1.9 Shipment, Protection, and Storage

.1 Ship and store equipment in accordance with Section 01600 unless otherwise specified.

.2 Prior to installation, protect all equipment store on or off site against corrosion. Provide blanks, plugs, packing grease, special covering, moisture absorbing material, and/or other appurtenances necessary to preclude moisture from equipment interior spaces. Take special care with electrical and control panels.

.3 During storage, turn shafts as required, run as necessary, and/or undertake all other special maintenance activities required to ensure that rotating equipment bearings are not subjected to excess wear.

1.10 Tagging Instructions

.1 Tag loose items associated with a particular unit with the equipment number. Make tagging materials of aluminum or stainless steel (no plastic) and securely attach to each item.

2. PRODUCTS

2.1 Spare Parts

.1 As required in the various specification sections, supply spare parts required for the various items of equipment. The lists in these sections are intended to include all parts which normally would be required within the warranty period for normal preventative maintenance and where fabrication requirements for special parts would delay delivery and could keep an item of equipment out of service for a period exceeding one week.

.2 Identify any spare parts not listed that would be required to meet this criteria, with a price list.

.3 In addition, provide a list of all spare parts, not including lubricants, which normally would be required through the first 5 years of operation. Provide prices for each part, guaranteed for 6 months.

.4 Assume responsibility to replenish the spare parts used within the warranty period at the end of the warranty period for the related item(s) of equipment.

2.2 Flanges and Pipe Threads

.1 Provide flanges on cast iron equipment and appurtenances that conform in dimension and drilling to ANSI B16.1, Class 125 and flanges on steel equipment and appurtenances that conform in dimension and drilling to ANSI B16.5, Class 150 unless otherwise specified.

.2 Provide pipe threads that conform in dimension and limits of size to ANSI B1.1, coarse threaded series, Class 2 fit.

.3 Provide flange assembly bolts that are heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Provide threads that conform to Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

2.3 Bearings

.1 Unless otherwise specified, provide oil or grease lubricated, ball or roller type equipment bearings, designed to withstand the stresses of the service specified. Rate each bearing in accordance with AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.

.2 Provide equipment bearings that have a minimum L-10 rating life of 50,000 hours, as determined using the maximum equipment operating speed, unless otherwise specified.

.3 Fit grease lubricated bearings, except those provided factory-sealed and lubricated, with easily accessible grease supply, flush, drain, and relief fittings. Use extension tubes where necessary. Provide standard [hydraulic alemite] type grease supply fittings.

.4 Ensure that all grease fittings on the project are the same size, North American standard.

.5 Extend grease fittings to an accessible location.

.6 Equip oil lubricated bearings with either a pressure lubricating system, or a separate oil reservoir type system. Provide each oil lubrication system to be of sufficient size to absorb the head energy generated in the bearing under a maximum ambient temperature of 40°C.

.7 For pressure lubricating systems or oil reservoirs, provide a filler pipe and an external level indicator gauge. Provide a cap, complete with retention chain, for the oil inlet.

2.4 Critical Speed

.1 For rotating equipment, ensure that operating speed is no more than 80% of the first critical speed unless otherwise specified.

2.5 V-Belt Assemblies

.1 Select belt for not less than 150% of rated driver power. Where two sheave sizes are specified, ensure belt sizing is appropriate for both sets.

.2 For explosion-proof equipment, use anti-static type belts.

.3 Statically balance sheaves and bushings. Where sheaves and bushings are to operate at peripheral speeds greater than 1650 m/min., dynamically balance the assembly.

.4 Separately mount sheaves on their bushings by means of three pull-up grub or cap tightening devices. Key seat bushings to the drive shaft.

2.6 Couplings

.1 For equipment with drives over 0.375 kW and less that 120 kW, and where the driver is directly connected to the driven unit, provide a flexible coupling. Couplings shall accommodate angular misalignment, parallel misalignment, and end float and shall cushion shock loads and dampen torsional vibrations.

.2 The flexible member of flexible couplings shall consist of a tire, with synthetic tension members bonded together in rubber. Attach the flexible member to flanges by means of clamping rings and cap screws, and attach the flanges to the stub shaft by means of taperlock bushings. Provide the equivalent of a shrunk-on fit. There will be no metal-to-metal contact.

