

C H A P T E R I I I

Physical occupational health effects

Part B-1 Noise

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Translation: Only the Danish document has legal validity.

CHAPTER III

Physical occupational health effects

Part B-1 Noise

Regulation 1 Application

- 1 The provisions in this part shall apply to all ships on which workers are employed.
- 2 The provisions shall also apply to one-man operated commercial vessels with a scantling number of or above 20.
- 3 The provisions have been formulated on the basis of the provisions hitherto in force in technical regulation no. 4 of 3 May 2002 on noise in ships as well as Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)

Regulation 2 Definitions

- 1 In this part the following definitions shall apply:
 - .1 "New ship" means a ship the keel of which is laid or which is at an equivalent stage of construction on or after 1 July 2002.
 - .2 "Existing ship" means a ship that is not a new ship.
 - .3 "Length (L)" means the ship's length L, as defined in the relevant regulations on ship's construction and equipment etc.
 - .4 "Scantling number" means the vessel's length multiplied by the vessel's breadth as defined in the relevant regulations on ship's construction and equipment etc.
 - .5 "Propulsive power" means the total maximum output (MCR) in kilowatts at continuous operation of all machinery that can simultaneously propel the ship. The output is determined by the Danish Maritime Authority on the basis of the engine manufacturer's test plan forms and shall be recorded in the

ship's minimum safe manning document.

- .6 "Maximum noise pressure, (P_{\max})" means the greatest value of the C-weighted instantaneous noise pressure (impulse noise).
- .7 "Energy equivalent noise level, $L_{Aeq,T}$ " means the constant noise pressure level, measured in dB(A), which in time period T has the same energy content as the measured, possibly varying noise level.
- .8 "Daily noise exposure level, $L_{EX,8h}$ " means the time-weighted average of the noise exposure levels for a nominal eight-hour working day measured in dB(A), as defined by international standard ISO 1999: 1990, point 3.6. This shall cover all noise in connection with work, including impulse noise. For a daily working period of T_d hours $L_{EX,8h} = L_{Aeq,T} + 10 \log(T_d/8)$.¹
- .9 "Air sound insulation, R_w " means the weighted reduction figure as defined in DS/EN ISO Standard 140-4 and 717-1.
- .10 "Impact sound insulation, $L_{n,w}$ " means the weighted impact sound level in the room as defined in DS/EN ISO Standard 140-7 and 717-2.
- .11 "Infrasound" means sound with a frequency of less than 20 Hz.
- .12 "Ultrasound" means sound with a frequency of more than 18,000 Hz.
- .13 "Unnecessary noise" means noise which can be reduced significantly in level and which it seems reasonable to protect against.

Regulation 3 Personal noise limits

- 1 The limit values for daily noise exposure and maximum sound pressure are fixed at:

$$L_{EX,8h} = 85 \text{ dB(A)}^2$$

$$P_{\max} = 130 \text{ dB(C)}$$

¹ For a working period T_d of 12 hours, the daily noise exposure is therefore increased by 1.8 dB(A) and for 16 hours by 3.0 dB(A), when the noise level is unchanged.

² For a 12-hour working day this corresponds to a maximum energy equivalent noise level, $L_{Aeq,12}$ of 83 dB(A).

When applying the exposure limit values, the determination of the worker's effective exposure shall take account of the attenuation provided by the individual ear protectors worn by the worker. The limit values shall not be exceeded, cf. regulation 7.

2 Action values in respect of the daily noise exposure and maximum sound pressure are fixed at:

.1 Upper action values

$$L_{EX,8h} = 85 \text{ dB(A)}$$

$$P_{max} = 130 \text{ dB(C)}$$

.2 Lower action values

$$L_{EX,8h} = 80 \text{ dB(A)}$$

$$P_{max} = 130 \text{ dB(C)}$$

When applying the action values, the determination of the worker's effective noise exposure shall not take account of the attenuation provided by the individual ear protectors worn by the worker. If the action values are exceeded, the measures stated in regulations 8, 10, 11 and 13 shall be taken.

