TWEED SHIRE COUNCIL

ELECTRICAL DESIGN SPECIFICATION

EL07

ELECTRIC MOTORS

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1 CITATION

This document is named “Tweed Shire Council, Electrical Design Specification EL07 - Electric Motors”

2 ORIGIN OF DOCUMENT, COPYRIGHT

3 VERSIONS

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.1	Original version		1 November 2005	

4 STANDARDS

Electric motors and all materials and equipment used in their construction, must comply with all relevant clauses of the following Australian Standards.

AS 1359	General Requirements for Rotating Electrical Machines.
AS 1360	Rotating Electrical Machines of Particular Types or for Particular Applications.
AS 2768	Electrical Insulating Materials – Evaluation and Classification based on Thermal Endurance.
AS 1023	
Part 1	Built-in Thermal Detectors and Associated Control Units:
Part 2	Thermal Overload Protective Devices;
Part 3	Inherent Overheat Protectors.
AS 1081	Methods of Measurement of Airborne Noise emitted by Rotating Electrical Equipment.
IEC 6000034-17	Rotating Electric Machines Part 17 – Cage Induction Motors when fed from converters

5 GENERAL DESIGN AND CONSTRUCTION

5.1 General

Cage-rotor type motors must be suitable for normal "direct-on-line", full voltage starting and for use with variable voltage variable frequency controllers.

Motors must be capable of continuous operation at rated load with a voltage variation of plus or minus 10%. Motors must operate satisfactorily during starting, accelerating and through voltage dips of short duration (not to exceed 20%). Motors must be designed to withstand up to 2% negative sequence voltage. Motors must operate satisfactorily with supply frequency ranges of 48-52Hz.

Unless otherwise specified, all motors must operate on a 415 V, 3 phase, and 50 Hz supply.

The nameplate kW must be the continuous maximum rating for continuous operation within the temperature rise for the nameplate rating.

Rated speed must not exceed 1,500 R.P.M. unless approved by Council and unless specified otherwise must be 4 pole.

Motors must be foot mounted, unless otherwise specified.

Bolts and thread devices must comply with ISO metric standards.

All motors must be provided with a stainless steel plate fixed with 2 screws on which the motor identification number has been engraved, in addition to the standard nameplate.

Motors are to be suitable for outdoor operation in a wet process environment. Motors must be constructed from cast iron or steel.

5.2 Insulation Class and Temperature

All motors must be wound with "H" class insulation and any components not rated at “H” class to be nominated. The ambient temperature must be taken as 50°C. The temperature rise at full load rated motor load must not exceed 75°C by resistance method in an ambient of 50ºC (Class E).

5.3 Enclosures

All motors must be totally enclosed, fan cooled (TEFC), protected to not less than IP56 in accordance with AS 1359.20. All joints must be fitted with approved O-rings. Sufficient and adequate porous type drain plugs must be fitted at either end of the motor, to suit the shaft orientation.

Frame size must be compatible with Australian standard AS 1359.10.

5.4 Cooling

Cooling fans must be of cast iron or steel, suitable for rotation in either direction, protected by steel fan housing.

Air flow must be from the outboard end to the coupling end.

5.5 Stators and Rotors

Stator and rotor windings must be of copper alloy. Copper used in windings need not be tinned.

Motors must be capable of withstanding 1.2 times the maximum rated speed without sustaining damage.

5.6 Motor Heaters

Anti condensation motor heaters must be fitted to all motors 90 kW and above. These must operate at 240V AC or as shown on the drawings.

Motor heaters must be connected in a separate terminal box.

5.7 Bearings and Seals

Bearings must be designed for a B10 life rating of no less than 60,000 hours that is factors a1, a2 and a3 of 1.0.

All motors must be provided with grease labyrinth type seals to avoid dust entry into the bearings and slip rings.

Drive end bearings must be roller type and non drive end bearings must be ball type.

Motor bearings, for frames greater than size 132, must be grease lubricated with Tecalemit hexagon greasing nipples and grease relief valves. New grease must displace old grease outside the motor casing.

5.8 Thermal Detector Protection

Thermal Detectors, with characteristics to AS 1023, Part 1 1971, must, where required, be inserted in the stator windings of the motors. Unless otherwise stated in the scope of work, motors required for low or variable speed operation must be fitted with thermal detectors.

At least one thermal detector must be inserted in the hottest part of each phase winding.

All motors above 22 kW and submerged motors must be fitted with thermistors in each phase winding. All motors above 250 kW must be fitted with RTD in each phase winding and RTD for each bearing.

Tripping must be set to AS 1023, Part 1, to operate at 140°C.

Thermal detectors must be connected in a separate terminal box.

5.9 Lifting Eye Bolts

All motors must be fitted with suitable lifting eye bolts or other approved means for lifting the motor.

