

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 standard specification for motor ratings of 40 kW or above is provided separately.

The motor shall comply with the following requirements:

- (a) Type : Energy efficient squirrel-cage induction motor with the following minimum full load efficiency:

Rated Output (P)	Minimum Motor Efficiency	
	2-pole	4-pole
1.1kW ≤ P < 1.5kW	82.8%	83.8%
1.5kW ≤ P < 2.2kW	84.1%	85.0%
2.2kW ≤ P < 3.0kW	85.6%	86.4%
3.0kW ≤ P < 4.0kW	86.7%	87.4%
4.0kW ≤ P < 5.5kW	87.6%	88.3%
5.5kW ≤ P < 7.5kW	88.6%	89.2%
7.5kW ≤ P < 11kW	89.5%	90.1%
11kW ≤ P < 15kW	90.5%	91.0%
15kW ≤ P < 18.5kW	91.3%	91.8%
18.5kW ≤ P < 22kW	91.8%	92.2%
22kW ≤ P < 30kW	92.2%	92.6%
30kW ≤ P < 37kW	92.9%	93.2%
37kW ≤ P < 40kW	93.3%	93.6%

- (b) Standards : BS 4999, BS EN 60034 and BS EN 50347 except where modified herein.
- (c) Degree of protection : Totally enclosed IP 55 to BS EN 60034-5.
- (d) Duty rating : Maximum continuous rating (MCR), S1 duty.
- (e) Insulation : Class F or Class B design with temperature rise not exceeding the limits applicable to Class B in BS EN 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 : $\pm 6\%$
- (j) Frequency variations : $\pm 2\%$

2 STARTING PERFORMANCE

Motor above 3.5 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 and shall be constructed of ferrous metal. Dimensions and frame number of motor shall comply with BS EN 50347.

Motors above 3 kW shall be provided with lifting facilities for easy handling during erection or maintenance.

4 RATING

The motor power output for fresh water pumpset shall be not less than 120% of the maximum power absorbed by the driven-load over the specified duty range. In case of salt water pumpset or other load which has a non-overloading characteristic, the motor power output shall be not less than 115% of the maximum power absorbed by the load.

The power factor at full load shall be not less than 0.83 lagging for motor over 16kW.

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.

For motor above 3.5 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 3.5 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. For motor above 16 kW, a separate totally enclosed (IP 55) terminal box for the anti-condensation heater shall be provided.

7 MARKING

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

8 TEST REQUIREMENTS

The following type test reports, to BS 4999 or BS EN 60034, conducted by the manufacturer on motor of the same design, rating and construction shall be submitted for verification. If the type test reports are not available, the following tests shall be carried out on one of the supplied motor of the same design, rating and construction.

<u>Tests</u>	<u>Standards</u>
(a) Temperature rise	(BS EN 60034-1)
(b) Power factor at rated load	-
(c) Locked rotor torque	-
(d) Starting (locked rotor) current	-

The following tests shall be conducted at the manufacturer's works in accordance with the specified applicable standards:

<u>Tests</u>	<u>Standards</u>
(a) No load losses and current (routine test on each motor)	(BS EN 60034-2)
(b) High voltage (dielectric) test (routine test on each motor)	(BS EN 60034-1)
(c) Vibration test (routine test on each motor)	(BS 4999 Part 142)
(d) Efficiency test at rated load (basic test on one motor of each rating and design)	(BS EN 60034-2)

- End of this Specification -