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JAPANESE INDUSTRIAL STANDARD

**Reciprocating pumps —
Testing methods**

JIS B 8311—1991

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Reciprocating pumps - Testing methods

B 8311-1991

1. Scope

This Japanese Industrial Standard specifies the testing and inspecting methods at the manufactories of reciprocating pumps of the following types (hereafter referred to as the "pumps", excluding oil hydraulic pumps.

- (1) Crank type That type of pumps of which plungers or pistons are driven by electric motors or other rotary type prime movers through cranks.
- (2) Steam direct acting type That type of pumps of which pistons perform reciprocating motions by steam power. Such types of pumps as Worthington type and weir type belong to this type.

Furthermore, the range of a pump shall be the partitioned part of the pump between the sections of the suction flange and the discharge flange. However, in the crank type pump, it includes up to the pump side pulley or coupling, and in the steam direct acting type pump, it includes from the steam inlet flange to outlet flange (See Fig. 1).

In the case where an air tank or the like proper to a pump is attached, it shall be considered to be a part of the pump.

Remarks 1. The applicable standards to this Standard are given in the following:

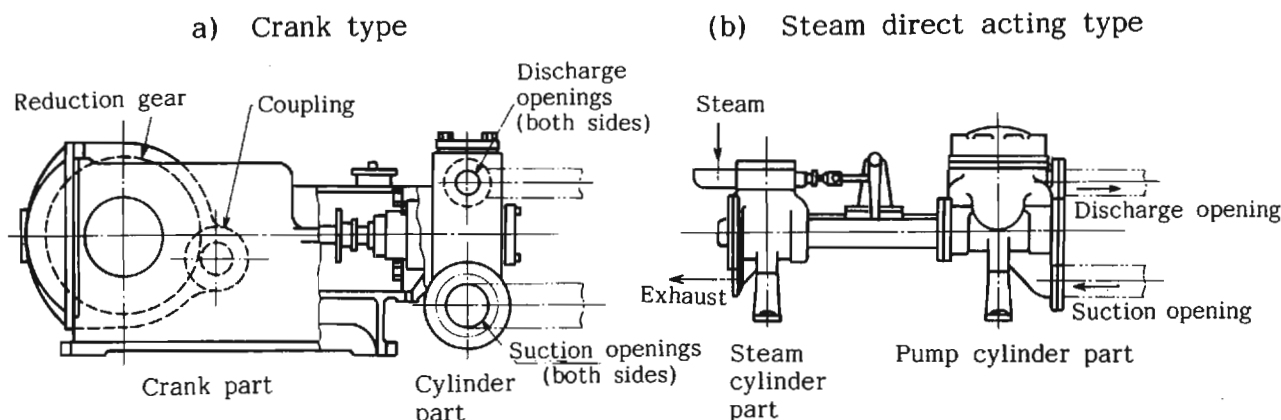
JIS B 8301 Testing Methods for Centrifugal Pumps, Mixed Flow Pump and Axial Flow Pumps

JIS F 0504 Application and Setting Pressure of Relief Valves for Ships' Machinery

JIS Z 8401 Rules for Rounding Off of Numerical Values

2. In this Standard, numerical values and units given in { } are in accordance with the traditional units, and are given for informative reference.
3. The head to be used in this Standard is indicated by a quotient of the energy of a fluid per unit mass, namely the specific energy, divided by a value, assuming the acceleration of free fall at the site as 9.80 m/s^2 .

Fig. 1. Reciprocating pumps



2. Test items and inspection items

2.1 Test items The test items of the pump shall be as follows.

(1) Performance tests The performance tests of the pump shall be as follows. However, the test items of (1.1) (b) and (1.2) (b) shall be conducted when required.

(1.1) Crank type

- (a) Total pressure, discharge rate, speed of rotation, shaft power, and operational conditions
- (b) Suction conditions

(1.2) Steam direct acting type

- (a) Total pressure, discharge rate, number of double strokes, and operational conditions
- (b) Suction conditions and steam consumption

(2) Continuous test The continuous test shall be carried out when required.

(3) Special test The special test of the pump shall be as follows. However, the test items of (b) shall be carried out when required.

- (a) Working conditions of relief valve
- (b) Over speed and minimum number of double strokes

2.2 Inspection items The inspection items of the pump shall be as follows. However, the inspection items of (b) shall be tested when required.

(1) Crank type

- (a) Total pressure and discharge rate, shaft power, pump efficiency, operational conditions, working condition of relief valve and hydraulic pressure resistance

(b) Working range and suction conditions

(2) Steam direct acting type

- (a) Total pressure and discharge rate or number of double strokes and discharge rate, volumetric efficiency, operational conditions, working conditions of relief valve, stroke length, hydraulic pressure resistance.
- (b) Working range, suction conditions, steam consumption rate or lifting rate of water.

