consisting of pre coated casing of thickness 0.8mm outside layer and 0.8 mm inside layer with polyurethane foam (puf) insulation having density 43±2 kg/m³ factory injected between them by injection moulding machine, consisting plug fans with VFD suitable for static pressure as required class suitable for 415 ± 10%V, 50hz, 3 phase AC supply, cooling coil section dx type with aluminium finned copper tubes, cooling coil of 6 row deep and prefilter-10 micron , prefilter should be washable synthetic type, fine filter - 3 micron, hepa filter - 0.3 micron, drain connections stainless steel drain pan with insulation, wherever required, necessary vibration isolation arrangement along with blower as per proved design 3 phase induction motor.

- 4) The Contractor shall carry out Testing & Commissioning of VRV/VRF units including supply and charging of environmental friendly R410A Gas as per site requirements after system leak test & 24 hours Nitrogen Pressure Hold & necessary Electric Connection etc. as required for commissioning of the system in all respect.

ELECTRICAL WORK:

- 1) The Contractor shall work in Supply, Installation, Testing, Commissioning and transportation of all electrical work like RMU unit 630A 11KV, outdoor type Transformer 800 KVA 11KV/415V level-1 , DG 500KVA set outdoor type, APFC 500 KVar with Panel IGBT based, 1250A ACB LT Panel, LED 200W lighting, cabling, connection, lugging, bymetallic shims, glanding, tray, laying, etc.
- 2) The Contractor shall execute required no. 24 of Earth Station of GI flat in pipe in which flat size is of 50 X 6 mm with pipe length 2 meter complete with its compound along with labour and material as per IS-3043 & its latest amendments. They shall prepare Earth Pits and provide Earthing connections to the respective Units of the Air Conditioning System & All Electrical equipment, LED Lighting as per direction Electrical in charge DPA.
- 3) Dismantling/ removal of all electrical unwanted item likes old panel, conventional lighting, junction box, fans, cabling which are not required as per direction of engineer in charge at SVP auditorium hall.
- 4) Supply, Installation, Testing and Commissioning of flush mount LED light ceiling fixture 200W in round size single phase AC Supply with inbuilt driver, cool white, LED lighting mount in SVP Hall top ceiling with aluminium die casting material.
- 5) The Contractor shall closely co-ordinate with the Executive Engineer (Electrical) and adopts all the Safety Precautions during execution of the work. Any damage/loss of Port property, during execution of the work, shall be repaired/replaced/made good by the Contractor immediately at his/her own cost and risk.

CMC PERIOD 02 YEARS:

Comprehensive Operation & Maintenance Contract includes electro/mechanical work of complete installation including man & materials. Minimum staff is to deployed as below:

1. Supervisor having knowledge of Air conditions and HT/LT electrical installation
2. Electrician cum fitter having knowledge of Air conditions and HT/LT electrical installation
3. Helper having sound knowledge of electrical installation
4. If any equipment creates fault/ problem/error to be attend easily and support
5. Two person shall be standby during booking of SVP auditorium hall
6. Watch and ward of complete installation is in the scope of contractor

VRF/VRV TECHNICAL SPECIFICATION:

1.0 Variable Refrigerant Flow Based Air Conditioning System

-VRV/VRF shall be air cooled variable refrigerant air conditioner consisting of 09 Numbers 40HP outdoor units, Floor horizontal mount direct expansion (dx) type 08 Numbers AHU units along with blower motor and 02 Number 8.0 Tr. Ductable AC units.

-Each indoor & outdoor unit has capability to cool independently for the requirement at location the SVP auditorium hall gopalpuri.

-The Indoor units circuit can be controlled individually.

Following type of indoor units shall be connected to the system:

- Ceiling mounted Cassette type unit (Multi flow type)
- Ceiling mounted Duct type

-Compressor installed in each modular outdoor unit shall be equipped with minimum 50 % inverter compressors for high reliability, improved life, better back up & duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling load.

-Outdoor unit shall be suitable for separate connection of each Indoor unit.

-Both indoor unit & outdoor unit shall be factory assembled, tested & filled with first charge of Refrigerant before delivering at site.

2.0 Quality Assurance

The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) latest Standard; alternative recognition of equally reputable institute shall be acceptable.

The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

System efficiency shall meet or exceed SEER as prescribed in ECBC Norms.

3.0 INDOOR_UNITS

supply, installation, testing, commissioning of indoor units confirming to general specification and suitable for the duty selected. The type & capacity of indoor units shall be as specified in detailed Bill of Quantity.

General

Indoor unit shall be either ceiling mounted Cassette type or ceiling mounted duct able type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

The address of the indoor unit shall be set automatically in case of individual.

The fan shall be dual suction, aerodynamically design turbo, multi blade type, statically & dynamically balanced to ensure low noise & vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes & have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically / mechanically expanded for minimum thermal contact resistance with fins. Each coil shall be factory tested at 21 Kg / Sq. Mtr. air pressure under water.

Unit shall have cleanable type filter fixed to an integrally molded plastic / aluminum frame. The filter shall be easily serviceable.

Each indoor unit shall have computerized PID control for maintaining design SVP auditorium hall temperature.

Each unit shall be provided with microprocessor thermostat for cooling.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement at SVP auditorium Hall.

3.1 Ceiling mounted Cassette type unit (Multi flow type)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section & DX coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight & shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type.

Unit shall have an external attractive panel for supply air and return air. Unit shall have four-way supply air grilles on sides & return grille in centre.

Each unit shall have high lift drain pump, fresh air intake provision (if specified) low gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

3.2 Ceiling mounted Duct able type unit

Unit shall be suitable for ceiling mounted type. The unit shall include pre-filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

3.3. Drain Piping

Condensate from the evaporative unit shall be drained through properly installed drain piping designed to prevent any accumulation of condensate in the drain pipe. Drain piping shall be made of 1" or 1.1/4" or 2" Dia. rigid PVC pipe of 6 Kg / Sq. Cm. pressure rating with water tight threaded connections, leading from the room unit to a suitable drain point. Complete drain piping shall be made leak proof sealant /

adhesives. Insulation of drain piping made by Nitrile Rubber pipe.

4.0 OUTDOOR UNITS

The system selected is a modular system, with number of outdoor units connected to centrally located indoor units, as per details designing by the contractor. The outdoor units for all the system shall be air cooled type installation at SVP auditorium gopalpuri as per direction electrical in charge DPA.

Outdoor units in various areas shall be as per Bill of Quantities.

All the Variable Refrigerant air conditioners shall be fully factory assembled, wired, internally piped & tested.

The outdoor unit 40HP (20HP+20HP) shall be pre charged with first charge of R 410A refrigerant. Additional charge shall be added as per refrigerant piping at site. All the units shall be suitable for operation with 415 V +/- 10 %, 50 Hz +/- 3 %, 3 Phase supply for outdoor units & 415 V +/- 10 %, 50 Hz +/- 3 %, 3 Phase supply for 8.0 Tr. Ductable indoor units.

The Variable Refrigerant system shall provide stable, trouble free & safe operation, with flexibility of operating desired outdoor units. The outdoor units must be capable of delivering exact capacity proportional to the number of indoor units switched on & the heat load in the air conditioned area. The proportional operation shall be achieved by varying speed of the compressor in the outdoor units / change in compressor configuration or capacity as per load.

Outdoors units of the Variable Refrigerant system shall be compact air cooled type.

All the compressors of the outdoor units must be hermetically sealed scroll / rotary type. Each module of outdoor unit must have separate 1# inverter / digital Compressor, suitable to operate at heat load proportional to indoor requirement / or by change in compressor configuration or capacity as per load.

Anti-Corrosive treatment (Blue Fins) for Al fins of Condenser Coils is mandatory. The treatment should be suitable for areas of high pollution and salt laden air.

Contractor has to furnish the rated capacity of the Outdoor units, considering the refrigerant piping of respective Indoor units.

Back up operation, in case of failure of one of the compressors of outdoor unit, for single module outdoor units or failure of one of the modules in case of multiple module outdoor units shall be possible. The Variable Refrigerant outdoor unit shall always be supplying at least 33% of back up operation, of the full load capacity.

The entire operation of outdoor units shall be through independent remotes of indoor units. Need separate Start / Stop function shall be required.

Starter for the Outdoor Unit compressor shall "Direct on Line" type. Inverter compressor / or equivalent system of the unit shall start first & at the minimum frequency / capacity, to reduce the inrush current during starting.

Refrigerant control in the outdoor unit shall be through Electronic Expansion Valve. Complete refrigerant circuit, oil balancing / equalizing circuit shall be factory assembled & tested.

Noise level of outdoor units shall not exceed 70 dB (A) at a distance of 1.0 m from the unit.

Outdoor unit shall be complete with following safety devices:

- i. High pressure switch
- ii. Fan driver overload protector
- iii. Over current relay
- iv. Inverter Overload Protector / Digital Protector
- v. Fusible Plug

Outdoor Unit shall be supplied with

- i. Installation manual
- ii. Operation Manual
- iii. Connection Pipes
- iv. Clamps

Units will use R - 410 as Refrigerant / Equivalent Green Refrigerant gas.

4.1 CONTROLS SYSTEM FOR VARIABLE REFRIGERANT SYSTEM

4.1.1 WIRED REMOTE CONTROLLER

- i. Wired remote controller shall be supplied as per standard / specified in the "Bill of Quantities"
- ii. The controller must have large crystal display screen, which displays complete operating status.
- iii. The digital display must allow setting of temperature with 1 Deg. C interval.
- iv. Remote shall be able to individually program by timer the respective times for operation start and stop within a maximum of 72 hours
- v. Remote must be equipped with thermostat sensor in the remote controller that will make possible more comfortable room temperature control.
- vi. The remote shall be able to monitor room temperature & preset temperature by microcomputer & can select cool / heat operation mode automatically.
- vii. The remote must constantly monitor malfunctions in the system & must be equipped with a "self-diagnosis function" that let know by a message immediately when a malfunction occurs.
- viii. It shall be possible to wire the remote up to 500 RMT.

4.1.2 WIRELESS REMOTE CONTROLLER

- i. Wireless remote controller shall be supplied as specified in the "Bill of Quantities".
- ii. The same operation modes & settings as with wired remote controllers must be possible.

- iii. Compact light receiving unit to be mounted into wall or ceiling shall be included.

Units shall be supplied with followings:

- i. Operation Manual
- ii. Installation Manual
- iii. Paper Pattern for installation
- iv. Drain hose / Clamp metal / Insulation for fitting / Sealing Pads / Clamps / Screws

4.2 Controls & Interlocking

Electrically operated control should have provided with all components, auxiliary relays, Capacitors, including wiring for Indoor & Outdoor interlocking.

Minimum features such as airflow / String display preset / Temperature Operation mode display / Programming time display. All displays should be liquid crystal which gives accurate status in letters, numbers & motion.