.3 For larger couplings, provide continuous sleeve flexible gear type, forged steel couplings.

.4 Size each coupling as recommended by the coupling manufacturer for the specific application, considering applied power, speed of rotation, type of service, and other pertinent details.

2.7 Guards

.1 On moving parts, provide sheet steel guards in accordance with workplace safety regulations. Fabricate of galvanized 14 gauge steel.

.2 Paint guards after fabrication to the same standard as the attached equipment.

.3 Guards shall be removable to facilitate maintenance of moving parts.

.4 Make provision for extension of lubrication fittings through the guards.

2.8 Equipment Installation

.1 Provide nameplate for all equipment in accordance with Section 11910.

.2 Provide nameplates for all electrical and control panels supplied with equipment, in accordance with Section 11910, Division 16, and Division 17 requirements.

2.9 Caution Signs

.1 For caution signs, use vinyl stick-on type decals placed onto clean, smooth surface of equipment to be posted.

.2 Where sufficient space exists, use decal applied to galvanized mild steel, fibreglass, or plastic sheet fastened to equipment.

.3 Provide signs that read "CAUTION – AUTOMATIC EQUIPMENT MAY START AT ANY TIME".

.4 Make letters 25 mm in height, red, on a yellow background.

.5 Provide mounting posts and hardware and mount close to guarded moving parts.

2.10 Gauge Taps and Test Plugs

.1 Refer to Division 15 and Division 17 for general requirements.

.2 Provide gauge taps on the suction and discharge side of pumps, blowers, and compressors.

.3 Install gauges at each location indicated.

.4 Tap and install plugs at locations indicated in the drawings and as required to practically complete testing of piping and equipment.

2.11 Concrete Pads

.1 Coordinate location of concrete pads for equipment.

.2 Ensure that, unless otherwise shown, concrete pads are a minimum of 100 mm above finished floor elevation and extend a minimum of 100 mm outside of the equipment base.

.3 Ensure that pads drain way from base.

.4 Ensure that conduit, drains, piping, etc. required for the equipment, rise through the pad.

2.12 Equipment Bases

.1 Structural Steel Bases

.1 Make bases of structural steel shapes with thickened steel pads for dowelling.

.2 Fabricate bases in a rectangular pattern. "T" and "L" patterns may be used where required to accommodate the equipment drive and accessories.

.3 Make perimeter members of structural beams with a minimum depth equal to 0.10 of the longest dimension of the base. Beam depth need not exceed 350 mm provided that the deflection and misalignment is kept within the manufacturer's recommendations.

.4 Provide grout holes where vibration isolation is not specified.

.2 Cast Iron Bases

.1 Seal in accordance with the requirements of Division 9 for bleeding surfaces, prior to grouting.

.2 Terminate fasteners requiring connection to the base by nuts welded to the bottom of the base and plugged with cork, plastic plugs or grease, or acorn nuts.

2.13 Anchor Bolts

.1 For all permanently or intermittently submerged services and for all exterior mounting locations, provide stainless steel anchor bolts conforming to Division 5, and ASTM A320.

.2 For all other anchor bolts, provide cadmium plated or galvanized steel anchor bolts conforming to ASTM A307, unless noted otherwise.

.3 For rotating equipment over 35 kW, provide anchor bolts with sleeves and washers to permit adjustment during installation of the equipment.

.4 Do not use drilled expansion or adhesive anchors for anchor bolts unless submitted and reviewed by the Engineer.

.5 Design anchor bolts for lateral forces for both pullout and shear in accordance with the requirements of Division 5.

2.14 Equipment Base Templates

.1 For rotating equipment where shown in the drawings, or specifically called for in the specifications for that equipment, provide an equipment base template for location of equipment anchor bolts to be embedded in concrete.

.2 Manufacture the equipment base template of structural steel with stops or holes placed for the anchor bolts.

.3 Shop finish the templates in accordance with Division 9 for items to be embedded in concrete.

.4 Provide access holes for the placement of grout or concrete, as applicable.

2.15 Jacking Screws

.1 On all base mounted rotating equipment larger that 7.5 kW, provide jacking screws for the driver and the driven end to facilitate alignment.

.2 Provide jacking screws consisting of a 12 mm nut welded to the frame of the equipment with the hole in a horizontal plane.