3. Test conditions

3.1 Testing liquid The testing liquid shall be the designated liquid. However, in the case where it is difficult to test by the designated liquid, a similar liquid to this or the clean water of 0 to 40°C in temperature may be used in testing as agreed between the parties concerned (hereafter referred to as the "agreement").

- (1) In the case where the density of testing liquid differs from that of the designated liquid, test results thereof shall be converted in accordance with 6.2.
- (2) In the case where the kinematic viscosity of the designated liquid is higher, or in the case where the designated liquid contains solid substances, the performance values by using the test liquid shall be determined upon the agreement in advance.

3.2 Test speed of rotation or number of double strokes

3.2.1 Crank type The test speed of rotation of the crank type pump shall be as follows:

- (1) It is desirable to employ the specified speed of rotation for the test speed of rotation in this standard.
- (2) In the case where the specified speed of rotation is not obtainable on account of the test equipment, it may also be tested by a different speed of rotation within a range of $\pm 5\%$ with respect to the specified speed of rotation.

In this case, test results shall be converted into the performance values for the specified speed of rotation in accordance with 6.1.

- (3) In the case where it is not possible to test in the range of (2) due to a large power pump, the test speed of rotation may be decreased to the range of -20% of the specified speed of rotation in accordance with the agreement.

Remarks: In this case, the conversion into the performance values at the specified rotational speed and the judgement for operational conditions shall be in accordance with the agreement.

- (4) In the case of the driving with an attached electric motor, the rotational speed as it is, when a pump has been operated under the specified load in a normal electric source conditions ⁽¹⁾, shall be used as the specified speed of rotation of the pump.
- (5) The pump which is driven by other prime mover than the electric motor shall be tested by using an electric motor for testing.

Note ⁽¹⁾ The electric source conditions in the ranges of $\pm 1\%$ for the specified frequency and $\pm 10\%$ for the specified voltage.

3.2.2 Steam direct acting type It is desirable that the test number of double strokes of a steam direct acting type pump shall be the specified number of double strokes.

Remarks: The specified number of double strokes shall be the number of double strokes to be obtained by using steam under the specified steam conditions (steam pressure, temperature and exhaust pressure).

3.3 Measuring points The measuring points shall be as follows:

- (1) In the case where no variation of rotational speed or number of double strokes is required, measure 5 kinds or more of various discharge pressures from the lower discharge pressure to the higher pressure as far as possible at the specified rotational speed or number of double strokes, and carry out testing, at least one kind of them, under a higher pressure than the specified discharge pressure.
- (2) In the case where the rotational speed or number of double strokes is required to vary, the test shall be carried out at 5 kinds or more of different speed of rotation or number of double strokes below and above the specified value including the specified one under the specified total pressure.

4. Test apparatus

The apparatus shall be arranged so that the test can be carried out under the similar conditions to the specifications which are designated by the purchaser. The arrangement of the test apparatus and measuring devices should desirably be in accordance with Fig. 2, Fig. 3, Fig. 4 or Fig. 5. In the case where the fluctuation of discharge pressures and discharge rates of the pump is larger, an air tank of sufficiently larger volume or other pulsation absorbing device shall be installed at the discharge side so that the fluctuations of indicated values of pressure gauge, measuring instrument of discharge rate, etc. are minimized sufficiently.

