

# JIS

JAPANESE INDUSTRIAL STANDARD

Submersible Motor Pumps  
for Sump

JIS B 8325—1985

Translated and Published

by

Japanese Standards Association

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## Submersible Motor Pumps for Sump

B 8325-1985

1. Scope

This Japanese Industrial Standard specifies submersible pumps of single-suction single-stage centrifugal type with pump bores <sup>(2)</sup> of 40 to 150 mm which are used for pumping sewage and miscellaneous drainage at 40°C or lower and with pH values of 6.5 to 8.0 produced from buildings and other facilities and containing solids <sup>(1)</sup> 20 mm or smaller in size, which are suspended or stationarily installed in sump pits and driven by 2-pole or 4-pole three-phase induction motors of 50 Hz or 60 Hz rated frequency that are directly connected with the pumps through a common shaft or shaft coupling, hereinafter referred to as the "pumps".

Notes <sup>(1)</sup> "Solids" means freely deformable soft substances.

<sup>(2)</sup> The pump bore shall be indicated by the nominal diameter of the discharge opening on the pump body.

Remark: The units and numerical values in { } in this standard are based on the conventional system of units and are appended for reference.

2. Size and Classification of Pumps

The size of pumps shall be indicated by the nominal bore of pump and the rated output of motor.

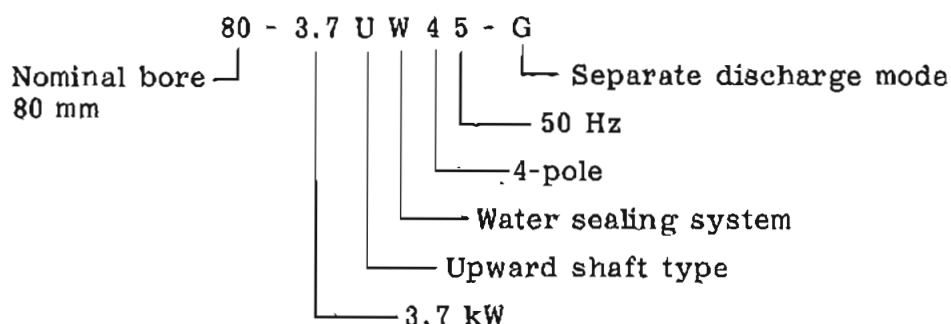
The kind of pump shall be indicated, in addition to the size, by the type, sealing system, number of poles, and rated frequency of the motor, and the mode of discharge, as shown in Table 1.

Table 1. Classification of Pumps

| Pump nominal bore mm. | Motor           |                          |                           |                 |                    | Mode of discharge (symbol)  |
|-----------------------|-----------------|--------------------------|---------------------------|-----------------|--------------------|-----------------------------|
|                       | Rated output kW | Type (symbol)            | Sealing system (symbol)   | Number of poles | Frequency (symbol) |                             |
| 40                    | 0.4             | Downward shaft type (D)  | Dry sealing system (D)    | 2               | 50 Hz (5)          | Enclosed discharge mode (N) |
|                       | 0.75            |                          |                           |                 |                    |                             |
|                       | 1.5             |                          |                           |                 |                    |                             |
|                       | 2.2             |                          |                           |                 |                    |                             |
| 50                    | 2.2             | Upward shaft type (U)    | Oil sealing system (L)    | 4               | 60 Hz (6)          | Separate discharge mode (G) |
| 65                    | 3.7             |                          | Canned sealing system (C) |                 |                    |                             |
| 80                    | 5.5             |                          |                           |                 |                    |                             |
| 100                   | 7.5             |                          |                           |                 |                    |                             |
| 125                   | 11              | Water sealing system (W) |                           |                 |                    |                             |
| 150                   | 15              |                          |                           |                 |                    |                             |
|                       | 18.5            |                          |                           |                 |                    |                             |
|                       | 22              |                          |                           |                 |                    |                             |

- Remarks 1. The enclosed discharge mode means a mode in which the liquid being pumped passes through the space between the periphery of the motor and the suction casing or the like which encloses the motor [refer to 4.2 (1)].
2. The separate discharge mode means a mode in which the periphery of the motor is exposed [refer to 4.2 (1)].

Example:



### 3. Performance

**3.1 Specified Capacity <sup>(3)</sup>** The specified capacity shall be represented by the value indicated on the nameplate which is selected, depending on the nominal bore, by the pump manufacturer according to the requirements of 12. (3) from the appropriate range of capacity shown in Table 2.