Regulation 4 Area-determined noise limits

- 1 On new ships with a length L of or above 15 metres and a scantling number of or above 100, the maximum noise levels stipulated in Annex 1 shall be observed and compliance with the recommended noise levels shall be sought. Furthermore, the values for air sound insulation and impact sound insulation in Annex 1 shall be observed.
- 2 In connection with the planning of new ships, it shall be documented by calculations, qualified assessments or the like of the expected noise level in the affected areas, that it is possible to observe the recommended noise limits in Annex 1 for these areas. The documentation shall be submitted to the Danish Maritime Authority.
- 3 Should the shipowner, on the basis of the documentation mentioned in subparagraph (2) above, find that the recommended noise limits stipulated in Annex 1 cannot be complied with,

despite reasonable technical initiatives, this shall be documented to the Danish Maritime Authority on request.

- 4 On existing ships with a length L of or above 15 metres or a scantling number of or above 100 as well as on new and existing ships with a length L below 15 metres and a scantling number of or above 20, but below 100, efforts shall be made to observe the maximum noise levels stipulated in Annex 1.

Regulation 5 Noise measurements

- 1 Noise measurements shall be carried out when it is necessary to determine the noise exposure and they shall always be carried out
 - .1 on completion of a new ship,
 - .2 after alterations or modifications to an existing ship that are considered to affect the noise level,
 - .3 when an existing ship is transferred to the Danish register and the results of existing relevant noise measurements are not available,
 - .4 if there are other grounds for suspecting that the noise levels have altered, and
 - .5 if the Danish Maritime Authority demands them.
- 2 Noise measurements shall be carried out so that it is possible to determine whether the values stipulated in regulation 3 have been exceeded.
- 3 The measurements shall be carried out in compliance with the guidelines stipulated in Annex 3, Noise Measurements.
- 4 The noise measurements shall be carried out or supervised by an expert approved by the Danish Maritime Authority. The Danish Maritime Authority accepts measurements carried out by approved testing institutes, including testing institutes in other EU Member States as well as in countries covered by the EEA agreement and which provide appropriate and satisfactory guarantees of a technical, professional and independent nature.

Regulation 6 Risk assessment

- 1 The risk assessment, cf. Chapter I A, regulation 2, shall contain an assessment of the exposure of workers to noise.

- 2 In preparation of the risk assessment, the following shall be afforded special consideration
 - .1 the level, type and duration of exposure, including impulse noise,
 - .2 limit values and action values stipulated in regulation 3,
 - .3 any effects concerning the health and safety of workers belonging to particularly sensitive risk groups,
 - .4 any effects on the safety and health of workers resulting from interactions between noise and ototoxic substances and between noise and vibrations,
 - .5 any risk that, due to noise, the worker cannot hear warning signals or other sounds to warn of the risk of accidents,
 - .6 information on noise levels provided by manufacturers of work equipment,
 - .7 the existence of alternative work equipment designed to reduce the noise level,
 - .8 exposure to noise on board the ship after work, particularly in accommodation and sleeping quarters,
 - .9 relevant information collected in connection with health inspection, and
 - .10 use of ear protectors with adequate sound-reduction effect.
- 3 The risk assessment shall state which measures are to be taken in accordance with regulations 7, 8, 9, 10 and 11.
- 4 The risk assessment shall be revised regularly. A revision is particularly necessary if there are significant changes which make it obsolete or if the health inspection shows that it is necessary.

Regulation 7 Limitation of exposure to noise

- 1 Under no circumstances shall the worker be exposed to noise in excess of the limit values in regulation 3, subparagraph (1).
- 2 If the limit value is exceeded the shipowner shall immediately
 - .1 take steps to reduce the exposure to less than the limit value,
 - .2 determine the reason for the limit value being exceeded, and
 - .3 adapt measures to prevent the exposure in order to prevent the limit value from being exceeded again.

