

Ships—Tachometers for Engine

1. **Scope** This Japanese Industrial Standard specifies the types and installations of revolution counter, and tachometer (hereinafter referred to as "Tachometer") used for engine in ships.

Remark: This standard makes reference to the following standards.

JIS B 7537 — Stationary governor type tachometers

JIS F 8520 — Electronic propeller shaft revolution indicators for marine use

JIS F 8521 — Electric type propeller shaft revolution indicators for marine use

2. **Definitions** For the purpose of this standard, following definitions apply.

(1) **Nominal diameter (size of tachometer)** For tachometers of centrifugal and electromagnetic types, the nominal diameter signifies the visible diameter of the dials in mm.

(2) **Driving shaft** The driving shaft signifies the revolution transmitting shaft directly coupled to the tachometers.

Remark: For tachometers driven by flexible shaft, the driving shaft signifies the transmitting shaft with flexible shaft coupled to the prime movers. For belt driven tachometers, the driving shaft signifies the pulley shaft of the tachometers.

(3) **Ratio of revolution (R)** For tachometers of centrifugal and electromagnetic types, the ratio of revolution signifies the value "R" obtained from the following formula:

$$R = \frac{\text{Reading of indicator for revolution speed of driving shaft}}{\text{Revolution speed of driving shaft}}$$

3. **Classification** The tachometers shall be classified into 4 classes as follows. However, the incorporations of two or three classes may also be adopted.

- (1) Revolution counter
- (2) Centrifugal tachometer
- (3) Electromagnetic tachometer
- (4) Electric tachometer

4. **Construction, shape and dimensions**

- 4.1 **Revolution Counter** The revolution counters shall be constructed to indicate mainly the integrating number of revolutions of main shafting by mechanical means and there are reciprocating drive and rotating drive type. The revolution counters combined with rotating direction indicator may also be adopted. The types by drive system shall be as given in **Table 1** and the construction, shape and dimensions shall be as shown in **Reference Figs. 1 to 4**.

Table 1 The type of revolution counters classified by drive system

Type	No. of figures in graduation	Support	Max. No. of integrating revolutions	Remark
Reciprocating drive	Lever type	stand type	—	See Reference Fig. 1
Rotating drive	Flexible shaft type	stand type	300 revolutions per minute	See Reference Fig. 2
	Direct drive type			See Reference Fig. 3 or Fig. 4 (fitted with a rotating direction indicator)

- Remarks:**
1. The reciprocating drive type counts the ratio of engine revolutions to the number of cycles of reciprocating motions of the lever as one reciprocating count or two counts.
 2. The rotating drive type sets the ratio of revolutions from the ratio of engine revolutions to driving shaft revolutions.
 3. The rotating direction indicator mechanically indicates rotating directions of engine with the pointer of counter driven by engine revolution. It is recommended that the pointer distinguishes ahead and astern runnings of the engine while indicating the rotational speed of the engine.
 4. Arrowheads and letters which denote the rotating direction of indicators shall be painted in black for ahead running and in red for astern running.

4.2 Centrifugal Tachometer The centrifugal tachometers shall be of such construction as capable of indicating the instantaneous revolution speed (in rpm) and rotating direction of engine, and the types by drive system shall be as given in Table 2, and the shape and dimensions shall be as shown in Reference Figs. 5 to 9.

Table 2 The type of centrifugal tachometers by drive system

Type	Nominal dia.	Mounting type	Support	Max. graduation setting of scale disc	Rotating speed range of driving shaft for maximum graduation	Remarks
Direct drive	70 100	Vertical	Stand type	May be set at approx. 1.4 times the rated speed or service speed.	Should, in principle, be set in the range between 300 and 4,800 rpm.	See Reference Fig. 5.
	150				Should, in principle, be set in the range between 250 and 4,000 rpm.	See Reference Fig. 6. Fitted with a rotating direction indicator and a revolution counter.
Flexible shaft drive	70 90 100 120		Pannel mounting type		Should, in principle, be set in the range between 300 and 1,800 rpm.	See Reference Fig. 7.
	150		Stand type		Should, in principle, be set in the range between 250 and 1,800 rpm.	See Reference Fig. 8. Fitted with a rotating direction indicator and a revolution counter.
Belt drive	100		Stand type		Should, in principle, be set in the range between 400 and 2,000 rpm.	See Reference Fig. 9. It is recommended that the linear speed of belts do not exceed 10 m/s.

Remark: Specifications of rotating direction indicators shall conform to Remarks 3 and 4 of Table 1.

4.3 Electromagnetic tachometers The electromagnetic tachometers indicate instantaneous rotational speed (in rpm) and the rotating direction, and the types by drive system are given in **Table 3**, and the shapes and dimensions are shown in **Reference Figs. 10 to 14**.

