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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | February 19, 2010 | Modified ‘Related Sections’ |
| 3 | March 21, 2011 | Minor edits |
| 4 | March 22, 2011 | Inserted the approved suppliers |
| 5 | June 26, 2013 | Final Draft – Consolidated Comments Spec Update Project. Incorporation of new Commissioning and Computerized Maintenance Management System Data Requirements Specification cross references. |
| 6 | July 29, 2014 | Changes to reflect renaming of commissioning specification and final review (AV) |
| 7 | February 4, 2015 | Finalized Specification – Reference eDOCS #5630493 v8 (AV) and update to standard (NEMA MG 1-2014) |
| 8 | February 10, 2017 | Removed the listed acceptable manufacturers for Thermal Overload Protection. (CPD PMO, OMM) (AV)  Updated Referenced standards (NEMA MG 1-2016) (AAM) |
| 9 | January 12, 2020 | Updated for pump testing project (Q-18-300) (BM) |

NOTE:

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# GENERAL

## Related Sections

### Section 01250 – Substitutions

### Section 01300 – Submittals

### Section 01425 – Computerized Maintenance Management System Data Requirements

### Section 01600 – Material and Equipment

### Section 01780 – Contract Closeout

### Section 01810 – Equipment Testing and Facility Commissioning

### Section 16010 – Electrical General Requirements

## References

### CSA C22.2 No.100, Motors and Generators

### CSA C390, Energy Efficiency Test Methods for Three-phase Induction Motors

### IEEE

#### IEEE Standard 112-2004, IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

### ISO

#### ISO 3741:2010, Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms.

### NEMA

#### ANSI/NEMA MG 1-2016, Motors and Generators

### American Bearing Manufacturers Association (ABMA), 1-Load Ratings and Fatigue Life for Ball Bearings; 2-Load Bearings and Fatigue Life for Roller Bearings.

## Measurement and Payment

### The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

## Product Data

### Submit Product data in accordance with Section 01300 – Submittals.

### The Contractor shall supply all Product data sheets, literature and drawings as requested, including the following items:

#### Dimensional outline drawing.

#### Bearing details.

#### Details of junction boxes.

#### Extension shaft, keyways and coupling fit details.

#### Heat damage curve.

#### Locked rotor and inrush current.

#### Permission number of fully loaded and unloaded starts over a defined time period.

#### Sound level data.

### Winding and insulation data shall be supplied as part of the drawing requirements for the motor.

### Three manuals with installation and maintenance instructions shall be supplied one month prior to the shipment of the motors.

### Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

### All other required information as detailed in the equipment information template and in an electronic format suitable for upload to the Region’s CMMS (Maximo). Comply with Section 01425 - Computerized Maintenance Management System Data Requirements.

## Shop Drawings

### Submit shop drawings in accordance with Section 01300 – Submittals.

### The shop drawings shall include, but not be limited to, the following information:

#### Overall dimensions of the motor

#### Shaft centre line to base dimension

#### Shaft extension diameter and keyway, coupling dimensions and details

#### Fixing support dimensions

#### Dimensioned position of ventilation openings, Details of ventilation duct attachments

#### Terminal box location and size of terminals

#### Arrangement and dimensions of accessories

#### Diagram of connections

#### Starting current and relative data necessary for use in design of the motor starting equipment

#### Speed/torque characteristic

#### Weight

#### Installation data

## Shop Test

### Each motor shall be given a certified routine test at the factory. A total of two certified copies of the Factory Acceptance Test (FAT) results on each motor shall be forwarded promptly to the Consultant and Region. The tests shall show the full load characteristics of the motor and shall be calculated by the equivalent circuits method based on IEEE 112-2004. All tests shall be done in accordance with the applicable IEEE standards. The testing shall include the following:

#### No-load test

#### Rotor impedance test

#### High potential test

#### Winding resistance test

#### Bearing inspection including vibration

#### Efficiency

### These tests may be witnessed by a representative of the Region. The Contractor shall give the Consultant a minimum of one week’s advance notice of the date on which these tests will be performed.

