

**VOLUME-2**  
**PART- I**  
**Section-17**  
**Air Conditioning &**  
**Ventilation System**

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## 17. Air Conditioning System

### 17.1 Intent of Specification

This specification is intended to cover detailed scope of work, design, technical requirement, manufacture, quality assurance, shop testing, erection, testing, commissioning of Ventilation & Air conditioning System complete with all accessories & spare parts.

### 17.2 Detailed Scope of Works

Scope of work under this section covers provision of labours, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation & commissioning, performance testing, acceptance testing, handing over to purchaser, training to Employer's engineers and guarantee of performance of Ventilation & Air Conditioning System as per the specification furnished hereunder each complete with all accessories, spare parts and warranting a trouble free safe operation of the installation as detailed below.

The scope also covers all the equipment & accessories required for completion of the system to give the desired performance even though specifically not mentioned in this specification.

#### 17.2.1 Air Conditioning system

Air Conditioning system:

- Ten (10) nos. 2.0 T capacity Inverter type Split Air conditioning units complete with all accessories, first
- charge of refrigerant, diffusers complete with volume control dampers etc. for control room, office, and conference room etc.
- One (1) no. - 415V/240 V; 3 phase / single phase AC distribution boards with MCCB controlled incoming and outgoing feeders for 5 x 2 TR plant.
- One (1) no. - Wall mounted power supply control cubicle for each air conditioning units.

The air conditioning system shall be designed to maintain a temperature of  $24^{\circ}\text{C} + 1^{\circ}\text{C}$  during summer at a relative humidity of  $70 + 5\%$  in the above areas.

#### 17.2.2 Ventilation System

- Sufficient nos. of wall mounted propeller fans (minimum 8 nos.) of suitable capacity for machine hall & service bay each suitable to exhaust used air complete with driving motors, inlet guards, weather hood complete with galvanised wire mesh at the discharge end, fixing devices, controls and all other necessary auxiliaries. Alternatively, fans with multi-louvered type automatically operated dampers fitted on the discharge opening, may be offered.

- Suitable capacity of exhaust fans suitable to exhaust used air from the W.C., switchgear rooms, DG room. The fans shall be complete with driving motor, controls, inlet guards, wire mesh at the discharge end, fixing devices and all other necessary auxiliaries.
- Suitable capacity of exhaust fan (at least 2 nos.) to exhaust used air from the Battery room. The fans shall be complete with driving motor, controls, inlet guards, wire mesh at the discharge end, fixing devices and all other necessary auxiliaries. Fan Impeller for the Battery room shall be coated with acid resistant paint coating.
- Power supply, distribution boards as required for the above exhaust system in complete.

### 17.2.3 Other Items

- Local control panels for fresh air blowers etc.
- Necessary pressure, temperature, flow/humidity sensing devices/instruments along with suitable Input and Output terminals (digital and analogue), meters, cables including optical fiber etc.
- Coordination and provision of necessary contacts and/or ports for integration with plant SCADA system (Station controller).
- Any additional ventilation fans and other items/equipment felt necessary during detailed engineering.
- Tools and instruments as per item "Tools and Appliances" of this section.
- Spares as per item "Spares" of this section.

The quantities of equipment/ units mentioned in clause above are tentative only. The actual quantities may need to be examined and reviews and shall have to be got approved from the Employed during detailed engineering.

### 17.3 Codes and Standards

All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / International Standards as given below except where modified and/or supplemented by this specification.

