



RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER

No. 313-67-1918c

dated 04.04.2023

Re:
amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2023, ND
No. 2- 020101-174-E, considering IACS UR M42 (Rev.6 Mar 2022) and the experience of the Rules
application

Item(s) of supervision:
Ships' machinery and equipment

Entry-into-force date:
Refer to Appendix 1

~~Cancels / amends / adds Circular Letter No.~~

~~dated~~

Number of pages: 1+13

Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Part VII "Machinery Installations" and IX "Machinery"

Director General

Sergey A. Kulikov

Text of CL:

We hereby inform that the Rules for the Classification and Construction of Sea-Going Ships shall be amended as specified in the Appendices to the Circular Letter

It is necessary to do the following:

1. Bring the content of the Circular Letter to notice of the RS surveyors, as well as interested organizations and persons in the area of the RS Branch Offices' activity.
2. Apply the provisions of the Circular Letter during review and approval of the technical documentation on the ICE crankshafts and vibration standards for ships' machinery and equipment applied to the ships contracted for construction or conversion on or after 01.05.2023, and with regard to steering engines on or after 01.07.2023 and in the absence of a contract, during review and approval of technical documentation on the ICE crankshafts and on vibration standards for ships' machinery and equipment applied to the ships on or after 01.05.2023, and with regard to steering engines on or after 01.07.2023.

List of the amended and/or introduced paras/chapters/sections:

Part VII: Section 9

Part IX: Paras 2.4.12 and 6.2.1.2.

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**Information on amendments introduced by the Circular Letter
(for inclusion in the Revision History to the RS Publication)**

| Nos. | Amended paras/chapters/ sections | Information on amendments | Number and date of the Circular Letter | Entry-into-force date |
|------|--|---|--|--------------------------|
| 1 | Part VII, Section 9 | Requirements for vibration standards for machinery and equipment have been specified | 313-67-1918c of 04.04.2023 | 01.05.2023 |
| 2 | Part IX, Section 2 | Requirements for the ICE crankshafts have been specified | 313-67-1918c of 04.04.2023 | 01.05.2023 |
| 3 | Part IX, Section 6 | Requirement for steering gear with hydraulic locking considering IACS UR M42 (Rev.6 Mar 2022) has been introduced | 313-67-1918c of 04.04.2023 | 01.07.2023 |

**RULES FOR THE CLASSIFICATION AND CONSTRUCTION
OF SEA- GOING SHIPS, 2023,**

ND NO. 2- 020101-174-E

PART VII. MACHINERY INSTALLATIONS

- 1 **Section 9** is replaced by the following text:

"9 VIBRATION OF MACHINERY AND EQUIPMENT. VIBRATION STANDARDS

9.1 GENERAL

9.1.1 This Section sets down the limits of vibration levels (vibration standards) for ships machinery and equipment.

9.1.1.1 The standards are intended to determine whether actual vibration levels in machinery and equipment installed onboard the ships during construction (after repair) and ships in service are permissible proceeding from vibration parameter measurements. The vibration standards provide three categories of technical condition of ship machinery and equipment:

A – condition of machinery and equipment after manufacturing (construction of the ship) or repair at the commissioning;

B – condition of machinery and equipment during normal operation;

C – condition of machinery and equipment when technical maintenance or repair is required.

The standards determine the upper limits of categories *A* and *B*.

9.1.1.2 For machinery and equipment, not mentioned in this section but affecting the safe operation of the ship, if it is required to assess their levels of vibration, one shall be guided by the standards specified by the manufacturer, or applicable national and international standards.

Manufacturer of ships machinery and equipment may apply other standards provided convincing data are available that the product is capable of operating under other vibration conditions.

9.1.2 Vibration measurements shall be taken on all the first ships of a series being built at each shipyard, on the first ship of modified design, on the single buildings and on the ships undergone conversion.

Vibration measurements of machinery and equipment shall be taken during construction of the ship according to the program approved by the Register in compliance with the instructions of 18.6 of the Guidelines on Technical Supervision of Ships under Construction.

9.1.3 During construction of the ship (or after repair) the vibration level of the machinery and equipment shall not exceed the upper limit of category *A*, determined as to ensure sufficient margin for changing of vibration level in operation.

Under conditions of long-term service of the ship the vibration level of the machinery and equipment shall not exceed the upper limit of category *B*, determined as to ensure vibration strength and reliability of ship machinery and equipment.

9.1.4 The measurement results shall be compared with the permissible vibration levels.

Where vibration exceeds the standards, measures shall be taken to reduce it to permissible level.

9.1.5 Vibration levels of machinery and equipment shall not exceed the standards both when the ship is lying and at specified ahead speeds under different loading conditions.

At non-specified rates of speed vibration exceeding established standards may be permitted, when these rates are not continuous.