Regulation 8 Prevention of noise

- 1 Taking account of technical progress and the available measures, the noise level shall be reduced at the source or reduced to a minimum.
- 2 Unnecessary noise shall be avoided and the acoustic conditions shall be satisfactory. The noise level, including the level from infrasound and ultrasound shall be kept as low as is reasonable, taking account of technical progress.
- 3 Limitation of noise exposure shall be carried out on the basis of the general principles on prevention in Chapter I, taking particular account of:
 - .1 technical means of noise reduction by which the origin, radiation and spread of noise is prevented or reduced:
 - i) reducing airborne noise, e.g. by shields, enclosures, sound-absorbent coverings,
 - ii) reducing structure-borne noise, e.g. by damping or isolation,
 - .2 alternative working methods that require less exposure to noise,
 - .3 choice of appropriate work equipment, taking account of the work to be done, emitting the least possible noise,
 - .4 the design and layout of workplaces,
 - .5 information and training to instruct workers to use work equipment correctly in order to reduce their exposure to noise to a minimum,
 - .6 maintenance of work equipment and workplaces,
 - .7 noise reduction by technical means:
 - i) limitation of the duration and intensity of the exposure,
 - ii) appropriate work schedules and adequate rest periods.
- 4 On the basis of the risk assessment, if the upper action values are exceeded, the shipowner shall establish and implement a programme of technical and organisational measures intended to reduce the exposure to noise, taking into account in particular the measures referred to in subparagraph 3.
- 5 The shipowner shall ensure that when choosing the measures, account is taken of workers belonging to particularly sensitive risk groups.

Regulation 9 Sign posting

At the entrance to rooms with a noise level above 80 dB(A), signs shall be posted in accordance with the regulation on safety sign posting, etc. on board ships in force at any time. This sign shall, by means of suitable symbols or in Danish text and, where relevant, English text, clearly state the directions given in Annex 2. Rooms or areas where the noise level exceeds 115 dB(A) shall not normally be entered.

Regulation 10 Personal protective equipment

- 1 If the risks arising from exposure to noise cannot be prevented by other means, appropriate, properly fitting individual ear protectors shall be made available to workers and used by them under the conditions set out below:
 - .1 where noise exposure exceeds the lower action values, the employer shall make individual ear protectors available to workers;
 - .2 where noise exposure matches or exceeds the upper action values, or where noise exposure is otherwise harmful or a great nuisance, individual ear protectors shall be used.
- 2 The personal ear protectors shall comply with the provisions of the relevant executive order from the Danish Working Environment Authority on the design of personal protective equipment.
- 3 The shipowner shall ensure the wearing of ear protectors when relevant pursuant to this regulation, and shall be responsible for checking the effectiveness of the measures taken in compliance with this regulation.

Regulation 11 Information and training

- 1 The shipowner shall ensure that workers who are exposed to noise at work at or above the lower action values, receive information and training relating to risks resulting from exposure to noise concerning, in particular:
 - .1 the nature of such risks,
 - .2 the measures taken to eliminate or reduce to a minimum the risks from noise,
 - .3 the limit values and action values,

- .4 the results of the assessments and measurements carried out pursuant to regulation 5 and of the injuries which can arise,
- .5 the correct use of ear protectors,
- .6 how to detect and report signs of hearing damage,
- .7 the circumstances in which workers are entitled to health checks,
- .8 safe working practices to minimise exposure to noise.

Regulation 12 Consultation of workers

- 1 Workers and the safety organisation shall be consulted in deciding matters concerning noise, in particular
 - .1 the risk assessment referred to in regulation 6,
 - .2 the measures against exposure referred to in regulations 8 and 9, and
 - .3 the choice of individual ear protectors referred to in regulation 10.

Regulation 13 Occupational medical examinations

- 1 If the risk assessment indicates a risk to the health of workers, these workers shall be ensured an occupational medical examination in accordance with the provisions of Chapter IX, part A.
- 2 A worker whose exposure exceeds the upper action values shall have the right to have his/her hearing checked by a doctor or by another suitably qualified person.
- 3 A worker whose exposure exceeds the lower action values shall have the right to a hearing test.
- 4 Where, as a result of a hearing check, a worker is found to have hearing damage, a doctor or a specialist if the doctor considers it necessary shall assess whether the damage is likely to be the result of exposure to noise at work. If this is the case the shipowner shall
 - .1 review the risk assessment,
 - .2 review the measures taken pursuant to regulations 8, 9 and 10,
 - .3 take into account the advice from the doctor or other suitably qualified person, and

- .4 arrange new health examinations of any worker who has been similarly exposed.

Regulation 14 Exemptions

In exceptional circumstances, the Danish Maritime Authority may grant derogations from the provisions of this part when it is deemed reasonable and appropriate in a health and safety context and to the extent it conforms with Directive 2003/10/EC of 6 February 2003 on minimum health and safety requirements regarding exposure of workers to the risks arising from physical agents (noise).