.3 Provide a 12 mm bolt that fits through the nut and extends to the mounting feet.

.4 Two jacking screws are required at each end of the equipment, one parallel to the axis of the equipment and one perpendicular.

3. EXECUTION

3.1 Operator Training

.1 Arrange for the training of the Owner's staff. As a minimum, training will include operating requirements, maintenance procedures, troubleshooting, and repair procedures for all electrical and mechanical components.

END OF SECTION

PROCESS EQUIPMENT INSTALLATION

1. GENERAL

1.1 Description

.1 Installation, including the supply of anchor bolts, and testing of equipment supplied under other sections in Division 11.

1.2 Definitions and Interpretations

.1 Testing: In this Division, testing is defined as the operation of a specific item of equipment under actual and/or simulated conditions for the purpose of ensuring the equipment satisfies its basic design criteria. Provide all materials, labour, power and equipment necessary to conduct all required tests.

.2 Commissioning: In this Division, commissioning is defined as the operation of equipment systems under actual and/or simulated conditions for the purpose of ensuring the system performs its intended functions.

1.3 Submissions

.1 Check all the shop drawings relative to the equipment and materials, dimensions, measurements, size of members, type of materials, controls, list of equipment being supplied, names of manufacturers, and other details to satisfy himself that they are correct and conform to the requirements and intent of the Contract.

.2 Where the shop drawings are submitted with coordination information missing, such as dimensions of structures, the Engineer will return the submission as soon as practicable marked "[Revise and Resubmit]".

2. PRODUCTS

2.1 Equipment List

.1 Unless indicated otherwise, supply and install all equipment listed on the Equipment List, detailed on the equipment specification sheets, or shown on the drawings.

.2 Determine the extent of equipment to be supplied from the specifications, list of equipment and materials and manufacturer's drawings covering the equipment. Furnish and install all additional materials necessary to complete the installation.

.3 Incorporate all ancillary devices in the installation including those providing for cooling water, seal water, lubricant supply, process drains, electrical connection, and instrumentation and control requirements.

2.2 Mounting Requirements

.1 Provide all supports, anchorage, and mounting of all equipment in accordance with the manufacturer's recommendations, the NBC, and industry standard requirements.

.2 Design and provide all elements required to resist the calculated forces described herein or required by the element manufacturer.

.3 Design anchorage for all equipment bases, supports, and foundations in accordance with NBC for [Seismic Zone 0].

.4 For rotating equipment, where specified, submit design notes and calculations for anchorage, signed and sealed by a Professional Engineer.

3. EXECUTION

3.1 Coordination

.1 Coordinate the work specified under this Section with the work of other Sections to produce a complete and workmanlike job.

.2 Coordinate the placement of equipment bases and housekeeping pads with Division 3.

.3 Coordinate the arrangement of conveyors and other conveyance equipment with Division 14.

.4 Coordinate the routing of ancillary piping with Division 15.

.5 Coordinate the routing of electrical and control wiring and conduit with Division 16 and Division 17.

3.2 Preparation

.1 Before commencing installation of the work, inspect and take field measurements and ensure that work conducted previously in the area is not prejudicial to the proper installation of the works.

.2 Refer to the equipment specifications and specification sheets for assistance in determining the form in which equipment is to be shipped and the extent of field assembly required.

.3 Dimensions shown on the Contract Documents for equipment bases, piping connections, etc., are approximate. Correct to suit the exact dimensions of the equipment provided for each application. Arrange any necessary modifications to piping connections, pipework, or other ancillaries at no cost and after acceptance by the Engineer.

.4 Schedule the visits to the site of the manufacturer's representative for the times and periods specified in other sections. Cooperate in his supervision of the installation and start-up. Follow all reasonable instructions of the manufacturer's representative. Should the Contractor require the manufacturer's representative to attend for longer or more frequent periods, he shall arrange this, at his own expense, with the manufacturer.

3.3 Installation of Equipment

.1 Install all equipment specified in other sections, detailed on the equipment specification sheets, or shown on the drawings.

.2 Supply and install all necessary shims, gaskets, etc., required to complete the installation.

.3 Provide for the use of all necessary lifting and loading equipment and all tools required to complete the installation.