NOTE:

Contractor is requested to submit design of VRV/VRF system, Electrical LT Panel details separately for Indoor & outdoor units for SVP auditorium hall gopalpuri. Power distribution and central controller operational logic is required in soft/hard copies submit in electrical department.

4.3 HANDING OVER OF VARIABLE REFRIGERANT SYSTEM

Following reading / data shall be generated as a part of handing over of the Variable Refrigerant air conditioning system.

OUT DOOR UNITS

- i. Inlet temperature
- ii. Discharge pipe temperature
- iii. Suction pipe temperature
- iv. Oil pressure
- v. Condensing Pressure
- vi. Evaporating Pressure
- vii. Power supply voltage
- viii. Inverter compressor frequency
- ix. Inverter current
- x. Fan operating current
- xi. Total ODU current

INDOOR UNITS

- i. Indoor unit operation – On / off from remote
- ii. Indoor unit operation – On / off from thermostat
- iii. Remote control presser temperature
- iv. Suction temperature
- v. Indoor liquid pipe temperature
- vi. Indoor gas pipe temperature
- vii. Electronic expansion valve opening
- viii. Fan operating current

5.0 AIR MOVING EQUIPMENTS:

5.1 Ventilation Fans:

The design, materials, construction, manufacture, inspection, testing and field performance of the fans shall comply with all currently applicable international / national codes / safety regulations. Nothing in this specification shall be construed to relieve the contractor of his responsibility. In particular, the equipment shall conform to latest editions of all applicable codes and standards listed below.

5.2 Construction

Floor mounted exhaust unit will consist of blower section with return air cut out and ventilation units will consist of filter section and fan section. Units will have the construction as per electrical in charge DPA.

5.3 Casing

Units will be in single skin construction with all the features similar to double skin construction units. Units will be fabricated out of Aluminum Extruded section and GI panels.

Extruded aluminum profiles will be duly anodized as per industrial standards (15 to 18Micron anodizing). The panels will be in 1.8 mm thick GI construction duly coated with pure epoxy powder / liquid polyurethane paint for the highest production against humid or polluted weather. The panels will be secured properly on the frame structure providing proper gasket between panel and frame.

Filter section (for ventilation units) will have rigid construction filter frame fabricated out of GI sheet to house required size filters. The filters will be in flange type construction having GI casing. Threaded inserts / nuts duly nickel-plated will be pre-fixed on filter frame for securing the filters.

Blower section will consists of fan base frame made out of extruded sections of proper size to facilitate the mounting of fan and motor. Vibration isolators will be provided to eliminate direct contact of fan base frame and AHU casing. Also flexible connection will be provided at the fan outlet. Suitable panel of blower section will be

provided with hole for cable entry with required fitting. If required, a proper size box cover will be provided on cable entry location.

A provision for earthing will be provided on mainframe near the cable entry hole.

Inspection doors at required location will be provided with elegant design hinges made out die cast Aluminum alloy or glass filled nylon. Two or more number of hinges per door will be provided depending upon the size of the door to provide required rigidity to the door panel. One or more number of door handles will be provided with cam type tightening arrangement. The handle and cam will be made out of glass filled nylon having galvanized iron spindle.

The inspection door for blower section will be provided at such a location that the motor and drive package and fan bearing can be assessed for easily maintenance. An additional guard made out of GI wire mesh of required strength will be provided at inner side of blower section inspection door. A limit switch / door switch with covered electrical terminal will be provided to facilitate the door inter locking with fan operation.

5.4 Fan

Fan wheels and scrolls shall be fabricated from best quality GI sheets. The fan wheels shall be of the forward / backward curved type enclosed in housing and mounted on a solid shaft. The fan shaft will be coated with suitable rust preventives after the final assembly. Backward curved impellers (wherever required) will be in galvanized iron or epoxy painted construction. Fan scrolls shall be fitted with die formed streamlined inlet to ensure smooth airflow into the fan.

5.5 Filters

Flanged type filters shall be HDPE washable types with required thickness and filtration level as per requirement.

5.6 Fan motors

Fan motors shall be 3 phases, sq. cage, and TEFC IP 55 Class F insulation induction type. The motors shall be capable of high initial starting torque requirement of fans.

6.0 SHEET METAL WORK-

a) CODES AND STANDARDS

Ducts shall be made of either Galvanized sheets or Aluminum sheet & confirm to IS: 655. The Galvanized steel sheet shall confirm to IS: 277. Aluminum sheet shall confirm to IS: 737.

The duct construction shall be as follows:

b) RECTANGULAR DUCT CONSTRUCTION:

MAX. SIDE	THICKNESS –		TYPE OF JOINT	<u>BRACING</u>
	GSS	AL		
Up to 750	24	22	25 mm QSS flanges	None
751 to 1500 MS angle	22	20	25 mm x 3 mm MS angle flange.	25 mm x 3 mm

1501 to 2250 MS angle	20	18	40 mm x 3 mm MS angle flange.	40 mm x 3 mm at 1.25 m centers.
2251 & above MS angle	18	16	40 mm x 3 mm MS angle flange.	40 mm x 3 mm at 1.25 m centers.

c) HANGERS FOR DUCT:

DUCT SIZE (MM)	SPACING (M)	SIZE OF MS ANGLE (MM X MM)	SIZE OF ROD DIA. (MM)
Up to 750	2.5	40 x 40 x 3	06
751 to 1500	2.5	50 x 50 x 3	08
1501 to 2250	2.5	50 x 50 x 3	10
Above 2250	2.5	50 x 50 x 3	12

d) DUCT INSTALLATION:

All ducts shall be fabricated and installed in workman like manner, generally confirming to IS: 655: 1963 updated. Round duct shall be die- formed for achieving perfect circle configuration.

Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made airtight.

All exposed ducts within conditioned spaces, shall have slip joints - no flanged joints. The internal ends of slip joints shall be in the direction of air flow. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two coats of mat black finish paint.

Changes in the dimensions and shape of ducts shall be gradual. Air-turns shall be installed in all vanes, arranged to permit the air to make the turn without appreciable turbulence.

Ducts shall be fabricated as per details shown on drawings. All ducts shall be rigid and adequately supported where required standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

All sheet metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans, shall be constructed of 22 G / 24 G Aluminium, thoroughly stiffened with 25mmx25mmx3mm angle iron braces and fitted with all necessary inspection doors as required to give access to all parts of the apparatus. Doors shall be not less than 45 cm x 45 cm in size.

Plenums shall be panel type and assembled at the site. Fixing of MS angle, iron flanges on duct pieces shall be with rivets heads from inside and riveting shall be done from outside.

Rubber lining 6 mm thick shall be used between duct flanges instead of felt, in all clean room ducting installations.

The contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of this specifications and drawings. The work shall meet with the approval of the engineer In-charge at site in all it parts and details.

The contractor shall make all necessary provisions and allowances to avoid beams or other structural work, plumbing or other pipes, and / or conduits, the ducts shall be transformed, divided or curved to on a side, (the required area being maintained) all

as per the site requirements.

If a duct cannot be run as shown on the drawings, the contractor shall install the ducts between the required points by any path available, in accordance with other services and as per approval of site engineer.

All duct work shall be independently supported from SVP auditorium hall construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of MS rods and angle iron.

Ducting over ceiling shall be supported from beams, after obtaining approval of site electrical in charge DPA. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling.

Where metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitting heavy flanged collars. Where ducts pass through brick or masonry openings, wooden frame work shall be provided within the opening and crossing of ducts provided with heavy flanged collars on each side of the wooden frame work, so that duct crossing is made leak - proof.

All ducts shall be totally free from vibration under all conditions of operation. Wherever duct work is connected to fans / air handling units or blower coil units that may cause vibrations in the ducts, ducts shall be provided with two flexible connections, located close to the unit, in mutually perpendicular directions, flexible heavy canvas sleeve at least 10 cm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting ductwork rigidly held by independent supports on both ends. The flexible connection shall be suitable for pressures at the point of installation and shall be of approved make.

Documentation & Measurement for Ducting

All ducts fabricated and installed should be accompanied and supported by following documentation:

1. For each drawing, all supply of ductwork must be accompanied by computer-generated detailed bill of materials indicating all relevant duct sizes, dimensions and quantities. In addition, summary sheets are also to be provided showing duct area by gauge and duct size range as applicable.
2. Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.
3. All duct pieces to have a part number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement, verification and approvals.

Testing

After duct installation, a part of duct section (approximately 5 % of total ductwork) may be selected at random and tested for leakage for class 12 as per SMACNA standards. The procedure for leak testing should be followed as per SMACNA - "HVAC Air Duct Leakage Test Manual" (First Edition)

Diffusers

Diffusers shall be of steel or aluminum. Steel diffusers shall be protected against rusting and shall be stove enameled / powder coated for finished color approved by the Architect. Diffusers shall incorporate an edge seal, diffusers mounted on ceilings shall have anti-smudge rings. Pan type diffusers shall be provided except where cone type diffusers are indicated,

Diffusers shall be provided with volume control dampers of the iris, flap or sleeve type which shall be adjustable from the front of the diffusers. Where the length of a vertical duct to a diffuser is less than twice the diameter of the diffuser an equalizing deflector shall be fitted.

The design of the supply air diffuser shall be capable to induce adequate air movement and provide the throw to cover the entire air-conditioning space without causing air turbulence and cold draft.

Linear diffusers shall be constructed of extruded aluminum section and include a control damper at the rear of the vanes giving volume control down to complete shutoff and operated from the face of the diffuser. Linear diffusers for supply air shall have adjustable blades to give directional control of air flow.

The linear diffuser shall be capable of maintaining a horizontal discharge pattern at a turn down ratio down to 20% of the maximum specified air volume without air dumping.

All the supply air grilles/diffusers will be provided with opposed blade volume control dampers fabricated from Al. anodized in matt black shade. The damper should be suitable for operation from front face of grille/diffuser. The Diffusers should have also removable core type fixing facility, constructed from the same material of the diffuser. The grilles / diffusers must be submitted to Site electrical in charge DPA for prior approval before procurement and installation.

Installation

A good quality expanded polyethylene / rubber of uniform thickness and width shall be used as gasket between flange joints. The gaskets shall be fixed by a suitable adhesive and holes made by passing a heated rod through.

All ducts shall be rigid and shall be adequately supported and braced where required withstanding seams, tees or angles of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing. All the joints shall be made tight and all interior surfaces shall be smooth. Bends shall be made with radius not less than one half the width of the duct or with properly designed interior curved vanes where metal ducts or sleeves terminate in woodwork, brick or masonry openings, tight-flanged collars. Ducting over false ceiling shall be supported from the slab above or from beams.

In no case a duct shall be supported from the false ceiling hangers or to be permitted site electrical in charge DPA to rest on a hung ceiling.

