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**Small-size submersible motor-pumps**

小型潜水电泵

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## Small-size submersible motor-pumps

### 1 Scope

This Standard specifies the type, model, basic parameters, technical requirements, test methods, inspection rules, marking, packaging, transportation, and storage, etc. of small-size submersible motor-pumps.

This Standard applies to single-phase or three-phase, single-stage or multi-stage small-size submersible motor-pumps (hereinafter referred to as motor-pumps) with a power of 22 kW or less.

### 2 Normative references

The following documents contain provisions which, through reference in this Standard, constitute provisions of this Standard. For the dated references, their subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, the parties who enter into agreement based on this Standard are encouraged to investigate whether the latest editions of these documents are applicable. For undated reference documents, the latest editions apply to this Standard.

GB/T 191 Packaging - Pictorial Marking for Handling of Goods (GB/T 191-2008, ISO 780:1997, MOD)

GB 755 Rotating Electrical Machines - Rating and Performance (GB 755-2008, IEC 60034-1:2004, IDT)

GB 1971 Rotating Electrical Machines - Terminal Markings and Direction of Rotation (GB 1971-2006, IEC 60034-8:2002, IDT)

GB/T 2828.1-2003 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (ISO 2859-1:1999, IDT)

GB/T 4942.1-2006 Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification (IEC 60034-5:2000, Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification, IDT)

GB/T 5013.4 Rubber insulated cables of rated voltages up to and including 450/750V - Part 4: Cords and flexible cables (GB/T 5013.4-2008, IEC 60245-

motor-pump with a specified flow rate of  $25 \text{ m}^3/\text{h}$ , a specified lift of 24 m, and a rated power of 3 kW is denoted as: QS25-24/2-3.

The single-phase dry single-stage lower-pump small-size submersible motor-pump with a specified flow rate of  $15 \text{ m}^3/\text{h}$ , a specified lift of 10 m, and a rated power of 0.75 kW is denoted as: QDX15-10-0.75.

The three-phase dry single-stage upper-pump built-in small-size submersible motor-pump with a specified flow rate of  $40 \text{ m}^3/\text{h}$ , a specified lift of 45 m, and a rated power of 9.2 kW is denoted as: QN40-45-9.2.

The three-phase shielded small-size submersible motor-pump with a specified flow rate of  $25 \text{ m}^3/\text{h}$ , a specified lift of 30 m, and a rated power of 4 kW is denoted as: QP25-30-4.

The single-phase dry single-stage lower-pump stainless-steel small-size submersible motor-pump with a specified flow rate of  $3 \text{ m}^3/\text{h}$ , a specified lift of 24 m, and a rated power of 0.75 kW is denoted as: QDX3-24-0.75G.

The single-phase dry single-stage lower-pump small-size submersible motor-pump with float switch with a specified flow rate of  $3 \text{ m}^3/\text{h}$ , a specified lift of 24 m, and a rated power of 0.75 kW is denoted as: QDX3-24-0.75F.

The single-phase dry single-stage lower-pump stainless-steel small-size submersible motor-pump with float switch with a specified flow rate of  $3 \text{ m}^3/\text{h}$ , a specified lift of 24 m, and a rated power of 0.75 kW is denoted as: QDX3-24-0.75GF.

**3.2.3** Supplementary identification refers to the necessary description or identification of the product by the enterprise according to the contract or regulations. It is labeled or not as required.

### **3.3 Basic parameters**

**3.3.1** When the power frequency is 50 Hz and the voltage is single-phase (220 V) or three-phase (380 V), and under the specified conditions of use, the basic parameters of single-stage motor-pumps shall conform to Table 1; the basic parameters of multi-stage motor-pumps shall conform to Table 2; the basic parameters of QXL and QXR motor-pumps shall conform to Table 3.

**3.3.2** When the basic parameters such as the flow rate, lift, synchronous speed, and number of stages of the motor-pump do not meet the requirements of Table 1~Table 3, the efficiency of the motor-pump is determined in accordance with Appendix A.

**3.3.3** When the motor-pump uses an open impeller, the motor-pump efficiency

insulation. The test voltage (peak) is 2000 V for single-phase motors; for three-phase motors, is 2300 V for power of 3 kW and below and 2600 V for power above 3 kW.