9.1.6 In case of withdrawal from the present standards the technical substantiation shall be submitted to the Register review.

9.1.7 Designing shall be carried out considering IACS recommendation No. 167 (Corr.1, Mar 2021).

9.2 STANDARDIZED VIBRATION PARAMETERS

9.2.1 The root-mean square value of vibration rate, measured in 1/3-octave band, is assumed as the basic vibration parameter. Standardized root-mean square values of vibration rate in frequency band 2 – 1000 Hz indicated in the normative documents for specified machinery and equipment, are assumed as an additional parameter for vibration control. Measuring of vibration in octave band is allowed.

9.2.2 Alongside with the vibration rate the root-mean square value of vibration acceleration may also be a parameter measured.

9.2.3 Vibration parameters are measured in absolute units or in decibels relatively to standard limiting values of speed or acceleration being equal to 5×10^{-5} , mm/s, and 3×10^{-4} , m/s², accordingly.

Conversion of the measured values of vibration rate into relative units shall be made using the formula

$$L = 20 \lg \frac{V_e}{V_{eo}}, \quad (9.2.3)$$

where V_e the measured root-mean square value of vibration rate, mm/s;
 $V_{eo} = 5 \times 10^{-5}$ mm/s.

9.2.4 When vibration is measured in octave bands, the permissible values of the parameter measured may be increased by $\sqrt{2} =$ times (3 dB) as compared to those stated in 9.3 to 9.8 for bands with geometric mean frequency values of 2; 4; 8; 16; 31,5; 63; 125; 250 and 500 Hz.

9.2.5 Measurements of vibration of the machinery and equipment shall be taken for each of the three inter-perpendicular direction about the ship axes: vertical, horizontal-transverse and horizontal-longitudinal. For internal combustion engines, measurements of vibration shall be taken according to direction of axes: *X* – axial (coincident with the direction of the crankshaft), *Y* – horizontal-transverse, *Z* – vertical. Such designation shall be applied for main diesel engines and diesel engines of diesel-generators. The points of vibration measuring are indicated in Figs. 9.2.5, 9.8.1-2 and 9.9.1.

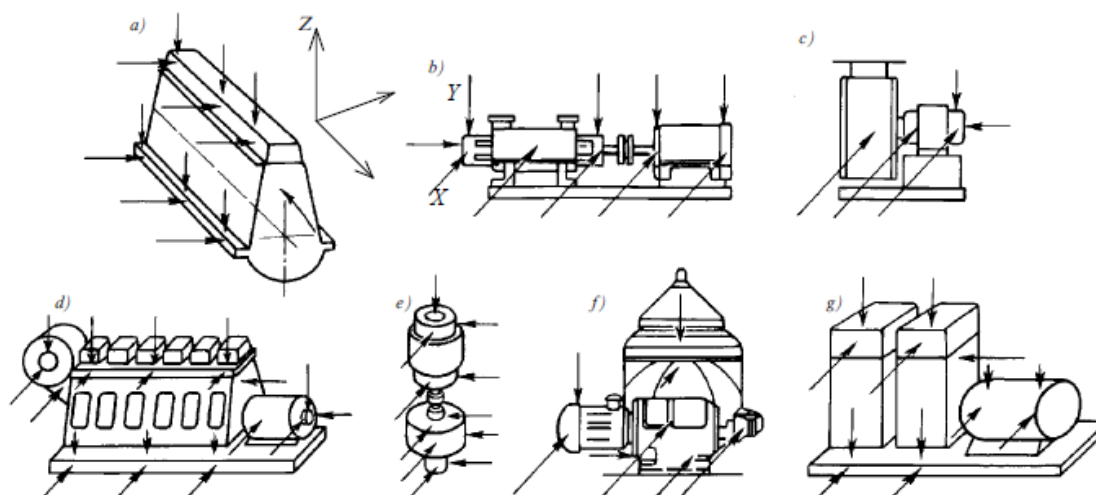


Fig. 9.2.5

Points of vibration measuring:

a – internal combustion engine; b – horizontal pump; c – fan; d – diesel-generator; e – vertical pump;
f – separator; g – piston compressor.

The points and directions of vibration measurement are shown by arrows

9.2.6 Vibration standards of machinery are specified in the relative chapters for rigid and yielding supports to which machinery can be attached under shipboard conditions. Rigid supports are those supports where the first natural frequency of the "support – machinery" system exceeds the basic exciting frequency (working frequency of revolution) in the vibration measurement direction by more than 25 per cent.

Yielding support is a support where the first natural frequency is less than 25 per cent of the machinery working frequency of revolution.

Yielding of the support is ensured by resilient mounting of the machinery or support (vibration insulators of various design – shock absorbers, springs, rubber insulators, etc.).

