

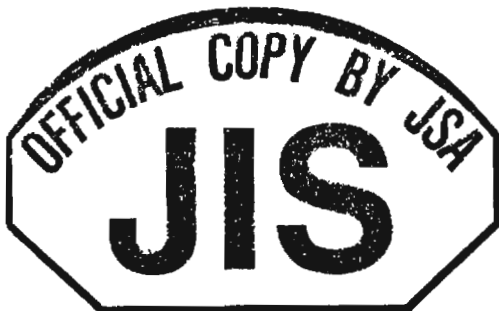
JIS

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JAPANESE INDUSTRIAL STANDARD

Submersible Motor-Pumps for Deep Well

JIS B 8324-1985



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J I S

Submersible Motor-Pumps for Deep Well

B 8324-1985

1. Scope

This Japanese Industrial Standard specifies single suction centrifugal or mixed flow submersible motor-pumps for deep well with a bore⁽²⁾ of 25 to 200 mm, hereinafter referred to as the "pumps", which handle clean water⁽¹⁾ at ordinary temperature, which are suspended from the lower parts of lifting pipes attached to well covers or fixing bands, and to the lower parts of which are directly coupled with 50 Hz or 60 Hz, 2-pole 3-phase induction motors by means of shaft couplings.

Notes ⁽¹⁾ The clean water at ordinary temperature means water at 10°C to 25°C which is 6.5 to 8.0 in pH, 200 ppm or under in chlorine, and 50 ppm or under in sand content, if any, of which size shall be not coarser than fine sand (0.1 mm to 0.25).

⁽²⁾ The bore of pump is expressed by the nominal diameter of the discharge opening of the valve casing of pump body.

Reference: As a large amount of sand content sometimes causes failures in motor due to the wear on the sliding parts of the pump, the amount of sand content should preferably be as smaller as possible.

Remark: The units and numerical values given in { } in this standard are in accordance with the conventional system of units, and are appended for reference.

2. Sizes

2.1 Size of Pump The size of pump shall be expressed by the pump-body number⁽³⁾, bore, and number of stages⁽⁴⁾.

Example: P8 x 100 mm x 3-stages

Notes ⁽³⁾ The pump-body number shall be as given in Table 1, according to well diameters to be applied.

⁽⁴⁾ The number of stages mean the number of impellers.

Applicable Standards and Reference Standard: See page 42.

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Table 1. Pump-body Numbers

Unit: mm

Pump-body number	P 4S ⁽⁵⁾	P 4	P 6	P 8	P 10	P 12	P 14
Well diameter to be applied	100 min.	105 min.	155.2 min.	204.7 min.	254.2 min.	304.7 min.	339.8 min.

Note ⁽⁵⁾ This is applicable to a well in which rigid PVC pipes of nominal diameter 100 mm are used.

2.2 Size of Motor The size of motor shall be expressed by the motor-frame number and rated output of Appendix Table 2.

Example: M 8 x 15 kW

3. Performance

3.1 Specified Capacity⁽⁶⁾ The specified capacity of a pump shall be the value selected by the pump manufacturer from the capacity range of Table 2 according to the nominal bore and pump-body number, and marked in accordance with the specifications of 5.6 Table 13.

Note ⁽⁶⁾ Generally this means the contract value between the parties concerned to acceptance, however, as stored goods are the subject in this standard, the name plate value of the manufacture is employed.

Table 2. Range of Capacities

Pump-body number (well diameter mm)			Nominal bore of pump mm	Capacity range m /min	
				59 Hz	60 Hz
P 4 S	P 4		25	0.025 to 0.050	0.028 to 0.056
(100)			35	0.040 to 0.080	0.045 to 0.090
	(105.3)	P 6	40	0.071 to 0.140	0.080 to 0.160
			50	0.112 to 0.224	0.125 to 0.250
		(155.2)	65	0.20 to 0.40	0.22 to 0.45
			80	0.36 to 0.71	0.40 to 0.80
		P 8	100	0.63 to 1.25	0.71 to 1.40
			125	1.0 to 2.0	1.12 to 2.24
		(254.2)	P 12	150	1.60 to 3.15
				1.80 to 3.55	
		(304.7)	P 14	200	2.5 to 5.0
			(339.8)		2.8 to 5.6

Reference: An appropriate discharge capacity is obtained from the step lifting test in a well.