Table 3 The type of Electromagnetic tachometers by drive system

Type	Nominal dia.	Mounting type	Support	Max. graduation setting of scale disc	Rotating speed range of driving shaft for maximum graduation	Remarks
Direct drive	90	Vertical	Stand type	May be set at approx. 1.4 times the rated speed or service speed. Ahead and astern may have the same settings.	Should, in principle, be set in the range between 150 and 2,400 rpm.	See Reference Fig. 10 . Fitted with a revolution counter.
	150	Hanging				See Reference Fig. 11 or 12 . Fitted with a revolution counter.
	200	Vertical				See Reference Fig. 13 or 14 (fitted with a revolution counter.).
Flexible shaft drive	150	Vertical			Should, in principle, be set in the range between 150 and 1,800 rpm.	See Reference Fig. 13 or 14 (fitted with a revolution counter.).

Remark: When used for an engine with a single direction of rotation, no ahead and astern indications are required, where graduations for a single rotating direction are provided.

4.4 Electric tachometers The electric tachometers indicate instantaneous rotational speed (in rpm) and rotating direction, and the types by drive system are given in **Table 4**. The shapes and dimensions are shown in **Reference Figs. 15 to 23**.

The types, shapes and dimensions of receivers shall conform to the requirements of **JIS F 8521**.

Table 4 Types of electric tachometers by drive system

Type	Detecting system	Support	Remarks
Non contact type	Frequency	Screw in mount type	For a single rotating direction indication, see Reference Fig. 15 .
		Stand type	For ahead and astern indications, see Reference Fig. 16 .
Direct type	Frequency	Cap nut mount type	For a single rotating direction indication, see Reference Figs. 17 to 20 .
	ac voltage	Stand type	
		Flange mount type	
	dc voltage	Stand type	For ahead and astern indications, see Reference Fig. 21 and 22 .
		Flange mount type	
Flexible shaft type	ac voltage	Stand type	For a single rotating direction indication, see Reference Fig. 23 .

Remark: Transmitters and receivers for ahead and astern indications of the non contact type shall conform to the requirements of **JIS F 8520**.

5. Performance

5.1 Accuracy of revolution counters shall be as follows:

- (1) The accuracy of the reciprocating drive type revolution counter shall be such that when the lever is subjected to 5 000 cycles of the reciprocating motions at various reciprocating speeds including the maximum at the specified angles, the indication of the counter shall be within $5\,000 \pm 1$.
- (2) The accuracy of the rotating drive type revolution counter shall be such that when rotated 5 000 revolutions in both ahead and astern directions at various rotational speed including the maximum speed, the indication of the counter shall be within $5\,000 \pm 1$.

5.2 The performance of the centrifugal type and the electromagnetic tachometers shall be as follows:

- (1) **Indication accuracy** Tolerable deviations for the indications of these tachometers shall be $\pm 1\%$ of the maximum graduation, and the pointer run-out shall be within 1% of the maximum graduation. However, the tolerable deviations for the indications of tachometers for ahead and astern shall be within $\pm 1\%$ of the sum of the maximum ahead speed graduation and the maximum astern speed graduation, and the pointer run-out shall be within 1% of the sum of the maximum ahead speed graduation and the maximum astern speed graduation.
- (2) **Vibration proof performance** The vibration proof performance shall be as follows:
 - (a) **Resonance** When the tachometer is subjected to vibrations at a frequency of 5 to 16.7 Hz with a double amplitude of 0.75 mm in 3 directions (up and down, right and left, and back and forth), there shall be no harmful resonant point.
 - (b) **Constant vibration** For any axis where resonance is found in (a) above, vibration of the severest resonance frequency with double amplitude of 0.75 mm shall be applied for 15 minutes each. While for an axis where no resonance is found, a vibration frequency of 16.7 Hz with double amplitude of 2.0 mm shall be applied for 30 minutes each. In any case, the performance specified in (1) above shall be satisfied.
- (3) **Durability** When continuously operated at the maximum rotational speed graduated on the scale for 10 hours, the tachometers shall satisfy the performance specified in (1).