ISO 9001	Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing.
IS 4720	Code for practice for ventilation of surface hydel power stations.
IS 3013	Code of practice for industrial ventilation.
ANSI/ ASHRAE standard 62	Ventilation for acceptable indoor air quality ASHRAE Handbook, data and guide book
IS: 659	Safety code for air conditioning

IS: 4894	Specification for Centrifugal fans
IS: 3588	Specification for Electric Axial flow fans
IS: 655	Air ducts - Specification
IS: 277	Galvanized steel sheets (Plain & Corrugated)-Specification
IS: 737	Specification for Wrought Aluminium and Aluminium alloy sheet and strip for
IS: 661	Thermal Insulation for Cold Storage - Code of Practice
IS: 7613	Methods of testing panel type air filters for air conditioning and ventilation purpose
BS:3928	Sodium flame test for air filters (other than for air supply to I.C. Engines and Compressors).
IS: 3069	Glossary of terms, symbols and units relating to thermal insulation materials
IS: 4671	Specification for Expanded Polystyrene for thermal insulation purposes
IS: 3768	Ventilation ducting -vinyl coated, flexible & semi-rigid - Specification
IS: 900	Code of practice for installation and maintenance of Induction motors
IS: 325	Three Phase Induction motors - Specification
IS: 3589	Steel pipes for Water and Sewage (168.3 to 2540 mm Outside Diameter) - Specification
IS : 1545	Solid Drawn Copper Alloy Tubes for Condensers and Heat Exchangers - Specification
IS : 1239 (Part I & II)	Steel Tubes, Tubular and Other Wrought Steel Fittings - Specification
IS : 1885 ( Part 17)	Electro technical Vocabulary - Switch Gear and Control Gear.
IS : 3624	Specification for Pressure and Vacuum Gauges.
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association
NFPA	National Fire Protection Association

AWS	American Welding Society
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Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Employer. In such case, copies of the English version of the standards adopted shall have to be submitted along with the bid.

#### **17.4 Reference drawings and documents & interfacing**

For the scheme of ventilation System, refer tender drawing.

#### **17.5 Special design and layout condition**

##### **SYSTEM - A**

An array of exhaust fans with louvers shall be provided on the upstream and downstream wall of the powerhouse in machine hall and the service bay area, above crane beam level. Hot air shall move up from floor openings to the machine hall area and will be then evacuated by these exhaust fans.

##### **SYSTEM - B**

Split type Air Conditioning units, in adequate numbers shall be provided for control room, Conference room and offices in control block.

##### **Basic Design Requirement, Dimensions and Ratings-**

The system design shall be based on criteria, factors and details recommended or indicated in the ASHRE handbook, IS: 655, 4720.

##### **Indoor Air Conditioner-**

All air-conditioned areas (control room, office areas, conference room, etc.) shall be maintained at temperature of  $24^{\circ}\text{C} \pm 1^{\circ}\text{C}$  and at relative humidity of not more than 55%.

The ventilation systems shall be designed and erected to guarantee the room conditions according to the design requirements. The internal heat production from electrical and mechanical equipment shall be calculated by the Contractor. Final calculation shall depend on the design data of individual manufacturer's equipment.

##### **Air changes per hour-**

For all ventilation and air-conditioned rooms, the air changes shall be as per relevant IEC /IS: 4720/ASHRAE code to provide the desired heat relief and maintain a minimum level of fresh air in the powerhouse and other areas. All ventilated and air-conditioned area shall be designed to maintain a positive pressure within the powerhouse.

##### **Noise Levels-**

The noise level when measured at 1.5 m from source, caused by operation of the VENTILATION systems shall not exceed:

- 45 dB (A) in rooms as in the control rooms and offices and 60dB (A) in other areas.
- 70 dB (A) for all diffusers grills and 85 dB (A) for motors, fans, etc.,

Silencer, as required, shall be provided to guarantee the above sound levels.

## **17.6 Performance Criteria and Guarantee**

The ventilation and air conditioning system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

## **17.7 Design and Construction**

### **a. Motor and drive**

The assembly shall be complete with motor, blower pulley and belts etc. Fan Motor shall be energy efficient and suitable for 415V  $\pm$  10% Volts, 50 Hz, three phase, supply, totally enclosed fan, air cooled with insulation class 'F'.

Motors are specifically designed for quiet operation.

### **b. Noise Level**

Fan and motor assemblies shall be complete with anti-vibration mountings.

