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ANNEX III

Technical Details of Sound Signal Appliances

1. Whistles

(a) Frequencies and range of audibility

The fundamental frequency of the signal shall lie within the range 70-700 Hz. The range of audibility of the signal from a whistle shall be determined by those frequencies, which may include the fundamental and/or one or more higher frequencies, which lie within the range 180-700 Hz (± 1 percent) and which provide the sound pressure levels specified in paragraph 1(c) below.

(b) Limits of fundamental frequencies

To ensure a wide variety of whistle characteristics, the fundamental frequency of a whistle shall be between the following limits:

- (i) 70-200 Hz, for a vessel 200 meters or more in length;
- (ii) 130-350 Hz, for a vessel 75 meters but less than 200 meters in length;
- (iii) 250-700 Hz, for a vessel less than 75 meters in length.

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ANNEX III

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Technical Details of Sound Signal Appliances

SUBPART A—WHISTLES

§ 86.01 Frequencies and range of audibility

The fundamental frequency of the signal shall lie within the range 70-525 Hz. The range of audibility of the signal from a whistle shall be determined by those frequencies, which may include the fundamental and/or one or more higher frequencies, which lie within the frequency ranges and provide the sound pressure levels specified in § 86.05.

§ 86.03 Limits of fundamental frequencies

To ensure a wide variety of whistle characteristics, the fundamental frequency of a whistle shall be between the following limits:

- (a) 70-200 Hz, for a vessel 200 meters or more in length;
- (b) 130-350 Hz, for a vessel 75 meters but less than 200 meters in length;
- (c) 250-525 Hz, for a vessel less than 75 meters in length.

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(c) **Sound signal intensity and range of audibility**

A whistle fitted in a vessel shall provide, in the direction of maximum intensity of the whistle and at a distance of 1 meter from it, a sound pressure level in at least one 1/3-octave band within the range of frequencies 180-700 Hz (± 1 percent) of not less than the appropriate figure given in the table below.

<i>Length of vessel in meters</i>	<i>1/3-octave band level at 1 meter in dB referred to 2×10^{-5} N/m²</i>	<i>Audibility range in nautical miles</i>
200 or more	143	2
75 but less than 200	138	1.5
20 but less than 75	130	1
Less than 20	120	0.5

NOTE: The range of audibility in the table above is for information and is approximately the range at which a whistle may be heard on its forward axis with 90 percent probability in conditions of still air on board a vessel having average background noise level at the listening posts (taken to be 68 dB in the octave band centered on 250 Hz and 63 dB in the octave band centered on 500 Hz). In practice the range at which a whistle may be heard is extremely variable and depends critically on weather conditions; the values given can be regarded as typical but under conditions of strong wind or high ambient noise level at the listening post the range may be much reduced.

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§ 86.05 Sound signal intensity and range of audibility

A whistle on a vessel shall provide, in the direction of the forward axis of the whistle and at a distance of 1 meter from it, a sound pressure level in at least one 1/3-octave band of not less than the appropriate figure given in Table 86.05 within the following frequency ranges (± 1 percent):

- (a) 130-1200 Hz, for a vessel 75 meters or more in length;
- (b) 250-1600 Hz, for a vessel 20 meters but less than 75 meters in length;
- (c) 250-2100 Hz, for a vessel 12 meters but less than 20 meters in length.

Table 86.05

Length of vessel in meters	Fundamental frequency range (Hz)	1/3-octave band		Audibility range in nautical miles
		For measured frequencies (Hz)	level at 1 meter in dB referred to 2×10^{-5} N/m ²	
200 or more	70-200	130-180	145	2
		180-250	143	
		250-1200	140	
75 but less than 200	130-350	130-180	140	1.5
		180-250	138	
		250-1200	134	
20 but less than 75	250-525	250-450	130	1.0
		450-800	125	
		800-1600	121	
12 but less than 20	250-525	250-450	120	0.5
		450-800	115	
		800-2100	111	

NOTE: The range of audibility in the table above is for information and is approximately the range at which a whistle may usually be heard on its forward axis in conditions of still air on board a vessel having average background noise level at the listening posts (taken to be 68 dB in the octave band centered on 250 Hz and 63 dB in the octave band centered on 500 Hz). In practice the range at which a whistle may be heard is extremely variable and depends critically on weather conditions; the values given can be regarded as typical but under conditions of strong wind or high ambient noise level at the listening post the range may be much reduced.

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(d) Directional properties

The sound pressure level of a directional whistle shall be not more than 4 dB below the prescribed sound pressure level on the axis at any direction in the horizontal plane within ± 45 degrees of the axis. The sound pressure level at any other direction in the horizontal plane shall be not more than 10 dB below the prescribed sound pressure level on the axis, so that the range in any direction will be at least half the range on the forward axis. The sound pressure level shall be measured in that one-third octave band which determines the audibility range.

