SECTION 21 05 13

FIRE PROTECTION MOTORS

PART 1 – GENERAL

1.1 PURPOSE
- A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**
- A.

1.3 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:
- A. Section 21 00 00 – Basic Fire Protection Requirements.
- B. Section 21 05 29 – Fire Protection Supports and Sleeves.
- C. Section 21 05 53 – Fire Protection Piping and Equipment Identification.

1.4 SECTION INCLUDES
- A. Single phase electric motors.
- B. Three phase electric motors.
- C. The Contractor shall provide all motors required for equipment supplied under this Division of the work.

1.5 RELATED WORK
- A. Section 21 13 13 – Fire Protection Systems.
- B. Section 21 30 00 – Fire Pumps.

1.6 REFERENCES
- A. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.
- D. ANSI/NEMA MG 1 – Motors and Generators.
- E. ANSI/NFPA 70 – National Electrical Code.

1.7 SUBMITTALS
- A. Submit product data under provisions of Section 21 00 00.
- B. Submit test results verifying nominal efficiency and power factor for motors 1 horsepower and larger.
- C. Submit manufacturer's installation instructions under provisions of Section 21 00 00.

1.8 OPERATION AND MAINTENANCE DATA
- A. Submit operation and maintenance data under provisions of Section 21 00 00.
- B. Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.9 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacture of electric motors for commercial use, and their accessories, with minimum three-years documented product development, testing, and manufacturing experience.

1.10 REGULATORY REQUIREMENTS
- A. Conform to the National Electrical Code.

1.11 DELIVERY AND STORAGE, AND HANDLING
- A. Deliver products to site under provisions of Section 21 00 00.

B. Store and protect products under provisions of Section 21 00 00.
C. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof coverings. For extended outdoor storage, remove motors from equipment and store separately.

1.12 WARRANTY
A. Provide five-year manufacturer's warranty under provisions of Section 21 00 00.
B. Warranty: Include coverage for motors 1 horsepower and larger.

PART 2 – PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Electrical Service: Refer to Drawing schedules for required electrical characteristics.
C. Design for continuous operation in 40 degrees C environment and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, Service Factor and motor enclosure type.
   1. Totally Enclosed Motors: Design for a service factor of 1.00 and an 80 degrees C maximum temperature rise in the same conditions.
   2. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.
D. Visible Stainless-Steel Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, Service Factor, Power Factor, efficiency.
E. Electrical Connection: Provide adequately sized metal electrical connection box for conduit connection. For fractional horsepower motors where connection is made directly, provide metal electrical box for conduit connection.
F. Motors shall be built in accordance with the latest ANSI, IEEE and NEMA Standards and shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled and of approved manufacturer as listed below or of the same manufacturer as the equipment which they serve. Nameplate rating of motors shall match the characteristics scheduled.
G. All motors shall be designed for normal starting torque unless the driven machine requires high starting torque and shall be selected for quiet operation, free from magnetic hum.
H. All motors shall be provided with adequately sized electrical connection box for attachment of flexible conduit. Paragraph 1.03 of this specification refers to the NEMA standards and publications relevant to applications and use of both metal and liquid tight flexible conduit. When motors are connected to driven equipment by the use of a V-belt drive, they shall be furnished with adjustable rails.
I. Motors shall be open drip-proof type, except where specified or noted otherwise on the construction drawing.
J. Motors ¼ to ¾ hp shall be Subtype II and meet the minimum requirements of EPAct92 for minimum NEMA nominal efficiency motors.
K. Motors 1 to 200 hp shall be Subtype I and meet the minimum requirements of NEMA Table 12- 12 for NEMA premium efficiency motors.

2.2 MANUFACTURERS
A. Manufacturer: Company specializing in the manufacture of electric motors for HVAC and plumbing equipment use, and their accessories, with minimum three (3) years documented product development, testing and manufacturing experience.
   1. Baldor - Super E – NEMA Premium Efficiency.
   2. Marathon - NEMA Premium Efficiency.
   3. Siemens – NEMA Premium Efficiency
   4. U.S. Electrical – NEMA Premium Efficiency

2.3 THREE PHASE POWER - SQUIRREL CAGE MOTORS
A. Enclosures shall be of the open drip proof type with a service factor as specified herein and Class B insulation rated at 90 degrees C temperature rise measured above 40 degrees C room ambient condition at full load, unless otherwise noted.
B. All motors 3/4 horsepower and larger, unless smaller motors are indicated to be supplied as 3-phase, shall be 3-

phase and shall be squirrel cage high efficiency induction type with standard NEMA frame sizes.