All holes in concrete, masonry etc. made by contractor for fixing supports etc. shall be made good and restored to original finish by him.

Air handling units and fans shall be connected to duct work by inserting at air inlet and air outlet a double canvass sleeve. Each sleeve shall be minimum 100mm long, securely bolted to duct and units. Each sleeve shall be made smooth and the

connecting ductwork rigidly held in the line with unit inlet or outlet.

Testing

All the test readings shall be furnished for peak summer and monsoon outside conditions.

After completion all such system shall be tested for leakage.

The entire air distribution system shall be balanced to supply the air quantities as required in various zones and Auditorium hall to maintain the specified room conditions. The final readings shall be recorded and submitted to the Consultant for approval before acceptance and taking over of the entire system by the Employer.

Painting

Angle iron flanges, stiffeners, hangers and supports shall be painted with 2 coats of anti-rust primer and those remaining uncovered shall be further painted with 2 coats of synthetic enamel paints of black color.

Dampers – General

The respective functions, types and general constructional requirements of dampers shall be in accordance with the HVAC ductwork specification unless otherwise indicated, sufficient dampers shall be provided to regulate and balance the system. Dampers on grilles or diffusers shall be used for line control only.

All dampers shall be of flanged type for connection to ductwork and shall be sufficiently rigid to prevent fluttering. Air leakage rate for dampers shall be tested according to EN 1751 Section 3 when the damper is in the closed position. For dampers installed for shut-off purpose, the maximum air leakage rate shall be tested according to EN 1751 Section 4.

Low Leakage Duct Damper

Air volume control dampers shall be of the aerofoil, double skin, opposed blade type with low pressure drop and noise regeneration characteristics. Damper blades in rectangular ductwork shall not exceed 225 mm in width and 1500 mm in length. Blades shall be of hollow section constructed from the same material of the ductwork or of stainless steel encapsulating an internal double contoured stud longitudinal reinforcing bar, mounted on square section steel spindles. Bearings shall be of nylon material and the units shall be of low-leakage design by incorporation of synthetic trailing edge seals and a peripheral gasket which shall be tested according to BS 476. All manually and automatically operated dampers shall include a means for indicating externally the position of the blades. Manual dampers shall include a device for positioning and locking the damper blades. The positions of all dampers 'as-set' after final regulation shall be indelibly marked at the adjusting device.

Each air volume control damper in the ductwork shall be fitted with a non-corrodible label stating the actual air flow in m³/s when in the fully open position, its overall cross sectional area, and the degree to which the damper has been closed in order to achieve the design or actual air flow.

Unless otherwise indicated, quadrants and operating handles shall be of die-cast aluminum or other material approved by the Architect with the words 'OPEN' and 'SHUT' marked on the quadrant. Quadrants shall be securely fixed and the damper

spindles shall be closely fitted in the quadrant hubs to prevent any damper movement when the damper levers are locked.

Access openings with readily removable air sealed covers shall be provided adjacent to all dampers. Subject to limitations of ductwork size the dimensions of access openings shall not be less than 300 mm x 300 mm and shall be located so as to afford easy access for inspection and maintenance.

Method of Measurements for Air Distribution System

Sheet Metal work:

Duct Length shall be measured along the centre line from flange face to face unless otherwise stated. Ductwork shall be measured on the basis of external surface area (length as measured above, multiply by duct perimeter) of ducts including the joints for each duct section. Duct measurement shall be taken before application of the insulation. For taper section average perimeter shall be used for measurement. For special pieces like bends, reducers, branches, and collars, mode of measurement shall be identical to as described above using the length along the centre line. The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles, and angles/flats with double nuts for supports, felt strip between duct and support, vibration isolation, inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications.

Duct Accessories:

Shall be measured by the cross section area perpendicular to air flow.

Grilles and diffusers:

Width multiplied by height, excluding flanges, volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.

Diffusers:

Cross-section area for airflow at discharge/capture area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.

Linear Diffusers:

Shall be measured by linear measurements only not by cross sectional areas, and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.

Fire Damper:

Shall be measured by their cross sectional area perpendicular to the direction of airflow. Quoted rates shall include the necessary collars, and flanges for mounting, inspection pieces with access door, solenoid valves etc. No special allowances shall be payable for extension of cross section outside the air stream.

Flexible connection:

Shall be measured by their cross sectional area perpendicular to the direction of airflow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.

7.0 NOISE AND VIBRATION CONTROL

General

This section of the Specification intends to direct the Contractor to select the appropriate and sufficient noise and vibration control measures on the plant/equipment, the interconnected piping, ductwork and conduit so that when the installed plant/equipment are put into operation, the resulting noise and vibration levels at locations within the building and at the adjacent or nearby buildings shall not exceed the acceptable limits.

The Corrected Noise Level at potential Noise Sensitive Receiver in the adjacent or nearby building, if so identified in the Particular Specification and/or Drawings, shall not exceed the Acceptable Noise Level stipulated in the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites issued by the Environmental Protection Department when the plant/equipment installed by the Contractor are put into operation.

Concrete Inertia Bases

Concrete inertia bases shall be formed within a structural steel beam or channel frame reinforced as required to prevent flexing, misalignment of the drive and driven units or transferable of stresses into equipment. The base shall be completed with height saving brackets, concrete reinforcement and equipment bolting down provisions.

In general the thickness of concrete inertia bases shall be of a minimum of 1/12th of the longest dimension of the base but never be less than 150 mm. The base depth needs not exceed 300 mm unless specifically required.

As an indication of the standards required, minimum thickness of the inertia base shall generally comply with the following table or be 1/12th of the longest dimension of the base, whichever is the larger:

Motor Size (KW)	Minimum Thickness
3.7-11	150mm
15-37	200mm
45-55	250mm
75 -185	300mm

Base forms shall include minimum concrete reinforcement consisting of 13 mm bars or angles welded in place on 150 mm centers running both ways in a layer of 40 mm above the bottom, or additional steel as is required by the structural conditions.

Unless otherwise specified, concrete inertia bases shall weigh from 2 to 3 times the combined weight of the equipment/plant to be installed thereon.

Height saving brackets shall be provided in all mounting locations to maintain a base clearance of 50 mm.

Vibration Isolators

The following types of vibration isolation mountings or suspensions are not exhaustive but serve to cover the main types that shall be applied as appropriate unless otherwise stated in the Particular Specifications.

Insulation for Refrigerant piping

Insulation Material Technical Specification – Class O Nitrile Rubber Plain

- Insulation material shall be Closed Cell Elastomeric Nitrile Rubber
- Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/(m.K) at mean temperature of 20 deg. C. (Tested acc. To EN 12667/ EN ISO 8497)
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame, also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category requirement as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990
- Material shall be FM (Factory Mutual), USA approved.
- Unlike other generic materials it should be self-extinguishing, does not drip and does not spread flames
- Moisture Diffusion Resistance Factor or 'μ' value shall be minimum 7,000 for the insulation material without any outer covering

Insulation Thickness: 19 mm

Insulation Material Technical Specification – Class O Nitrile Rubber sleeve covered with treated woven glass cloth (GC tubing)

- Insulation material shall be Closed Cell Elastomeric Nitrile Rubber
- Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/(m.K) at mean temperature of 20 deg. C. (Tested acc. To EN 12667/ EN ISO 8497)
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame, also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category requirement as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990
- Material shall be FM (Factory Mutual), USA approved.
- Unlike other generic materials it should be self-extinguishing, does not drip and does not spread flames
- Moisture Diffusion Resistance Factor or 'μ' value shall be minimum 7,000 for the insulation material without any outer covering

Woven glass Fibre for Outer covering of Insulation Material

- Temperature Range: 0°C to +105°C Overall (irrespective of the base product)
Color Code: Black
- Treatment: Shall be treated Water Based Acrylic binder to give crisp and non-piling property to the fabric, to help in easy installation, minimize fiber erosion, good aesthetics and resistance to abrasion. Fibre spillage / Thread raveling should be minimum.

Density: 200 +/- 20 gsm

Tensile Strength: 275 +/- 25 Kg / 50 mm (minimum)

Thickness: 0.18 mm / 7 mill

Type: Solvent based Acrylic Adhesive

Peel Strength: 1000 gm / 25 mm (minimum) - (Adhesive to steel)

Insulation Thickness: 19 mm

Drain pipe insulation.

(Class 'O' Nitrile - 13 mm thick sleeve without bonded cloth & neither self-sleeve Nitrile shall be used for drain piping) i.e. Only plain Nitrile rubber sleeve to be applied with the help of specified adhesive

Material technical specifications:

- Insulation material shall be Closed Cell Elastomeric Nitrile Rubber
- Thermal conductivity of elastomeric Nitrile rubber shall not exceed 0.035 W/(m.K) at an average temperature of 0 °C
- The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990
- Material shall be FM (Factory Mutual), USA approved.
- Moisture Diffusion Resistance Factor or 'μ' value shall be minimum 7,000.

Measurement of Insulation

Unless otherwise specified measurement for duct and pipe insulation for the project shall be on the basis of centre line measurements described herewith Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements described earlier. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plate and strainers are not separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding, valves, orifice plates and strainers shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

Duct Insulation and Acoustic Lining shall be measured on the basis of surface area along the centre line of insulation thickness. Thus the surface area of externally thermally insulated or acoustically lined be based on the perimeter comprising centre line (of thickness of insulation) width and depth of the cross section of insulated or lined duct, multiplied by the centre-line length including tapered pieces, bends, tees, branches, etc. as measured for bare ducting.

8.0 PAINTING - COLOUR CODE.

All Equipments shall be supplied with approved finish. Shop coat of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with two coat of synthetic enamel paint. Pump base-plate / piping supports subject to water exposure to be painted with rubber paint using zinc base primer. Water treatment Units to be painted with anticorrosive paint / CGC, as exposed to acid and caustic solutions.

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be baked in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

All exposed condenser water piping shall be applied with cold galvanizing spray / paint.

9.0 INSPECTION AND TESTING

9.1 Inspection (pre-dispatch & site), testing & acceptance

Pre-dispatch inspection shall be carried out for certain items. All VRV/VRF Indoor Outdoor unit, 8.0 Tr. Duct able AC unit, Electrical items, parts shall be checked for physical damage, before commencing the installation work. Complete fabrication, installation and commissioning work shall be jointly supervised and shall be carried out as per the specifications and instructions of site Engineer In-charge DPA. All the rotating equipment shall be checked for static and dynamic balancing, minimum operating vibration and noise.

All the system /equipment's shall be checked before / after satisfactory commissioning, at manufacturer's works / site as may be required for the approved technical specifications, performance data provided by supplier / manufacturer. Actual capacity of each equipment shall be calculated based on the test readings, recorded jointly for design conditions / operating conditions. Performance acceptance is subject to comparison of test results with supplier / manufacturer's performance data and contract specification. Acceptance is subject to satisfactory installation, commissioning and performance testing with respect to technical specifications. Rejected items must be replaced or rectified for the defects. In case of system modification / rectification complete performance tests are to be repeated. Site test readings shall be jointly recorded.

