



Fig. 5.1 Allowable daily and occasional noise exposure zones

5.4 24 hour equivalent continuous sound level limit

As an alternative to compliance with the provisions of 5.3 (fig. 5.1), no unprotected seafarer should be exposed to a 24 hour equivalent continuous sound level greater than 80 dB(A). Each individual's daily exposure duration in spaces requiring the use of ear protectors should not exceed 4 hours continuously or 8 hours in total. In those cases, where the Administration determines that exposures are intermittent, no unprotected seafarer should be exposed to an equivalent effective sound level which in the case of a 5 dB exchange rate would be $L_{ef(5)}(24)$ equal to 77 dB(A).

5.5 Hearing conservation programme

5.5.1 A hearing conservation programme may be provided for seafarers exposed to the noise levels referred to in 5.3.3 in order to train them in the hazards of noise and use of ear protection, and to monitor hearing acuity. Some elements of a hearing conservation programme are as follows:

- .1 Initial and periodic audiometric tests administered by a trained and appropriately qualified person, to the satisfaction of the Administration.
- .2 Instruction of exposed persons on the hazards of high and long duration noise exposures and on the proper use of ear protectors (see Appendix 2).
- .3 Maintenance of audiometric test records.
- .4 Periodic analysis of records and hearing acuity of individuals with high hearing loss.

An optional element of a hearing conservation programme is to control the 24 hour equivalent continuous or effective sound level to which individuals working in high noise level spaces are exposed. Such control requires calculation of the 24 hour equivalent continuous or effective sound level based upon the measurement of exposure durations for steady noise levels in accordance with 2.6.5 or the equivalent continuous sound level measurement for fluctuating noise in accordance with 2.6.4. If this 24 hour level does not meet the limits, the duration of exposure should be controlled or ear protectors used at appropriate times to bring the individual's exposure within the limit.

CHAPTER 6 – ACOUSTIC INSULATION BETWEEN ACCOMMODATION SPACES

6.1 General

Consideration should be given to the acoustic insulation between accommodation spaces in order to make rest and recreation possible even if activities are going on in adjacent spaces, e.g. music, talking, cargo-handling, etc.

6.2 Sound insulation index

6.2.1 The airborne sound insulation properties for bulkheads and decks within the accommodation should comply at least with the following airborne sound insulation index (I_a) according to ISO Standard R717*:

Cabin to cabin	$I_a = 30$
Messrooms, recreation rooms to cabins and hospitals	$I_a = 45$

6.2.2 The airborne sound insulation properties should be determined by laboratory tests in accordance with ISO Standard R140 Pt III**, to the satisfaction of the Administration.

6.3 Erection of materials

Care should be taken in the erection of materials and in the construction of accommodation spaces to ensure to the greatest practicable extent that the attenuation values specified in 6.2 are not significantly impaired.

* ISO Standard R717 – Rating of Sound Insulation for Dwellings.

** ISO Standard R140 Pt III – Laboratory Measurements of Airborne Sound Insulation and of Building Elements.

CHAPTER 7 – EAR PROTECTION AND WARNING INFORMATION

7.1 General

When the application of means for controlling sound at source does not reduce the noise level in any space to that specified in 4.1.3, seafarers who are required to enter such spaces should be supplied with effective ear protection on an individual basis. The provision of ear protectors should not be considered to be a substitute for effective noise control. Appendix 3 summarizes current noise abatement methods which may be applied on new ships.

7.2 Recommendation for ear protectors

7.2.1 Ear protectors should provide at least the attenuation listed in table 7.1. The attenuation to be compared with that in the table should be the result of the average value of the ear protector attenuation minus the standard deviation measured in accordance with ISO Standard (DIS 4869) or similar standard acceptable to the Administration.

7.2.2 For the purpose of developing the criteria specified in Chapter 4 and section 5.3, ear protectors have been assumed to provide approximately the following insertion loss:

- .1 ear plugs – 20 dB(A)
- .2 ear muffs – 30 dB(A)
- .3 ear plugs and ear muffs – 35 dB(A)

Therefore, care should be exercised when using ear plugs in very high noise areas (i.e. over 100 dB(A)) unless the attenuation of the plug used sufficiently exceeds the values of table 7.1 or appropriate attenuations at individual frequencies are known.