.4 Comply with the specific requirements for installation noted in other sections of this specification and with the instructions of the Manufacturer. Where there is a conflict in these requirements, identify the conflict to the Engineer and proceed as directed.

3.4 Equipment Bases and Anchorage

.1 For rotating equipment of 7.5 kW or above and for equipment requiring structural anchoring, set anchor bolts in advance. Where required, set anchor bolts in sleeves to permit minor adjustment during installation. Use machine base templates where shown. Tie anchor bolts to reinforcing steel to resist tensile forces, as shown.

.2 Prepare grout as specified in Division 3 and provide full contact with the equipment bases unless otherwise recommended by the equipment manufacturer and accepted by the Engineer. Neatly bevel, form, or trim the grout.

.3 Where equipment is supplied with a plate steel base, provide access holes in the top of the plate and use a pour grade, non-shrink, non-metallic grout as specified in Division 3 to fill the entire void under the base.

3.5 Alignment

.1 Set and align all rotating equipment in accordance with the more stringent requirements of either the manufacturer's requirements or the following:

.1 Level base, use machinists level on all machined bases.

.2 Align couplings to satisfy the following criteria:

Allowable Coupling Speed Misalignment	Allowable Angular Misalignment	Parallel
Under 100 rpm, below 50 hp	4'00'	0.25 mm
Under 100 rpm, 50 hp and over	3'00'	0.12 mm
100 to 600 rpm	2'00"	0.12 mm
600 to 1800 rpm	1'00"	0.10 mm
1800 to 3600 rpm	0'5"	0.5 mm

.3 Check for soft foot, maximum permissible 0.002 mm.

.2 Where equipment undergoes a substantial differential temperature rise (equal to or exceeding 30°C between driver and driven unit), provide precision benchmarks in foundation and on equipment. Perform alignment at operating temperatures.

.3 Demonstrate the final alignment to the Owner, Engineer, and Manufacturer' Representative.

3.6 Lubricants

.1 Extend any inaccessible lubrication points and lubrication drains to convenient locations.

.2 Remove storage lubricant and provide the initial fill of new lubricants for the equipment. Lubricant grade to be as recommended by the manufacturer.

3.7 Vibration Survey

.1 Conduct a vibration survey under normal operating conditions for all equipment with a motor size exceeding 37 kW and for smaller units where specified.

.2 Use a calibrated vibration sensor, accepted by the Engineer, and capable of measuring unfiltered vibration velocities and peak-to-peak amplitudes. Select a sensor capable of measuring velocities at a precision of 0.1 mm/s and an accuracy of plus or minus 0.2 mm/s.

.3 Monitor vibration in all three dimensions at the head and tail end of both the driver and driven units, at intermediate bearing points, and at other critical locations which may be specified by the Engineer.

.4 Record the vibration velocities for each item of equipment and submit a report to the Engineer detailing the findings. Include a description of the measuring equipment, identification of equipment on which vibration monitoring was completed, description of conditions under which the test was conducted, and a listing of all of the collected data.

.5 Unless specified otherwise, use unfiltered velocities as the vibration criteria. Unfiltered velocities less that 5 mm/s shall be considered acceptable. Correct unfiltered velocities which exceed 5 mm/s.

3.8 Noise Survey

.1 Conduct a noise survey for all equipment over 37 kW and for smaller units where specified.

.2 Use a calibrated noise meter, accepted by the Engineer, and capable of measuring noise in the A Scale at a precision of 0.5 dBA and an accuracy of 1.0 dBA.

.3 Measure noise levels at an elevation similar to the major noise emitter from the equipment (bearing housing, muffler, etc.) and at a horizontal distance of 1.0 metres.

.4 Record the noise levels for each item of equipment and submit a report to the Engineer detailing the findings. Include a description of the measuring equipment, identification of equipment on which noise level monitoring was completed, description of conditions under which the test was conducted, and a listing of all of the collected data.

.5 Equipment is to operate at a noise level less than 85 dBA, when measured in free field at 1.0 metre. Noise requirements may be more stringent in areas where more than one item of process equipment is intended to operate concurrently. Specific requirements for equipment that differ from 85 dBA are listed in the sections related to those items of equipment.

.6 Noise abatement features (acoustic panels, acoustic insulation, etc.) are specified in other sections.