3.2 Total Pump Head The total pump head in respect to the rated capacity shall be tested in accordance with 9.1, and shall be as given in Attached Fig. 6 and Attached Fig. 7⁽⁷⁾.

Note ⁽⁷⁾ The framed areas in Attached Figs. 6 and 7 indicate the standard total pump heads, when pumps are directly coupled with the submersible type 2-pole 3-phase induction motors, and powers are given in the rated outputs of driving motors for reference.

3.3 Suction Performance The pump shall be capable of running normally, when the submerged depth to the upper part of strainer is not less than the value of Table 3, even if the water level lowers in running.

Table 3. Minimum Submerged Depth

Unit: mm

Nominal bore of pump (mm)	25	32	40	50	65	80	100	125	150	200
Submerged depth	0.4	0.4	0.5	0.7	0.9	1.2	1.6	2.5	3.6	5.6

Remark: When a pump is to be installed to an actual well, it shall be necessary to be submerged sufficiently deeper than the value of Table 3, to cope with the variation of water level in running due to drought and other causes. However, in the case of testing the suction performance of a pump, any smaller value than given in Table 3 may be employed if no abnormality appears.

3.4 Speed of Rotation The speed of rotation of the pump shall be the number of rotations per minute of the driving motor under the normal conditions of electrical source.

3.5 Pump Efficiency The maximum value of the pump efficiency shall be not less than the efficiency A of Attached Fig. 8 at a capacity where the maximum efficiency appears.

In addition, the pump efficiency at the specified capacity shall be not less than the efficiency B of Attached Fig. 8.

The capacity at the maximum efficiency should preferably be in the range of Table 2.

Furthermore, the permissible value of the efficiency shall be in accordance with 9.3 of JIS B 8301.

3.6 Shaft Power The shaft power, when subjected to the test in accordance with 9.4, shall be in accordance with 9.2 of JIS B 8301.

3.7 Running Conditions The running conditions, when subjected to the test in accordance with 9.5, shall be in accordance with 9.4 of JIS B 8301.

3.8 Hydrostatic Pressure Resistance The pump, when a hydrostatic pressure is applied in accordance with the specifications of 9.6, shall be free from abnormalities of water leakage and the like on respective parts.

4. Construction

4.1 General The pumps shall be constructed as given in Attached Figs. 1 to 5, and shall consist of a pump body, impellers, motor and others.

4.2 Pump Bodies The pump bodies shall be as follows:

- (1) The pump bodies are classified into two types, i.e.; the one is composed of a valve casing, upper casing, intermediate casing with guide vane, and suction frame, and the other is composed of a valve casing, upper casing, guide vane, intermediate stage, outer casing, and suction frame. In the former, the components shall be assembled by sockets and spigots and fastened with bolts or clips, or the components shall be screwed in each other. In the assembling of the latter, to the upper part of the outer casing, in which the guide vane and intermediate stage have been contained, the upper casing and valve casing, and to the lower part, the suction frame shall be attached by screwing-in or by other methods.

The upper end of the pump body shall be connected to the lifting pipe directly or through the connecting pipe, and to the lower part of the suction frame, the motor shall be attached directly or by means of the connecting frame or the like.

Pumps of lower lift may not be equipped with the valve casing.

- (2) The pipe coupling of the connection with the lifting pipe shall be of a flanged type coupling or screwed-in type coupling, and the screw thread of the screwed-in type coupling shall be Rc 1, Rc 1 1/4, Rc 1 1/2, Rc 2, Rc 2 1/2, RC 3, RC 4, RC 5, RC 6 or RC 8 of JIS B 0203.
- (3) The valve casing shall contain a valve to prevent sudden backward flow of water.

Furthermore, the valve should preferably be such a valve that through which the water in the lifting pipe leaks gradually.