9.2 Methodology

In general, following Inspection / tests are involved. Type of test, duration of test, testing procedure / parameters, will be as per the applicable BIS codes. However, the detail Inspection and test procedure shall be worked out jointly by the purchaser and the contractor along with the approval of drawings, within 30 days from the date of contact agreement.

- a. Pre-dispatch Inspection (as per client/consultant's format)
- b. Pre-dispatch testing at manufacturers shop / factory. (Material, performance, pressure, joints, etc.)
- c. Physical Inspection – Pre-installation at site.

- d. Brazing / welding joint inspection and testing at site.
- e. Pressure and / or leak testing at site.
- f. Performance testing at site (capacity, power consumption, pressure drop, vibration, etc.)
- g. Calibration at site if required

SR. NO.	ITEM / EQUIPMENT	INSPECTION / TEST INVOLVED.
1.	AC Units	a, b, c, e, f.
2.	Refrigerant Piping	c, d, e
3.	Inline / Propeller Fans	a, b, c, e, f
4.	Ducting	c, e
5.	Insulation	c
6.	Diffusers / Dampers and Grilles	c

9.3 Test certificates and documents

- Contractor shall furnish following Test certificates for Approval by Executive Electrical Engineer DPA.
- Material Test Certificates for items 1, 2, 3, 4, 5 under table mentioned above.
- Welder's / Brazer's qualification certificate.
- Performance test certificates and Calibration Certificates - carried out by manufacturer before Pre- dispatch inspection & testing.
- All equipment operation and maintenance manual.

9.4 Testing the equipment at site

The following aspects shall be considered for performance testing.

- Prevailing conditions shall be as close as to design conditions at the time of performance testing procedure.
- Type, quantity, location, frequency, duration of test parameters shall be decided and recorded accordingly during the test.
- Rated capacity, power consumption, and other operating parameters shall be checked.
- Functional test for all Instruments, controls (safety and capacity) shall be carried out to check for the expected operation / action / accuracy / response time / repeatability parameters.

(a) Air Conditioning Unit:

The unit shall be selected and installed for the lowest operating speed and noise level. Capacity ratings and power consumption with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation. Measurements of air flow rate and temperature of air entering the DX coil (Return Air) and leaving the coil (Dew Point Temperature) shall be used to ascertain tonnage capacity of each unit. Calibration certificates of the measuring instruments shall be furnished by contractor.

Power consumption shall be computed from measurements of incoming voltage & input current.

Above VRV/VRF side and Electrical Side measurements shall be carried out simultaneously for arriving at the measured performance at SVP auditorium hall gopalpuri.

(b) Control & Instruments:

All Instruments shall be factory calibrated and provided with necessary instructions for site calibration and testing. Various items of the same type shall be completely interchangeable and the manufacturer shall guarantee/warranty 01 year their accuracy. All automatic controls and instruments used in the DX unit (Thermostat / Pressure Cut-outs) shall be tested at site for accuracy and reliability before commissioning the installation.

(c) Piping:

- Refrigerant Piping Test Procedure shall be submitted for approval by the short listed bidder for approval of Client / Consultant
- All piping shall be tested to hydrostatic test pressure of at least one and half times the Maximum operating pressure, but not less than 10 kg/cm² gauge for a period of not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified and gotten approved at site.
- Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.
- System may be tested in sections and such sections shall be securely capped, then re-tested for entire system.
- The Contractor shall make sure that proper noiseless circulation of fluid is achieved through all coils and other heat exchange equipment in the system concerned. If proper circulation is not achieved due to air bound connection, the Contractor shall rectify the defective connections. He shall bear all expenses for carrying out the above rectifications including the tearing up and re- finishing of floors, ceiling and walls as required.
- The Contractor shall provide all materials, tools, equipment, instruments, and services and labour required to perform the test and to remove water resulting from cleaning and after testing.

(A) Inspection Check List

SR. INSPECTION ITEM NO.	SYSTEM COMPONENTS	
	DUCTABLE / HI WALL / HIDE AWAY UNITS	AIR DISTRIBUTION
1. Physical	- Body	-Sheet metal

			Work / Ducting
2.	Fabrication, Installation & commissioning	- Compressor - Condenser - Cooling Coil	- Dampers - Diffusers / Registers / Grilles
3.	Vibration and noise.	- Fan- Blower - TSE valve. -Refrigerant piping	----- - Supports etc.
4.	Insulation and painting.	- Accessories	

(B) Testing:

All the system / equipments shall be checked after satisfactory commissioning, for the tender specifications, performance/ technical data provided by supplier / manufacturer. Actual capacity all equipments shall be calculated based on the test readings, recorded jointly, for design conditions / operating conditions. Performance acceptance is subject to comparison of test results with supplier / manufacturer's performance data and contract specification. In case of system modification / rectification complete performance tests are to be repeated. Test readings shall be jointly recorded.

(C) Test Reading sheet:

Duct able type Air Conditioning Units.

(i) Unit :

Main volts / Amps.

(ii) Compressor:

Refrigerant suction pressure (LP, Bar) / Temp. °C.

Refrigerant Discharge pressure (HP, Bar) / Temp. °C

Discharge cutout pressure (Bar)

Discharge cut in pressure (Bar)

Suction cutout pressure (Bar)

Suction cut in pressure (Bar)

Compressor motor Amp.

(iii) Cooling Coil:

Surface (Face) area - Sq. Mt.

Return (entering coil) air Temp. DBT / WBT °C

Supply (leaving coil) air Temp. DBT / WBT °C

Air velocity across the cooling coil – Mt. / Min.

Air volume -CMH capacity

(iv) Air cooled Condenser:

Air Temp. In - DBT °C

Air velocity across the coil - Mt. / Min.

Air Temp. at Fan outlet - DBT °C

Air Temp. at Grilles, Supply Duct outlets - DBT °C

Air volume - CMH at Supply Duct outlets

Air volume – CMH at fresh air intake

(v) Room Conditions:

Average reading of DBT / WBT °C, at 12-00 PM, 14-00 PM, and 16-00 PM on a test (summer / monsoon) day, shall be recorded to check the inside / room design condition.

-sd-

**Signature & Seal
Of Contractor**

**Executive Engineer (E)
Deendayal Port Authority**

ELECTRICAL TECHNICAL SPECIFICATION OF PART-C

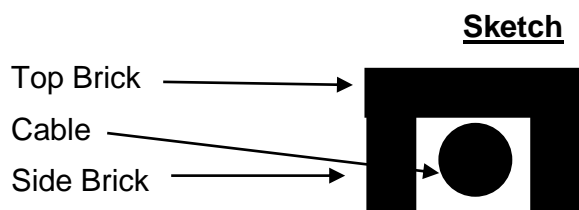
TECHNICAL SPECIFICATION NO.01:

This item includes supply 3 Core, 120 Sq. mm (E) of XLPE Insulated 11 KV grade aluminium conductor XLPE insulated armoured cable confirming to IS 7098 (Part-II) with latest amendments with ISI mark. The cable shall have marking/embossing at the interval of every meter showing its progressive length. The contractor shall submit the type test certificate at the time of supply of Cable at site. The type test certificate shall not be more than 3 years old. The rate shall be inclusive of all taxes (excluding GST), loading, packing, forwarding, insurance, and transportation and unloading at site of work.

- a) 3 Core, 120 Sq. mm (E)

TECHNICAL SPECIFICATION NO.02:

- (a) The item includes laying of double length cable of size 3 Core, 120 Sq. mm XLPE Insulated aluminium conductor XLPE insulated armoured cable of 11kV grade in the existing SVP substation cable trench. The cable shall be laid after opening of trench by removing the Concrete cable trough. After laying of the cable, cable trench shall be properly covered with existing Concrete cable trough with cable tray inbuilt trench as per direction site in charge. The item includes required material and labour.
- (b) The item includes laying of double length cable of size 3 Core, 120 Sq. mm XLPE Insulated aluminium conductor XLPE insulated armoured cable of 11kV grade through excavation in hard/soft soil. The trench to be excavated of 300 mm. width & 1.5-meter depth. The bed of 50mm. of river sand shall be provided in the bottom of the excavated trench. The cable shall be protected as per Sketch shown below by providing and laying bricks both the sides lengthwise parallel to the cable & the gaps shall be filled with river sand. The cable shall be covered by keeping two bricks over the side bricks shown in the sketch. The filling of the trench shall be done with the excavated stuff & should be watered and rammed properly to its original position. The excess excavated stuff shall be disposed-off from the Site of work and spreaded in low laying area as directed. The item includes required material and labour as directed by Engineer in charge.



- (c) The item includes laying of double length cable of size 3 Core, 120 Sq. mm XLPE Insulated aluminium conductor XLPE insulated armoured cable of 11kV grade in the existing cable Trench. After laying of the cable, the manhole shall be properly covered with existing removed RCC covers as per its original position. The item includes required material and labour as directed by Engineer in charge.

laying of cables

-This specification is intended to cover the requirements of installation and energizing of PVC/XLPE power cables including jointing of cables.

Before the commencement of cable laying, it shall be ensured by the Engineer-in-Charge that only ISI marked cables are used. It shall be the responsibility of the contractor to check the soundness and correctness of the size of the cable while taking delivery of the cable from stores. Any defect noticed shall be brought to

the notice of the issuing authorities immediately. If any defects are noticed after the cable is laid or during the process of laying, the same shall be brought to the notice of the Engineer-in-Charge and upon his satisfaction, that the cable is not damaged due to bad handling, it will be the entire responsibility of the contractor to retrieve the cable already laid and return the defective cable to store and take fresh length of the cable from the store and relay the same.

-The material such as bricks, sand, cable route markers, and RCC slab of best quality as approved by the Engineer-in-Charge only shall be used for cable laying works.

-The contractor shall provide the necessary labour, tools, pumps and other requisites at his own cost for carrying out pumping of water and removing of water from trenches, if any, wherever it is required.

-Installation shall be carried out in a neat, workman like manner by skilled, experienced and competent workman in accordance with standard practices.

-The method of cable laying and routing of cables, shall in every case be as directed by the Engineer-in-Charge DPA.

-After placing the cables in the trench, it shall be filled in layers ensuring that each layer is well rammed by spraying water and consolidated. The extra earth shall be removed from the place of trench and deposited at a place as directed by the Engineer-in-Charge DPA.

Cables laid in built up trench

Before the commencement of cable laying the cable trench shall be drained properly. Cable shall be laid as explained above. Cable shall be properly clamped to the cable supports, which are provided in the cable trench. The method of clamping shall suit the size of the cable and the cable supports, which are provided in the cable trench. The method of clamping shall suit the size of the cable and the cable supports, as directed by the Engineer-in-Charge. Care shall be taken while removing and replacing the trench cover slab. It is the responsibility of the contractor to make good any damaged trench covers.