## Maintenance Data

### Provide maintenance data for motors for incorporation into the manual specified in Section 01780 – Contract Closeout.

## Delivery, Storage and Handling

### Handle motors with suitable lifting equipment.

### Store motors in a heated, dry, weather-protected enclosure.

### Refer to Section 01600 – Material and Equipment for additional requirements.

## Quality Assurance

### The Consultant reserves the right to witness standard the factory testing of motors 37 kW (50 hp) and above.

# PRODUCTS

## General

### The design, construction, testing and performance of all supplied motors shall conform to the latest requirements of the applicable NEMA standards and all other appropriate standards referred to herein and shall bear the CSA approval label. Each motor shall be TEFC, squirrel cage induction type. The type of motor and shaft requirements shall be dependent on the corresponding pump requirements. Characteristics shall be in accordance with NEMA MG 1 , for continuous operation on 575 V, three phase, 60 cycles per second supply. The speed and rotation of the motor shall be in accordance with the requirements of the pump that it drives. The accelerating and torque capabilities of the motor shall be compatible with the inertia characteristics of the pump load. The motor shaft shall be compatible with the driven shaft. Horizontal motors which are mounted vertically shall not be acceptable.

### The motor shall be suitable for the following types of starting methods: reduced voltage starting, auto transformer type and soft starter, and full voltage. The motor shall be designed in accordance with NEMA MG 1 . Torque capability shall be in accordance with NEMA MG 1*.*

### The motor shall be specifically designed and selected for intermittent start-stop operation. The Contractor shall provide evidence, upon notification of award of the Contract, of the basis or methods of achieving this capability. The rating/frame assignments and shaft extension dimensions shall be those of “T” frame motors.

### All supplied motors shall be high efficiency motors. The Contractor shall require special written permission from the Consultant to supply motors other than those specified in this Section.

### All motors must be suitable for VFD applications and must be rated for inverter duty conforming to Part 30 & 31 of NEMA MG 1 Section IV.

## Power Supply

### The motor shall be suitable for operation on a 600 V+10% three-phase, 60Hz system. It shall operate satisfactorily at full load with voltages 10% above and below the nameplate voltage. Nameplate voltage shall be 575 volts.

## Performance

### The service factor for cranes and hoists shall be 1.25 and shall be 1.15 for other equipment. The efficiency and power factor of the motor shall be the highest practicable at the load specified for the pump at the noted speeds. In particular, the power factor shall be at least 0.90 at the rated load and not less than 0.85 under half-load conditions. If a motor has a power factor lower than these values under field test conditions, the necessary corrective equipment shall be provided and installed by the Contractor at no additional cost to the Region. This applies to both pre-selected and post-selected equipment.

### The design shall incorporate features and equipment types capable of efficient energy use and follow the Region’s energy optimization objectives in accordance with Design Guidelines Section 12 - Electrical. The use of premium rated motors shall be standard. The design shall incorporate energy monitoring capabilities in order to operationalize energy management initiatives.

## Insulation and Winding

### The insulation system for the motor, including leads, shall be Class B and the temperature rise of the motor shall not exceed 80°C over an ambient temperature of 40°C.

## Balance and Vibration

### All rotating components of the drive shall be statically and dynamically balanced as an assembled unit in accordance with the latest NEMA standards and shall be such as to produce minimum amount of vibration acceptable under service conditions.

## Thermal Overload Protection

### There shall be six thermistors embedded in the windings of the motor, two per phase. A tripping unit rated at 115 V, 60 Hz shall be provided for remote mounting in the motor starter.

## Bearings and Lubrication

### The bearings for the motor shall be of the same type as the bearings specified for the pumps and shall be capable of carrying the weight of all rotating parts plus the hydraulic upward or downward thrust that the driven equipment may impose during the startup operation at any capacity including shutoff without overheating. Bearings shall be of the heavy-duty anti-friction grease lubricated type with B-10 (L-10) bearing rating life of at least 50,000 hours as defined by the ABMA. The housings for the bearing shall be provided with two plugged openings accessible from the exterior of the motor; one to receive pressure grease fittings and one to serve as a drain and vent during greasing. An efficient system of seals shall be provided to prevent the loss of grease and the entrance of water and other foreign material into the bearing housing. If necessary, one lubricating system shall lubricate both the pump and motor bearings. The Contractor shall provide complete information about the size and type of the proposed bearings.