- (4) The liner rings, bushings and the like shall be fixed by driven fit or by screw, and these shall not be turned during running. However, the intermediate bushing may be omitted. In the case where the material of the casing is bronze, the liner rings, bushings and the like may not be provided.
- (5) The bearings shall be sliding bearings, and these shall be provided at the upper and lower part of the pump shaft. However, if the upper bearing of the motor serves also as the lower bearing of the pump, or the intermediate bushing of the pump shares the role of a bearing, the lower part of the pump shaft may have no bearing.
- (6) The upper bearing shall be of water lubrication or grease lubrication, and the lower bearing shall be of water lubrication. In the case where the upper bearing is of grease lubrication, it shall not allow flow out of grease.
- (7) In such type that the guide vane is attached to the casing, the vane shall be fixed by means of screws, nicks, clipping or the like, so that it does not be turned or loosened during running.
- (8) Diameter of the underground lifting pipe and surface bent pipe shall generally be the same with the pump bore. If the diameter of the underground lifting pipe and surface bent pipe is to be changed inevitably, a deformed pipe may be used between the pump body and the underground lifting pipe.

4.3 Impeller The impeller shall be as follows:

- (1) The balance quality of the impeller (including the shaft for test) shall be the "balance quality G 6.3" in accordance with JIS B 0905. However, in the case where the mass of the impeller (including the shaft for test) is 2 kg or under, the "balance quality G 16" may also be permissible.
- (2) The outer periphery, sliding part, shaft hole of hub, and both end faces of hub of the impeller shall be machine finished.

4.4 Balancing Device of Axial Thrust The balancing device of the axial thrust shall be as follows:

- (1) The axial thrust shall be balanced by the balancing hole, balancing piston and other means, and the residual thrust shall generally be in downward direction, and its magnitude shall be not more than that of Table 4.

Table 4. Maximum Thrust of Pumps

Unit: kN {kgf}

Pump body number	P 4S or P 4	P 6	P 8	P 10	P 12	P 14
Maximum downward thrust	0.64 {64}	0.85 {85}	1.12 {112}	1.5 {150}	2.0 {200}	2.65 {265}

- (2) Even if any thrust of opposite direction to (1) is caused, its magnitude shall not exceed 40 % of that given in Table 4.
- (3) The axial thrust shall be born by the thrust bearing of the motor side, through shaft coupling.

4.5 Shaft Coupling The shaft coupling shall be as follows:

- (1) The shaft coupling shall be a cylindrical shape, and shall have sufficient strength for power transmission.
- (2) In the case where the shaft of the pump and the shaft of the motor are connected and rotated, the axes of both shafts shall lie on the same straight line.
- (3) The fixing in the rotational direction of the shaft coupling with the shaft shall generally be made using keys, so that these shall neither be loosened nor be broken due to sudden rotation or reversal rotation.
- (4) The shaft coupling shall be equipped with slip-off preventing measure such as set screws, so that it does not slip off from the pump shaft and the motor shaft.

4.6 Sand Preventing Device The bearing which comes in direct contact with lifting water shall be equipped with a sand preventing device, so that the bearing is prevented from intrusion of sand during the running and rest.

4.7 Motor The motor shall be as specified in Appendix.

4.8 Other Parts The construction of other parts shall be as follows:

- (1) The rotational direction of the pump shall generally be clockwise, when viewed from the discharge side of the pump.
- (2) The strainer shall be provided on the outer periphery of suction part of the suction frame.
- (3) Nuts and the like to be used for the pump shaft shall be processed with whirl-stop by washers and otehr method, so that they will not work loose in either direction of rotation of the shaft.

5. Dimensions and Fits5.1 Pump Body The pump body shall be as follows:

- (1) The nominal bore of pump, actual bore of flange and dimensions of screwed part shall be as given in Table 5.

Table 5. Actual Bore of Flange and Dimension of Screwed Part

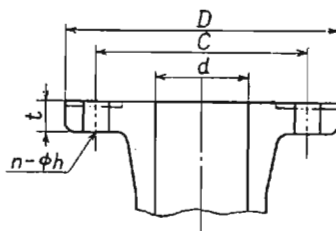
Nominal bore of pump mm	25	32	40	50	65	80	100	125	150	200
Actual bore of flange mm	22±0.28	29±0.35	37±0.43	47±0.53	61±0.69	76±0.84	96±1.04	121±1.29	145±1.55	195±2.05
Dimension of screwed part	R _c 1	R _c 1 ¼	R _c 1 ½	R _c 2	R _c 2 ½	R _c 3	R _c 4	R _c 5	R _c 6	R _c 8

- (2) The dimensions of the flange shall be as given in Table 6.

