

JIS

JAPANESE INDUSTRIAL STANDARD

Water Ring Vacuum Pumps

JIS B 8323—1985

Translated and Published

by

Japanese Standards Association

Printed in Japan



Documents

Document Sharing Hub

15 S

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.



Documents

Document Sharing Hub

JAPANESE INDUSTRIAL STANDARD

J I S

Water Ring Vacuum Pumps

B 8323-1985

1. Scope

This Japanese Industrial Standard specifies the water ring vacuum pumps⁽¹⁾, hereinafter referred to as the "pumps", for general uses of 20 to 150 mm in suction opening bore which are directly connected by flexible shaft joint with 50 Hz or 60 Hz three phase induction motor on a common bed and are connected by V belt.

Further, the gas to be handled by the pump shall, as a rule, be air at -10°C to 50°C.

Note (1) These pumps includes those of short time rating and those of continuous rating. The short time rating and continuous rating herein are in accordance with the following:
Short time rating means that the continuous operating time is less than 30 min.
Continuous rating means that the continuous operating not less than 30 min in capable.

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

Further, 1 kPa = 7.5 mmHg

2. Size and Classification

The size and classification of pumps shall be as follows:

- (1) The size shall be expressed by suction opening bore⁽²⁾.
- (2) The classification shall be expressed by rated time, bore of pump, speed of rotation and rated output of prime mover driving it.

Note (2) The bore of pump is expressed by nominal diameter of flange.

3. Performance

3.1 Suction Air Volume The suction air volume shall be tested according to 9.2.1 and the results satisfy the specifications of Table 1 for each bore. In this case the suction air volume shall be the value⁽³⁾ in the state of suction negative pressure.

Note (3)

$$Q_s = Q_a \times \frac{p_a}{p_s}$$

where Q_s : suction air volume in the state of suction negative pressure (m³/min)
 Q_a : suction air volume in the state of atmospheric pressure (m³/min)
 p_s : suction pressure (kPa){kgf/m²} (absolute)
 p_a : atmospheric pressure (kPa){kgf/m²} (absolute)

Applicable Standards and Reference Standards: See page 22.



Documents

Document Sharing Hub

Table 1. Suction Air Volume

Bore ⁽⁴⁾ mm	Motor rated output kW	Maximum negative pressure ⁽⁵⁾ kPa {mmHg}	Suction air volume (m ³ /min) ⁽⁷⁾			Negative pressure Maximum value of make-up water at 84 kPa (405 mmHg) ⁽⁸⁾ l/min	Synchronous speed of rotation (informa- tive reference)		Suction style
			Maximum ⁽⁶⁾	Negative pressure 54 kPa {405 mmHg}			50Hz	60Hz	
				Suction nega- tive pressure state	Atmospheric pressure state (Informative reference)				
20	0.75	75 {560}	0.28	0.257	0.12	3 (2)	3 000 1 500	3 600 1 800	Single suction
25	1.5	80 {600}	0.56	0.514	0.24	5.5 (3.6)	3 000 1 500	3 600 1 800	Single suction
32	2.2	80 {600}	0.90	0.835	0.39	7.5 (5)	3 000 1 500	3 600 1 800	Single suction Double suction
40	3.7	80 {600}	1.60	1.50	0.70	12 (8)	1 500	1 800	Single suction Double suction
50 (40)	5.5	84 {630}	2.50	2.40	1.12	17 (11)	1 500	1 800	Single suction Double suction
65 (50)	7.5	84 {630}	3.55	3.40	1.59	23 (15)	1 500	1 800 1 200	Single suction Double suction
80 (65)	11	84 {630}	5.6	5.35	2.50	32 (21)	1 500 1 000	1 800 1 200	Double suction
100 (80)	15	84 {630}	8.0	7.64	3.57	42 (28)	1 500 1 000	1 200 900	Double suction
100	18.5	84 {630}	10.0	9.53	4.45	51 (34)	1 000 750	1 200 900	Double suction
125 (100)	22	84 {630}	12.5	12.0	5.6	59 (39)	1 000 750	1 200 900	Double suction
150 (125)	30	84 {630}	18.0	17.1	8.0	77 (51)	1 000 750	900 720	Double suction
150	37	84 {630}	32.4	21.4	10.0	90 (60)	1 000 750	900 720	Double suction

Notes ⁽⁴⁾ The bore shown in () may be used.

⁽⁵⁾ The maximum negative pressure shall be the pressure able to be maintained at least for 1 min as it is at the suction side negative pressure when the suction side spill valve is closed and the air volume is made 0.

⁽⁶⁾ The maximum air volume means the air volume when the suction side spill valve is fully opened.

⁽⁷⁾ It indicates the air volume when the temperature of make-up water is at 15°C.

⁽⁸⁾ The values outside () indicates the values for actuation 1 type, and the values shown in () indicates the values for actuation 2 type.

Further, for structures of actuation 1 type and actuation 2 type, see 4.1.2 (1).

Remark: The speed of rotation of pump may be selected suitably by the manufacturer.