The vibration standards of categories A and B for machinery installed on rigid supports are specified in the relevant tables and figures. When the machinery is attached to yielding supports, the values of permissible vibration standards are increased. To determine the values of permissible vibration rate, multiplication factor for the particular type of machinery shall be applied.

9.3 VIBRATION STANDARDS FOR INTERNAL COMBUSTION ENGINES

9.3.1 Vibration standards are extended to cover ICE with 55 kW and above in power and rotation frequency $\leq 3000 \text{ min}^{-1}$.

9.3.2 Vibration of low-speed internal combustion engines installed on rigid supports is considered permissible for categories A and B, provided the root-means square values of vibration rate and vibration acceleration measured in the direction of axes x and z do not exceed the values specified in Table 9.3.2. When vibration is measured along the axis y (in horizontal-transverse direction) the permissible vibration rate standards for categories A and B shall be increased by 1,4 times.

When the internal combustion engines are installed on yielding supports (main medium-speed diesel engines and diesel engines of diesel-generators) the permissible vibration standards for categories A and B in the direction of axes x, y and z, specified in Table 9.3.2 shall be increased by 1,4 times.

9.3.3 Vibration of machinery and devices hung on ICE shall not exceed the levels given in 9.3.2.

9.3.4 Vibration of turbo-compressors measured on bearing housings is considered permissible for categories *A* and *B*, provided the root-meansquare values of vibration rate or vibration acceleration do not exceed the values specified in Table 9.3.4.

Table 9.3.2

Vibration standards for internal combustion engines

| Geometric mean frequencies of 1/3-octave bands, Hz | Engines with piston stroke, cm | | | | | | | | | | | | | | | | | | | |
|--|--------------------------------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|------------|-----|
| | under 30 | | | | 30 to 70 | | | | 71 to 140 | | | | 141 to 240 | | | | over 240 | | | |
| | Permissible values of vibration rate | | | | | | | | | | | | | | | | | | | |
| | category A | | category B | | category A | | category B | | category A | | category B | | category A | | category B | | category A | | category B | |
| | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB |
| 1,6 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 |
| 2 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4,5 | 99 | 6,3 | 102 |
| 2,5 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4,6 | 99 | 6,3 | 102 | 5,6 | 101 | 8,0 | 104 |
| 3,2 | 4 | 98 | 5,6 | 101 | 4 | 98 | 5,6 | 101 | 4,5 | 99 | 6,3 | 102 | 5,6 | 101 | 8,0 | 104 | 7,1 | 103 | 10 | 106 |
| 4 | 4 | 98 | 5,6 | 101 | 4,5 | 99 | 6,3 | 102 | 5,6 | 101 | 8,0 | 104 | 7,1 | 103 | 10 | 106 | 8,9 | 105 | 12,5 | 108 |
| 5 | 4,5 | 99 | 6,3 | 102 | 5,6 | 101 | 8,0 | 104 | 7,1 | 103 | 10 | 106 | 8,9 | 105 | 12,5 | 108 | 11 | 107 | 16 | 110 |
| 6,3 | 5,6 | 101 | 8,0 | 104 | 7,1 | 103 | 10 | 106 | 8,9 | 105 | 12,5 | 108 | 11 | 107 | 16 | 110 | 14 | 109 | 20 | 112 |
| 8 | 7,1 | 103 | 10 | 106 | 8,9 | 105 | 12,5 | 108 | 11 | 107 | 16 | 110 | 14 | 109 | 20 | 112 | 16 | 110 | 22 | 113 |
| 10 | 8,9 | 105 | 12,5 | 108 | 11 | 107 | 16 | 110 | 14 | 109 | 20 | 112 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 |
| 12,5 | 11 | 107 | 16 | 110 | 14 | 109 | 20 | 112 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 |
| 16 | 14 | 109 | 20 | 112 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 |
| 20 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 |
| 25 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 12,5 | 108 | 18 | 111 |
| 31,5 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 12,5 | 108 | 18 | 111 | 10 | 106 | 14 | 109 |
| 40 | 16 | 110 | 22 | 113 | 16 | 110 | 22 | 113 | 12,5 | 108 | 18 | 111 | 10 | 106 | 14 | 109 | 8 | 104 | 11 | 107 |
| 50 | 16 | 110 | 22 | 113 | 12,5 | 108 | 18 | 111 | 10 | 106 | 14 | 109 | 8 | 104 | 11 | 107 | 6,3 | 102 | 8,9 | 105 |
| 63 | 12,5 | 108 | 18 | 111 | 10 | 106 | 14 | 109 | 8 | 104 | 11 | 107 | 6,3 | 102 | 8,9 | 105 | 5 | 100 | 7,1 | 103 |
| 80 | 10 | 106 | 14 | 109 | 8 | 104 | 11 | 107 | 6,3 | 102 | 8,9 | 105 | 5 | 100 | 7,1 | 103 | 4 | 98 | 5,6 | 101 |
| 100 | 8 | 104 | 11 | 107 | 6,3 | 102 | 8,9 | 105 | 5 | 100 | 7,1 | 103 | 4 | 98 | 5,6 | 101 | 3,2 | 96 | 4,5 | 99 |
| 125 | 6,3 | 102 | 8,9 | 105 | 5 | 100 | 7,1 | 103 | 4 | 98 | 5,6 | 101 | 3,2 | 96 | 4,5 | 99 | 2,5 | 94 | 3,6 | 97 |
| 160 | 5 | 100 | 7,1 | 103 | 4 | 98 | 5,6 | 101 | 3,2 | 96 | 4,5 | 99 | 2,5 | 94 | 3,6 | 97 | 2 | 92 | 2,8 | 95 |