**Note <sup>(3)</sup>** The specified capacity generally means the value of delivery agreed upon between the parties concerned with the contract, but in this standard, it is specified as the value indicated on the nameplate because this standard is intended for application to products in stock.

Table 2. Range of Delivery

Unit: m<sup>3</sup>/min

| Nominal bore (mm) |       | 40           | 50           | 65           | 80           | 100          | 125          | 150          |
|-------------------|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Range of capacity | 50 Hz | 0.10 to 0.20 | 0.16 to 0.32 | 0.25 to 0.50 | 0.40 to 0.80 | 0.63 to 1.25 | 1.00 to 2.00 | 1.60 to 3.15 |
|                   | 60 Hz | 0.11 to 0.22 | 0.18 to 0.36 | 0.28 to 0.56 | 0.45 to 0.90 | 0.71 to 1.40 | 1.12 to 2.24 | 1.80 to 3.55 |

**3.2 Total Pump Head** The total pump head corresponding to the specified delivery shall be determined by the test of 9.1 and shall conform to Appended Fig. 4 and Appended Fig. 5 <sup>(4)</sup>.

**Note <sup>(4)</sup>** The framed parts in Appended Fig. 4 and Appended Fig. 5 show the basic ranges of pump heads, and even if the range of actual pump heads partially deviate from those frames, it may be accepted as far as the performance and other elements of the pump meet the requirements of this standard. The powers in those figures show the rated outputs (kW) of the driving motor for reference.

**3.3 Operational Requirements** The operational requirements of pump are as follows:

- (1) Pumps shall be capable of running without any abnormality even under the following conditions:

The minimum water depth for starting the pump is (pump nominal bore  $\times$  2.0) mm above the upper end of the suction opening of the pump strainer (for upward shaft type motors, suction casing).

The minimum water depth for operating the pump is (pump nominal bore  $\times$  1.0) mm above the upper end of the suction opening of the pump strainer.

Reference: In the case of the above [(pump nominal bore  $\times$  1.0) mm], air may happen to be sucked partially from the water surface.

- (2) Pumps whose motor is exposed above the water surface shall be capable of running for at least 30 min after the beginning of exposure to atmospheric air of the motor during running. The resting period from stopping to restarting shall be longer than the running period from the beginning of exposure to stopping.

**3.4 Speed of Rotation** The speed of rotation of pump shall be represented by the number of revolutions per minute of the driving motor under normal condition of power supply.

**3.5 Pump Efficiency** The maximum value of pump efficiency shall be not less than that of efficiency A in Appended Fig. 6 corresponding to the capacity giving that maximum value of pump efficiency.

The pump efficiency at a specified capacity shall be not lower than the efficiency B in Appended Fig. 6.

The capacity giving the maximum efficiency shall be as specified in 9.3 of the range shown in Table 2.

The permissible limit value of efficiency shall be as specified in 9.3 of JIS B 8301.

**3.6 Shaft Power** The shaft power shall be tested according to 9.4 and shall meet the requirements of 9.2 of JIS B 8301.

**3.7 Running Condition** When the pump is tested according to 9.5, remarkable vibration, noise, or temperature rise in the motor <sup>(5)</sup> shall not be observed from outside, when the suction head of the pump is smallest [when the water level is (pump nominal bore  $\times$  1.0) mm above the strainer]. In this case, the running time shall be about 10 min.

Note <sup>(5)</sup> This temperature rise shall be measured for pumps whose motor is exposed above the water surface.

**3.8 Hydrostatic Pressure Resistance** When a hydraulic pressure is applied to the pump according to 9.6, no abnormality such as water leakage shall appear in any part.

#### 4. Construction

**4.1 General Requirements** Pumps shall have a construction as shown in Appended Figs. 1 to 3 and consist of a pump body, impeller, motor, and other parts.