**4.4.5** The motor-pump shall have safe and reliable overheating or overcurrent protection device. It shall meet the following requirements:

- a) The built-in protection device is provided with the product. The protection device is clearly stated in the product instruction manual;
- b) The specific requirements and configuration methods for the external protection device shall be given in the product instruction manual;
- c) When required by the user, an earth leakage protection device may be equipped with.

**4.4.6** Motor-pumps shall have reliable grounding devices or bolts and have obvious grounding signs.

**4.4.7** The terminal marking and direction of rotation of the cable shall comply with the provisions of GB 1971. The direction of rotation shall be consistent with the working direction of the pump. It shall be ensured that the marking is not easy to be worn during the life of the motor-pump.

**4.4.8** The no-load current, no-load loss, locked-rotor current, and locked-rotor loss of the motor of the motor-pump shall be controlled within the specified range, to ensure that the performance of the motor meets the requirements of this Standard. The motor-pump shall be able to start and run for 30 min at 85% of the rated voltage, without the pump being unable to run and causing fault.

**4.4.9** The safety of motor-pumps shall meet the requirements of GB 10395.8.

**4.4.10** The safety signs of motor-pumps shall comply with the provisions of GB 10396.

## **4.5 Requirements for parts and components**

**4.5.1** The centrifugal switch for the starting of single-phase motors, after installation, has a disconnecting speed of 60%~75% of the synchronous speed. Other performance shall meet the requirements of JB/T 7591.

**4.5.2** The lead-out cable of the motor-pump shall be the cable specified in GB/T 5013.4 or a cable with the same performance. The cable length shall be no less than 5 m and may also be provided according to user requirements.

**4.5.3** The parts which are subjected to water pressure in the motor-pump shall be able to withstand the water (air) pressure test for 3 min without leakage. The

**4.6.1** All parts of the motor-pump shall pass the inspection before assembly can be carried out.

**4.6.2** The assembly of the motor-pump shall be complete and correct. The plates and signs shall be complete.

**4.6.3** The motor-pump shall be able to rotate freely and stably, without jamming and rubbing.

**4.6.4** The paint coating on the surface of the motor-pump shall be uniform in color, flat and smooth, free from stains, bumps, rubs, scratches, and cracks, etc. and shall conform to the provisions of JB/T 5673.

**4.6.5** Effective anti-corrosion measures shall be taken for motor-pumps.

#### **4.7 Reliability requirements**

Under the specified use conditions, the average working time before the first fault of the motor-pump is 2000 h for water-filled motor-pumps and 2500 h for oil-filled and dry motor-pumps.

### **5 Test methods**

**5.1** The performance test of the motor-pump is carried out in accordance with the requirements of level 2 in GB/T 12785-2002. During the test, the motor-pump shall be submerged in the water. The cable length is 5 m.

**5.2** The hydrostatic test of the parts which are subjected to water pressure in the motor-pump shall be carried out on a hydrostatic test device. Its requirements shall conform to 4.5.3 (Without disassembly, it may be replaced by parts with the same specifications).

**5.3** The terminal marking and direction of rotation of the motor-pump are tested in accordance with GB 1971.

**5.4** The static (dynamic) balance test of the motor-pump impeller is carried out in accordance with the provisions of GB/T 9239.1 (Without disassembly, it may be replaced by parts with the same specifications).

**5.5** Painting check shall be conducted in accordance with the provisions of JB/T 5673.

**5.6** Check of safety and safety signs shall be conducted in accordance with the provisions of GB 10395.8 and GB 10396.

**5.7** The reliability test method is carried out according to the provisions of JB/T

## 6.2 Type inspection

**6.2.1** In any of the following cases, it shall carry out the type inspection:

- a) Pattern evaluation for plant transfer production of new products or old products;
- b) After the official production, if there are major changes in the structure, materials, and processes and the product performance may be affected;
- c) When the production resumes after the product is discontinued for a long time;
- d) During periodic inspections for batch-produced products (at least once a year);
- e) When the exit-factory inspection result is significantly different from the previous type inspection;
- f) When the national quality supervision agency proposes a requirement for type inspection.