(e) Positioning of whistles

When a directional whistle is to be used as the only whistle on a vessel, it shall be installed with its maximum intensity directed straight ahead.

A whistle shall be placed as high as practicable on a vessel, in order to reduce interception of the emitted sound by obstructions and also to minimize hearing damage risk to personnel. The sound pressure level of the vessel's own signal at listening posts shall not exceed 110 dB(A) and so far as practicable should not exceed 100 dB(A).

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§ 86.07 Directional properties

The sound pressure level of a directional whistle shall be not more than 4 dB below the sound pressure level specified in § 86.05 in any direction in the horizontal plane within ± 45 degrees of the forward axis. The sound pressure level of the whistle in any other direction in the horizontal plane shall not be more than 10 dB less than the sound pressure level specified for the forward axis, so that the range of audibility in any direction will be at least half the range required on the forward axis. The sound pressure level shall be measured in that one-third octave band which determines the audibility range.

§ 86.09 Positioning of whistles

(a) When a directional whistle is to be used as the only whistle on the vessel and is permanently installed, it shall be installed with its forward axis directed forward.

(b) A whistle shall be placed as high as practicable on a vessel, in order to reduce interception of the emitted sound by obstructions and also to minimize hearing damage risk to personnel. The sound pressure level of the vessel's own signal at listening posts shall not exceed 110 dB(A) and so far as practicable should not exceed 100 dB(A).

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(f) Fitting of more than one whistle

If whistles are fitted at a distance apart of more than 100 meters, it shall be so arranged that they are not sounded simultaneously.

(g) Combined whistle systems

If due to the presence of obstructions the sound field of a single whistle or of one of the whistles referred to in paragraph 1(f) above is likely to have a zone of greatly reduced signal level, it is recommended that a combined whistle system be fitted so as to overcome this reduction. For the purposes of the Rules a combined whistle system is to be regarded as a single whistle. The whistles of a combined system shall be located at a distance apart of not more than 100 meters and arranged to be sounded simultaneously. The frequency of any one whistle shall differ from those of the others by at least 10 Hz.

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§ 86.11 Fitting of more than one whistle

If whistles are fitted at a distance apart of more than 100 meters, they shall not be sounded simultaneously.

§ 86.13 Combined whistle systems

(a) A combined whistle system is a number of whistles (sound emitting sources) operated together. For the purposes of the Rules a combined whistle system is to be regarded as a single whistle.

(b) The whistles of a combined system shall:

- (1) Be located at a distance apart of not more than 100 meters,
- (2) Be sounded simultaneously,
- (3) Each have a fundamental frequency different from those of the others by at least 10 Hz, and
- (4) Have a tonal characteristic appropriate for the length of vessel which shall be evidenced by at least two-thirds of the whistles in the combined system having fundamental frequencies falling within the limits prescribed in § 86.03, or if there are only two whistles in the combined system, by the higher fundamental frequency falling within the limits prescribed § 86.03.

NOTE: If due to the presence of obstructions the sound field of a single whistle or of one of the whistles referred to in §86.11 is likely to have a zone of greatly reduced signal level a combined whistle system should be fitted so as to overcome this reduction.

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ANNEX III—Continued

2. Bell or gong

(a) Intensity of signal

A bell or gong, or other device having similar sound characteristics shall produce a sound pressure level of not less than 110 dB at a distance of 1 meter from it.

(b) Construction

Bells and gongs shall be made of corrosion-resistant material and designed to give a clear tone. The diameter of the mouth of the bell shall be not less than 300 mm for vessels of 20 meters or more in length, and shall be not less than 200 mm for vessels of 12 meters or more but of less than 20 meters in length. Where practicable, a power-driven bell striker is recommended to ensure constant force but manual operation shall be possible. The mass of the striker shall be not less than 3 percent of the mass of the bell.

3. Approval

The construction of sound signal appliances, their performance and their installation on board the vessel shall be to the satisfaction of the appropriate authority of the State whose flag the vessel is entitled to fly.

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§ 86.15 Towing vessel whistles

A power-driven vessel normally engaged in pushing ahead or towing alongside may, at all times, use a whistle whose characteristic falls within the limits prescribed by § 86.03 for the longest customary composite length of the vessel and its tow.

Subpart B—Bell or gong

§ 86.21 Intensity of signal

A bell or gong, or other device having similar sound characteristics shall produce a sound pressure level of not less than 110 dB at 1 meter.

§ 86.23 Construction

Bells and gongs shall be made of corrosion-resistant material and designed to give a clear tone. The diameter of the mouth of the bell shall be not less than 300 mm for vessels of more than 20 meters in length, and shall be not less than 200 mm for vessels of 12 to 20 meters in length. The mass of the striker shall be not less than 3 percent of the mass of the bell. The striker shall be capable of manual operation.

NOTE: When practicable, a power-driven bell striker is recommended to ensure constant force.

Subpart C—Approval

§ 86.31 Approval [Reserved]