**4.2 Pump Body** The pump body shall be as shown below:

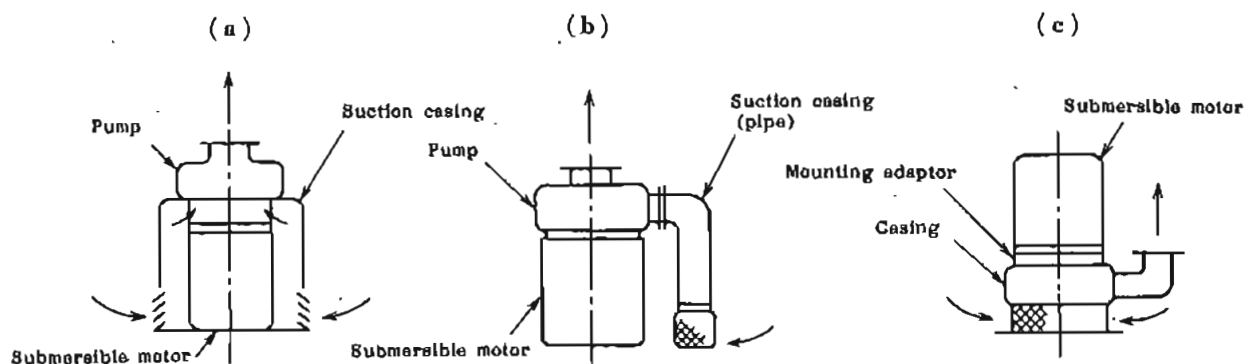
(1) The construction of the pump body shall meet the following requirements according to the type of the motor connected to the pump.

(a) Where an upward shaft type motor is used, the pump body shall consist of a suction frame, mounting adaptor, casing, and the like which are assembled by spigot joint and fastened with bolts, and the motor shall be mounted inside the extended suction frame so that water is sucked in from the bottom [refer to Fig. 1 (a)].

In this case, a water passage such as a suction casing (in this case, a pipe) may be separately provided outside the motor [refer to Fig. 1 (b)].

(b) Where a downward shaft type motor is used, the pump shall consist of a suction cover, casing, mounting adaptor, and the like which are assembled by spigot joint and fastened with bolts, and the motor shall be connected above the adaptor by spigot joint [refer to Fig. 1 (c)].

Fig. 1. Types of Motor



- (2) The discharge opening of a pump shall have a flange coupling, but for pumps having discharge bores of within 50 mm, a screw coupling may be used.
- (3) The liner ring shall be fixed by driving or screwing and shall not rotate during the operation of the pump. Where the material of the casing and suction cover is a copper alloy, the liner ring may be omitted.
- (4) The pump suction opening shall be provided with a strainer resistant to corrosion, deformation, and other harmful effects, and the construction of the strainer shall be made particularly durable by reinforcement or by increasing the wall thickness according to whether it is stationarily installed or subjected to external forces.

- (5) The shaft sealing device shall consist of an oil seal or mechanical seal to prevent the penetration of the pumped liquid into the inside of the motor through shaft. For a motor of the dry sealing system, a double mechanical sealing system, having one mechanical seal both on the pump side and motor side with lubricating oil enclosed between them, shall be provided. The sliding surface of the mechanical seal on the pump side shall be made of a super-hard alloy or a material having an equivalent hardness.
- (6) The bearing bushing of the pump shall be lubricated with water or grease and protected against the penetration of solids from outside.

For bearing bushings lubricated with grease, a means shall be provided to prevent the grease from flowing out.

#### 4.3 Impeller The impeller shall meet the following requirements:

- (1) The impeller shall have a construction to prevent its clogging with foreign matters <sup>(6)</sup> in the liquid being pumped.

Note <sup>(6)</sup> For pumps of 40 mm nominal bore, the size of solids shall be considered as 10 mm or smaller.

- (2) The balance quality of the impeller (including the test shaft) shall conform to "balance quality G 6.3" specified in JIS B 0905. However, where the mass of the impeller (including the test shaft) is within 2 kg, it may be "balance quality G 16".
- (3) The peripheral surface of the impeller, sliding part, shaft hole of the hub, and both end surfaces of the hub shall be machined. However, for impellers made of synthetic resin, such machining may be omitted except for the shaft hole of the hub if the surfaces are smooth.

#### 4.4 Balancing Device for Axial Thrust The balancing device for axial thrust shall meet the following requirements:

- (1) The axial thrust shall be directed downward as a rule, and its magnitude shall not exceed the value specified in Table 3. Where it exceeds the specified value, it shall be restrained below value in Table 3 by means of a balancing hole or the like.

Table 3. Maximum Permissible Thrust of Pump

| Rated output of motor kW      | 0.4, 0.75 | 1.5, 2.2 | 3.7, 5.5, 7.5 | 11, 15   | 18.5, 22   |
|-------------------------------|-----------|----------|---------------|----------|------------|
| Maximum thrust of pump N(kgf) | 400 {40}  | 500 {50} | 630 {63}      | 800 {80} | 1000 {100} |

- (2) Even if a thrust in the direction opposite to that in (1) is produced, its magnitude shall not exceed 40 % of the value in Table 3.
- (3) The axial thrust shall be borne by a thrust bearing on motor side.