Table 6. Dimensions of Flanges

Unit: mm

Nominal bore	Dimensions of flange					
	Outside diameter <i>D</i>	<i>C</i>	Number of bolt holes <i>n</i> pieces	Bolt hole <i>h</i> (°)	<i>t</i>	
					FC 15 (°)	Others
25	90	69	4	11	16	12
32	95	75	4	11	16	12
40	115	90	6	11	18	14
50	125	100	6	11	18	14
65	140	115	8	11	18	14
80	165	136	8	15	22	18
100	180	155	8	15	22	18
125	224	190	8	19	24	20
150	258	224	8	19	26	22
200	305	272	12	19	26	22



Notes ⁽⁸⁾ This hole may be a threaded hole for bolt.

⁽⁹⁾ This is as given in JIS G 5501.

(3) The outside diameter of connecting part of the screwed type pump shall be not less than the dimension of Table 7.

Table 7. Minimum Outside Diameter of Connecting Part Unit: mm

Nominal bore of pump	25	32	40	50	65	80	100	125	150	200
Minimum outside diameter of connecting part	50	60	68	82	100	118	150	180	210	265

(4) The wall thickness of the pressure resistant part of the casing shall be a thickness to withstand the hydrostatic pressure test of 9.6 and suspending weight, and the minimum wall thickness, irrespective of unevenness in thickness, if any, shall be not less than the value given in Table 8.

Table 8. Minimum Wall Thicknesses of Casing Unit: mm

Pump-body number	Minimum wall thicknesses		
	For cast iron	For steel pipe	For stainless steel and steel pipe
P 4 S or P 4	3.2	3.2 (2)	1.2
P 6	4	4 (2.5)	1.5
P 8	5	4.5 (3)	-
P10	6.3	5 (3.5)	-
P12	7.1	6.3 (4.5)	-
P14	8	7.1 (5)	-

Remark: Numerical value given in parentheses gives the wall thickness at the root of the thread, in the case where screw thread is used for the connecting part.

(5) The size of hole of the strainer shall be 80 % or under of the width of the outlet opening of the impeller, and its total effective area shall be 3 times or over the sectional area of the discharge opening of the pump.

- (6) The effective length of the bearing shall be 1.4 times or over the diameter of bearing part⁽¹⁰⁾.

Note (¹⁰) In the case where a sleeve is provided on the shaft, the diameter of the bearing part shall be taken as the diameter of the pump shaft, not considering the wall thickness of the sleeve.

5.2 Impeller The minimum wall thickness of the impeller shall be as given in Table 9.

Table 9. Minimum Wall Thickness of Impeller Unit: mm

Outside diameter of impeller	Minimum wall thickness
150 and under	2 (0.8)
Over 150	2.5

Remark: The numerical value in parentheses gives the wall thickness in the case of stainless steel.

5.3 Pump Shaft The diameter d ⁽¹¹⁾ of the pump shaft shall be not less than the value which has been calculated from the following formula:

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

where d : diameter of pump shaft (mm)

L : pump power (kW)

n : speed of rotation (rpm)

K : 116, in the case of SUS 403 of JIS G 4303

Note (¹¹) The " d " is the diameter of the part which is related to the power transmission, and for the part which is not related to the power transmission, any smaller value than this may be employed.

5.4 Fits of Respective Parts The grades of fits of respective parts shall be those given in Table 10 or more precise grades.

Table 10. Fits

Impeller with pump shaft	H7/g6	Shaft coupling with pump shaft, in the case of cylindrical shaft coupling	H7/g6
Sleeve with pump shaft	H7/g6	In the case of shaft coupling of claw type	H7/js7
Balancing piston with pump shaft	H7/g6	Spigot part of pump body	H7/h7
Bearing with pump shaft	H7/d8	Pump body with spigot part of morot	H7/h7
		Pump body with bearing	H7/js7 or H7/h7 ⁽¹²⁾

Note ⁽¹²⁾ In the case where the fit of the pump body with the bearing is H7/h7, the bearing shall be fixed so that it does not slip off or turn.

Remarks 1. The fits shall be in accordance with JIS B 0401.

2. The fits shall generally be in accordance with the hole basis, however, the shaft basis may also be employed. In this case, the allowable dimensional deviations shall be based on the hole basis.

5.5 Maximum Clearance Between Impeller and Liner Ring The maximum clearance between the impeller and the liner ring shall be as given in Table 11.