Annex 1 Area-determined noise limits

1 Maximum and recommended noise limits

		Maximum dB(A)	Rec. dB(A)
Work areas:			
1	Engine room, incl. steering machinery	110	105
2	At stopped machinery in the engine room ³	85	85
3	Workshops	85	80
4	Separate separator room	85	85
5	Engine control room and manoeuvre room	75	70
6	Galley	75	70
7	Wheelhouse	65	65
8	Radio room	60	60
9	Listening posts ⁴	70	70
10	Offices in accommodation and deck control room	65	65
11	Shop areas and newsagent's	65	65
12a	Other work areas, fishing vessels	85	85
12b	Other work areas, other ships ⁵	90	85
Recreational areas etc.:			
13	Infirmary (hospital)	60	60
14	Sleeping quarters	60	55
15	Leisure and exercise rooms	65	65
16	Dining room and other living rooms	65	60
17	External leisure areas	75	70
18	At rescue stations ⁶	75	70

³ The noise in the service area at a stopped main or auxiliary engine may not exceed 85 dB when the other machinery is operating normally.

⁴ According to the Convention on the International Regulations for preventing Collisions at Sea, 1972, as amended (COLREG). In fishing vessels a wheelhouse with open windows may be acceptable as a listening post, provided *all* deck machinery is stopped.

⁵ If the noise level exceeds 85 dB(A), ear protectors shall be used, cf. regulation 10.

⁶ Measurements at rescue stations may be made at reduced speed, cf. annex 3.

2 Sound insulation

Bulkhead and deck constructions shall be made of materials with sufficient sound insulation in order to avoid disturbance from activities in adjacent rooms, including human activities such as music, conversation, steps, etc. The structural elements shall comply with the following requirements:

Airborne sound insulation, cf. ISO 140/3 and ISO 717/1

Bulkheads in accommodation in general	R_w : min. 35 dB
Decks in accommodation in general	R_w : min. 40 dB
Between sleeping quarters and open deck, living rooms, galley, pantry, leisure and hobby rooms and engine rooms	R_w : min. 45 dB

Impact sound insulation, cf. ISO 140/7 and ISO 717/2

From passageways on open deck, galley, pantry or other rooms with loud impact sounds to sleeping quarters and living rooms	$L'_{n,w}$: max. 65 dB
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The airborne sound insulation of the final construction measured in the ship (the weighted apparent sound reduction index, R'_w) may not be lower than the laboratory values (those stipulated above) by more than 2 dB.

Annex 2 Sign posting at the entrance to noisy rooms

80-85 dB(A)

HØJT STØJNIVEAU
BRUG HØREVÆRN

HIGH NOISE LEVEL
USE EAR PROTECTORS

85-110 dB(A)

FARLIG STØJ
HØREVÆRN SKAL ANVENDES

DANGEROUS NOISE
USE OF EAR PROTECTORS MANDATORY

110-115 dB(A)

ADVARSEL:
FARLIG STØJ
HØREVÆRN SKAL ANVENDES
KUN OPHOLD I KORTERE TID

CAUTION:
DANGEROUS NOISE
USE OF EAR PROTECTORS MANDATORY
SHORT STAY ONLY

>115 dB(A)

ADVARSEL:
MEGET FARLIG STØJ
HØREVÆRN SKAL ANVENDES
HØJEST 10 MIN OPHOLD FOR
INSPEKTION

CAUTION:
EXCESSIVELY HIGH NOISE LEVEL
USE OF EAR PROTECTORS MANDATORY
NO STAY LONGER THAN 10 MINUTES
FOR INSPECTION

Annex 3 Noise measurements

1 General

- 1.1 Upon completion of a ship, and when otherwise required pursuant to regulation 5, noise levels shall be measured in the areas specified in Annex 1. The noise measurements shall be documented in a noise report.

2 Operational conditions at sea

- 2.1 Noise measurements shall be carried out at sea with a minimum load of 90 per cent of the continuous propulsive power installed, MCR. Measurements at rescue stations may, however, be carried out at reduced speed "Dead Slow Ahead" and with nearby ventilation running.
- 2.2 Auxiliary machinery, such as generators, hydraulic systems, boilers, refrigeration and air compressors, mechanical ventilation, including air-conditioning systems, navigational instruments, radio and radar installations and other equipment intended for use during normal operational conditions, shall be running. Conditions that are thus of importance in connection with noise measurements shall be recorded in the noise report.
- 2.3 Special operational situations that may occur for longer periods of time, such as dynamic positioning, shallow water operation, fishing and similar, shall be measured separately.