Table 9.3.4

Vibration standards for turbo-compressors

| Geometric mean frequencies of 1/3-octave band, Hz | Permissible values of vibration rate | | | |
|--|--------------------------------------|-----|-------------------|-----|
| | category <i>A</i> | | category <i>B</i> | |
| | mm/s | dB | mm/s | dB |
| 1,6 | 10 | 106 | 14 | 109 |
| 2 | 12,5 | 108 | 16 | 110 |
| 2,5 | 14 | 109 | 20 | 112 |
| 3,2 | 20 | 112 | 25,5 | 114 |
| 4 | 24 | 114 | 34 | 116 |
| 5 | 24 | 114 | 34 | 116 |
| 6,3 | 24 | 114 | 34 | 116 |
| 8 | 24 | 114 | 34 | 116 |
| 10 | 24 | 114 | 34 | 116 |
| 12,5 | 24 | 114 | 34 | 116 |
| 16 | 24 | 114 | 34 | 116 |
| 20 | 24 | 114 | 34 | 116 |
| 25 | 24 | 114 | 34 | 116 |
| 31,5 | 24 | 114 | 34 | 116 |
| 40 | 24 | 114 | 34 | 116 |
| 50 | 24 | 114 | 34 | 116 |
| 63 | 24 | 114 | 34 | 116 |
| 80 | 24 | 114 | 34 | 116 |
| 100 | 24 | 114 | 34 | 116 |
| 125 | 24 | 114 | 34 | 116 |
| 160 | 24 | 114 | 34 | 116 |
| 200 | 24 | 114 | 34 | 116 |
| 250 | 18 | 111 | 26 | 116 |
| 320 | 14 | 109 | 20 | 112 |
| 400 | 11 | 107 | 16 | 110 |
| 500 | 9 | 106 | 13 | 109 |

9.4 VIBRATION STANDARDS FOR MAIN GEARED TURBINES AND THRUST BEARINGS

9.4.1 The running vibration of 15000 to 30000 kW horse power main geared turbines measured on the bearing housings is considered permissible for categories *A* and *B*, provided the root-means square values of vibration rate or vibration acceleration do not exceed the values specified in Table 9.4.1.

The vibration standards specified in Table 9.4.1, shall be applied to the main geared turbines when installed both on rigid and on yielding supports.

9.4.2 For main geared turbines of less than 15000 kW power the vibration standards are 3 dB lower than the values specified in Table 9.4.1.

9.4.3 Vibration of thrust bearings shall not exceed the standards given in 9.4.1 and 9.4.2.

Table 9.4.1

**Vibration standards for main geared turbines, thrust bearings, boilers, heat exchangers,
ICE- driven generators, shaft- generators, turbo- drives, turbo- generators and piston compressors**