C. Three phase motors not connected to variable frequency drives are to be protected for phase loss and phase unbalance protection.
D. Motors 1 HP and larger shall have integral frames.
E. Starting Torque: Between one and one and one-half times full load torque.
F. Starting Current: Six times full load current.
G. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics.
H. Design, Construction, Testing and Performance: Conform to ANSI/NEMA MG 1 for Design B motors.
I. Insulation System: NEMA Class B or better.
J. Testing Procedure: In accordance with ANSI/IEEE 112, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and compliance with performance data.
K. Motor Frames: NEMA standard T-frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
L. Bearings:
    1. Ball or roller type, double shielded with continuous grease relief to accommodate excessive pressure caused by thermal expansion or over lubrication.
    2. All motor bearings shall be factory prepacked with a nondetergent lubricant and shall be provided with lubrication fitting arranged to provide easy access when installed on the driven apparatus except as noted hereinafter.
    3. Permanently lubricated factory-sealed motors may be provided in fractional horsepower sizes only where they are an integral part of a piece of approved apparatus.
    4. All bearings shall be designed for L-10, 40,000 hour minimum life hours of continuous service. Direct driven equipment may require specific bearings other than ball type, verify equipment specification where motor may be used where bearing life requirement may exceed L-10 rating. Stamp bearing sizes on nameplate.

M. Sound Power Levels: Refer to ANSI/NEMA MG 1.
N. Part Winding Start (Where Indicated): Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel. Bearings shall be double shielded with waterproof non-washing grease.
O. Nominal Efficiency and Power Factor: Meet or exceed values as scheduled at load and rated voltage when tested in accordance with ANSI/IEEE 112.
P. Motors one horsepower and larger shall be provided with a copper frame grounding lug of hydraulic compression design, for installation by the electrical subcontractor.

2.4 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. Starting equipment shall be furnished by this Division.
B. Relays and equipment supplied by this Contractor shall be integral with electrical equipment supplied.

2.5 RATING

A. Speed and Size: Speed and approximate horsepower ratings are specified in equipment Specification Sections or are indicated on the Drawings. Furnish motors sufficiently sized for the particular application and with full-load rating not less than required by the driven equipment at specified capacity. Size motors so as not to overload at any point throughout the normal operating range.
B. Voltage:
    1. Three phase: 230 volts for 240-volt nominal system voltage.
    2. Three phase: 230/460 volts for 240/480-volt nominal system voltage.
    3. Three phase: 460 volts for 480-volt nominal system voltage.
C. Frequency: 60 Hertz.
D. Efficiency: Provide energy-efficient motors meeting the requirements of NEMA MG1-12.55A, Table 12Y and MG 1.41.3. Efficiency to be determined by testing in accordance with NEMA MG 112.53 using IEEE 112A – Method B.

E. Service Factor: According to NEMA MG 1-12.47 but not less than those indicated per the Table below.

PART 3 – EXECUTION

3.1 APPLICATION

A. Motors located in exterior locations shall be totally enclosed weatherproof epoxy-sealed type.

3.2 NEMA OPEN MOTOR SERVICE FACTORS

Horsepower	3600 RPM	1800 RPM	1200 RPM	900 RPM
1/6 – 1/3	1.35	1.35	1.35	1.35
½	1.25	1.25	1.25	1.15
¾	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15
1.5-150 and above 150	1.15	1.15	1.15	1.15

3.3 MANUFACTURER INSTALLED

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
B. All installation shall be in accordance with manufacturer's published recommendations.
C. Properly install and align motors after installation on the driven equipment.
D. Motor feeders shall be free of splices. In special cases when splice-free feeders are impractical, splices may be allowed given prior written approval from the Owner.
E. Use crimp-on, solderless copper terminals on the branch circuit conductors. For motors 20 horsepower and larger, use 5300 Series 3M motor lead splicing kit or approved equal.
F. When the motor and equipment are installed, the motor's nameplate must be in full view.
G. MOTOR EFFICIENCY TABLE

Minimum Nominal Full Load Efficiency (5) for Motors Manufactured on or after December 19, 2010								
Open Drip-Proof Motors					Totally Enclosed Fan Cooled Motors			
Number of Poles	2	4	6	8	2	4	6	8
Synchronous Speed (RPM) ➔	3600	1800	1200	900	3600	1800	1200	900
Motor Horsepower								
1	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40	91.7	93.0	93.0	91.0	91.7	93.0	93.0	93.0
50	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0

125	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
350	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500	95.8	95.8	NR	NR	95.4	95.8	NR	NR

RE: ANSI/ASHRAE/IES Standard 90.1-ZD10, Table 10.8c minimum nominal full-load efficiency of general purpose electric motors (subtype 11 and design 13)

END OF SECTION