Exhaust Fans-

Exhaust air fans shall be propeller flow fans. Propeller air fans shall be of the multi blade vane type. The hub of the impeller shall be directly coupled to the motor shaft and its diameter adapted to the motor frame. The impeller shall be statically and dynamically balanced.

All bearings shall be pre-lubricated, self-aligning and selected for a minimum of 40000 hour's average life at the maximum design rating. If, however, frequent lubrication is required this should be possible from the outside of the fan casing without disturbing the fan duct assembly. Bearing supports shall be specially designed for trouble-free bearing service. All fan shafts and wheels shall be designed to operate at their maximum rated speed, which is below the first critical speed.

The steel casing of the air fans shall be made of galvanized steel or aluminium.

Where the impeller is accessible in operation, guards shall prevent injuries to maintenance personnel.

Anti-vibration mountings shall be provided for each fan.

Bolts, nuts and washers-

All bolts, screws and nuts shall be of metric thread standards and have hexagonal heads.

The material shall be of stainless steel.

Controls and Electrical equipment-

The ventilation system shall be equipped with operation on manual mode. All the necessary cabling between the control panels and the field ventilation components (as fans, sensors, pumps, valves, air dampers, etc.) shall be included in the supply.

Manual mode-

Individual starting and stopping of equipment shall be done from push buttons on the local control panels.

## **17.8 Spare Parts**

### **17.8.1 General Spare Parts**

The Contractor shall supply the general spare parts as per clause of "General Technical Specification (GTS)". The supply of these spare shall be as per the list of spares for each component/ equipment/ item approved during detail engineering.

The spare parts mentioned here under are meant for use by the Employer during operation and maintenance stage and shall not be used as erection spares required during installation.

### **17.8.2 Specified Spare Parts**

Mandatory spare parts shall be supplied in accordance with the list mutually agreed between the Owner and Contract, which is furnished by the Contractor in their final offers.

### **17.8.3 Recommended Spare Parts**

The Contractor shall furnish the list of recommended spare parts as per "General Technical Specification (GTS)".

## **17.9 Drawings, Documents and Design Calculations**

### **17.9.1 Drawings and documents**

The Contractor shall submit the all the drawings and documents in accordance with requirements stipulations in "General Technical Specification (GTS)".

### **17.9.2 Design calculation**

The contractor is required to submit the design calculation for following to the Engineer for approval during detail engineering.

- Sizing of ducts for air distribution,
- Calculation for selecting the Air conditioning capacity,

The Contractor shall also provide other calculations as required by the Engineer for his approval of the Contractor's design.



### **17.10 Quality control and Assurance**

The contractor shall furnish detail document for Quality Assurance Plan for Purchaser's review & approval.

### **17.11 Tests**

#### **17.11.1 General**

The Employer or his authorized representative shall have access to the manufacturer's work at all reasonable times for the purpose of witnessing the manufacture, inspection of assembly, match marking etc. and testing of all the components, subassemblies and assemblies of complete system. The Engineer may reject any work found defective or, unsatisfactory. The contractor shall furnish indicating the process of inspection for manufacture of component quality assurance plan. Customers hold points shall be clearly marked on the plan.

#### **17.11.2 Shop Tests**

The ventilation system shall be type and routine tested as per relevant IEC / IS / Standards.

The contractor is required to carry out all type tests on equipment of one-unit and routine tests on all units and submit the reports to the Engineer. At the discretion of the Employer, type test certificates can be accepted in place of type tests.

#### **17.11.3 Field Tests**

After installation, the ventilation system shall be field tested for operational tests, visual inspection of complete installations, main air flow rates, performance of coolers, electrical consumption of electrical components, room conditions in all rooms, control system, hydrostatical tests of whole piping systems. The contractor shall prepare and hand over to Engineer details of all test results in a report in a mutually agreed format.

### **17.12 Installation and Commissioning**

The supplier shall follow the requirements of delivery, Installation and commissioning elaborated in General Technical Requirements.

The supplier shall arrange personnel to oversee proper storage of equipment at site, their transshipment to powerhouse, installation and commissioning.