**4.5 Shaft Coupling** The shaft coupling, if used, shall meet the following requirements:

- (1) The shaft coupling shall be of the cylindrical type and have sufficient strength for power transmission.
- (2) The shaft coupling shall fix the pump shaft and motor shaft together, and the axes of both shafts shall coincide with each other on the same straight line.
- (3) The fixing of the shaft and shaft coupling in rotating direction shall be made by using a key as a rule, and the key shall not be loosened or broken by sudden rotation or reverse rotation.

**4.6 Motor** The motor shall be as specified in Appendix.

**4.7 Other parts** The construction of the other parts shall meet the following requirements:

- (1) The rotating direction of the pump shall as a rule be clockwise when viewed from the above.
- (2) The nuts or the like used for the pump shaft shall be equipped with a rotation stop by use of washers or the like to prevent loosening when the shaft rotates in either direction. The retaining ring of the impeller shall be prevented from shifting or dropping out during running of the pump.
- (3) The pump shall not have anchor bolt holes.
- (4) The pump shall be equipped with lugs or fittings for suspension.
- (5) The pump shall have no trouble in running even when it is inclined by up to 5 degrees against the vertical line.
- (6) The pump shall be capable of being attached an earth terminal at a suitable position.

## 5. Dimensions and Fits

**5.1 Pump Body** The pump body shall meet the following requirements:

- (1) The nominal bores and actual bores of pumps shall be as given Table 4.

Table 4. Actual Bore

Unit: mm

| Nominal bore    | 40     | 50     | 65     | 80     | 100     | 125      | 150      |
|-----------------|--------|--------|--------|--------|---------|----------|----------|
| Actual bore (d) | 37to43 | 47to53 | 61to69 | 76to84 | 96to104 | 121to129 | 145to155 |

- (2) **Pump Discharge Opening** The pump discharge opening shall meet the following requirements:

- (a) Where a flange coupling is used, its dimensions shall conform to JIS B 2210.

- (b) Where a screw coupling is used, its dimensions shall conform to JIS B 0203.
- (3) The minimum wall thickness of the pressure bearing parts of pump body and of suction casing shall be 5 mm or larger where they are made of cast iron, and 4 mm or larger where they are made of copper alloy.
- (4) The wall thickness of strainer shall be as given in Table 5.

Table 5. Wall Thickness of Strainer

|                        |                        |                        | Unit: mm                 |
|------------------------|------------------------|------------------------|--------------------------|
| Material               | FC 15 of<br>JIS G 5501 | SS 41 of<br>JIS G 3101 | SUS 403 of<br>JIS G 4305 |
| Minimum wall thickness | 5                      | 1.6                    | 0.6                      |

- (5) The size of strainer opening shall be made sufficiently large for prevention of clogging of the impeller with solids of 20 mm size, and the total effective cross-sectional area of the opening shall be 3 or more times the cross-sectional area of the pump discharge opening.
- (6) The effective length of pump bearing bushing shall be 1.4 or more times the pump shaft diameter (<sup>7</sup>).

Note (<sup>7</sup>) Even where the pump shaft has a sleeve, the diameter of the pump shaft shall be taken as the base, regardless of the wall thickness of the sleeve.

5.2 Impeller The wall thickness of the impeller shall be as given in Table 6. However, the wall thickness of the ends of the inlet and outlet of the impeller may be decided arbitrarily.

Table 6. Minimum Wall Thickness of Impeller

| Outer diameter<br>of impeller | Unit: mm               |                       |
|-------------------------------|------------------------|-----------------------|
|                               | Minimum wall thickness |                       |
|                               | Casting                | Stainless steel plate |
| Within 200                    | 3                      | 0.8                   |
| Over 200                      | 4                      | -                     |

5.3 Pump Shaft The diameter  $d$  (<sup>8</sup>) of the pump shaft shall be not smaller than the value calculated from the following formula:

$$d = K^3 \sqrt{\frac{L}{n}} \quad (\text{mm})$$

where  $d$  : pump shaft diameter (mm)  
 $L$  : shaft power (kW)  
 $n$  : speed of rotation (rpm)  
 $K$  : 116 in the case of SUS 403 of JIS G 4303

Note (<sup>8</sup>) Dimension  $d$  is the diameter of the part related to power transmission, and the diameters of those parts not related to power transmission may be smaller than this value.