Fig. 2. Volumetric method

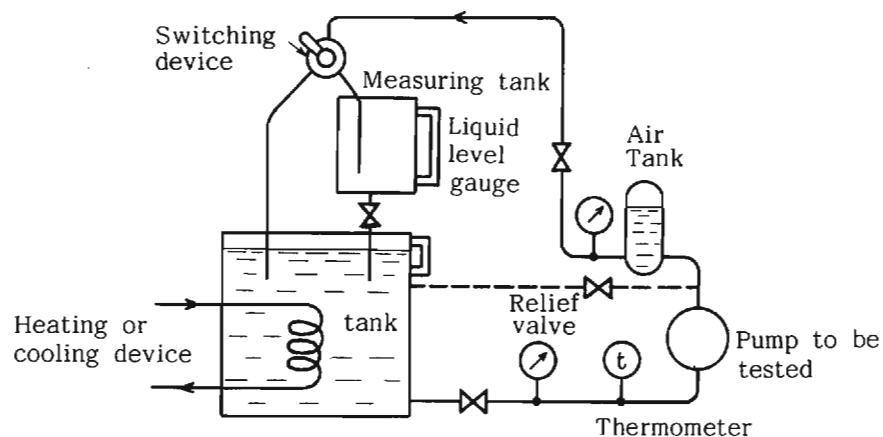


Fig. 3. Gravimetric method

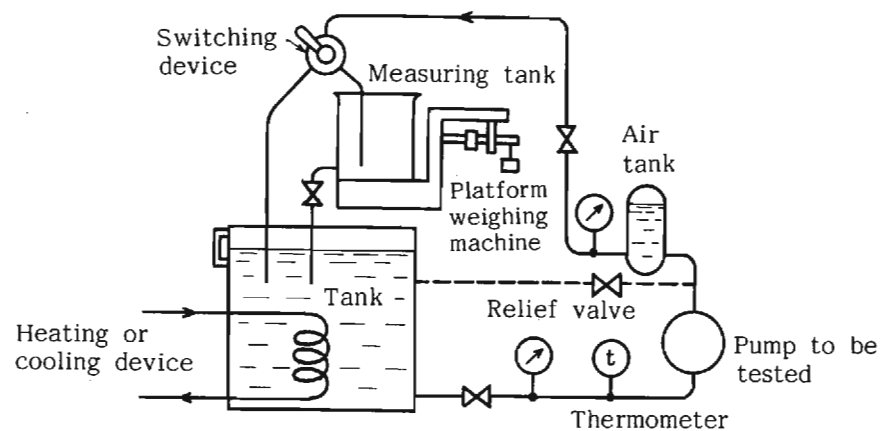


Fig. 4. Method using weir

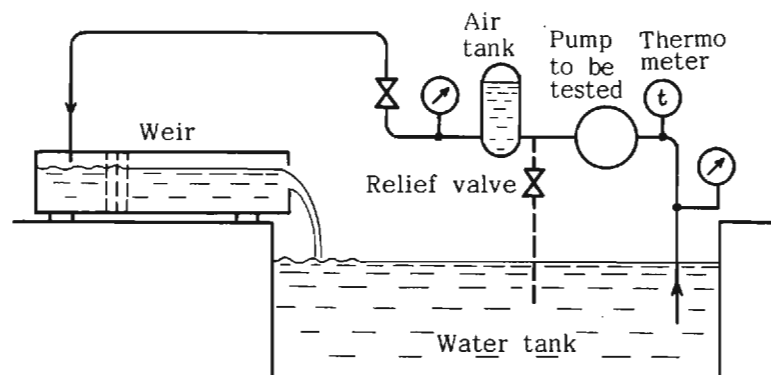


Fig. 5. Method using throttling mechanism or instrument

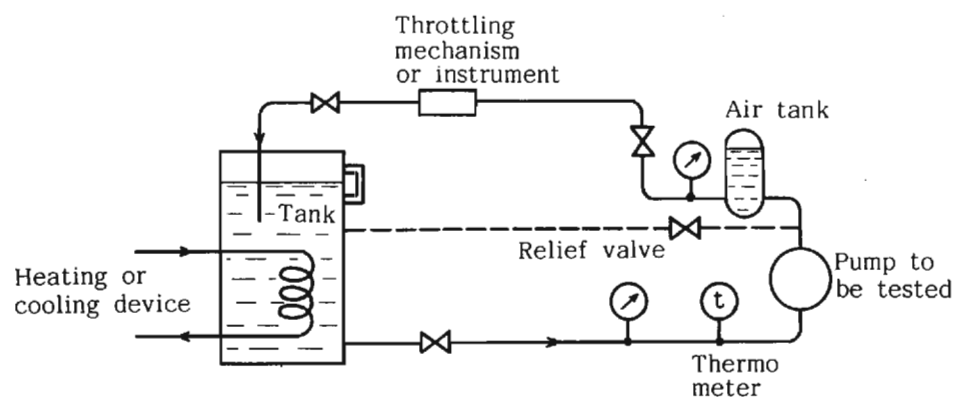
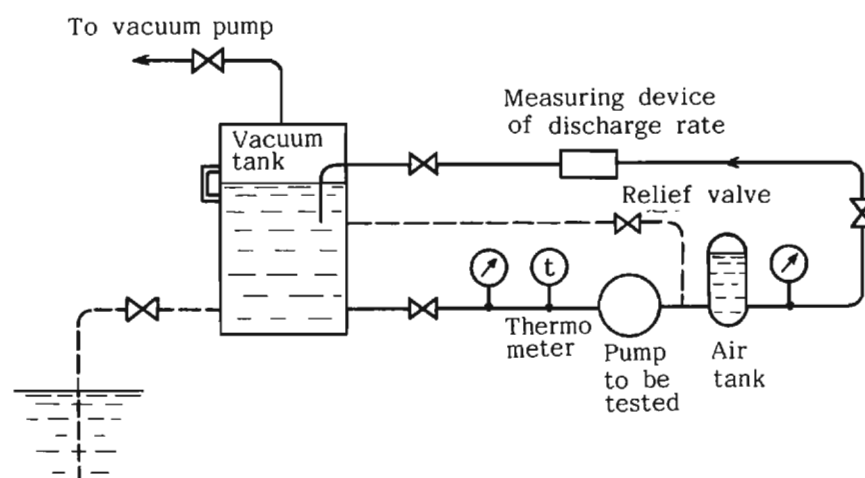


Fig. 6. Method interposing vacuum tank

(a) Closed circuit



(b) Open circuit