Cable terminations and straight through joints

All cable joining materials such as straight through joint boxes, cable compound, cable lugs, insulation tapes etc., shall be of best quality and as approved by the Engineer-in-Charge.

Cable glands for strip / armoured cables shall include a suitable armoured clamp for receiving and entering end side. The clamping ring shall be solid and of adequate strength. Provision shall be made for attachment of an external earthing bond between the metallic covering of the cable and the metallic structure of the apparatus to which the cable box is attached.

Sealing boxes

A sealing box, irrespective of the class of insulation of the cable for which it is intended, shall be so designed by contractor. It may be filled with compound after connecting the cable especially in flame proof areas.

All parts and connection for attaching the armouring, wiping or clamping the metallic sheath in a sealing box, shall be easily accessible. This may be achieved by splitting the box or by providing a suitable cover or other such means.

The box shall be of sufficient length to allow for manipulation of the insulated cover without damage to them or to the insulation.

A sealing box intended to be attached directly to the apparatus shall be designed such that the box together with the connected cable may be detached from the apparatus without disturbing the sealing compound.

Cable sealing and dividing boxes intended for use in the flame-proof areas shall comply additionally with the relevant requirements of IS: 2148-1968.

Testing of cable:

Once cable is laid, following tests shall be conducted in the presence of Engineer-in-Charge, before energizing the cable:

- i) Insulation resistance test (Sectional and overall)
- ii) Sheathing continuity test.
- iii) Continuity and conductor resistance test.
- iv) Earth test.
- v) High voltage test.

TECHNICAL SPECIFICATION NO.03:

Supply, Installation, Testing and Commissioning of 3 Way Gas Insulated Maintenance free RMU IP54 12KV 630A 21Ka for 3 sec. with Robotically welded SS-304 tank manufactured according to ISO 9001, 14001 and OHSAS 18001 to be supplied and installed at SVP substation auditorium, Gopalpuri.

Out of 3 RMU One will be Incomer having its compartment of CT/PT and the RMU is equipped with breaker, isolator and earth switch, remaining 2 will be its outgoing with breaker and isolator with TNC switch.

-MFM meters for all the ways

-The RMU shall be of Indoor type

-1 No. of Energy Meter for each RMU to be installed as per norms of PGVCL.

-All equipment's and materials shall be designed manufactured and tested in accordance with the latest applicable IEC standard. The electrical installation shall meet the requirement of relevant IS code.

-Necessary current sensors / transformers for protection and metering (wherever required).

-All necessary dry (potential-free) contacts for indications relevant to RMU monitoring status and control.

- PT Panel including auxiliary power transformer for measurement of system voltage and for charging the batteries.

-Battery and battery charger, to provide stable power as per motor rating, 24 VDC, power for the RMU's motors.

-The incomer CTs (3 Nos. in each) shall be circular with 300- 150/5A and the outgoing shall be provided with circular CTs (3 Nos. in each) with 150-50/5A ratio with 5VA load for all the CTs.

-Fixed type SF-6 gas insulated circuit breakers. It should be maintenance free, having stainless steel robotically/TIG/MIG welded enclosure for RMU.

- Low gas pressure devices- 1.3 bar pressure. 1.3 bar pressure of SF-6 gas in chamber of RMU is required.
- Back up relay with auxiliary supply (24V DC) shall be provided.
- For Indoor Cable boxes should be front access and interlocked with earth switch.
- Cable testing possible without disconnection of cables.
- Circuit Breaker with back up relay with auxiliary supply (24V DC) shall be provided
- Low pressure, sealed for life equipment, can operate at "0" bar pressure.
- Cable earthing switches on all switching device-standard, for operator safety.
- Enclosure with IP-54 standard protection for Indoor RMU.
- All live parts should be inside a stainless steel enclosure for RMU & minimum 2 mm thickness of stainless steel robotically/TIG/MIG welded enclosure for RMU.
- Earth Fault, Over Current, etc. protection numerical relays with all appropriate configuration and other parameters to be installed.
- The relays shall be either REF-615 of ABB or 7SJ62 of Siemens or even latest, as directed and shall have all the latest features with wide range of settings.
- Analogue Manometer gauge for gas pressure indicator is to be installed.
- Relay setting and co-ordination is in the scope of contractor.
- The RMU shall be provided with multifunction meter.
- The numerical relay shall be provided with RS-485 facility to establish the connectivity.
- The CT ratings and accuracy class and tolerances for protection CT and measurement CT should be precisely as per latest applicable IE rules and standards. The CT should be bidirectional.
- The standard accuracy classes of current transformer as per IS-2705 is 0.5S for metering CT.
- The standard accuracy class for the protection current transformer, as per IS-2705 is 0.5S.
- The 24 V DC Power Pack Unit with 1 Hr. Battery Back-up for system working.

ELECTRICAL DATA:

12KV – 28KV-1min Nominal voltage: 11 KV Rated frequencies: 50Hz.

Rated current bus bars: 630A

Rated current cable switch Disconnect or: 630A

Short time withstands current:

Relay & Protection Scheme:

-Numerical Relay with Control Supply 24V DC, 50HZ. Phase current input Relay shall be suitable for 1A and 5A CT secondary (selectable at site) Relay shall be suitable for 3CT as well as 3CT connection. Ground current input Relay shall be suitable for residually connected CT input and for CBCT input. The relay shall have provision for digital inputs, speed switch inputs. Communication System: the relay shall be equipped with RS485 for remote communication or for connection to DCS, SCADA or PLC. The relay shall be suitable for RS485 port for connection to Laptop and PC preferably of front. The relay shall support multiple/universal

protocols for communication with any type of DCS/SCADA. Output relays having Minimum 4(four) programmable relays with contact rating 5A at 110V DC continuous with latching option of output relays. The relay shall support minimum following protection elements. Triple pole instantaneous over current in all three phases (equivalent to CAG-37). Sensitive earth fault protection (equivalent to CTUM -15). Shot circuit protection. Instantaneous Earth fault. Relay can operate Inst., definite time and Inverse type protection of over current. S/c and earth fault. Inst. Under voltage relay (Incomer) Master tripping.

-All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent, dust tight cover, removable from the front. All protective relays shall have for easy replacement. They shall either have built-in test facilities or shall be provided with necessary test blocks and test switches located immediately below each relay. The auxiliary relays and timers may be furnished in non-draw out cases. The contact multiplying auxiliary relays if any may be located inside the auxiliary compartment and may be of fixed type.

HV SWITCHGEAR CIRCUIT BREAKER 11KV RMU:

1.	Type	Three pole operated simultaneously by a common shaft
2.	No of phase	3 Phase, 11KV
3.	Arc interruption in dielectric medium	RMU based on SF6 Breaker
4.	Type of Charging, Mechanism:	Manual(spring assisted)as well as motorized with 230/110 VAC operated motor
5.	Continuous Rating	630Amp. At ambient design 45°C
6.	Short Circuit Withstand	21 KA for 3Sec
7.	Fault making Capacity	52.5 KA
8.	Fault Breaking Capacity	21 KA minimum
9.	Current Transformer	3 nos. epoxy cast Current Transformers with 15 VA burden STR of 21 KA for 3 second metering accuracy Class 0.5 and protection accuracy 10P10 and having of CTR 150/75/5A.
10.	Potential Transformer	3-phase draw out type PT of Ratio 11000/110 Volts of 50 VA burden to meet with auxiliary requirement with Class-0.5accuracy including HT fuses on both incomer end.
11.	Protection Relay	Numeric type or updated version (Make: SCHNEIDER/ALSTOM/SIEMENS/C&S/ABB With the protection of inverse, definite time, short circuit, over current, instantaneous and earth fault, master trip and trip supervision.
12.	Metering Compartment	Multi-Function meter having digital type (single) with voltage, current, PF, frequency, KW and KWH (Make : Secure /L&T/ Conzerv / ENCRON)
13.	Accessories	2 sets of operating handle, spring charging handle, spanner set and other required accessories.
14.	Optional	One no. shunt trip and tripping coil operating on 12VDC. 2 nos. of space heater with ON/OFF switch and thermostat in each side of panel

-The SF-6 breaker shall be completed with necessary interconnection with fine wiring, ferruled properly including foundation bolts, earthling etc. The layout drawing, dimensional drawings

and electrical wiring diagram and operation & maintenance manuals shall be supplied with SF-6 Breaker. The SF-6 breaker shall be supplied in conformity with relevant ISS i.e. with up to date amendments along with manufacturers test certificate.

-This includes all labour and material as directed by Engineer-in-Charge DPA.

TECHNICAL SPECIFICATION NO. 04:

-Supply, Installation, Testing and Commissioning of 800 KVA 11/0.415KV, level-1 Outdoor type Distribution Transformer Oil Cooled, off load tap changer, with level one. Having Protection and Metering Device, etc. with other relevant accessories in a suitable enclosure with IP-65.

-Supply, Installation, Testing and Commissioning of Outdoor Type Transformer of 11kV/415 Volts, equipped with 800 KVA at 11KV fault making load breaking switch with one as SF-6 Circuit Breaker for the primary side controls & with LV 1250 Amp. Air Circuit Breaker as secondary side connection. All the components shall comply with their relevant latest IS/IEC standards protection with Metering Device. Same is to be install on cement concrete platform with suitable height and shall have oil drain soak pit of 600-liter oil complete with labour and material includes CPVC pipe line of 200 mm.

TRANSFORMER 800 KVA:

The transformer shall be fully tested for routine tests as per BIS-1985. The tenderer shall furnish date regarding adequacy DIN of Transformer capacity.

1.	Transformer capacity	800 KVA (Off load Tap Change),Level-1
2.	Primary voltage	11 KV +/- 10%
3.	Frequency	50 Hz.
4.	No. of Phases	3
5.	Insulation Class	'F'
6.	Cooling	Oil cooled
7.	Temperature	Max 115°C by RTD
8.	Percentage Rise	As per IS
9.	In winding	90°C
10.	Winding connection	Delta/Star
11.	Impedance	As per IS/BIS/DIN
12.	Vector Group	Dyn– 11
13.	Neutral Grounding	HV ungrounded LV Solidly Grounded
14.	Winding material	Copper
15.	Noise Level	As per IEEE-141
16.	Vibration Level	3 G (min.)
17.	Painting	632 Shed of IS:5 or BIS/DIN Standard
18.	Tapping Range	+/- 5%
19.	Tapping	Off load Tap Changing
20.	Panel	--
21.	Protection	WTI ,OTI ,Buchhloz Relay with Alarm
22.	MAKE	Voltamp, Schneider Electrical, ABB,SIEMENS,Cromton greves, Bharat Bijilee

TECHNICAL SPECIFICATION NO.05:

Supply, fixing and testing of Indoor Cable Termination kit for 11KV 120 Sq. mm. XLPE Cable

The Indoor cable termination is to be mandatorily used for 11kV 120 Sq. mm. XLPE cables termination.