| Geometric mean frequencies of 1/3-octave bands, Hz | Main geared turbines and trust bearings | | | | Boilers and heat exchangers | | | | ICE-driven generators, turbodrives and turbo-generators ¹ | | | | Piston compressors | | | |
|---|--|-----|------------|-----|-----------------------------|-----|------------|-----|---|-----|------------|-----|--------------------|-----|------------|-----|
| | Permissible values of vibration rate | | | | | | | | | | | | | | | |
| | category A | | category B | | category A | | category B | | category A | | category B | | category A | | category B | |
| | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB |
| 1,6 | 1,5 | 90 | 2,5 | 94 | 3,5 | 97 | 5,6 | 101 | 1 | 86 | 1,6 | 90 | 2 | 92 | 3,2 | 96 |
| 2 | 1,9 | 92 | 3,1 | 96 | 3,5 | 97 | 5,6 | 101 | 1,3 | 88 | 1,9 | 92 | 2,5 | 94 | 4 | 98 |
| 2,5 | 2,4 | 94 | 3,8 | 98 | 3,5 | 97 | 5,6 | 101 | 1,5 | 90 | 2,4 | 94 | 3,1 | 96 | 5,1 | 100 |
| 3,2 | 3 | 96 | 4,8 | 100 | 4,4 | 99 | 7,1 | 103 | 1,9 | 92 | 3 | 96 | 4 | 98 | 6,4 | 102 |
| 4 | 3,7 | 97 | 6 | 102 | 5,6 | 101 | 8,9 | 105 | 2,3 | 93 | 3,7 | 97 | 5 | 100 | 8 | 104 |
| 5 | 4,6 | 99 | 7,5 | 104 | 7 | 103 | 11 | 107 | 2,9 | 95 | 4,6 | 99 | 6,2 | 102 | 10 | 106 |
| 6,3 | 5,7 | 101 | 9,3 | 105 | 8,8 | 105 | 14 | 109 | 3,6 | 97 | 5,7 | 101 | 7,9 | 104 | 12,5 | 108 |
| 8 | 7 | 103 | 11,5 | 107 | 10 | 106 | 16 | 110 | 4,5 | 99 | 7,1 | 103 | 10 | 106 | 16 | 110 |
| 10 | 8,8 | 105 | 14,5 | 109 | 10 | 106 | 16 | 110 | 5,6 | 101 | 8,9 | 105 | 10 | 106 | 16 | 110 |
| 12,5 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 16 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 20 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 25 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 31,5 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 40 | 11 | 107 | 18 | 111 | 10 | 106 | 16 | 110 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 50 | 8,8 | 105 | 14,5 | 109 | 8 | 104 | 12,5 | 108 | 7 | 103 | 11 | 107 | 10 | 106 | 16 | 110 |
| 63 | 7 | 103 | 11,5 | 107 | 6,3 | 102 | 10 | 106 | 7 | 103 | 11 | 107 | 7,9 | 104 | 12,5 | 108 |
| 80 | 5,7 | 101 | 9,3 | 105 | 5,2 | 100 | 8 | 104 | 7 | 103 | 11 | 107 | 6,2 | 102 | 10 | 106 |
| 100 | 4,6 | 99 | 7,5 | 104 | — | — | — | — | 5,6 | 101 | 8,9 | 105 | 5 | 100 | 8 | 104 |
| 125 | — | — | — | — | — | — | — | — | 4,5 | 99 | 7,1 | 103 | 4 | 98 | 6,4 | 102 |
| 160 | — | — | — | — | — | — | — | — | 3,6 | 97 | 5,7 | 101 | 3,1 | 96 | 5,1 | 100 |
| 200 | — | — | — | — | — | — | — | — | 2,9 | 95 | 4,6 | 99 | 2,5 | 94 | 4 | 98 |
| 250 | — | — | — | — | — | — | — | — | 2,3 | 93 | 3,7 | 97 | 2 | 92 | 3,2 | 96 |
| 320 | — | — | — | — | — | — | — | — | 1,9 | 92 | 3 | 96 | 1,6 | 90 | 2,5 | 94 |
| 400 | — | — | — | — | — | — | — | — | — | — | — | — | 1,3 | 88 | 2,1 | 92 |
| 500 | — | — | — | — | — | — | — | — | — | — | — | — | 1 | 86 | 1,6 | 90 |

¹ Refer to 9.5.4.

9.5 VIBRATION STANDARDS FOR AUXILIARY MACHINERY OF ROTARY TYPE

9.5.1 Vibration of vertical pumps with the capacity of 15 to 75 kW, including their electric drive, is assumed permissible for categories *A* and *B*, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.5.1.