5.4 Fit of Respective Parts The grade of fit between respective parts shall conform to Table 7 or be a finer grade.

Table 7. Fit

|                               |          |                                          |                                      |
|-------------------------------|----------|------------------------------------------|--------------------------------------|
| Impeller to pump shaft        | H 7/g 6  | Spigot joint of pump body                | H 7/h 7                              |
| Sleeve to pump shaft          | H 7/g 6  | Spigot joint between pump body and motor | H 7/h 7                              |
| Bearing bushing to pump shaft | H 7/d 8  | Pump body to shaft bearing bushing       | H 7/js 7 or H 7/h 7 ( <sup>9</sup> ) |
| Shaft coupling to pump shaft  | H 7/js 7 |                                          |                                      |

Note (<sup>9</sup>) Where the fit between the pump body and bearing bushing is taken as H 7/h 7, the bearing bushing shall be fixed not to slip out or rotate.

Remarks 1. The grades of fit shown in the table are based on JIS B 0401.  
 2. The fit shall as a rule be based on the hole, but it may also be based on the shaft. The dimensional deviations in the latter case shall be those based on the hole.

5.5 Clearance between Impeller and Liner Ring The maximum clearance between the impeller and liner ring shall be as specified in Table 8.

Table 8. Maximum Clearance of Liner Ring

| Unit: mm                            |           |                       |                       |                        |                         |                         |
|-------------------------------------|-----------|-----------------------|-----------------------|------------------------|-------------------------|-------------------------|
| Inner diameter of liner ring        | Within 50 | Over 50 and within 63 | Over 63 and within 80 | Over 80 and within 100 | Over 100 and within 125 | Over 125 and within 160 |
| Maximum clearance ( <sup>10</sup> ) | 0.35      | 0.38                  | 0.40                  | 0.42                   | 0.45                    | 0.50                    |

Note (<sup>10</sup>) The value of maximum clearance shall be represented by that of the diametrical clearance for a liner ring which slides on its cylindrical face, and that of the axial clearance for a liner ring which slides on its plane face.

5.6 Other Parts The dimensions of the other parts shall be as specified below:

- (1) The dimensions of keys shall conform to JIS B 1301. However, the thickness of keys other than those for the shaft coupling may be otherwise decided.

## 6. Appearance

The appearance of pumps shall meet the following requirements:

- (1) Castings Cast products shall have smooth inner and outer surfaces by visual observation and be free from defects such as detrimental blowholes, fissures, and unevenness in wall thickness.
- (2) Anticorrosion Treatment The inner and outer surfaces of the pump body shall be treated deterrent to corrosion with the oil primer specified in JIS K 5591 as the undercoating, and with the phthalic resin enamel specified in JIS K 5572, the tar epoxy resin paint specified in JIS K 5664, or with an equivalent anticorrosive paint as the final coating. However, such treatments may be omitted where materials having no risk of corrosion in water are used.

## 7. Material

The materials used in the main parts of the pump body shall be as specified in Table 9 or be materials equivalent thereto in quality.

Table 9. Material

| Part name                                                            | Material                                                                                                                                                       |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Casing, upper casing, mounting adaptor, suction frame, suction cover | FC 15 of JIS G 5501, BC 6 of JIS H 5111, or YBsC 2 of JIS H 5101.                                                                                              |
| Impeller                                                             | BC 6 of JIS H 5111, PBC 2 of JIS H 5113, FC 15 ( <sup>12</sup> ) of JIS G 5501, SUS 304 ( <sup>11</sup> ) of JIS G 4305, or synthetic resin ( <sup>14</sup> ). |
| Liner ring                                                           | BC 6 of JIS H 5111, YBsC 2 of JIS H 5101, FC 15 ( <sup>12</sup> ) of JIS G 5501, SUS 403 of JIS G 4303, or synthetic resin or synthetic rubber.                |
| Pump shaft                                                           | SUS 403 of JIS G 4303 (quenched and tempered)                                                                                                                  |
| Shaft coupling                                                       | SUS 403 of JIS G 4303, S 35 C of JIS G 4051, or FC 20 of JIS G 5501.                                                                                           |
| Impeller nut, Impeller bolt                                          | BC 6 of JIS H 5111, YBsC 2 of JIS H 5101, C 3604 BE or C 3604 BD of JIS H 3250, or SUS 403 of JIS G 4303.                                                      |