Title	IS Standard	IEC Standard
Applicable IS Standard	IS 13573	
Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) - ALL PARTS	IS 7098 (Part-II) IS 13573,1992	IEC 60502
Heat shrinkable moulded shapes - Part 1: Definitions and general requirements	-	IEC 62329-1
Heat-shrinkable moulded shapes - Part 2: Methods of test	-	IEC 62329-2

-The cable termination work of the kit should be done as per latest standard practice of PGVCL.

TECHNICAL SPECIFICATION NO.06:

Preparation and installation of Earth Station

-This includes preparation of 24 Nos. earth station GI type with latest chemical treated back filled compound 50x6 mm. diameter Flat in Pipe length 2Mtr. Depth, Maintenance free including all accessories & Masonry work Enclosure with cover plate. The value of earth pit shall be less than 5 ohm. A cement concrete (ratio of Cement: Sand: Metal should be 1:2:4) chamber of at least 50cm x 50cm shall be provided just below the surface of ground over the funnel for watering and having RCC cover of suitable size as directed. This also includes removal of extra-excavated earth from the site.

-The work shall be carried out as directed by Engineer-in-Charge.

TECHNICAL SPECIFICATION NO.07:

-Supply, laying, fixing including, termination/connection of following type and size of earth strips 50X6mm. Hot Dip Galvanised earth strips.

-This includes supply, Laying & connecting, Hot Dip galvanized earth strip of size 50 X 6mm. Hot DIP coating on GI as per the earthing system, connected to two separate and distinct main earth as directed and shall be clamped suitably on wall /floor or buried in the ground trench as directed. The pieces of GI strips shall be connected using GI nut bolts rigidly and the GI strip shall be laid either on RCC with proper clamping or in the ground minimum 300 mm. below the ground level as the case may be and as directed and shall be buried properly or as directed by Engineer-in-charge.

TECHNICAL SPECIFICATION NO. 08:

- Supply, installation, testing and commissioning of Strip Earthing. Earthing installations shall conform latest, as amended from time to time and IS 3043-1989 "Code of practice for Earthing", with latest amendments.
- Earth Strip electrode shall not be smaller than 25 x 3 mm

Conductor shall be buried in trenches not less than 0.5 m deep.

General

- i) All materials used for connecting the earth lead with electrode shall be of GI. The earthing lead shall be securely connected at the other end to the main board.
- ii) The earthing lead from electrode onwards shall be suitably protected against mechanical injury by routing the earth wire / strip through a suitable size of GI pipe.
- iii) All medium voltage equipment shall be earthed by two separate and distinct connections with the earth. In case of high voltages, the neutral points shall be earthed by not less than two separate and distinct connections with the earth, each having its own electrode.
- iv) All materials, fittings etc. used in earthing shall conform to Indian latest standard specifications wherever they exist. In the case of materials for which Indian standard specifications do not exist, such materials shall be approved by the Engineer-in-Charge.
- v) The earth electrode shall be kept free from paint, enamel and grease.
- vi) It shall be ensured that similar materials for respective earth electrodes and earth conductors are used.
- vii) Earth electrode shall not be installed in proximity to a metal fence.
- viii) GI strip shall be connected to the respective earth electrodes, either by brazing or welding respectively. The GI strip shall be jointed only either by brazing or by riveting at the end of over lapping portions. The overlap shall not be less than 50 mm.
- ix) Earthing clamps used for supporting earth strips shall be made of such materials so as to avoid bimetallic action between strip and clamps.

The earth resistance of each electrode shall be measured by using a reliable and calibrated earth megger and the value shall be as per IS/IE rules also, information by the Engineer-in-Charge.

TECHNICAL SPECIFICATION NO. 09:

Servo Voltage Stabilizer 750 KVA:

-This include Supply, installation, erection, of 03 phase, 50HZ, 415VAC, 750 KVA Servo Voltage Stabilizers Based on amount of high voltage or low voltage observed at input, "motor driver" moves servo motor across winding of auto transformer so as to increase or decrease the number of winding and hence voltage across primary of buck-boost transformer.

-Three Phase Oil Cooled Servo Voltage Stabilizer shall be fully tested for routine tests of regarding capacity. All parameter monitors in display, with Supply, Testing, Connection, Lugging, tapping include work.

-Servo stabilizer with panel all parameter monitor in display, with Supply, Testing, Connection, Lugging, tapping. The Cement concrete platform is the scope of contactor and platform shall be height shall be 300 mm above ground level.

Sr. No.	Parameter	Three Phase Unit
1.	Servo Voltage Stabilizer	750 KVA
2.	Input Voltage Range	360V – 470V
3.	Nominal Output Voltage	415V
4.	Output Voltage Accuracy	± 1%
5.	Line Frequency variation	47Hz-53Hz

6.	Effect of Power Factor	None
7.	Cooling System	Oil Cooled
8.	Controller	Digital/Analogue
9.	Response Time	5 Mint.
10.	LCD Display (20 x 2 matrix)	Date & Time, Input Voltage, Output Voltage & Current

TECHNICAL SPECIFICATION NO. 10:

DG SET 500 KVA:

-This included supply, installation, testing & commissioning of 500KVA Silent DG Set outdoor type with latest CPCB norms of 415V, 3-Phase, 4-Wire, 50Hz unbalance load DG set.

-Diesel Engine with AMF panel and all parameter monitor in display, with Supply, Testing, Connection, Lugging, tapping. The Cement concrete platform is the scope of contactor and platform shall be height shall be 400 mm above ground level.

-Necessary shocks absorber pads are to be kept at all four side to minimizes the vibration, similarly FRP sheet of 0.5 mm thickness is to be fixed on the frame of angle 50*50*6 mm along with the fabrication work and all four legs shall have grouted in ground with minimum 300 mm depth duly cement concrete for sheltering against rain and sunlight.

-Alternator operation parameters – voltage, power, current, frequency, power factor.

-Diesel engine operation all parameters – RPM, coolant temperature, oil pressure.

-Temperature scanner along with RTDs & BTDS in the generator as sensors to monitor the temperature of Windings & Bearings.

1.	DG set capacity	500 KVA
2.	No. of cylinders	06
3.	Primary voltage	24 V/DC
4.	Secondary Voltage	415-430 V/AC
5.	Frequency	50 HZ
6.	No. of Phases	03
7.	Panel	AMF 415 V (With All Protection/Meter)
8.	Temperature	Max 115 C by RTD
9.	Class of Insulation	H class
10.	Fuel Tank Capacity	600 Litre or above
11.	Make	Cummins/Kirloskar/Sudhir/CG/Mahindra/Jakson/ Ashok Leyland

TECHNICAL SPECIFICATION NO. 11:

APFC PANEL 500 KVAR:

- The Work Included supply, installation, testing, commissioning of the APFC Panel with IGBT Latest Version with Microcontroller based, and shall be fully tested with for routine tests.

- APFC Panel has microcontroller based programmable controller which switches the capacitor banks of 25,50,75,100 KVar of latest technology suitable for automatically in multiple stages by directly reading the reactive load (KVAR) which works in the principle of VAR sensing tends to maintain the PF to 0.99 Lag.

- The 415V APFC Panel shall be metal clad, indoor type floor mounted spacious. The position of various control switches, push buttons, louvers shall be on the front side of panel and same shall operate in both mode that is Auto/ Manual.
- The operational Height of Panel shall be at a height not less than 300 mm and shall not exceed 1850 mm from the finished floor level.
- APFC panel Auto/ Manual Operating System with APFC controller and all parameter monitor display, with Supply, Testing, Connection, Lugging, tapping include work.

Sr. No.	Parameter	Three Phase Unit
1.	APFC Panel Rating	500 Kvar
2.	Mounting	Indoor, Floor Mounting
3.	Usage/Application	3 Phase HVAC/ Lighting load
4.	Monitor	Industrial Display, Microcontroller IGBT based
5.	Modules stage	10 (25kvar, 50kvar, 75 kvar 100kvar)
6.	Voltage	415 V /AC,3 Phase, 50Hz
7.	Current of Capacitor	640 Amps. Approx.
8.	Make	BCH Electrical Ltd./P2 Power Solutions Pvt. Ltd./ABB/ Reputed

TECHNICAL SPECIFICATION NO.12:

LT Panel Feeder units:

-The Work Included supply, installation, testing, commissioning of LT Panel 1250A ACB along contractor design panel.

-LT Panel design shall be of draw by contractor. Each feeder shall be provided with MCCB, DOL Starter, MCB, Energy Meter, voltmeter, ammeter, Contactor, thermal O/L relay, START/STOP Push Buttons, Test Push Button, Local/Remote Selector switch, indicating lamps for on/off/trip, control circuit MCB.

-All elements of functional unit shall be accommodated in one/two/tree compartment as per contractor LT Panel design.

-The door shall be interlocked with the associated MCB so that the door can be opened only when the switch is OFF and the MCB cannot be switched ON when the door is open.

-The MCCBs shall have the provision for Pad locking in the OFF position.

-The compartments shall have nameplate to designate the feeder.

Bus bars:

MCC shall be provided with 4 nos. power bus bars for 3 phase and neutral and 2 Nos. control bus bars at the top in a separate compartment. Bus bar arrangement shall generally conform to IS :375-1963.The bus bars shall run continuously throughout the length of the MCC. Bus bars shall be rated for 1.2 times the ratings of the incoming breaker.

Both horizontal and vertical bus bars shall be of EC grade copper alloy equivalent to E 63401-WP (E91E) as per IS: 5082-1981. The power bus bars shall have a short-circuit withstand capacity of 50 KA rms for 1 sec and dynamic withstand capacity of 105 KA peak. The control bus bars shall be of high conductivity electrolytic grade copper as per IS: 613-1984.

The bus bar shall be three phase identified by colours Red, Yellow and Blue for phases, black for neutral.

The bus bars shall be rated for 40°C temp rises over an ambient of 45°C. Cross section of bus bars shall be uniform throughout.

The clearance between bare phase power bus bars and between phase and earth bus bars in air shall not be less than 50 mm.

All bus bar joints shall be bolted type, belle ville/spring washers shall be used for joints to prevent loosening of nuts and overheating.

Incomer:

The incomer Air Circuit breaker 1250 amps. which is microprocessor based shall be of suitable capacity, 4 pole and neutral arrangement along with voltmeter and CT operated ammeter, indication lamps etc.

The ACB shall have the following features:

-Suitable for operation to 415 V, 4 Phase, 4 wire system.
 Air break, triple pole, conforming to latest IS.
 Suitably de rated for 80 deg. C ambient to cater to load.
 Quick make and quick break, manually operated, trip free switching mechanism non-draw out type.