Table 9.5.1

Vibration standards for pumps, centrifugal separators and fans

| Geometric mean frequencies of 1/3-octave bands, Hz | Pumps with the capacity of 15 to 75 kW | | | | Centrifugal separators | | | | Fans | | | |
|--|---|-----|------------|-----|------------------------|-----|------------|-----|------------|-----|------------|-----|
| | Permissible values of vibration rate | | | | | | | | | | | |
| | category A | | category B | | category A | | category B | | category A | | category B | |
| | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB | mm/s | dB |
| 1,6 | 1 | 86 | 1 | 86 | 1 | 86 | 1,3 | 88 | 1 | 86 | 1,3 | 88 |
| 2 | 1 | 86 | 1,2 | 88 | 1 | 86 | 1,6 | 90 | 1 | 86 | 1,6 | 90 |
| 2,5 | 1,1 | 87 | 1,4 | 89 | 1,3 | 88 | 2 | 92 | 1,3 | 88 | 2 | 92 |
| 3,2 | 1,4 | 89 | 2 | 92 | 1,6 | 90 | 2,5 | 94 | 1,6 | 90 | 2,5 | 94 |
| 4 | 1,7 | 91 | 2,5 | 94 | 2 | 92 | 3,2 | 96 | 2 | 92 | 3,2 | 96 |
| 5 | 2,2 | 93 | 3,3 | 96 | 2,5 | 94 | 4 | 98 | 2,6 | 94 | 4 | 98 |
| 6,3 | 2,7 | 95 | 4 | 98 | 3,2 | 96 | 5 | 100 | 3,3 | 96 | 5 | 100 |
| 8 | 3,5 | 97 | 5 | 100 | 4 | 98 | 6,4 | 102 | 4,1 | 98 | 6,4 | 102 |
| 10 | 4,3 | 99 | 6,3 | 102 | 5 | 100 | 8 | 104 | 5,2 | 100 | 8 | 104 |
| 12,5 | 5,5 | 101 | 8 | 104 | 5 | 100 | 8 | 104 | 6,7 | 103 | 10,3 | 106 |
| 16 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 20 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 25 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 31,5 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 40 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 50 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 8,5 | 105 | 13 | 108 |
| 63 | 7 | 103 | 10 | 106 | 5 | 100 | 8 | 104 | 6,7 | 103 | 10,3 | 106 |
| 80 | 5,5 | 101 | 8 | 104 | 5 | 100 | 8 | 104 | 5,2 | 100 | 8 | 104 |
| 100 | 4,3 | 99 | 6,3 | 102 | 5 | 100 | 8 | 104 | 4,1 | 98 | 6,4 | 102 |
| 125 | 3,5 | 97 | 5 | 100 | 4 | 98 | 6,4 | 102 | 3,3 | 96 | 5 | 100 |
| 160 | 2,7 | 95 | 4 | 98 | 3,2 | 96 | 5 | 100 | 2,6 | 94 | 4 | 98 |
| 200 | 2,2 | 93 | 3,3 | 96 | 2,5 | 94 | 4 | 98 | 2 | 92 | 3,2 | 96 |
| 250 | 1,7 | 91 | 2,5 | 94 | 2 | 92 | 3,2 | 96 | 1,6 | 90 | 2,5 | 94 |
| 320 | 1,4 | 89 | 2 | 92 | 1,6 | 90 | 2,5 | 94 | 1,3 | 88 | 2 | 92 |
| 400 | — | — | — | — | 1,3 | 88 | 2 | 92 | 1 | 86 | 1,6 | 90 |
| 500 | — | — | — | — | 1 | 86 | 1,6 | 90 | 1 | 86 | 1,3 | 88 |

For pumps having the capacity of 2 to 15 kW the vibration standards for categories *A* and *B* are assumed being 3 dB lower compared with the vibration standards for the pumps hewing the capacity of 15 to 75 kW, and for the pumps with the capacity of 75 to 300 kW such standards shall be raised by 2 dB. Vibration standards for horizontal pumps for the above mentioned capacity range are assumed being 2 dB lower.

The vibration standards specified in Table 9.5.1, shall be applied to all pumps when installed on rigid support. In case when the pumps are installed on yielding support, the permissible vibration standards shall be increased by 1,4 times for categories *A* and *B*.

9.5.2 Vibration of centrifugal separators is assumed permissible for categories *A* and *B*, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.5.1.

The vibration standards are specified considering the installation of separators on shock absorbers.

9.5.3 Vibration of fans and gas blowers of the inert gas systems is assumed permissible for categories *A* and *B*, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.5.1.

9.5.4 Vibration of turbo-drives, turbo-generators and generators of diesel-generators (ICE-driven generators) with the capacity of 1000 to 2000 kW, measured on the bearing

housings, is assumed permissible for categories A and B, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.4.1.

For the turbo-drives, turbo-generators and generators of diesel-generators with the capacity under 1000 kW the vibration standards for categories A and B are by 4 dB lower than the values stated in Table 9.4.1.

The vibration standards for turbo-drives and turbo-generators shall be applied when these are installed both on rigid and on yielding supports.

The vibration standards for generators of diesel-generators when installed on yielding supports shall be doubled.

9.6 VIBRATION STANDARDS FOR PISTON AIR COMPRESSORS

9.6.1 Vibration of piston air compressors is assumed permissible for categories A and B, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.4.1. When the compressor is mounted on the shock-absorbers, the vibration standards shall be raised by 4 dB.

9.7 VIBRATION STANDARDS FOR BOILERS AND HEAT EXCHANGERS

9.7.1 Vibration of boilers and heat exchangers is assumed permissible for categories A and B, when the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.4.1.

9.7.2 Vibration standards for auxiliary machinery and equipments, not covered by 9.5 and 9.6, shall be chosen based on 9.7.1.

9.8 VIBRATION STANDARDS FOR GEARED GAS TURBINES

9.8.1 Vibration of 250 to 25000 kW main geared gas turbines measured on the gas turbine supports and reduction gear bearings is considered permissible, provided the root-mean square values of vibration rate and vibration acceleration do not exceed the values stated in Table 9.8.1.

Points of vibration measuring are shown in Fig. 9.8.1-2.