.7 In any process area, recommend whatever measures necessary to maintain a composite noise level below 90 dBA. Where directed by the Engineer, undertake those corrective actions.

3.9 Quality Assurance

.1 Test all process equipment to ensure it operates in accordance with the basic design criteria listed in the specification sections or equipment specification sheets.

END OF SECTION

PROCESS MOTORS LESS THAN 150 kW

1. GENERAL

1.1 Description

.1 This Section specifies alternating current induction motors, 150 kW or less, to be provided with the driven equipment.

.2 This Section does not specify medium voltage (2300 V and greater) and specialty motors such as submersible motors, valve operator motors or torque rated motors.

.3 Unless specified otherwise, the manufacturer of the driven equipment is to provide electric motors as an integral component of the driven equipment, as specified in Section 11005.

.4 This Section specifies motors suitable for driving centrifugal pumps, fans, blowers, compressors, gears, progressive cavity pumps or other loads fed via the variable frequency drive or connected across-the-line.

1.2 Reference Standards

.1 Conform to the following reference standards, in accordance with Division 01:

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

.2 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.

.3 CSA C390, Energy Efficient Test Methods for Three Phase Induction Motors.

.4 EEMAC M1-7, Motors and Generators.

.5 NEMA Std. MG1, Motors and Generators.

.6 IEEE 112, Polyphase Induction Motors and Generators – Testing.

.7 IEEE 114, Single Phase Induction Motors – Testing.

1.3 Submittals

.1 Shop Drawings: Submit with the related items of equipment in accordance with Division 01 and Section 11005. In addition, submit the following details: Provide the specified information for each typical size or type of motor driven equipment.

.1 Shop drawings and product data in accordance with Division 16.

.2 Overall dimensions of motor.

.3 Shaft centreline to base dimension.

.4 Shaft extension diameter and keyway, coupling dimensions and details.

.5 Fixing support dimensions.

.6 Terminal box location and size of terminals.

.7 Arrangement and dimensions of accessories.

.8 Diagram of connections.

.9 Speed/torque characteristic.

.10 Weight of motor.

.11 Installation data.

.12 Rotation direction.

.13 Starting restrictions (time between starts).

.14 Terminal leads marking.

.15 Bearing data (including part numbers).

.16 Recommended lubricant.

.17 Design ambient temperature and temperature rise ratings.

.18 Torque characteristics including rated starting torque and breakdown torque.

.19 The AFBMA L-10 rated life for the motor bearings.

.20 The nominal efficiency of all motors.

.21 Class, division, group, and UL frame temperature limit code for explosion-proof motors.

.2 Operating and Maintenance Data: Provide for incorporation in Operation and Maintenance Manual of the related item of process equipment as specified in Division 1.

1.4 Coordination

.1 For motors fed via variable frequency drives (VFD), communicate motor requirements to, and comply with drive requirements of, the VFD manufacturer in accordance with Division 16.

1.5 Quality Assurance

.1 Build motors in accordance with CSA C22.2 No. 100, CSA C22.2 No. 145, NEMA Standard MG1, and to the requirements specified.

1.6 Shipment, Protection and Storage

.1 Ship, protect and store equipment in a manner that prevents damage or premature aging.

.2 Handle motors with suitable lifting equipment.

.3 Store motors in heated, dry, weather-protected enclosure.

2. PRODUCTS

2.1 Description

.1 Unless specified otherwise, provide motors suitable for continuous operation at an elevation of 600 m above sea level.

.2 Provide motors suitable for continuous operation in a 40°C ambient temperature.

2.2 Acceptable Manufacturers

.1 Baldor

.2 General Electric

.3 GEC Alsthom

.4 Reliance

.5 Siemens

.6 Toshiba

.7 Westinghouse

.8 U.S. Motors.

2.3 Materials

.1 Motors: to EEMAC M1-6.

.2 Lead markings: to EEMAC M2-1.

.3 Unless specified otherwise, provide all motors with:

.1 Cast iron frame

.2 Cast metal fan blades and shrouds

.3 Stainless steel hardware

.4 Non hygroscopic windings.

2.4 Components

.1 Bearings

.1 Provide sealed ball bearing type on motors less than 37.5 kW.