-Breaking capacity: ACB 1250A
 Clearly identifiable handle position for ON, OFF and trip.
 4 NO & 4 NC auxiliary contacts wired up to the terminals.

Outgoing feeders:

MCCB/ DOL STARTER / MCB shall be provided for all the outgoing feeders of the MCC, as per contractor drawing suitable for motor back up protection and shall have following features:

Capable of providing protection, lamp indicator coordination in conjunction with suitably rated contactor and over load relay for protection as per latest IS.

Quick make, quick break, trip free mechanism.
 Push to trip facility.
 Outgoing module shall also have -
 One no. Energy meter (0-500 V) along with LT Panel
 One no. Voltmeter (0-500 V) with 4 position selector switch and back up fuses.
 One no. Ammeter (Suppressed Scale)

<u>MCCB -1 (250A)</u>	<u>MCCB-2 (300A)</u>	<u>MCCB-3 (300A)</u>	<u>MCCB - 4 (250A)</u>
<u>DOL STARTER</u>	<u>4P MCCB 63A.</u>	<u>4P MCCB 63A.</u>	<u>4P MCB 32A/16A</u>
<u>08</u>	<u>10</u>	<u>10</u>	<u>06/06</u>
<u>INDOOR UNIT</u>	<u>OUTDOOR UNIT</u>	<u>OUTDOOR UNIT</u>	<u>LIGHTING/SPARE</u>

Over load relays:

The thermal O/L relays shall be three elements bi-metallic type, manually reset. The reset button shall be available for operation when the door is closed. O/L relays shall be directly connected to the contactor. O/L relay shall be selected to suit starting time of the drive. Relay shall be provided with 2NO+2NC contact.

Indicating Instruments:

Ammeters:

Shall be with Class 1 accuracy, 96 mm x 96 mm tout band (Suppressed Scale) for all outgoing.

A red mark shall be provided on the ammeter dial corresponding to full load current of motor.

Shall have suppressed O/L range (cramped end scale) beyond full load current to read starting current of 600 to 800% of full load current of motor.

The ammeter shall be provided for all motors and shall be CT operated.

Volt meter:

A voltmeter, 0-500 V AC range 96 mm x 96 mm size for incomer and 96 mm x 96 mm for outgoing along with selector switch and control fuses shall be provided. Incomer panel shall have a voltmeter of 0-250 V AC range for control supply voltage. Voltmeter shall be industrial Grade B accuracy and shall have suppressed scale for the lower range.

Selector switches shall have 3-way and off position with black colour knob.

Indicating lamps:

All indicating lamps shall be Red, Green and Amber colour lenses as required shall be provided. Red for ON indication, green for OFF indication and amber for Tripped on over load.

Push buttons:

Push buttons shall be heavy-duty type with 2NO+2NC contact rated for 10 Amps. The color code shall be green, red and black for 'Start', 'Stop' and 'Test' respectively.

Wiring and Termination:

MCC shall be completely factory assembled and wired.

Power connection shall be done by 4 Core X 185 Sq. mm. aluminium LT XLPE Cable PVC insulated aluminium conductor for Transformer LV side to LT panel main Incomer cable laying.

- Indoor/Outdoor Cable Termination Kit for 4 Core X 185 Sq. mm. al. LT XLPE Cable.
- 4C x 2.5 sq mm. copper armoured xlpe cable for DOL starter feeder to AHU for 3 phase Induction Motor Connection.
- 4C x 10 sq mm. copper armoured xlpe cable for 4P MCCB 63Amp. feeder to Outdoor unit 40HP (20HP+20HP) for Separate Connection.
- 4C x 2.5 sq mm. copper armoured xlpe cable for 4P MCCB 63Amp. feeder to 8.0Tr. Ductable unit Connection.
- 3C x 1.5 sq mm copper un armoured flexible cable for LED Lighting 200W.

- All cable connection should be properly tightness and lugging, clamping, glanding, dressing.
- Each wire shall be identified by ferrules at each end in accordance with the schematics.
- Wiring to the door shall be done by flexible cable and the cables shall be bunched, sleeved and created so that no mechanical damage can occur to the cables while opening/closing the door.
- All terminations shall be of adequate current rating and size to suit individual feeder requirements.

Earthing :

Earthing shall be provided for the MCC at the bottom with an earthing bolt at each end. All Indoor / Outdoor VRV/VRF unit, Motor, AHU and lighting.

The earth bus shall be of Aluminum having the same size as that of neutral bus bar. The MCC are to be connected with the existing earth grid with the help of 50x6 mm hot dip GI flat/strip.

Labels:

A designation plate for the MCC shall be affixed at approximately the center of the MCC (length wise) with letters not less than 25 mm.

Inscriptions plates shall be provided for all units mounted on the door indicating the purpose with minimum 5 mm height letters.

Each component shall be clearly labeled as per schematics.

All inscriptions shall be on black trifoliate sheets/black anodized aluminum plate with white lettering.

Danger notice board as per IS: 2551-1982 shall be provided on front and backside of MCC.

Painting:

The paint of MCC should be as per IS: 631 (Tata grey) only.

Tests:

-Inspection shall be carried out as per the QAP to be approved by the Owner/Consultant.

-The MCC shall be routine tested as per IS: 8623 - 1993 and IEC: 439.

-The supplier shall furnish test certificates for the type test conducted on similar type of MCC conforming to above standards.

-All tests shall be conducted in the presence of Engineer in charge DPA.

-Approval of test certificates shall be obtained from Owner and MCC shall be dispatched only after receipt of Engineer's dispatch clearance.

Drawings

After the award of the work order the contractor shall submit three copies of the following drawings for approval of the EIC.

Dimensional drawing of the MCC showing arrangement indicating the following:

- a) Power and control cable entry points,
- b) Bus-bar clearances,
- c) Details of support insulators and spacing,
- d) Configuration of bus-bars.
- e) Outgoing power cable termination arrangements.

Control circuits for the starters & metering units along with nomenclature

LT PANEL & FEEDER EARTHING:

All Indoor, outdoor unit, Motor, lighting, MCC, LCP, control components etc. shall be adequately earth and shall be inter-connected with the existing system. Earthing shall conform latest IS. As per IE rules statutory regulations.

The grounding connection shall be suitable for accommodation of ground conductors as follows:

Electrical MCC	: 50 x 6 mm GI flat.
AHU Blower Motor	:25 x 3 mm GI flat.
Indoor/Outdoor VRV/VRF	:25 x 3 mm GI flat.
Local control panel	: 25 x 6 mm GI flat.

LV PANEL BUSBAR:

LT Panel should be designed by the award of the contract the contractor to the following:
The equipment shall have all the following features

1.	LV bus bar	ACB 1250 Amp. to MCCBs Feeder
2.	Bus bar size for phase and neutral	Copper bus-bar, size shall be as per manufacturer design. All the phases and neutral bus-bar shall be same rating/size. Bus-bar size for phase & neutral Suitable spreader to be provided at outgoing side of MCCB to connect 300 Sq. mm. cable through aluminum Lug.
3.	Bus bar support	Insulators 1 kV voltage Class, SMC Epoxy
4.	Bus bar sleeve	Insulation Color coded, for 1kv
5.	Bus bar rated current	Suitable for 1250 A continuous current rating within the 10 K class enclosure @ 150°C ambient temp.
6.	Bus bar short circuit	Withstand 50 kA for 1 sec.

LT PANEL WITH ACB 1250 AMP & FEEDER & STARTER:

1.	Rated operational voltage (V) at 50 Hz	415-440 V/AC
2.	Rated frequency (Hz.)	50Hz.
3.	ACB, Current rating Amps (rms)	1250 Amps
4.	Rated insulation voltage (V) at 50 Hz.	440 V
5.	Number of poles	4
6.	Rated impulse withstand voltage(kV)	8
7.	Rated Ultimate Short circuit breaking capacity at 415 V, 50 Hz (kA rms) Icu	50

8.	Rated Service Short circuit breaking capacity at 415 V,50 Hz. (kA rms), Ics	50
9.	Rated short circuit making capacity at 50Hz.(kA peak), expressed as multiples of Icu	105
10.	Rated short time withstand current for1 sec at 50Hz. (kA rms), Icw, expressed as percentage of Icu	50
11.	Category of utilization	B
12.	Shutterson' Trip'& 'Close' push button with sealing facility	Yes
13.	Accessory mounting	Accessories shall be front accessible plug in type with Energy Meter Accessories namely motor shunt trip & closing coil, UVT etc. should be common for the entire range & shall be suitable for both AC& DC voltage
14.	Operating mechanism	Spring charging stored energy type, manual &Automatic
15.	Minimum Mechanical life (Operating cycles)	20000
16.	Indications	Breaker shall have following mechanical indications: 1. ON, 2. OFF, 3. TRIP 4. SPRING CHARGE STATUS 5.VOLTAGE 6.CURRENT
17.	Sensing	True RMS based
18.	Type	Microprocessor based
19.	Control Terminal	Should be front accessible and minimum NO/NC contacts shall be provided for electrical interlocking.
20.	Protection	Overload protection Pick up 0.4 to 1.0 Time delay 0.2 to 40 sec Short Circuit Pick up 2 to 10 Time delay 20 to 400 Micro sec. Instantaneous Over Current Pick up 4 to 16 & OFF Earth Fault Pick up 0.2 to 0.6 & OFF Time delay 100 to 400 m sec
21.	Metering required	Multi-Function meter for measuring 3 Ph. current,3 Ph. Voltage, KWH, KVAH, Power Factor, Max Demand (KVA), Fault History of Minimum Events,
22.	Indication	Release shall give individual indication for each type of fault
23.	DOL Starter for AHU MCCB 63 Amps. (4 Pole) MCCB 63 Amps. (4 Pole)	08 Nos. (IDU AHU Motor) 18 Nos. (ODU VFD /Comp.) 02 Nos. (8.0 Tr. Ductable Unit AC)
24.	4P MCCB 300 Amp. 4P MCCB 250 Amp. 4P MCB 32 Amp. 4P MCB 16 Amp.	02 Nos. 02 Nos. 06 Nos. 06 Nos.
25.	Analog/Digital	Voltmeter, Ammeter

26.	Energy Meter	Secure/L&T/ SIEMENS/ABB
27.	Bus bar Capacity	1250 A
28.	Panel Manufacture	ERDA/CPRI APPROVAL

SAFETY DEVICES:

Rubber Mats, Fire Extinguisher & First Aid Box should include along with the SVP Substation. The rate should be inclusive of all taxes, levies, service tax, loading at manufacturer's depot, transportation and unloading at the site of work etc. This includes all labour and material as directed by Engineer-in-Charge DPA.

