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# GB/T 2818-2014

**Replacing GB/T 2818-2002**

# Submersible motor for deep well



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**Standardization Administration of the People's Republic of China.**

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# Foreword

This Standard was formulated in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces GB/T 2818-2002 " Submersible motor for deep well".

Compared with GB/T 2818-2002, except the editorial changes, the main technical differences of this Standard are as follows:

-- MODIFY the motor rated voltage (see 3.4 of this version; 3.4 of 2002-version);

-- ADD 8 power levels - 0.25kW, 250kW, 280kW, 315kW, 355kW, 400kW, 450kW, and 500kW (see 3.5 of this version);

-- ADD the frame size and the corresponding power levels (see Table 1 of this version);

-- MODIFY the connection dimensions and tolerances of motor and submersible pump (see Table 2 of this version; Table 2 of 2002-version);

-- ADD the recommended values of spurious loss Ps of rated load of cast aluminum rotor motor (see Table 8 of this version);

-- DELETE the E-class insulation (see 4.4 of this version; 4.4 of 2002-version);

-- MODIFY the guarantee-values of the ratio OF motor stall torque TO the rated torque (see Table 9 of this version; Table 9 of 2002-version);

-- MODIFY the guarantee-values of motor maximum torque (see 4.7 of this version; 4.7 of 2002-version);

-- MODIFY the tolerance table of guarantee-values of electrical performance (see Table 12 of this version; Table 11 of 2002-version);

-- ADD the polypropylene-type; DELETE the polyvinyl chloride type (see Table 13 of this version; Table 12 of 2002-version);

-- MODIFY the hot insulation resistance of the stator windings (see 4.12 of this version; 4.12 of 2002-version);

-- ADD the the conventional withstand voltage test for the 200kW and below motors that are mass-produced, in accordance with the provisions in 9.2 of GB 755-2008 (see 4.13 of this version);

-- ADD the provision – impact voltage peak in inter-turn impulse withstand voltage of three-phase motor (see Table 14 of this version);

-- ADD the downward bearing capacity of thrust bearing (see Table 15 of this version);

# Submersible motor for deep well

## 1 Scope

This Standard specifies the types, basic parameters, technical requirements, test methods, inspection rules, marks and packaging for well submersible three-phase, single-phase asynchronous motor (hereinafter referred to as motor.

This Standard is applicable to water-filled, oil-filled, dry and shielded structure motors that are integrated with well submersible pumps, submerged and run vertically in water.

## 2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this Standard.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB 755-2008 Rotating electrical machines - Rating and performance

GB/T 997-2008 Rotating electrical machines - Classification of types of construction, mounting arrangements and terminal box position (IM Code)

GB/T 2423.4-2008 Environmental testing for electric and electronic products - Part 2: Test method - Test Db: Damp heat, cyclic (12h+12h cycle)

GB/T 9239.1-2006 Mechanical vibration - Balance quality requirements for rotors in a constant (rigid) state - Part 1: Specification and verification of balance tolerances

GB/T 12785 Test methods for submersible motor-pumps

GB/T 13384 General specifications for packing of mechanical and electrical product

GB 14711 General requirements for safety of small and medium size rotating electrical machines

GB/T 22719.1 Interturn insulation of random-wound winding for AC low-voltage electrical machines - Part 1: Test methods

**3.8** The radial runout of circumferential surface, when shaft is rotating, at midpoint of motor shaft extending connection shall not be greater than requirements in Table 3.

**Table 3 Radial runout of circumferential surface, when shaft is rotating, at midpoint of motor shaft extending connection** mm

| Diameter of shaft extension | Radial runout limit | |
|---|---|---|
| | Rolling bearing support | Sliding bearing support |
| ≤ 30 | 0.04 | 0.07 |
| > 30 ~ 50 | 0.05 | 0.08 |
| > 50 ~ 80 | 0.06 | 0.10 |
| > 80 | 0.07 | 0.11 |
| Note: For sliding bearing support, radial runout limit does not include the bearing's side clearances. | | |

3.9 Radial runout and face runout OF flange stopper connecting the motor and pump TO the shaft centerline: for rolling bearing support, it shall not be greater than 0.08mm; for sliding bearing support, it shall not be greater than two-side clearance of bearing plus 0.1mm.

# 4 Technical requirements

**4.1** Motors shall comply with the requirements of this Standard, and is manufactured according to the drawings and technical documents that are approved per specified procedure.

**4.2** Under the following conditions, the motor shall be able to operate normally:

a) motor is fully submerged in water, the depth is not more than 70m;

b) the water temperature is not higher than 20°C;

c) the solid content in water (by mass) is not more than 0.01%;

d) pH of the water is 6.5 ~ 8.5;

e) chloride content in water is not more than 400mg/L;

f) hydrogen sulfide content in water is not more than 1.5mg/L;

g) for water-filled motor, the cavity shall be filled by clear-water or other solution specified by the manufacturer.

NOTE: When the using conditions do not meet the above requirements, the users shall

For oil-filled, dry and shielded motors that are immersed in water that is near to room temperature, the insulation resistance between the stator winding (including signal lines) and chassis shall not be less than 100MΩ.

**4.12** When closing to operating temperature, thermal insulation resistance of the stator windings shall not be less than 1MΩ.

