# GENERAL

## SECTION INCLUDES

### Electrical Requirements for:

#### Motors

#### Starters, Electrical Devices, and Wiring

#### Manual Motor Starters

#### Motor Connections

#### Capacitors

#### Safety Switches

## REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

### Quality assurance.

#### Electrical components and materials shall be UL labeled and listed.

### References.

#### The design, manufacture, testing and method of installation of all equipment and materials furnished under the requirements of this specification section shall conform to the following:

##### AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

##### AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

##### ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.

##### ANSI/NEMA Standard MG 1 – Motors and Generators.

##### ANSI/NFPA 70 - National Electrical Code.

##### NEMA Standard ICS 2 – Industrial Control Devices, Controllers, and Assemblies.

##### NEMA Standard 250 – Enclosures for Electrical Equipment.

##### NEMA Standard KS 1 – Enclosed Switches.

### Submittals.

#### No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, or as required by the individual equipment specification sections.

### Operation and maintenance manuals.

### Project record documents.

### Delivery, storage, and holding

### Related sections.

#### Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

## SUMMARY

### This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment. In addition, this section covers necessary coordination issues between mechanical and electrical disciplines. All mechanical and electrical construction documents must be completely reviewed by the Mechanical and Electrical Contractors prior to the submission of bids. Any discrepancies in the documents should be brought to the Architect/Engineer's attention at that time. Failure to properly coordinate or review documents in advance of submission of bids will not be valid cause for changes to the overall Contract amount.

### Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

# PRODUCTS

## MOTORS

### The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

#### Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

#### Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. Minimum service factors shall be as follows:

|  |  |  |
| --- | --- | --- |
| **Motor Service Factor Schedule** | | |
| **Horsepower:** | **3600 RPM:** | **1800 RPM:** |
| 1/6 – 1/3 | 1.35 | 1.35 |
| 1/2 | 1.25 | 1.25 |
| 3/4 | 1.25 | 1.25 |
| 1 – 1.25 | 1.25 | 1.15 |
| 1.5 - 150 | 1.15 | 1.15 |

#### Two‑speed poly-phase motors shall have two separate windings served by a single point electrical connection to the two speed starter. Two speed starters shall be located at the motor location unless otherwise noted.

#### Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

#### Starting capability: Frequency of starts as indicated by automatic control system, and not less than five (5) evenly timed starts per hour for manually controlled motors.

#### Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

##### Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit each specific application.

##### Bearings: Ball or roller bearings with inner and outer shaft seals; re‑greasable; designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.

##### Enclosure Type: Unless otherwise noted, use open drip‑proof motors where satisfactorily housed or remotely located during operation; guarded drip‑proof motors where exposed to contact by employees or building occupants; weather protected Type I for outdoor use, Type II where not housed.

##### Overload protection: Built‑in thermal overload protection (in accordance with NEC requirements) and, where indicated, an internal sensing device suitable for signaling and stopping the motor at the starter.

#### Noise rating: "Quiet"

#### Efficiency: **"Premium efficiency"** motors, as defined in NEMA MG 1, most recent edition.

#### Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

#### All three-phase motors shall be inverter duty type.

#### Motors Used With Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motor shall be designed and labeled for use with variable frequency drives (NEMA MG1, Part 31.4.4.2 (1,600V) rated motors, Class F temperature rise, Class H insulation). Motor shall be designed with critical vibration frequencies outside the operating range of the drive output and shall be suitable for use throughout speed range without overheating.

##### All motors served by VFD’s must have an internal factory installed shaft grounding assembly or external field installed shaft grounding assembly. Acceptable manufacturer of external shaft ground kit shall be Helwig carbon brush. **Aegis brand shaft grounding kits shall not be allowed for internal or external grounding.**

#### Motors Used for Wet or Corrosive Duty: Severe duty with cast-iron frame, epoxy finish, stainless steel nameplate, polymer shaft seal, corrosion-resistant fasteners and fan, moisture-resistant windings, and non-wicking leads.