Table 9.8.1

Vibration standards for geared gas turbines

| Geometric mean frequencies of 1/3-octave bands, Hz | Permissible values of vibration rate | | | | Geometric mean frequencies of 1/3-octave bands, Hz | Permissible values of vibration rate | | | |
|--|--------------------------------------|-----|------------|-----|--|--------------------------------------|-----|------------|-----|
| | category A | | category B | | | category A | | category B | |
| | mm/s | dB | mm/s | dB | | mm/s | dB | mm/s | dB |
| 1,6 | 1,6 | 90 | 2,9 | 96 | 125 | 8 | 104 | 16,5 | 110 |
| 2 | 1,8 | 91 | 3,5 | 97 | 160 | 8 | 104 | 16,5 | 110 |
| 2,5 | 2,2 | 93 | 4,3 | 98 | 200 | 8 | 104 | 16,5 | 110 |
| 3,2 | 2,7 | 95 | 5,3 | 100 | 250 | 8 | 104 | 16,5 | 110 |
| 4 | 3,2 | 96 | 7,0 | 103 | 320 | 8 | 104 | 16,5 | 110 |
| 5 | 4 | 98 | 9 | 105 | 400 | 8 | 104 | 16,5 | 110 |
| 6,3 | 5 | 100 | 11 | 107 | 500 | 8 | 104 | 16,5 | 110 |
| 8 | 6,7 | 103 | 13 | 108 | 640 | 6,5 | 102 | 12,5 | 108 |
| 10 | 8 | 104 | 16,5 | 110 | 800 | 4,8 | 100 | 10 | 106 |
| 12,5 | 8 | 104 | 16,5 | 110 | 1000 | 4 | 98 | 8 | 104 |
| 16 | 8 | 104 | 16,5 | 110 | 1280 | 3 | 96 | 7 | 103 |
| 20 | 8 | 104 | 16,5 | 110 | 1600 | 2,6 | 94 | 5 | 100 |
| 25 | 8 | 104 | 16,5 | 110 | 2000 | 2,1 | 92 | 3,9 | 98 |

| Geometric mean frequencies of 1/3-octave bands, Hz | Permissible values of vibration rate | | | | Geometric mean frequencies of 1/3-octave bands, Hz | Permissible values of vibration rate | | | |
|--|--------------------------------------|-----|------------|-----|--|--------------------------------------|----|------------|----|
| | category A | | category B | | | category A | | category B | |
| | mm/s | dB | mm/s | dB | | mm/s | dB | mm/s | dB |
| 31,5 | 8 | 104 | 16,5 | 110 | 2560 | 1,8 | 91 | 3 | 96 |
| 40 | 8 | 104 | 16,5 | 110 | 3200 | 1,5 | 90 | 2,4 | 95 |
| 50 | 8 | 104 | 16,5 | 110 | 4000 | 1 | 86 | 2 | 92 |
| 63 | 8 | 104 | 16,5 | 110 | 5120 | — | — | 1,7 | 91 |
| 80 | 8 | 104 | 16,5 | 110 | 6400 | — | — | 1,4 | 89 |
| 100 | 8 | 104 | 16,5 | 110 | 8000 | — | — | 1 | 86 |

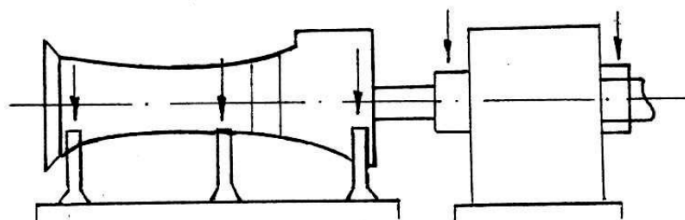


Fig. 9.8.1-2
Points of vibration measuring
(the points and directions of vibration measurement are shown by arrows)

9.8.2 Vibration standards for auxiliary gas turbines of less than 250 kW power shall be subject to special consideration by the Register and shall be submitted by the gas turbine manufacturer.

9.8.3 Vibration of gas-turbine-driven servo-machinery and devices shall not exceed the levels given in 9.8.1 and 9.8.2.

9.9 VIBRATION STANDARDS FOR MAIN AZIMUTH THRUSTERS

9.9.1 Vibration standards are extended to cover ICE- or electric motor driven main azimuth thrusters.

It is allowed to use vibration standards for auxiliary azimuth thrusters and athwartship thrusters.

The points and directions of vibration measuring are given in Fig. 9.9.1.

