WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION E-51-04

SQUIRREL CAGE INDUCTION MOTORS BELOW 40 kW

1 GENERAL

This standard specification is for low voltage squirrel cage induction motors of rating below 40 kW.

The motor shall comply with the following requirements:

(a) Type : Energy efficient squirrel-cage induction motor to Class IE2 of IEC 60034-30 with the following minimum full load efficiency measured according to IEC 60034-2-1:

Rated Output (P)	Minimum Motor Efficiency	
	2-pole	4-pole
0.75 kW	77.4 %	79.6 %
1.1 kW	79.6 %	81.4 %
1.5 kW	81.3 %	82.8 %
2.2 kW	83.2 %	84.3%
3 kW	84.6 %	85.5 %
4 kW	85.8 %	86.6 %
5.5 kW	87.0 %	87.7 %
7.5kW	88.1 %	88.7 %
11 kW	89.4 %	89.8 %
15 kW	90.3 %	90.6 %
18.5 kW	90.9 %	91.2 %
22 kW	91.3 %	91.6 %
30 kW	92.0 %	92.3 %
37 kW	92.5 %	92.7 %

(b) Standards : IEC 60034 and IEC 60072 except where modified herein.

(c) Degree of protection : Totally enclosed IP 55 to IEC 60034-5.

(d) Duty rating : Maximum continuous rating (MCR), S1 duty to IEC 60034-1.

(e) Insulation : Class F design with temperature rise not exceeding the limits applicable to Class B in IEC 60034-1.

(f) Ambient temperature : 40°C maximum continuous for 4 hours.

35°C average over 24 hours.

5°C minimum.

(g) Humidity : Up to 98% relative humidity.

(h) Electricity supply : 380V 3 phase, 50 hertz, 4 wire system with solidly earthed neutral.

(i) Voltage variations : ±6 %

(j) Frequency variations : ±2 %

2 STARTING PERFORMANCE

Motor above 3 kW shall be suitable for both direct-on-line and star/delta starting. The direct-on-line starting current at rated voltage shall not exceed 7.5 times the full load current. The starting time (time taken to attain 90% of the rated speed) under the most arduous conditions shall be as follows:

85% rated voltage at motor terminals - not more than 4 seconds
49% rated voltage at motor terminals - not more than 10 seconds

The motor shall be suitable for two starts in succession followed by a cooling period of 15 minutes before attempting another starting sequence. The motor shall also be capable of at least six starts per hour equally spaced during normal running conditions.

3 ENCLOSURE CONSTRUCTION

Motor frames, end covers, end shields and external fan cowls shall be of adequate mechanical strength and robustness. Motors rated at 15kW or above shall have cast iron casings. Dimensions and frame number of motor shall comply with IEC 60072.

Motors above 3 kW or weighed more than 25 kg shall be provided with lifting lugs for easy handling during erection or maintenance.

4 RATING

The rated motor power output shall be not less than 120% for fresh water pumpset and 115% for salt water pumpset of the maximum power absorbed by the pump over the entire pump operating range specified. The foregoing power margin shall not be reduced by any factors such as tolerances of pumpset or accuracy of test equipment.

The power factor at full load shall be not less than 0.83 lagging for motor over 15 kW.

When used in conjunction with a variable speed drive (VSD) or inverter supply, the motor shall be suitably de-rated to account for the reduced cooling effect of the motor fan. Moreover, the motor shall be designed with reference to IEC TS60034-17 or other equivalent standards to withstand over-voltage, higher rate of rise of voltage, over-heating due to harmonics, flow of bearing current and other stressing effects

arising from the pulse width modulated (PWM) waveform of the supply voltage.

5 CABLING AND TERMINATION

The insulation of terminals, connectors, cables and conductors shall be water-proof, e.g. butyl rubber, PVC heat-shrinkable tubing or similar homogeneous material.

The cable terminal box for the motor power supply cable(s) shall be adequately sized and suitable for cable entry from below. The terminal box shall be diagonally split to enable quick and easy installation and maintenance.

For motor above 3 kW, an earthing terminal shall be provided adjacent to the cable terminal box. A tapped hole with screw would be acceptable.

6 ANTI-CONDENSATION HEATERS

For motor above 15 kW, anti-condensation heater suitable for operation on a 220V, single phase, 50 hertz supply shall be fitted. Terminals shall be provided for the heater to be switched off when the motor is running and vice versa. A separate totally enclosed (IP 55) terminal box for the anti-condensation heater shall be provided.

A label of durable material shall be fixed on the lid of the heater terminal box with inscriptions "Separate Supply for Space Heater – Isolate Before Opening this Lid" for warning purpose.

7 MARKING

A permanent stainless steel data plate to IEC 60034-1 giving the motor data and the phase connections for the required direction of rotation shall be provided.

8 TEST REQUIREMENTS

The following tests shall be conducted on each motor above 3kW at the manufacturer's works in accordance with the specified applicable standards:

	Tests	Standards
(a)	Resistance of winding (cold) and direction of rotation	(IEC 60034-1)
(b)	No load losses, power factor and current	(IEC 60034-2-1)
(c)	Withstand voltage	(IEC 60034-1)
(d)	Vibration	(IEC 60034-14)

Test reports shall be submitted for approval within 14 days after completion of the tests.

9 INFORMATION FOR ASSESSMENT

The following type test reports on motor of the same design, frame size and

construction shall be submitted for assessment.

	Tests	Standards
(a)	Temperature rise	(IEC 60034-1)
(b)	Power factor at rated output	-
(c)	Locked rotor torque	-
(d)	Starting (locked rotor) current	-
(e)	Efficiency at rated output	(IEC 60034-2-1)

- End of this Specification -