5.3 The performance of the electric tachometers shall conform to the requirements of 3. of JIS F 8521.

6. Inspection

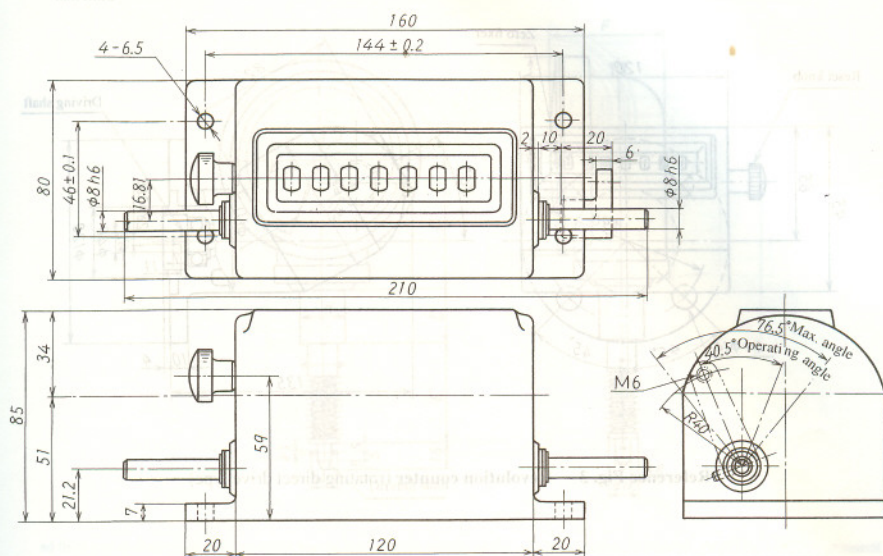
- 6.1 Inspections of accuracy of revolution counters shall be carried out in accordance with the requirements of 5.1 (1) or (2) and shall comply therewith.
- 6.2 Performance inspections of centrifugal tachometers and electromagnetic tachometers shall conform to the requirements of 7.4 of JIS B 7537.
- 6.3 Performance inspections of electric tachometers shall be carried out in accordance with the requirements of 7.3, 7.4, 7.5, 7.6, 7.7, 7.15 and 7.16 of JIS F 8521.

Reference Fig. 2 Revolution counter driving drive - Brakes and stop

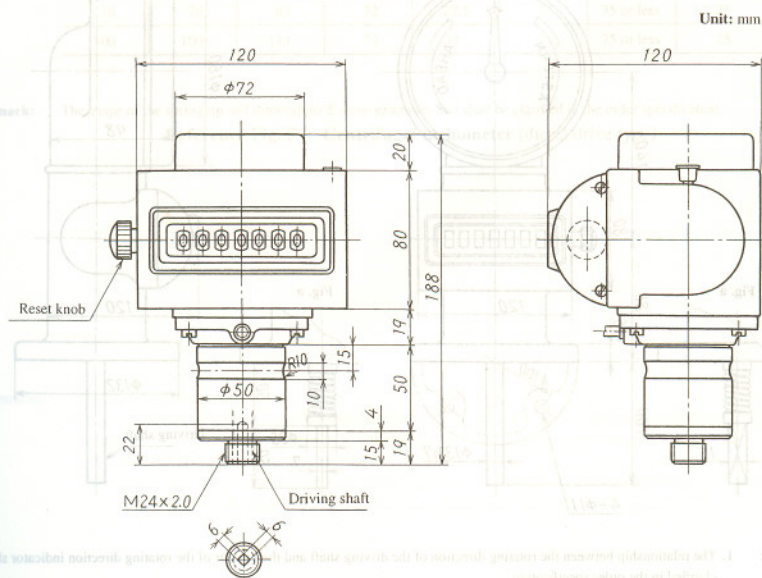
7. **Installations** Selection of installations of tachometers shall be made from **Table 5** according to the requirements, referring to figures for their fitting procedures.

Table 5 Installation of tachometers

Kind of engine	Type of tachometer	Reference Fig.
Main steam turbine	Rotating drive type revolution counter (fitted with a rotating direction indicator)	4
	Centrifugal drive type tachometer (fitted with a rotating direction indicator and a revolution counter)	6
	Electromagnetic tachometer (direct drive type fitted with a revolution counter)	10-12
	Electromagnetic tachometer (flexible shaft type)	13
	Electromagnetic tachometer (flexible shaft type fitted with a revolution counter)	14
	Electric tachometer (frequency type)	15-18
	Electric tachometer (ac or dc voltage type)	19-23
Main diesel engine	Reciprocating type revolution counter	1
	Rotating drive type revolution counter	2, 3
	Centrifugal type tachometer (direct drive type)	5
	Centrifugal type tachometer (direct drive type fitted with a revolution counter)	6
	Centrifugal type tachometer (flexible shaft type)	7
	Centrifugal type tachometer (flexible shaft type fitted with a rotating direction indicator and a revolution counter)	8
	Centrifugal type tachometer (belt type)	9
	Electromagnetic tachometer (direct drive type fitted with a revolution counter)	10
	Electromagnetic tachometer (flexible shaft type)	13
	Electromagnetic tachometer (flexible shaft type fitted with a revolution counter)	14
	Electromagnetic tachometer (frequency type)	15-18
	Electromagnetic tachometer (ac or dc voltage type)	19-23
Auxiliary engine	Centrifugal tachometer (direct drive type)	5
	Centrifugal tachometer (flexible shaft type)	7
	Centrifugal tachometer (flexible shaft type fitted with a revolution counter)	7
	Centrifugal tachometer (belt drive type)	9
	Electric tachometer (frequency type)	15-18
	Electric tachometer (ac voltage type)	19, 20, 23



Reference Fig. 1 Revolution counter (reciprocating drive – lever type)



Reference Fig. 2 Revolution counter (rotating drive – flexible shaft type)