**4.13** Motor's stator winding (including signal lines) shall be able to withstand the withstand voltage test for 1min, without breakdown. Test voltage frequency is 50Hz, and shall be sinusoidal waveform as possible. For three-phase motor of which the rated voltage is 380 V, the effective value of test voltage is 1760V; For three-phase motor of which the rated voltage is 660 V, the effective value of test voltage is 2320V; for single-phase motor, the effective value of test voltage is 1500V. Before the test, the water-filled motor shall be immersed in water that is near to room temperature for 12h. Motor's withstand voltage test shall not be repeated; if it is indeed necessary, the test voltage shall be 80% of the specified value.

For mass-production 200kW-and-below motors, it shall be in accordance with the requirements of GB 755-2008.

For type test, the stator winding's withstand voltage test shall be carried out when the winding is near to operating temperature.

**4.14** Motor's stator windings (except the wires that are directly immersed) shall be able to withstand the inter-turn impulse withstand voltage test, without breakdown; for single-phase motor, the test voltage (peak value) is 1800V; for three-phase motor, the test impulse voltage's peak value shall be according to Table 14.

**Table 14 Test impulse voltage peak value of three-phase motor**

| Rated voltage /V | 380 | 660 |
|---|---|---|
| Test impulse voltage's peak value | 3000 | 3900 |

**4.15** For dry motor, it shall be carried out according to the 40°C cyclic damp heat test method as specified in GB/T 2423.4-2008; after 12 cycles test, measure the insulation resistance of motor stator winding; for rated voltage of 380V, it shall not be less than 1.14MΩ; for rated voltage of 660V, it shall not be less than 1.98MΩ; and it shall be able to withstand the withstand voltage test for 1min, without breakdown; for rated voltage of 380V, the effective value of test voltage is 1500V; for rated voltage of 660V, it is 1970V. Motor's withstand voltage test shall not be repeated; if it is indeed necessary, the test voltage shall be 80% of the specified value. Before the repeated test, motor shall be dried.

**4.16** When the three-phase power source is balanced, the tolerance BETWEEN any phase in no-load current of three-phase motor AND the average value of three phases

**4.25** Motor assembly shall be complete and correct; the motor shall rotate freely and stable, brisk operation, no stuck phenomenon. Nameplate and mark shall be complete. Painted surfaces shall be dry and intact, without fouling, bumps and cracks.

**4.26** Motor's cable length, measured from the pump outlet, shall not be less than 2m, and be able to ensure the submersible pump's normal installation and use.

**4.27** When the alphabet's sequence of marking at wire outlet is same as the direction of voltage phase sequence of three-phase power, then, observing from the end of shaft extension, the motor is generally rotated counterclockwise. When there is a need on the connecting structure of submersible pump and ascending pipe, it is also allowed to rotate in clockwise direction.

**4.28** motor's shaft extending's flat key, maintenance manual and product qualification certificate shall be accompanied with each motor, and be supplied to each user. Each motor shall be supplied with necessary spare parts.

**4.29** Motor's safety requirements shall comply with the requirements of GB14711.

# 5 Test methods and inspection rules

### 5.1 Test Method

The analysis and calculation of motor performance's test methods and test results shall comply with the provisions of GB/T 12785 and GB/T 22719.1.

### 5.2 Inspection Rules

Product inspection is divided into the exit-factory inspection and type inspection.

#### 5.2.1 Exit-factory inspection

**5.2.1.1** Each motor shall be subject to inspection before leaving the factory, and shall be accompanied with product qualification certificate.

**5.2.1.2** Each motor shall be subject to exit-factory inspection; exit-factory inspection items include:

a) mechanical inspection: assembly, rotation, appearance, radial runout, face runout, and connection dimensions of submersible pump;

NOTE: radial runout, face runout may make a random inspection. Sampling method shall be stipulated by the manufacturer.

b) cavity pressure withstand test;

c) oil inspection (for oil-filled motor, oil shall be inspected before idling);

b) thermal test;

c) determination of efficiency, power factor and slip;

d) determining of maximum torque;

e) determination of minimum torque during start-up (performed only when the identification of new products);

f) for dry-type motor, 40°C cyclic damp heat test;

g) inspection of product mean time to first failure (MTTFF) (performed only when type identification of new products).

# 6 Marks and packaging

**6.1** Nameplate shall be fixed at obvious position on motor housing; nameplate's material and its engraving shall ensure that the wordings are indelible within the valid lifetime of the motor. On the nameplate, it shall be marked with at least the following contents:

a) name of the manufacturer;

b) motor name, model and specifications;

c) rated power, in kilowatt (kW);

d) rated frequency, in hertz (Hz);

e) rated voltage, in volt (V);

f) rated current, in ampere (A);

g) rated speed, in revolutions per minute (r/min);

h) thermal grading [130 (B), 155 (F), 180 (H)] or temperature rise limits;

i) wiring method;

j) factory serial number and date of manufacture;

k) mass, in kilogram (kg);

l) implemented standards.

**6.2** At water fill-hole and water drain-hole of the motor, it shall have obvious marks "fill-water" and "drain-water".

**6.3** Motor's stator windings shall have 3 or 6 outlet wire-ends; there shall have clear

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