

## **SECTION 6 - ELECTRICAL EQUIPMENT AND CONTROLS**

### **6.01 SCOPE**

- a) The Contractor shall supply all panel boards, starting equipment, circuit breakers, busses, isolators, conducting cables, wiring, conduits, etc, for the entire HVAC system except exclusions described in Clause 7.03 "Distribution and Control Scheme".
- b) The earthing system shall consist of supply and installation of earth connecting points, earthing leads and earth continuity conductor and running earth conductor all along the cable length. All material such as earth continuity conductors, earth connecting points, earthing lead and earth electrode including the installation material and accessories shall be supplied and installed by the Contractor upto the power cable terminating points provided by others.

### **6.02 GENERAL**

All electrically operated equipment shall comply in all respects with the relevant B.S Standards including dimensional standards where these exist, except in so far as this Specification is at variance therewith.

All electrically operated equipment shall be so designed that it will continue to function without damage to itself or otherwise, if the voltage and/or frequency vary within the following tolerances:

Voltage: plus or minus TEN percent.

Frequency: plus or minus TWO percent.

The entire installation shall be in accordance with the requirements and to the entire approval of the Electricity Department of the Government and the approval of the Engineer.

All electrically operated equipment shall be suitable for continuous and prolonged operation in an ambient temperature 122°F (50°C). This temperature makes no allowance for local rises in air temperatures due to the operation of the equipment itself or of heat produced in or by adjacent equipment such as compressors, condensers or heaters. The maximum operating temperature in standards specified shall be observed. Allowance for local high ambient temperature shall be made by reducing the permitted rises of temperature above ambient.

### **6-03 DISTRIBUTION AND CONTROL SCHEME**

- a) Civil Contractor shall provide power supply and earthing points at DB near each condensing unit. Interconnection of condensing units with DBs and Indoor AC units shall be in scope of work of the HVAC Contractor.

#### **6.04 ELECTRICAL MOTORS**

Unless otherwise indicated in these Specifications or in the Schedules, all motors shall be totally enclosed, fan cooled, of squirrel cage construction and of approved manufacturer.

Insulation on all motors shall be equal to Class F with IP Class 55. All motors shall be designed for continuous operation in the ambient temperature of 122°F (50°C).

All motors and accessories like, protection and control devices etc. shall comply in all respects with NEMA, current B.S. Standards and I.E.E. Regulations. Single-phase motors shall be capacitor start induction run construction, unless otherwise indicated or specified.

All motors shall be quiet operating guaranteed to fulfill specified requirements without producing any sound audible outside of plant rooms. All belt driven motors shall have adjustable bases and setscrews to maintain proper belt tension, with proper belt guards. Motors installed in the building should be super silent sleeve bearing type.

The starting current of all motors above 10 h.p shall not exceed twice its rated full load current. For motor rating 10 h.p. and below the starting current shall not exceed 7 times its rated full load current or one hundred amps per line, whichever ever is less.

Motors used with Frequency converters for variable speed application shall be suitable for use with the Frequency converter without any overheating at all operating speeds.

#### **6.05 MOTOR STARTERS AND ISOLATION**

Each three-phase motor shall be provided with a protective automatic starter to disconnect the supply in case of:

- Failure of the supply
- Serious drop in voltage
- Flow of excess current
- Failure of any phase (single phasing)

All starters shall be properly derated for operation in an ambient temperature of 122°F (50°C).

Manual starters may be used for motors 1/2 HP rating and less and shall include thermal overload protection and disconnect switch. These should only be used when no automatic switching is intended.

DOL starters shall be used only on motors of 10 HP and less. Automatic Star-Delta starters shall be used for motors above 10 HP rating.

All motors, control gear and ancillary equipment shall be protected by H.R.C fuses or circuit breakers in addition to the protective starter mentioned above. Such fuses shall be part of the control gear. The isolator shall be integral with control gear.

Single phase motors shall be protected by circuit breakers with overload protection. Where several starters are mounted in a panel rack or bank, each starter shall have separate H.R.C fuses or circuit breaker isolator.

Where starter operating circuits and ancillary apparatus are energized by an auxiliary supply other than the main power circuit to the motor the isolator shall incorporate auxiliary contact to effectively isolate all poles of phases of such auxiliary supplies. Where necessary, two isolators shall be used.

All starters not in a central panel shall have a sheet metal enclosure with a removable lid and cover and necessary brackets for mounting on panel or wall. A clear schematic diagram of the starter circuit shall be fixed inside the cover of each starter.

All magnetic starters subject to manual start shall have momentary contact start and stop buttons built into cover.

All magnetic starters subject to electrical interlock or automatic control shall have hand-off automatic switches built into cover.

All coils, cores, insulation, contacts and trippers to starters and relays and all parts subject to wear and arcing shall be renewable.

#### **6.06 POWER & CONTROL WIRING**

All power wiring from the point of supply as described in previous sections, to each equipment shall be carried out by the HVAC contractor. All control wiring between indoor and outdoor units shall also be in scope of HVAC Contractor.

All power wiring shall be executed as per specifications given under "Electrical Works".

All control wiring shall be executed as per specifications given under "Electrical Works" and as per instruction of the controls manufacturer.

#### **6.07 LOCAL ISOLATING SWITCHES**

The Contractor shall provide additional local isolating switches for all HVAC equipment.

**6.08 EARTHING**

All HVAC equipment with electrical connection and all motor starting equipment panels shall have their frames, carcasses and all metal parts not normally carrying current, effectively and continually connected to the general mass of the earth. Each motor, starter, regulator and other components shall be separately connected to a main earth conductor which shall be directly connected at each end to the principal earth conductor. Not less than two principal earth conductors shall be used. Earth conductor sizes shall be as per I.E.E. regulations.

**6.09 MEASUREMENT AND PAYMENT**

**Measurement:**

Measurement of acceptably completed works of these items and associated accessories will be made on the basis of actual number provided and work acceptably furnished, installed, tested and commissioned.

**Payment:**

Payment will be made for acceptable measured number of respective items on the basis of rate per number quoted in the Bill of Quantities.

**Measurement:**

Measurement of acceptably completed works of this item will be made in the unit of LOT/JOB, acceptably furnished and where required installed, tested and commissioned.

**Payment:**

Payment will be made for acceptable measured number of respective items on the basis of lumpsum price per LOT/JOB quoted against the respective item in the Bill of Quantities, and shall constitute full compensation for all the works related to these item.