TABLE 7.1 – REAL EAR ATTENUATION OF EAR PROTECTORS – dB

Type of ear protector	Octave band centre frequency – Hz							
	125	250	500	1000	2000	3150	4000	6300
Ear plugs	0	5	10	15	22	22	22	22
Ear muffs	5	12	20	30	30	30	30	30

7.3 Selection and use of ear protectors

Seafarers should be instructed in the proper use of ear protectors in accordance with Appendix 2.

.2 Auxiliary diesel engines

Manufacturer: Type:
 Output: kW Number of units:

.3 Main reduction gear:

.4 Type of propeller (fixed propeller, controllable pitch propeller, Voith-Schneider propeller)

Number of propellers: Number of blades:
 Designed propeller shaft speed: r.p.m.

3 Measuring instrumentation

- | | | | | |
|----|--|-------------|--------------------|----------------------------|
| .1 | Instrumentation | <i>Make</i> | <i>Type</i> | <i>Serial No.</i> |
| | Sound level meter | | | |
| | Microphone | | | |
| | Filter | | | |
| | Windscreen | | | |
| | Calibrator | | | |
| | Other equipment | | | |
| .2 | Calibration of sound level meter
– at survey by competent authority | <i>Date</i> | <i>Calibration</i> | <i>Start</i> <i>Finish</i> |

4 Conditions during measurement

- .1 Date of measurement: Starting time: Completion time:
- .2 Vessel's position during measurement
- .3 Type of voyage
- .4 Conditions during measurement
 – Draught forward
 – Draught aft
 – Depth of water under keel
- .5 Weather conditions
 – Wind force
 – Sea state
- .6 Ship speed
- .7 Actual propeller shaft speed: r.p.m.

Note: Those spaces and areas where noise rating numbers are calculated are indicated by * and the data will be found in the Attachment.

- .8 Propeller pitch:
- .9 Propulsion machinery speed: r.p.m.
- .10 Propulsion machinery power: kW
- .11 Number of propulsion machinery units operating:
- .12 Number of diesel auxiliary engines operating:
- .13 Number of turbogenerators operating:
- .14 Other auxiliary equipment operating:

5 Measuring data

*Noise limits
dB(A)*

*Measured sound
pressure levels
dB(A)*

Machinery spaces:

Control rooms

Workshops

Propulsion machinery:

Turbocharger

Top propulsion machinery

Auxiliary diesel engines/
Turbogenerators

Reduction gear

Non-specified workspaces

Accommodation and other spaces

Messes

Recreation rooms

Offices

Galleys

Serveries and pantries

Cabins

Note: Those spaces and areas where noise rating numbers are calculated are indicated by * and the data will be found in the Attachment.

APPENDIX 2

INSTRUCTIONS TO SEAFARERS AND RESPONSIBILITY

1 Instruction to seafarers

1.1 Seafarers should be instructed in the hazards of high and long duration noise exposures and the risk of noise induced hearing loss. Instruction should be given to all seafarers on initial employment and periodically thereafter to those regularly working in spaces with noise levels in excess of 85 dB(A). Instruction in the provisions of the Code should include:

- .1 noise exposure limits of Chapter 5 and the use of warning notices in complying with the criteria;
- .2 the types of ear protectors provided, their approximate attenuation and their proper use, fitting, and risk effects experienced when first wearing such protection;
- .3 any hearing conservation programme which may be available if working in spaces covered by warning notices;
- .4 some of the possible signs of hearing loss such as ringing in the ear, dead ear, or fullness in the ear.

1.2 Appropriate seafarers should receive such instruction as is necessary in the correct use and maintenance of machinery and silencers or attenuators in order to avoid the production of unnecessary noise.

2 Responsibility of shipowners

2.1 The shipowner should be responsible for ensuring that means for noise reduction and control are applied and maintained such that the requirements of the Code are met.

2.2 Where noise levels in any space exceed the limit of 85 dB(A), shipowners should ensure that:

- .1 the space is identified and the warning notice described in 7.4 of the Code is displayed;
- .2 the master and senior officers of the ship are notified as to the importance of controlling entry into the space and the importance of the use of suitable ear protectors;
- .3 suitable ear protectors are provided in sufficient numbers for distribution on an individual basis;
- .4 an instruction is issued to the master, senior officers and any safety officer of the ship pointing out the desirability of providing the instruction outlined in 1.1 and 1.2 to seafarers.