## Noise Levels

### The motor shall be specifically designed for quiet operation consistent with best commercial practice. The overall sound pressure level at all possible operator locations within a radius of 1 m from the equipment shall not exceed 80 db on the “A” weighting scale using the octave band frequency analyzer. The overall sound pressure level shall be determined in accordance with ISO 3741:2010. The Contractor shall supply three certified copies of the test data.

## Terminal Box

### Terminal boxes: Waterproof, cast iron or heavy wall steel, split design, threaded conduit holes, field rotatable in 90 degree steps for bottom, side or top conduit entry.

### Terminal box location: On the right hand side when viewed from the non-driving end, unless otherwise indicated in the Contract Documents.

### Motor lead terminations: Solderless type for incoming cable connections and clamp terminal for ground connections. Clearly and permanently mark motor leads.

### Frame to terminal box cable passage: Seal to prevent the entry of moisture or foreign matter.

### Gaskets: Between cover and box mating surfaces.

### Ancillary devices: Provide a separate termination box. Clearly identify leads. Supply nameplate and connection wiring diagrams.

## Miscellaneous Features

### A motor nameplate of non-ferrous material and permanently riveted to the motor main frame shall be provided. All nameplate lettering shall be stamped into the surface and shall list the following data:

#### Rated kW

#### Rated Voltage in volts

#### Number of phases

#### Full load speed in RPM

#### Full load amperes

#### Frequency

#### Rated power factor

#### Service factor

#### Class of insulation system

#### Type of enclosure

#### Serial number

#### Frame size

#### Temperature rise in °C

#### Bearing type and manufacturer and Code letter

### Lifting hooks, or eyes, shall be provided for lifting the entire motor.

### The motor bases shall be suitable for bolted and dowelled connection to the mounting pad. The motor shall be fitted with a non-reversing mechanism to protect line shaft bearings from reverse rotation. The motor shall be equipped with a cast-iron shield to prevent direct entry of liquids that might be released by a pump seal failure.

## Acceptable Manufacturers

### Electric Motor (< 37 kW (50 hp)):

#### U.S. Electrical Motors, division Emerson.

#### WEG Electric Motors Corp.

#### Wolong (General Electric Company).

#### TECO-Westinghouse Motors (Canada) Inc.

#### Brook Crompton (Canada) Inc.

#### Emerson Industrial Automation (Leroy-Somer).

#### Or Equivalent.

### Electric Motor (> 37 kW (50 hp)):

#### U.S. Electrical Motors, division Emerson.

#### WEG Electric Motors Corp.

#### General Electric Company.

#### Or Equivalent.

## Warranty

### All motors supplied shall include a 5 year comprehensive manufacturer’s warranty.

# EXECUTION

## Installation

### Dry out the motor if dampness is present in accordance with the manufacturer's instructions.

### Install the motor on driven machinery, baseplate, structure, slide rails, and concrete base, ensuring that it has fully cured before installation, rigid plumb and square, using only the lifting facilities provided.

### Make wiring connections. Use liquid tight PVC jacketed flexible conduit between the rigid conduit and the motor.

### Make flexible conduit long enough to permit movement of the motor over the entire length of the slide rails.

### Check for the correct direction of rotation, with the motor uncoupled from the driven equipment.

### Align and couple the motor to driven machinery in accordance with the manufacturer's instructions, using only correct parts such as couplings, belts, and sheaves, as provided by the manufacturer.

## Field Quality Control

### Perform tests in accordance with Section 01810 – Equipment Testing and Facility Commissioning.

## Commissioning

### For all commissioning activities on systems where components of this Section are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning. All inspection and testing activities shall be completed in accordance with the documentation required as part of the commissioning plan that shall be provided to the Consultant prior to the commencement of commissioning activities.

**END OF SECTION**