

WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION E-51-06
SUBMERSIBLE MOTORS BELOW 40 kW

1 GENERAL

This standard specification is for submersible motors of rating below 40 kW. The standard specification for submersible 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 |
|-------------------------------------|--------------------------|
| $5\text{kW} \leq P < 7.5\text{kW}$ | 84.0% |
| $7.5\text{kW} \leq P < 15\text{kW}$ | 85.5% |
| $15\text{kW} \leq P < 37\text{kW}$ | 88.5% |
| $37\text{kW} \leq P < 40\text{kW}$ | 90.0% |
- (b) Standards : BS 4999 and BS EN 60034 except where modified herein.
- (c) Degree of protection : IP 68 to BS EN 60034-5 for continuous submersion in water.
- (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 any 24 hours.
5°C minimum.
- (g) Humidity : Up to 98% relative humidity.
- (h) Water temperature : 5°C - 40°C
- (i) Electricity supply : 380V 3 phase, 50 hertz, 4 wire system with solidly earthed neutral.
- (j) Voltage variations : $\pm 6\%$
- (k) Frequency variations : $\pm 2\%$

2 STARTING PERFORMANCE

Motors 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 seven times the full load current. The motor shall be capable of accelerating its driven load from standstill to 90% of its final running speed with 49% voltage across motor terminals in 10 seconds.

The motor shall be suitable for two starts in succession followed by a cooling period of 10 minutes before attempting another starting sequence. The motor shall also be capable of at least twelve starts per hour equally spaced during normal running conditions.

3 DESIGN AND CONSTRUCTION

3.1 Ventilation and Cooling

Water-sealing type motor shall have self-circulation cooling to BS EN 60034-6, characteristic code IC 4W1W0 (viz. machine cooled by water in an internal closed circuit and immersed in water externally). Dry-type motor shall have self-circulation cooling to BS EN 60034-6, characteristic code IC 4A1W0 (viz. machine cooled by air in an internal closed circuit and immersed in water externally).

3.2 Bearings

Metric size rolling bearings shall be supplied, viz. imperial size bearings shall not be acceptable.

Vertical shafts shall have approved thrust and guide bearings.

3.3 Cabling and Termination

Power supply cables and control cables (where applicable) shall be supplied integral with the motor. The length of the power supply and control cables shall be 50 metres unless otherwise specified. The voltage drop on cable at full load shall not be greater than 2.5%.

The power supply cable shall be waterproof, flexible, resistant to abrasion and impact, of adequate current rating and complete with an integral earth continuity conductor. The earth continuity conductor shall have the same current carrying capacity as the line conductors and terminate at an earthing terminal inside the casing. Cable cores shall be identified by colour codes or lettering. The cable shall be synthetic rubber insulated and sheathed, 450/750V grade to BS 6007 with a maximum conductor temperature of 85°C.

The cables and termination at the motor end shall be suitable for continuous operation under water and shall have the same degree of protection as for the motor. The other end of the cables shall be suitably sealed to keep out moisture.

The size of power supply cable shall be selected according to the motor rated full load current (FLC) from the following Table 1.

Table 1 - Power Supply Cable Schedule (50 metres)

Stranded Copper Size (mm ²)	Permissible Motor Rated Full Load Current for 1 cable (A)	Permissible Motor Rated Full Load Current for 2 cables * (A)
2.5	14	20
4	22	33
6	31	49
10	43	74
16	58	100
25	76	-
35	94	-

* Note : This is applicable to star-delta starting motor for which each of the supply cables will share 0.577 of the motor rated full load current and the permissible maximum voltage drop on cables is 2.5%.

3.4 Markings and Data Plates

An instruction plate and a data plate of stainless steel, brass or other non-tarnishing metal shall be provided. The instruction plate shall give the connections and phase sequence for the required direction of rotation while the data plate shall be stamped with the information specified in BS EN 60034-1.

4 PROTECTIVE EQUIPMENT

A winding embedded thermostat switch shall be provided for pump motor above 3.5kW.

5 INFORMATION TO BE SUBMITTED

Descriptive literature relevant to the motor and auxiliary equipment, in particular the dimensions of the motor shall be submitted with the tender.

The following torque-speed characteristics shall be furnished by the tenderer:

- (a) Torque characteristic at rated voltage.
- (b) Torque characteristic at the lowest specified voltage across the motor terminals.

The Y-axis shall be torque in N-m while the X-axis shall be the motor speed in r/min.

- End of this Specification -