Table 11. Maximum Clearance Between Impeller and Liner ring

Inside diameter of liner ring	50 and under	Over 50 to 63 incl.	Over 63 to 80 incl.	Over 80 to 100 incl.	Over 100 to 125 incl.	Over 125 to 160 incl.	Over 160 to 200 incl.	Over 200 to 250 incl.
Maximum clearance(at diameter)	0.42	0.45	0.50	0.56	0.63	0.71	0.81	0.90

5.6 Other Parts The dimensions of other parts shall be as follows:

- (1) The pump shaft is fitted with all of the impeller, sleeve and others, and fastened with nuts and others, and the deflection of such shaft at its centre, when supported at both shaft ends, shall be not more than the value given in Table 12 per a distance of 1000 mm between the supports.

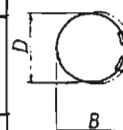
Table 12. Maximum Deflection of Shaft at Centre of Shaft
Unit: mm

Pump-body number	P 4	P 6	P 8	P 10	P 12	P 14
Deflection of shaft	0.25	0.20	0.16	0.13	0.10	0.08

- (2) The dimensions of the keys shall be in accordance with JIS B 1301. However, the dimensions of the keys for other than the shaft coupling may be not conforming to the said standard.
- (3) The dimensions of the parts of the pump which enters in the well shall be not more than the value given in Table 13. The dimension B means the diameter of a circumscribed circle in the case where the cover, clipping metal fitting of the submergible cable and/or other protrusion are provided.

Table 13. Outside Diameter of Pump
unit: mm

Pump-body number	P 4S	P 4	P 6	P 8	P 10	P 12	P 14
Outside diameter of pump-Body (dimension D) ⁽¹³⁾	87	95	140	182	226	274	305
Dimension B	95	99	147	194	242	290	322



Note ⁽¹³⁾ The dimension D gives the basic dimension, and the accuracy of this machined part shall be in accordance with JIS B 0405.

5.7 Assembling Accuracies The assembling accuracies, in the case where the pump has been placed in horizontal position, shall be as follows:

- (1) The value of the runout of the pump shaft end (total width) shall be 0.08 mm or under at the shaft end.
- (2) The perpendicularity of the face of pump body which is connected with the motor in respect to the pump shaft shall be 0.04 mm or under per 100 mm of diameter.
- (3) The eccentricity of the spigot part of the pump body which is connected with the motor in respect to the shaft axis shall be not more than the sum of 0.03 mm and the clearance between the bearing and the shaft.

Furthermore, this measurement shall be carried out several times turning the pump body in arbitrary angles.

Remark: The inspection on the assembling accuracies may also be carried out fitting the shaft coupling or other sleeve with the pump shaft.

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6. Appearance

The appearance of the pump shall be as follows:

- (1) Casting Goods The casting goods shall be visually examined to ensure that the inside and outside surfaces are smooth, and they are free from defects such as harmful blowholes, fissures and unevenness in wall thickness.
- (2) Corrosion Proof Treatment The inside and outside surfaces of the pump body shall sufficiently be treated with anticorrosive painting of epoxy resin paint, PVC resin paint or the paint equal to or superior to this in quality. However, for the material which is not liable to be corroded in water, the painting may be omitted.

7. Materials

The materials to be used for the principal parts of the pump shall be those given in Table 14 or equal to or superior to these in quality.

Furthermore, the materials which are liable to be corroded in water shall be processed with suitable anticorrosive measures.

Table 14. Materials

Name of parts	Materials
Suction frame, intermediate casing, upper casing, valve casing	FC 15 of JIS G 5501, BC 6 of JIS H 5111 or YBSC 2 of JIS H 5101
Outer casing	SGP of JIS G 3452, SUS 304 TPD of JIS G 3448 or SUS 304 of JIS G 4305
Impeller	BC 6 of JIS H 5111, PBC 2 of JIS H 5113, SUS 403 of JIS G 4305 or synthetic resin ⁽¹⁴⁾
Sliding bearing	Special bronze suitable to submergible bearing, synthetic resins, rubber or carbon ⁽¹⁵⁾
Balancing piston	BC 6 of JIS H 5111 or SUS 403 of JIS G 4303
Balancing bushing	BC 6 of JIS H 5111, FC 15 of JIS G 5501, LBC 3 of JIS H 5115 or SUS 403 of JIS G 4303
Guide vane	BC 6 of JIS H 5111, FC 15 of JIS G 5501 or synthetic resin