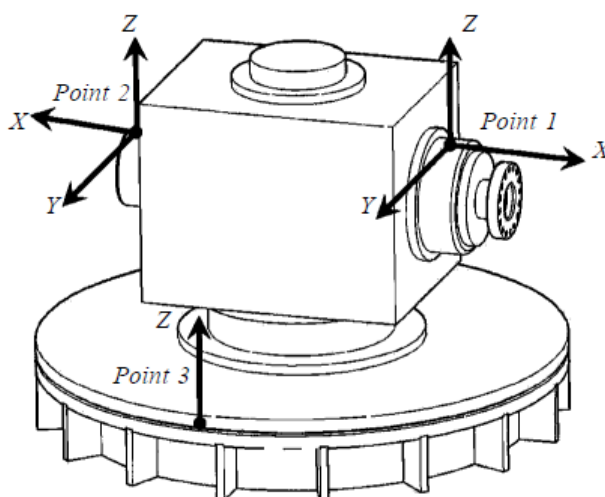


Fig. 9.9.1
Points of vibration measuring of main azimuth thrusters

9.9.2 Vibration of main azimuth thrusters is considered admissible for the categories as follows A and B, if the root-mean square values of vibration rate measured in the direction of axes X, Y, Z do not exceed the values in Table 9.9.3 and in Fig. 9.9.3.

9.9.3 Vibration of machinery and devices hung on main azimuth thrusters shall not exceed the levels listed in this Section for specified machinery and devices.

Table 9.9.3

Vibration standards of azimuth thrusters

| Geometric mean frequencies of 1/3-octave bands, Hz | Category A | | Category B | |
|--|------------|-----|------------|-----|
| | mm/s | dB | mm/s | dB |
| 4 | 2,3 | 93 | 4,0 | 98 |
| 5 | 2,8 | 95 | 5,0 | 100 |
| 6,3 | 3,5 | 97 | 6,2 | 102 |
| 8 | 4,5 | 99 | 7,8 | 104 |
| 10 | 5,7 | 101 | 9,8 | 106 |
| 12,5 | 7,0 | 103 | 12,0 | 108 |
| 16 | 7,0 | 103 | 12,0 | 108 |
| 20 | 7,0 | 103 | 12,0 | 108 |
| 25 | 7,0 | 103 | 12,0 | 108 |
| 31,5 | 7,0 | 103 | 12,0 | 108 |
| 40 | 7,0 | 103 | 12,0 | 108 |
| 50 | 7,0 | 103 | 12,0 | 108 |
| 63 | 7,0 | 103 | 12,0 | 108 |
| 80 | 7,0 | 103 | 12,0 | 108 |
| 100 | 7,0 | 103 | 12,0 | 108 |
| 125 | 7,0 | 103 | 12,0 | 108 |
| 160 | 7,0 | 103 | 12,0 | 108 |
| 200 | 7,0 | 103 | 12,0 | 108 |
| 250 | 7,0 | 103 | 12,0 | 108 |
| 320 | 7,0 | 103 | 12,0 | 108 |
| 400 | 7,0 | 103 | 12,0 | 108 |
| 500 | 7,0 | 103 | 12,0 | 108 |
| 630 | 5,7 | 101 | 9,8 | 106 |
| 800 | 4,4 | 99 | 7,8 | 104 |
| 1000 | 3,5 | 97 | 6,2 | 102 |

"

PART IX. MACHINERY

2 INTERNAL COMBUSTION ENGINES

2 **Para 2.4.12** is replaced by the following text:

"2.4.12 At the junction of the web with the journal or pin, the radius of the fillet shall not be less than $0,05D$.

Where crankshafts have flanges, the radius of the fillet at the junction of the flange with the journal shall not be less than $0,08D$.

Smaller values of radii can be allowed if the requirements of 2.4.11 are met and substantiating calculations of calculations or operating experience are submitted."

6 DECK MACHINERY

3 **Para 6.2.1.2** is replaced by the following text:

"6.2.1.2 Main steering gear comprising two or more identical power units (refer to 2.9.4, Part III "Equipment, Arrangements and Outfit") shall be so arranged that a single failure in its piping or in one of the power units will not impair the integrity of the remaining part of the steering gear.

Where the steering gear contracted for construction or conversion on or after 01.07.2023, and in the absence of a contract, during review and approval of technical documentation on steering engines, requested for review on or after 01.07.2023, is so arranged that more than one system (either power or control) can be simultaneously operated, the risk of hydraulic locking caused by single failure shall be considered.

Hydraulic locking means all situations where two hydraulic systems (usually identical) oppose each other in such a way that it may lead to loss of steering. It can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic "bypass" meaning that the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure.

In oil tankers, oil tankers (≥ 60 °C), chemical tankers or gas carriers of 10000 gross tonnage and upwards, hydraulic steering gear shall be provided with audible and visual alarms to give the indication of hydraulic fluid leakage in any part of the hydraulic system as well as with the arrangements of automatic isolation of the defective part of the system so that the steering capability shall be regained in not more than 45 s after the loss of the defective port of the hydraulic system."