.2 Bearings on 37.5 kW motors or larger to be greasable ball bearing type, rated for a minimum L-10 life of 100,000 hours at the ambient temperature specified herein.

.2 Provide adequately sized, diagonally split, gasketted, EEMAC 4 terminal boxes complete with threaded hub for conduit entry for ODP and TEFC motors.

.3 Provide adequately sized, diagonally split, gasketted EEMAC 7 terminal boxes complete with threaded hub for conduit entry for explosion-proof motors.

.4 Provide a ground connection and lifting eyes or lugs.

.5 Align and balance the motor with the related equipment in the shop to minimize vibration and undue stresses.

.6 Where specified, equip motors with anti-condensation heaters suitable for connection to 120 volts, single phase, 60 Hz power supply.

.7 Current Imbalance

.1 Do not exceed the values listed below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:

.1 Under 37.5 kW: 25%.

.2 37.5 kW and above: 10%.

.2 Base imbalance criteria upon the lowest value measured.

.8 Winding Over Temperature Protection

.1 Provide stator winding over temperature protection on all motors rated 45 kW and larger.

.2 Provide stator winding over temperature protection on motors rated less than 45 kW, when required by the specific equipment specification section, or if recommended by the driven equipment manufacturer.

.3 Over temperature protection for motors rated 45 kW and larger and other motors, where specified, to be NEMA MG1-12.53, Type 1, winding running and locked rotor over temperature protection. Provide one detector per phase. Detectors to be positive thermal protection (PTC) thermistor type, with leads brought out to a terminal strip in a NEMA 4 enclosure in Type 2 motors and a NEMA 7C or 9 enclosure for Type 3 motors.

2.5 High Efficiency Motors

.1 Use motors that have efficiencies that conform to or exceed the requirements of EPACT.

.2 Where vertical motors are specified or provided, ensure efficiency is within 0.5 percent of the values specified for horizontal motors.

.3 Test motor efficiency in accordance with CSA C390 and NEMA MG1, accounting for stray load losses, measured indirectly based on the IEEE method.

2.6 Motors Smaller Than 0.25 kW

.1 General

.1 Unless otherwise specified, provide squirrel cage, single phase, capacitor start, induction run type motors 0.25 kW and smaller.

.2 Provide single phase motors with Class F insulation.

.3 Small fan motors may be split-phase or shaded pole type.

.4 Provide copper windings.

.2 Rating

.1 Unless specified otherwise, provide motors rated for operation at 115/1/60 VAC, and continuous-time rated in conformance with NEMA Standard MG1, paragraph 10.35.

.3 Enclosures

.1 Unless otherwise specified, provide motors with totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) enclosures.

.2 Where explosion-proof motors are specified or required, provide explosion-proof motors bearing the UL label for Class I, Division 1, Group D hazardous locations.

.3 Provide advice in the enclosure to detect over temperature and automatically de-energize the motor.

2.7 Motors 0.25 kW to 150 kW

.1 General

.1 Unless otherwise specified, provide 3-phase, squirrel cage, full voltage start, high efficiency induction type motors 0.25 kW to 150 kW.

.2 Rating

.1 Unless otherwise specified, provide heavy duty, high efficiency, and TEFC motors for all motors which run continuously.

.2 Unless otherwise specified, provide squirrel cage induction type motors, with a service factor of 1.15 at 40°C ambient, Class F insulation and non hygroscopic windings.

.3 Provide motors with EEMAC Design B torque characteristics. Size motors to satisfy the driven equipment's starting torque requirements. For special high torque applications such as sweep arm drives, motors with Design C characteristics may be specified or provided subject to the Engineer's acceptance.

.4 Rated for 600/3/60 VAC service unless otherwise specified.

.5 Design motors for full voltage starting, capable of running successfully when terminal voltage is from +10% to -10% of nameplate voltage.

.6 Motors with a service factor of 1.0 to operate at no more than 90% of their nameplate current rating and motors with a service factor of 1.15 to operate at not more than 100% of their nameplate current rating.

.7 Ensure sufficient capacity to operate the driven load and associated devices under all conditions of operation without overloading.

.3 Enclosure and Insulation

.1 Classify motors as:

.1 Type 1 (General Duty)

.2 Type 2 (Process)

.3 Type 3 (Explosion-proof).