## SHEAVES

### All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.

### When replacing sheaves, use sheaves of at least the originally supplied sizes.

### Contractor shall be responsible for replacement sheaves required to achieve specified performance. Coordinate with testing and balancing of the equipment.

## STARTERS, ELECTRICAL DEVICES, AND WIRING

### Motor-Starter Characteristics: Motor starters shall be compatible with the equipment they serve. In general, motor starter characteristics shall meet the requirements of Division 26 specification sections and as outlined as follows:

### Motor Connections

#### Provide connections to motors in accordance with the requirements listed in the electrical specifications.

#### See Division 26 for the use of lugs for motor connections.

### Capacitors

#### Capacitor features shall include:

##### Individual unit cells.

##### All welded steel housing.

##### Each capacitor shall be internally fused.

##### Non‑flammable synthetic liquid impregnate.

##### Craft tissue insulation.

##### Aluminum foil electrodes

#### KVAR size shall be determined by the Contractor/Supplier and shall correct motor power factor to 95 percent or better and shall be installed on all motors 10 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load. Power factor correction is not required for motors used in conjunction with variable frequency drives.

### FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS

#### See specification section 26 29 13 – Motor Controllers for requirements.

### FULL VOLTAGE NON-REVERSING COMBINATION STARTERS

#### See specification section 26 29 13 – Motor Controllers for requirements.

### MANUAL MOTOR STARTERS

### See specification section 26 29 13 – Motor Controllers for requirements.

### CAPACITORS

#### Capacitor features shall include:

##### Individual unit cells.

##### All welded steel housing.

##### Each capacitor shall be internally fused.

##### Non‑flammable synthetic liquid impregnate.

##### Craft tissue insulation.

##### Aluminum foil electrodes

#### KVAR size shall be determined by the Contractor/Supplier and shall correct motor power factor to 95 percent or better and shall be installed on all motors 10 horsepower and larger that have an uncorrected power factor of less than 85 percent at rated load. Power factor correction is not required for motors used in conjunction with variable frequency drives.

## SAFETY SWITCHES

### See specification section 26 05 01 – Basic Electrical Materials and Methods.

# EXECUTION

## INSTALLATION

### All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

### For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer’s recommendations. Align shafts to manufacturer’s requirements or within 0.002 inch per inch diameter of coupling hub.

### For belt drive motors, mount sheaves on the appropriate shafts per manufacturer’s instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer’s recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

## CONTRACTOR COORDINATION

### General contractor is responsible for coordination of all subcontractors and associated scopes of work.

### Unless otherwise indicated on drawings, all motors, equipment, controls, etc. shall be furnished, set in place and wired in accordance with this specification section and the following schedule.