The lifting facility must be capable of lifting twice the motor weight (i.e. factor of safety greater than two).

5.10 Motor Terminal Boxes

The terminal box must be totally enclosed, sealed against air from the motor carcass and have flanged joints fitted with neoprene rubber gaskets and sufficient bolts or studs to ensure proper sealing.

Due to long cable runs oversize cables may have to be used. Terminal boxes must be of ample size to terminate these larger cables. The Contractor must confirm suitability of terminal box for motor cables.

An earthing terminal must be provided inside the terminal box. Terminal boxes must be suitable for Steel Wire Armoured (SWA) cable glands.

The terminal box must be capable of being mounted in any one of four positions and must be on the right hand side of the motor when viewed from the shaft end unless specific otherwise.

The terminal box on motors above 37 kW must be fitted with a 6mm brass gland plate to allow the removal of the motor without disturbing the gland connection.

In the case of brake motors, the terminal box must have sufficient space and terminals to connect the brake to a separate power circuit via a separate cable.

5.11 Protective Finish

In accordance with Standard Specification EL06 Corrosion Protection for Electrical and Mechanical Equipment Structures

The final colour must be Orange X15 to AS 2700.

5.12 Packing for Shipment

Motors must be completely enclosed in a polyethylene shroud or waterproof wrap. It must then be crated so that it is totally enclosed and constrained from movement. To avoid bearing damage, motor shafts must be prevented from movement during transport and storage.

5.13 Fluid Couplings

Where fluid couplings are used the motor shaft ends must be centrally drilled and tapped as follows:

5.13.1 SHAFT SIZE TAPPING SIZE

24 30 M10 x 25 deep Ray, need these details here

30 38 M12 x 30 deep

38 50 M16 x 40 deep

50 85 M20 x 45 deep

85 130 M24 x 50 deep

5.14 Motor Selection

The Contractor must select sizes and ratings taking into account transient conditions including starting, braking, reversing, load and speed variations, load torque requirements and motor speed - torque characteristics.

The kW ratings of all motors must be in accordance with the load to be driven plus at least 10% or as specified and must be sufficiently sized for the starting method employed.

In particular the motors must be manufactured in accordance with Australian Standards AS 1360 with an electrical performance which complies with the relevant sections of AS 1359.

The locked rotor current must not exceed 700% full load current.

5.15 Motor Design

Torque characteristics of motors must be dependent on the specific application for the motor.

All applications other than drives requiring high starting torque must be high efficiency type motors complying with torque requirements specified for design, classification "N" in AS 1359.41 and as follows.

Motors must have performance characteristics not less than:

- motor locked rotor torque 140%;
- motor pull up torque 110%;
- motor breakdown torque 220%.

Screens are examples of drives that may require high starting torque motors. Preference must be given to using a larger motor rather than a high starting torque motor. The Contractor must obtain approval from the Council before using a high starting torque motor.

High starting torque motors must comply with the requirements below.

Motor must have performance characteristics not less than:

- motor locked rotor torque 220%;
- motor pull up torque 140%;
- motor breakdown torque 220%.

The motor torque classification must be stamped on the nameplate.

5.15.1 Duty

The duty of the motor is "S1" (AS 1359.30).

5.16 Covers

5.16.1 Vertical Mounted Motors

Rain covers must be provided for all motors specified as being vertically mounted.

5.16.2 Horizontal Mounted Motors

If specified in the scope of works, motors must be fitted with sheet stainless steel covers designed to reflect and prevent the building up of debris on the motor carcass and cooling fins. This cover when fitted should also be of a design suitable to enhance the efficiency of motor fan cooling and prevent direct solar radiation from de-rating the motor rating.

5.17 Efficiencies

The Contractor must provide type test certificates for motor efficiencies when requested.

Motor efficiency calculations are to be performed in accordance with AS 1359.102.

Efficiencies and performance data must be for bi-directional rotation.

5.17.1 Noise

Motors must be designed to comply with noise level limits of AS 1359.109 or better. Any options which are available to reduce noise, and the guaranteed results achievable, are to be provided.

The mean pressure level at 1.0m must be not more than 80 dB(A) at 75% load.

5.17.2 Vibration

Motors must be balanced to G2.5 or better.

Motors over 250 kW must be fitted with bearing vibration sensors. Sensors must be installed so as to be in direct mechanical contact with each motor bearing and must be installed in such a position as to be safely and readily accessible without the need to remove any covers or other components that may obscure the sensor.

5.17.3 Inrush

Inrush current is the term used for the current that flows at the moment of energisation of a motor circuit. The inrush current must not exceed 1600% full load current. The Contractor must detail motors exceeding this requirement; the detail must include the motor power and the associated inrush current. This information will allow appropriate switchgear to be selected. The Contractor must provide type test certificates for motor inrush current when requested.