3.2 Shaft Power The shaft power shall be tested according to 9.2.3 and the maximum negative pressure may be not more than 110 % of the motor rated output in Table 1. However, at a negative pressure not more than 90 % of the maximum negative pressure, it shall not be made overload.

Remark: In the case where the efficiency of pump is required, it shall be calculated according to the following formulae:

$$\eta = \frac{L_{is}}{L} \times 100\%$$

$$L_{is} = \frac{1}{60} \times p_s Q_s \log_e \frac{p_a}{p_s} \left\{ L_{is} = \frac{1}{6120} \times p_s Q_s \log_e \frac{p_a}{p_s} \right\}$$

where

η : pump efficiency

L_{is} : theoretical isothermal air power (kW)

p_s : suction pressure (kPa){kgf/m²}
(absolute)

p_a : atmospheric pressure (kPa){kgf/m²}
(absolute)

Q_s : suction air volume in the negative pressure state (m³/min)

L : shaft power (kW)

3.3 Maximum Make-up Water The maximum make-up water shall be tested according to 9.2.4, and be not more than the value of Table 1. In the case where the make-up water is of self-feed type and the negative pressure is different, it shall be taken as the value increased or decreased about in proportion to $\sqrt{H/54} \{ \sqrt{H/405} \}$ (in the formula, H is negative pressure kPa {mmHg}).

Remark: The make-up water volume shall be the water volume to operate the pump during the rated time without abnormalities. Even the negative pressure of the pump has changed, the throttle device of make-up water tube shall not be adjusted.

3.4 Operating State For the operating state, the test shall be carried out according to 9.2.5, and the operating state be good and free from abnormal vibration, noise, water leakage, air leakage, temperature rise.

3.5 Water Leakage of Pump Body The water leakage of pump body shall be tested according to 9.2.6 and each part shall be free from abnormalities such as water leakage and the like.

4. Structure

4.1 Pump Body

4.1.1 Constitution of Body The pump body shall be constituted by casing, cover and port plate or port cylinder or port cone.

4.1.2 Casing and Cover The casing and the cover shall be as follows:

- (1) The shapes of inside surface of casings shall be of two types of circular section eccentric to the shaft centre (called as actuation 1 type) and of cocoon shape section symmetrical to shaft centre (called as actuation 2 type).

Further, these are divided into single suction type and double suction type according to circulation style of air.
- (2) The direction of suction opening and discharge opening shall, as a rule, be upward vertical or lateral horizontal.
- (3) The inner surfaces of cocoon and circular parts shall be flat and smooth, and the shape, dimensions, and position be accurate and free from remarkable deviation.
- (4) Attachment of casing and cover of single suction type shall be combined by spigot joint and fastened by bolts, and for single side cover, the cover shall be attached to the opposite side to the driving side.
- (5) Attachment of casing and cover of double suction type shall be combined by spigot joint or in the case of without spigot joint, on both sides out of fastening bolts, each two pieces, be reamer bolts or separately each two knock pins, be knocked in and fastened.
- (6) The flange shall be in accordance with JIS B 2210. However, the flange for pump of nominal diameter of 32 mm or less the thread joints specified in JIS B 0203 may be used.
- (7) The inner partition of casing and cover shall be free from short-circuiting place and remarkable unbalance of thickness.
- (8) The vent line of pump body (specially, the attaching parts of port cylinder, port plate, etc.) shall be free from remarkable dislocation and throttling causing large influence to the performance.
- (9) The height of shaft centre should preferably be in accordance with JIS B 0902.

4.1.3 Port Plate, Port Cylinder or Port Cone The port plate, port cylinder or port cone shall be as follows:

- (1) The port plate, port cylinder or port cone shall be free from cracking and remarkable unbalance in thickness. The attaching parts and sliding parts shall be applied with mechanical working.
- (2) The shape and dimensions of port shall be accurate and on its position in the same machine type there shall be no remarkable difference.

- (3) The port cylinder, port cone or port plate to be attached to the casing and cover shall be combined by spigot joint and attached by machine screws or bolts.
- (4) The attaching part and sliding part of port liner shall be applied with mechanical working, and be thermally inserted or pressed in the port cylinder to be so fixed as not to be loosened during operation.

4.1.4 Other Parts The other parts shall be as follows:

- (1) The pump body shall be provided with drain hole, pressure taking-out hole, make-up water taking in hole and, as required, priming funnel attaching holes. Screws for these holes shall be in accordance with JIS B 0202. However, the places to be attached with plug and tube may be in accordance with JIS B 0203.
- (2) The stuffing box shall, as a rule, be provided with sealing ring to introduce pressure water and to seal tightly.
Further, instead of pressure water, grease may be poured into.
- (3) The depth of inserting packing shall be such depth that not less than three pieces of square packing can be inserted and formed packing may be used. Further, the gland can be taken off from the gland bolts and be such structure that the exchange of packing can be performed easily.
- (4) Instead of packing, mechanical seal may be used.