3 Operational conditions in port

- 3.1 Noise measurements shall be carried out of the ship's loading gear, cargo pumps, inert gas systems, cargo refrigerating systems, hydraulic systems, hydraulic mooring winches, noisy cargo (refrigerating/freezing containers) and similar running in the areas in question and in the accommodation. Instead of noise measurements of refrigerating/freezing containers, the Danish Maritime Authority may approve a calculation of the expected noise level.
- 3.2 On car decks on board ro-ro ships, noise measurements shall be carried out during loading/unloading operations with the car deck ventilation running.

4 External conditions

- 4.1 Results of measurements could be affected by external conditions such as depth of water, weather, external sources of noise, or similar. Therefore such conditions shall be reported in the noise report.

- 4.2 If the depth of water is more than five times the ship's draught, the conditions shall be deemed satisfactory. In operational situations, for example in the case of regular service between the same ports with low depth of water, the measurement shall be carried out under the actual conditions.
- 4.3 Weather conditions, such as the wind, precipitation and seas (wave height) may not affect the results of the measurements. The wind speed and the seas should not exceed eight metres/second and sea state 3 (wave height 1.25 metres),
- 4.4 External sources of noise, such as traffic, workshops and shipyards, may not affect the noise level at the measuring positions. If necessary, the results of the measurements shall be corrected for the effect from such sources of noise.

5 Measuring equipment

- 5.1 Equipment meeting the requirements for "Precision Grade Sound Level Meter", according to IEC publication 60651, shall be used for the noise measurements. Frequency analyses shall be performed in 1/1 octave frequency band, cf. IEC 61260. If integrated sound pressure gauges are used, they shall comply with the provisions of IEC standard 60804.
- 5.2 The noise level shall be measured as A-weighted sound pressure level in decibels, reference 20μ (micro) Pascal. In frequency analyses, 1/1 octave frequency band with centre frequencies from 31.5 to 8,000 Hz shall be used.
- 5.3 In cases where the noise level fluctuates by more than 5 dB, a measurement shall be carried out using an integrated sound pressure gauge over a period of at least 30 seconds.

6 Measuring positions

- 6.1 Only the necessary operational crew and persons carrying out noise measurements may move about in the actual measuring area.
- 6.2 The noise measurements shall in general be carried out in the middle of rooms at a height of 1.5 metres above the floor and, if possible, not less than 0.5 metres from large reflective surfaces or surfaces on running machinery. In large rooms where the sound pressure varies by more than 6 dB, measurements shall be carried out at several positions on each deck at a reciprocal distance of less than 10 metres. In engine rooms and wheelhouses, additional measurements shall be carried out at operator positions where persons move about regularly.

- 6.3 All doors and windows shall be kept closed when noise measurements are being carried out.
- 6.4 In radio rooms, noise measurements shall be carried out while the radio installation is running, but without making an acoustic signal.
- 6.5 Measurements at listening posts shall be taken with and without a signal from the ship's whistle. Measurements shall also be taken in accordance with the relevant IMO Recommendation on Methods of Measuring Noise Levels at Listening Posts.

7 Reporting

- 7.1 The results of the measurements shall be submitted to the Danish Maritime Authority in the form of a standardised report containing the following:
- a plan of the ship on which the measurement values and measuring positions are indicated;
 - conditions of importance to the evaluation of the noise conditions, including:
 - 1) draught fore and aft,
 - 2) wind and seas,
 - 3) speed and course,
 - 4) load and revolutions on main and auxiliary machinery,
 - 5) other sources of noise running during the measurements, such as ventilation in engine rooms and holds and ventilation in the accommodation,
 - 6) the make and type of the measuring instrument and the microphone,
 - 7) information about the person who has carried out the measurement,
 - 8) depth of water under the keel.
- 7.2 The results shall be recorded as total A-weighted sound pressures in the measuring table of the standardised report. In cases where the noise exceeds the maximum dB(A) or where annoying, low, frequency noise or easily distinguishable pure notes occur, frequency analyses shall be carried out in 1/1 octave frequency band.