| **ITEM** | **FURNISHED**  **BY** | **SET BY** | **POWER WIRING** | **CONTROL WIRING** |
| --- | --- | --- | --- | --- |
| Equipment Motors | MC | MC | EC | UNL BSM |
| Motor Control Centers | EC | EC | EC | UNL BSM |
| Unit Mounted Motor Starters, Contactors, Disconnect Switches, Thermal Overloads And Heaters | MC | MC | EC | UNL BSM |
| Loose Motor Starters, Contactors, Disconnect Switches, Thermal Overloads And Heaters | EC | EC | EC | UNL BSM |
| Pushbutton Stations And Safety Stop Switches – Air Handling Systems And Hydronic Systems | EC | EC | NA | UNL BSM |
| Variable Speed Drives And Associated Safety Disconnects (with appropriate fuses) | UNL BSM | EC | EC | UNL BSM |
| Temporary Heating/Cooling And Connections | GC | MC/EC | EC | MC/EC |
| Thermostats And Terminal Controls – Line Voltage | UNL BSM | EC | EC | EC |
| Chillers and Boilers | MC | MC | EC | MC |
| Computer Room Air Conditioning and Controls | MC | MC | EC | MC |
| DX Split Systems Controls | MC | MC | EC | MC |
| Room Controls Transformer Panels | UNL BSM | EC | EC | UNL BSM |
| Thermostats And Terminal Unit Controls – Low Voltage | UNL BSM | UNL BSM | UNL BSM | UNL BSM |
| Air Terminal Units And Hydronic Reheat Coils | MC | MC | NA | NA |
| Air Terminal Units And Electric Reheat Coils | MC | MC | EC | NA |
| Lab Room and Fume Hood Air Terminal Units | MC | MC | NA | UNL BSM |
| Lab Fume Hood Monitors and/or Controllers | UNL BSM | NA | NA | UNL BSM |
| Air Compressors and Air Dryers | MC | MC | EC | NA |
| Pneumatic Control Air Mains | MC | MC | NA | NA |
| Pneumatic Control Device Terminations | NA | NA | NA | Termination  UNL BSM |
| Building Automation System Control Panels | UNL BSM | UNL BSM | EC | UNL BSM |
| Air Handling And Hydronic Systems Controls | UNL BSM | UNL BSM | NA | UNL BSM |
| Air Handling Systems Pressure Sensors | UNL BSM | UNL BSM | NA | UNL BSM |
| Automatic Control Damper Actuators | UNL BSM | UNL BSM | NA | UNL BSM |
| Automatic Control Dampers AHU Economizer | UNL BSM | MC | NA | UNL BSM |
| Air Handling Systems Air Flow Stations | UNL BSM | UNL BSM | NA | UNL BSM |
| Smoke/Fire Dampers | MC | MC | EC | UNL BSM |
| Automatic Flow Control Devices | MC | MC | NA | NA |
| Automatic Control Valves And Actuators | UNL BSM | MC | NA | UNL BSM |
| Hydronic Systems Temperature Sensor Wells | UNL BSM | MC | NA | UNL BSM |
| Hydronic And Steam Systems Pressure Taps | MC | MC | NA | NA |
| Hydronic And Steam Systems Pressure Sensors | UNL BSM | MC | NA | UNL BSM |
| Hydronic Systems Automatic Makeup Systems | MC | MC | EC | UNL BSM |
| Chilled Water Btu Meters | UNL UTIL | MC | EC | UNL BSM |
| Heating Water Flow Meters | UNL UTIL | MC | NA | UNL BSM |
| Steam Condensate Meters | UNL UTIL | MC | EC | UNL BSM |
| Steam Condensate Level Alarm | MC | MC | NA | UNL BSM |
| Sump and Sewage Pump Level Alarm | MC | MC | EC | UNL BSM |
| Water Purification Systems | MC | MC | EC | EC |
| Card Access Conduit | EC | EC | EC | NA |
| Card Access Cabling – Line Voltage | EC | EC | EC | EC |
| Card Access Cabling – Low Voltage | UNL BSM | NA | NA | UNL BSM |
| Card Access Building Controllers | UNL BSM | UNL BSM | EC | UNL BSM |
| Card Access Network Connections | GC | GC | NA | NA |
| Card Access Door Controllers | UNL BSM | UNL BSM | EC | UNL BSM |
| Card Access Door Hardware | GC | GC | EC | UNL BSM |
| Card Access Handicap Door Hardware | GC | GC | EC | UNL BSM |
| Handicap Door Hardware (No Card Access) | GC | GC | EC | EC |
| Card Access Readers | UNL BSM | GC | EC | UNL BSM |
| Card Access Door Position Switch | UNL BSM | GC | EC | UNL BSM |
| Fire Alarm Panels | UNL BSM | UNL BSM | EC | UNL BSM |
| Fire Alarm Communications Circuits | GC | GC | NA | NA |
| Fire Alarm Detectors, Pull Stations, Horns & Strobes | UNL BSM | UNL BSM | EC | UNL BSM |
| Fire Alarm Cabling and Conduit | UNL BSM | UNL BSM | EC | UNL BSM |
| Fire Alarm Relays | UNL BSM | UNL BSM | EC | UNL BSM |
| Room Lighting and Occupancy Sensing | EC | EC | EC | EC |
| Room Occupancy Sensing HVAC Interface | EC | EC | EC | UNL BSM |
|  |  |  |  |  |

END OF SECTION 23 05 13