4.2 Impeller The impeller shall be as follows:

- (1) The bend of vanes of impeller shall, as a rule, be frontward to rotary direction in both the single suction type and double suction type and their shapes and pitches shall be free from remarkable difference respectively. In both, the axial direction flowing-in and radial direction flowing-in, the shape and size of air circulation hole shall be uniform and free from remarkable difference.
Further, for double suction type, these shall be symmetrical in right and left relative to the centre plane.
- (2) The balance quality of impeller (including the test shaft) shall be "balance quality G 6.3" according to JIS B 0905. However, in the case where the mass of impeller (including shaft for test) is not more than 2 kg, "balance quality G 16" may be used.
- (3) The surface of impeller shall be so flat and smooth that the friction of fluid is little, and at least to the outer diameter of impeller, sliding part, hub shaft hole, and both end faces of hub mechanical working shall be applied.

4.3 Pump Shaft The pump shaft shall be as follows:

- (1) The screw threads of pump shaft shall be in such direction that the nut is not loosened at starting of motion or the baffle of nut by washer and other methods shall be applied.

- (2) The pump shaft shall be attached with deflector or the like so as water not to enter into bearing.

4.4 Bearing The bearing of pump shall be as follows:

- (1) The type of bearing and its number to be provided with the body shall be as shown in Table 2 according to the rating of pump, suction style, and driving style.

Table 2. Classification and Number of Bearings

Rating	Suction style	Classification and number of bearings		
		Direct connection driving		Belt driving
Continuous rating	Single suction	Bearing bush (oil lubrication)	Two pieces	As a rule, the number and classification of bearings shall be same as in the case of direct connection driving. However, in some cases at the shaft end of outside of pulley for belt, separately outer bearing may be set.
		Rolling bearing of JIS B 1521 or JIS B 1533	Two pieces	
	Double suction	Bearing bush (oil lubrication)	Each one piece on both sides of body	
		Rolling bearing of JIS B 1521 or JIS B 1533	Each one piece on both sides of body	
Short time rating	Single suction	Bearing bush (grease or oil lubrication)	One piece min.	In the case of one piece of bearing bush (grease lubrication, oil lubrication), outer bearing shall be set.
		Rolling bearing of JIS B 1521 or JIS B 1533	Two pieces	Two pieces
		Rolling bearing of JIS B 1521 or JIS B 1533 and interior bearing	Each one piece	Each one piece

Remark: The interior bearing means the bearing to be attached to the inside of pump body, and usually the bearing bush is used.

- (2) The interior bearing shall be lubricated sufficiently by water or grease.
- (3) The bearing shall be of such structure that the grease or oil does not flow out nor spatter during operation. In the case of oil lubrication, it shall be of such structure that the oil surface can be checked, and the provided with oil drain hole. In the case of using oil ring, the peep hole for oil ring shall be provided. In the case where the rolling bearing is lubricated by grease, as a rule, grease supplementary feed hole is not provided.

Further, in the case where the bearing is specially lubricated by grease, the grease supplementary feed hole shall be provided and the grease cup of JIS B 1574 be attached.

- (4) Bearing bush shall be attached stiffly, applied with baffle, and its effective length shall be not less than 1.2 times the shaft diameter.
- (5) The oil ring shall have wide contact surface and sufficient oil-supply capability.
- (6) Water drain holes and overflow holes shall be so provided at the attaching part of bearing that no water enters into inside of bearing.

4.5 Other Structures Other structures shall be as follows:

- (1) The leg of the pump may be provided at either casing or bearing, but the attaching bolts shall be not less than 4 pieces and the foundation bolts of common bed also be not less than 4 pieces.
- (2) Moving of rotary part in axial direction shall be supported safely and securely by a thrust collar or ball bearing.
- (3) The minimum thickness of sleeve shall be 2 mm, and air shall not be sucked from the space between the pump shaft and the sleeve.
- (4) The balance of belt pulley shall be good.
- (5) For the shaft joint, shaft joint guard shall be provided at the outside. For belt pulley and belts, belt guard or enclosure shall be provided.
- (6) Name of each part of pump shall be in accordance with Attached Figs. 1 to 4.
- (7) The rotary direction of pump, shall be clockwise, as a rule, viewing from the driving side.

5. Shape and Dimensions

5.1 Nominal Bore and Actual Bore of Pump The nominal bore and actual bore of the pump shall be in accordance with Table 3.

Table 3. Actual Bore

	Unit: mm									
Nominal bore of pump	20	25	32	40	50	65	80	100	125	150
Actual bore	18 to 22	22 to 28	29 to 35	37 to 43	47 to 53	61 to 69	76 to 84	96 to 104	121 to 129	145 to 155

Remark: For pump of nominal bore of not more than 32 mm, screwed joint may be used.

5.2 Casing and Cover The thickness of casing and cover shall be the thickness resistant to 9.2 and even in the case where the unbalance of thickness exists the minimum thickness shall be not less than the value of Table 4. However, the finished thickness of port parts may be not in accordance with this.