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JAPANESE INDUSTRIAL STANDARD

**Parshall flume type
flowmeters**

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

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Parshall flume type flowmeters

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1. Scope This Japanese Industrial Standard specifies the Parshall flume type flowmeters to be used in the flow measurement of water flowing in the artificial open channels.

- Remarks 1. When an open channel is throttled on its midway, a critical flow generates at the throat section, thereby the flow rate can be obtained as the function of the upstream side water level. The Parshall flume type flowmeters are the flowmeters based on this principle, and which calculate and indicate the flow rates by measuring the water levels of the upstream side of the throat section with a level meter, installing the flume body of a defined shape and dimensions in the channel.
2. The standards cited in this Standard are given in the following:
JIS B 7516 Metal rules
JIS Z 8103 Glossary of terms used in instrumentation
3. The International standard corresponding to this Standard is as follows:
ISO 9826:1992 Measurement of liquid flow in open channels—
Parshall and SANIIRI flumes
4. When it is in accordance with the corresponding International standard, the designation of the Parshall flume type flowmeter, working flow rate range, measuring range of level, flow rate calculation formula, dimensions of principal parts, etc. shall be in accordance with the Annex.

2. Definitions For the purposes of this Standard, the definitions of main terms in JIS Z 8103 apply, and others are in the following:

- (1) converging section The upstream portion of the Parshall flume, of which floor is horizontal, and of which width is gradually throttled along the flowing direction.
- (2) throat section The central portion of the Parshall flume, of which floor inclines gradually downwards along the flowing direction from the floor of the converging section, and of which side walls are parallel to the flowing direction.
- (3) diverging section The downstream portion of the Parshall flume, of which floor inclines upwards in respect to the flowing direction from the floor of the throat section, and of which width diverges gradually along the flowing direction.
- (4) flume body That constituted of the converging section, the throat section and the diverging section.
- (5) crest The line of intersection of the downstream end of the converging section floor with the upstream end of the throat section floor.

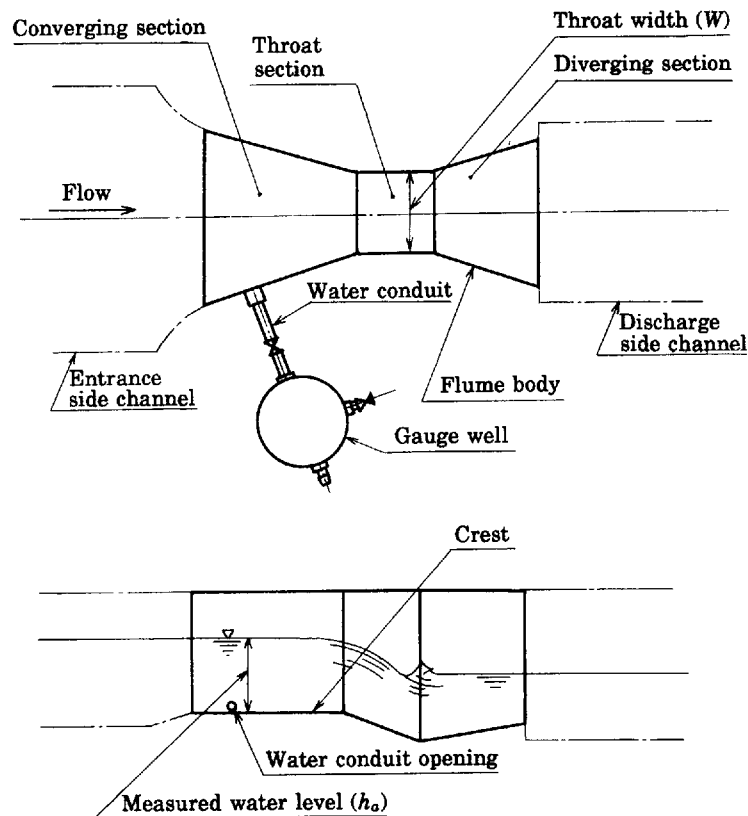
- (6) gauge well The water tank for water level measurement being installed outside the flume body, in order to carry out the steady level measurements, avoiding the waving of the water surface.
- (7) water conduit The duct introduces the water level into the gauge well from the level measuring position of the converging section.
- (8) entrance side channel The straight-line rectangular channel upstream of the flume, of which length is 5 times to 10 times the throat width and, of which width is uniform.
- (9) discharge side channel In order to prevent the flume from the generation of submerged flow or back current, the channel downstream of the flume not subjected to the influences of the gate and dam up downstream of the flume, and the ebb and flow of the tide.
- (10) measured water level In the converging section, the water level to be measured at the position of $\frac{1}{3}$ the distance between its inlet and the crest.
- (11) critical flow In a given discharge flow, the flow of which total energy is the minimum. In this condition, the Froude number⁽¹⁾ is equal to 1, and the disturbance of the free surface of the flow does not propagate upstream.

Note ⁽¹⁾ A nondimensional number obtained by dividing the mean flow velocity by the propagating velocity of extremely small surface wave (it is obtained by $\sqrt{gd}$ from the acceleration of gravity g and the depth of flow d).

- (12) submerged flow That flow of which water level in the converging section is subjected to the influence of the downstream side.

3. Names of main parts The names of the main parts of the Parshall flume type flowmeters (hereafter referred to as "flowmeters") shall be in accordance with Fig. 1.

Fig. 1. Names of main parts



4. Nominal size The nominal size of the flowmeters shall be as given in Table 1 according to the widths of the throats of the flume bodies.

Table 1. Nominal size

Nominal size	Throat width mm
PF-03	76.2
PF-06	152.4
PF-09	228.6
PF-10	304.8
PF-15	457.2
PF-20	609.6
PF-30	914.4
PF-40	1219.2
PF-50	1524.0
PF-60	1828.8
PF-70	2133.6
PF-80	2438.4

5. Constitution The flowmeter shall be constituted of a flume body, level meter, transducer and indicating instrument. However, the level meter, transducer and indicating instrument may be constructed integrally.

6. Performances and functions

6.1 Working flow rate ranges The working minimum flow rate and the working maximum flow rate of the flowmeter shall be defined within the ranges of the values given in Table 2 according to nominal size, and be inscribed on the level meter, transducer or indicating instrument.

Table 2. Flow rate ranges

Unit: m ³ /h		
Nominal size	Minimum flow rate	Maximum flow rate
PF-03	3	193
PF-06	5	398
PF-09	9	907
PF-10	11	1641
PF-15	15	2508
PF-20	43	3374
PF-30	62	5138
PF-40	133	6922
PF-50	163	8726
PF-60	265	10551
PF-70	306	12376
PF-80	357	14221

6.2 Measuring ranges of level meter The level meters shall be those capable of measuring the water levels equivalent to the working flow rate ranges being inscribed.

The equivalent water levels to the minimum flow rate and maximum flow rate in Table 2 are given in the following for informative reference.

(Informative reference) Measuring ranges of level meter
Unit: 10⁻³m

Nominal size	Minimum	Maximum
PF-03	31	464
PF-06	29	457
PF-09	30	611
PF-10	28	761
PF-15	27	763
PF-20	46	762
PF-30	45	762
PF-40	62	762
PF-50	62	762
PF-60	76	762
PF-70	76	762
PF-80	77	762

6.3 Calculation formula of flow rate The formula for calculating the flow rate from the measured water level shall be in accordance with the following:

$$Q = K \cdot h_a^n$$

where, Q : flow rate (m³/h)
 h_a : water level (m)

K and n : constants as defined in Table 3 according to the nominal size