TECHNICAL SPECIFICATION NO. 13:

-Supply, Installation, Testing and Commissioning of flush mount LED light ceiling fixture 200W in round size single phase Supply with inbuilt driver, cool white, LED lighting mount in SVP Hall top ceiling with aluminum die casting material

-LED Light 200 Watt round size single phase AC Supply.

-Supply at site 200 Watt LED Ceiling Light Fixture. the rate shall be firm and inclusive of all taxes, packing and forwarding, insurance, loading at supplier's depot, transportation and unloading at site work. The LED fixtures should be suitable for ceiling mounting in SVP Auditorium Hall.

-All LED Light should be providing Earthing proper.

-The contractor shall take approval from the Engineer in charge for make of LED Light fixture.

Technical Requirements for LED Light is as under:		
Sr. No.	Parameter	Requirement
1.	Input Voltage AC	130 - 260 V
2.	Input Frequency	50 Hz +/-1 HZ
3.	Life	50,000 glow hrs.
4.	Luminary mounting arrangement	Adjustable mounting arrangement
5.	Total Harmonic Distortion	<15% maximum
6.	Working Temperature	-5°C to +60°C
7.	Working Humidity	10% to 90% RH
8.	Temperature	5000° K to 6500° K
9.	Wattage	<200 W per LED
10.	System Efficacy (Lumens / Watt)	≥100
11.	Finishing	Excellent with Powder Coating
12.	Power factor	≥0.90
13.	Warrantee	1 year
14.	Heat sink	Good thermal management System should be provided & LED must be mounted on heat Sink conductive aluminum.

15.	Working Humidity	10% to 90% RH
16.	Color	Cool White
17.	Rated wattage	200 Watt
18.	Color Rendering Index	≥70
19.	Ingress protection Level	IP 66 for lamp compartment and Driver unit
20.	Body of fitting	Die cast aluminum / aluminum Extrusion. Round fitting
21.	Power efficiency	≥ 85%
22.	Beam Angle	60° for Luminary & 120° for bare LED
23.	Light Source	SMD LED array with lens
24.	Make	Syska/Nichia/Edison//Philips Lumiled Citizen/Havells

**Signature & Seal
of Contractor**

-sd-
**Executive Engineer (E)
Deendayal Port Authority**

Approved Make List for Electrical Items

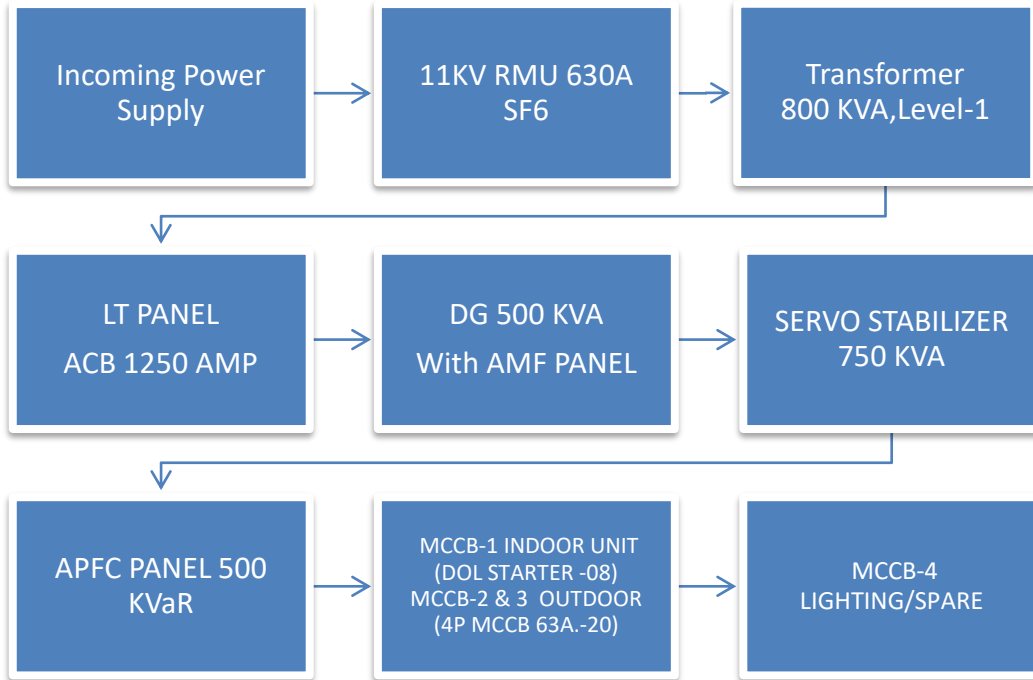
Sr. No.	Description	Recommended Makes
1	HV VCB	SIEMENS / CROMPTON GREAVES/ABB/Schneider
1(a)	HV Gas Insulated Breakers	SIEMENS /Schneider/ABB
2	POWER TRANSFORMERS	VOLTAMP/CROMPTON GREAVES /BHARAT BIJLEE/ BHEL/ SIEMENS/ABB/ Schneider/T&R
3	DISTRIBUTION TRANSFORMERS	EMCO/KIRLOSKAR/PATSON/VOLTAMP/ABB/Schneider /T&R
4	RESIN CAST TRANSFORMERS	
	A) RESIN CAST IMPREGNATED	VOLTAMP / KIRLOSKAR / EMCO
	B) DRY CAST	VOLTAMP/KIRLOSKAR/EMCO
5	HT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/GLOSTER/ UNISTAR/ UNIVERSAL
6	LT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/ RALLISON/PRIMECAB/ HAVELLS/ UNIVERSAL/ UNISTAR/AVOCAB
7	LT ACB	SIEMENS/L&T/SCHNEIDER/C&S
8	PROTECTION RELAYS	AREVA/L&T/SIEMENS/ABB/C&S
9	LT PANEL	CPRI APPROVED
10	CHANGE OVER SWITCH	SIEMENS/L&T/ABB/C&S/SCHNIDER/ LEGRAND / INDOASIAN
11	SFU FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/L&T/ABB/C&S
12	SFU FOR DISTRIBUTION PANELS & FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNEIDER/ LEGRAND/ INDOASIAN/HAVELLS
13	MCCB FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/L&T/ABB
14	MCCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNIDER/ LEGRAND/ INDOASIAN/HAVELLS
15	MCB/ELCB/RCCB/ RCCBO FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/HAGER L&T/ABB
16	MCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNEIDER/ LEGRAND/ INDOASIAN/ HAVELLS/ STANDARD
17	MCB DISTRIBUTION BOARD	STANDARD / HENSEL/LEGRAND / INDOASIAN / HAVELLS
18	MULTI FUNCTION DIGITAL METER FOR MAIN LT DISTRIBUTION PANELS/DIGITAL KWH METERS	L&T/ENERCON/SECURE/L&G/ RISHABH

19	ANALOG VOLT/AMPARE METER FOR DISTRIBUTION PANELS AND FEEDER PILLERS	RISHABH/AE/ENERCON/L&T
20	SLECTOR SWITCH FOR VOLTMETER/AMPARE METER	L&T/SIEMENS/C&S
21	POWER CONTACTOR & OVER LOAD RELAYS	L&T/SIEMENS/ABB
22	QUARTZ TIME CLOCK SWITCH	L&T/INDOASIAN/SIEMENS
23	PVC WIRE WITH COPPER CONDUCTOR	RR KABEL/KEI/POLYCAB/MILEX/GUJCAB/STANDARD/ FINOLEX/ANCHOR
24	FLUSH TYPE SWITCHES, SOCKETS, HOLDERS AND CEILING ROSES & ELECTRONIC REGULATORS	ANCHOR/MK/NORTHWEST/VINAY/PANAMA/HAVELLS
25	DOOR BELLS/CALL BELLS	ANCHOR/LEGEND/MK/NORTHWEST
26	MODULAR SWITCHES, SOCKETS, PLATES & BOXES	ANCHOR / MK / NORTHWEST / LEGRAND /HAVELLS/INDOASIANSIEMENS
27	PVC CONDUIT/OVAL CONDUIT & CASSING CAPPING AND ACCESSORIES	PRECISION/VULCAN/FINOLEX/GARWARE/RESTOPLAST/SWASTIK/BPI
28	GLS LAMPS & FLUORESCENT LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
29	HPSV, HPMV & METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
30	IGNITORS FOR HPSV, METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31	LUMINARIES	PHILIPS/BAJAJ/WIPRO/CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31a	LED Luminaries	Philips /Bajaj/Wipro/CG/Surya/Pyrotech/Syska/Nessa having surge Protection $\geq 10KV$ for fittings & internal Surge rotection for Driver of $\geq 4KV$, LED Chip only OSRAM/CREE/Philips Lumileds/Citizen/Nicia with LM-79,80 CERTIFICATION
32	CEILING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
33	WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
34	EXHUAST FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
35	HEAVY DUTY INDUSTRIAL WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
36	WATER COOLER	VOLTAS/SHRIRAM USHA/BLUE STAR

37	AIR CONDITIONERS	VOLTAS/CARRIER/BLUESTAR/USHA/ HITACHI/LG/ SAMSUNG/ONIDA
38	REFRIGERATORS	VOLTAS/CARRIER/BLUESTAR/USHA/ HITACHI/LG/ SAMSUNG/WHIRLPOOL
39	VOLTAGE STABILIZER	VEELINE / CAPRI
40	INVERTERS	SUKAM / MICROTEK
41	D.G. SETS A) ENGINE B) ALTERNATOR	CUMMINS/GREAVES/KIRLOSKAR/ CATERPILLAR/ ASHOK LEYLAND/VOLVO STAMFORD/CROMPTON GREAVES /JYOTI/ KIRLOSKAR ELECTRIC
42	ELECTRIC MOTOR	ALSTOM/CROMPTON GREAVES /SIEMENS/ KIRLOSKAR/ABB
43	WATER PUMPS	SWASTIK / KSB
44	WATER GEYSER	BAJAJ/USHA / CROMPTON GREAVES / SPHEREHOT / RACOLD
45	LUGS & CABLE GLANDS	DOWELLS / JAINSON / BRACO

BOUNDARY OF ELECTRICAL WORK:

Contractor's scope of work



LT PANEL ACB 1250A:

<u>MCCB -1 (250A)</u>	<u>MCCB-2 (300A)</u>	<u>MCCB-3 (300A)</u>	<u>MCCB - 4 (250A)</u>
<u>DOL STARTER</u>	<u>4P MCCB 63A.</u>	<u>4P MCCB 63A.</u>	<u>4P MCB 32A/16A</u>
<u>08</u>	<u>10</u>	<u>10</u>	<u>06/06</u>
<u>INDOOR UNIT</u>	<u>OUTDOOR UNIT</u>	<u>OUTDOOR UNIT</u>	<u>LIGHTING/SPARE</u>

**Signature & Seal
of Contractor**

-sd-
Executive Engineer (E)
Deendayal Port Authority