.2 Enclosures and insulation systems are specified in the following clauses. Temperature rise for all motor types not to exceed that permitted by Note II, paragraph 12.42, NEMA MG1.

.3 Provide non hygroscopic insulation.

.4 Type 1 Motors (General Duty): Unless specified otherwise, provide TEFC enclosures with Class F insulation.

.5 Type 2 Motors (Process): Provide TEFC enclosures, with Class F insulation, suitable for moist and corrosive environment. Provide Class F insulation with Class B temperature rise for motors rated 7.5 kW and larger. Coat all internal surfaces with an epoxy paint. Aluminum frame motors are permitted. Steel frame motors are permitted for motors with frames 184 and smaller.

.6 Type 3 Motors (Explosion-proof): Provide motors to be rated for operation in a Class 1, Division 1, Group D hazardous location in accordance with CSA C22.1. Provide a Class F insulation. Steel frame motors are not permitted. Provide an approved breather/drain device in the motor drain hole.

2.8 Motors for Variable Frequency Drives

.1 Comply with the characteristics of the intended variable frequency drives.

.2 Select premium efficiency units, inverter duty rated, in conformance with NEMA MG1.

.3 Use Type 2 or Type 3 motors.

.4 Insulation: Class F insulation with Class B temperature rise, suitable for moist and corrosive environments and in accordance with NEMA MG1, Part 30 and Part 31.

.5 Motors for variable frequency systems are not to deliver more than 80% of the motor's service factor rating by any load imposed by the driven machine at any specified operating condition or any condition imposed by the driven machine's performance curve at maximum operating speed.

.6 Ensure motors have adequate cooling capacity when operating through the entire speed range capacity of the drive.

2.9 Vertical Motors

.1 Unless otherwise specified, provide full voltage vertical motors with a Type P base specifically designed for vertical installation.

.2 Universal position motors are not acceptable.

.3 Provide vertical motors with solid shafts unless specified otherwise.

.4 Provide thrust bearing rating compatible with the loads imposed by the driven equipment.

2.10 Two Speed Motors

.1 Provide two speed motors with separate windings. Single winding two speed motors are not acceptable.

2.11 Power Factor Correction Capacitor Sizing

.1 Confirm the maximum capacitor size which may be connected to motors 37.5 kW and larger, on constant speed drives.

2.12 Finishes

.1 Finish motors in accordance with Division 16.

2.13 Equipment Identification

.1 Provide equipment identification in accordance with Division 11 and Division 16.

.2 Nameplates

.1 Provide motor nameplates on engraved or stamped stainless steel. Include information enumerated in NEMA Standard MG1, paragraph 10.37, 10.38 or 20.60, as applicable.

.2 Additionally, indicate:

.1 The AFBMA L-10 rated life for the motor bearings for motors 37.5 kW and larger.

.2 The nominal efficiency for all motors.

.3 Class, division, group and UL frame temperature limit code for explosion-proof motors.

.4 Permanently fasten nameplates to the motor frame and position to be easily visible for inspection.

2.14 Spare Parts

.1 Provide maintenance materials and spare parts in accordance with Division 01.

3. EXECUTION

3.1 Manufacturers Representative

.1 All motors are supplied as an integral component of some other item of equipment. The manufacturer's representative for that equipment is responsible for the supervision of installation, site testing, and commissioning of the motor as part of the equipment as specified in other sections. Ensure that the motor manufacturer's representative informs both the representative for the equipment and the installer of requirements for the motor, installation, testing and commissioning.

3.2 Installation

.1 Dry the motor if dampness present, in accordance with manufacturer's recommendations.

.2 Install or ensure the motor is properly installed to provide satisfactory service.

.3 Make connections as indicated. Use liquid-tight PVC jacketed flexible conduit between rigid conduit and motor.

.4 Make flexible conduit long enough to permit movement of motor over entire length of slide rails, when applicable.

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

.6 Align and couple motor to driven machinery to manufacturers instructions, using only correct parts such as couplings, belts, sheaves, as provided by manufacturer.

.7 Install anchor devices and setting templates in accordance with Division 03.

3.3 Testing

.1 Perform tests and document results in accordance with Division 16.

3.4 Testing and Commissioning

.1 Ensure the motor operates as intended during testing of the individual equipment and during process commissioning

END OF SECTION