**6.2.2** Type inspection items

- a) All items of exit-factory inspection;
- b) Temperature rise test;
- c) Measurement of hot insulation resistance;
- d) Determination of motor-pump's flow rate-characteristic curve (including lift-flow rate curve, input power-flow rate curve, motor-pump efficiency-flow rate curve);
- e) Determination of motor's load-characteristic curve (including power factor-input power curve, stator current-input power curve);
- f) Impeller static and dynamic balance tests, motor-pump water or air pressure test, motor no-load characteristic tests, motor locked-rotor characteristic tests may be replaced by process inspection of parts or components without disassembly (When there are special requirements or regulations that disintegration tests must be performed, the factors that may affect the performance of disintegration shall be clarified);
- g) Reliability test.

**6.2.3** Sampling, judgment and disposal rules of type inspection shall meet the

- o) Mass (net weight), in kilograms (kg);
- p) Executive standard number.

**7.1.1.3** The motor-pump shall have obvious sign for direction of rotation.

### **7.1.2 Package marking**

The words and signs on the outer wall of the packaging box shall be clear and tidy. The main contents are as follows:

- a) Manufacturer name;
- b) Product model, name, and quantity;
- c) Mass (net weight and gross weight along with the package), in kilograms (kg);
- d) Overall dimensions of packaging box: length (mm)×width (mm)×height (mm);
- e) Appropriate parts of the packaging box shall have marking in accordance with GB/T 191.

## **7.2 Packaging and transportation**

**7.2.1** The packaging of the motor-pump shall ensure that it will not be damaged by improper packaging under normal transportation conditions. Before packaging the water-filled motor-pump, it shall drain the water in the machine.

**7.2.2** Before packaging, the exposed machined surfaces of the product shall be coated with anti-rust grease.

**7.2.3** Each motor-pump shall be accompanied by the following accompanying documents and accessories:

- a) Packing list;
- b) Product qualification certificate;
- c) Instruction manual;
- d) Necessary accompanying accessories.

**7.2.4** The mode of transportation and requirements may be determined as needed or according to the contract.

## **7.3 Storage**

## Appendix A

### (Normative)

#### Correction and determination of efficiency

##### A.1 Pump efficiency

**A.1.1** For lower-pump motor-pumps, when the specific speed  $n_s$  is in the range of 120~210, the pump efficiency shall meet the requirements of Figure A.1 or Table A.1. For upper-pump motor-pumps, when the specific speed  $n_s$  is in the range of 120~210, the pump efficiency shall meet the requirements of Figure A.3 or Table A.1. For QXL motor-pumps, when the specific speed  $n_s$  is in the range of 100~200, the pump efficiency shall meet the requirements of Figure A.5 or Table A.1. For QXR motor-pumps, when the specific speed  $n_s$  is in the range of 100~200, the pump efficiency shall meet the requirements of Figure A.7 or Table A.1.

**A.1.2** For lower-pump motor-pumps, when the specific speed  $n_s$  is not in the range of 120~210, the pump efficiency shall be corrected in accordance with Figure A.2 or Table A.2. For upper-pump motor-pumps, when the specific speed  $n_s$  is not in the range of 120~210, the pump efficiency shall be corrected in accordance with Figure A.4 or Table A.2. For QXL motor-pumps, when the specific speed  $n_s$  is not in the range of 100~200, the pump efficiency shall be corrected in accordance with Figure A.6 or Table A.2. For QXR motor-pumps, when the specific speed  $n_s$  is not in the range of 100~200, the pump efficiency shall be corrected in accordance with Figure A.8 or Table A.2.

**A.1.3** The pump efficiency is calculated according to formula (A.1):

$$\eta_B = \eta_{SP} - \Delta\eta \quad \dots\dots\dots (A.1)$$

Where:

$\eta_B$  - Pump efficiency, %;

$\eta_{SP}$  - Pump efficiency obtained under specified flow rate (see Figure A.1~Figure A.8 or Table A.1 and Table A.2), %;

$\Delta\eta$  - Efficiency correction value at corresponding specific speed  $n_s$ , %.

**A.1.4** Example of determination of pump efficiency:

The specified parameters of a lower-pump motor-pump are:  $Q=20 \text{ m}^3/\text{h}$ ,  $n_s=50$

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