3 Responsibility of seafarers

3.1 Seafarers should be responsible for ensuring that:

- .1 measures adopted for noise control are used;
- .2 defective noise control equipment is reported to a responsible person;
- .3 suitable ear protectors are normally worn when entering areas in which their use is required by warning notices and that these protectors are not removed, even for short periods; and
- .4 ear protectors provided for use are not damaged or misused and are maintained in a clean condition.

APPENDIX 3

SUGGESTED METHODS OF CONTROLLING NOISE EXPOSURE

1 General

1.1 In order to obtain a noise reduction on board ships to comply with the recommended limits given in Chapters 4 and 5 of the Code careful consideration should be given to means of such reduction. This Appendix is intended to provide guidance for the design of a ship in this respect.

1.2 Design and construction of noise control measures should be supervised by persons skilled in noise control techniques.

1.3 Some of the measures which can be taken to control the noise level or reduce the exposure of seafarers to potentially harmful noise are indicated in sections 2 to 10 of this Appendix. It is emphasized that it will not be necessary to implement all or any of the measures recommended in this Appendix on all ships. This Code does not provide detailed technical information needed for putting constructional noise control measures into effect, or for deciding which measures are appropriate in particular circumstances.

1.4 In applying noise control measures, care should be taken to ensure that rules and regulations concerning ship structure, accommodation and other safety matters are not infringed and the use of sound reduction materials should not introduce fire or health hazards.

1.5 The need for noise control should be taken into account at the design stage when deciding which of different designs of engines and machinery are to be installed, the method of installation and the siting of machinery in relation to other spaces, and the acoustic insulation and siting of the accommodation spaces.

1.6 Due to the normal method of ship construction it is most probable that noise originating from machinery and propellers reaching the accommodation and other spaces outside the machinery spaces will be of the structure-borne type.

1.7 When designing efficient and economic measures for noise control of machinery installations in existing ships, the measurement of sound produced in terms of A-weighted sound level may need to be supplemented by some form of frequency analysis.

2 Isolation of sources of noise

2.1 Where practicable any engines or machinery producing noise levels in excess of the limits set out in 4.2 of the Code should be installed in compartments which do not require continuous attendance (see also 6.1 of this Appendix).

2.2 Accommodation should be sited both horizontally and vertically as far away as is practicable from sources of noise such as propellers and propulsion machinery.

2.3 Machinery casings should, where practicable, be arranged outside superstructures and deckhouses containing accommodation spaces. Where this is not feasible, passageways should be arranged between the casings and accommodation spaces, if practicable.

2.4 Consideration should be given, where practicable, to the placing of accommodation spaces in deck houses not in superstructures extending to the ship's side.

2.5 Consideration may also be given where applicable to the separation of accommodation spaces from machinery spaces by unoccupied spaces, sanitary and washing rooms.

2.6 Suitable partitions, bulkheads, decks, etc. may be needed to prevent the spread of sound. It is important that these be of the correct construction and location in relation to the source of sound and the frequency of the sound to be attenuated.

2.7 Where a space, such as a machinery space, is being divided into noisy (not continually manned) and less noisy (capable of being continually manned) spaces, it is preferable to have complete separation*.

2.8 It may be advisable to provide sound absorbing material in certain spaces in order to prevent increase of noise level due to reflection from partitions, bulkheads, decks, etc.

3 Exhaust and intake silencing

3.1 Exhaust systems from internal combustion engines, air intake systems to machinery spaces, accommodation spaces and other spaces should be so arranged that the inflow or discharge orifices are remote from places frequented by seafarers.

3.2 Silencers or attenuators should be fitted when necessary.

3.3 To minimize accommodation noise levels it is normally necessary to isolate exhaust systems and certain pipework and ductwork from casings, bulkheads, etc.

* In these cases it may be necessary to ensure the supervision of the plant by installing alarms in the less noisy compartments and to arrange means of escape so that seafarers may leave these compartments without danger.

4 Machinery enclosure

4.1 In continuously manned spaces or spaces where seafarers might reasonably be expected to spend lengthy periods of time on maintenance or overhaul work, and where separation as detailed in section 2 of this Appendix is not practicable, consideration may have to be given to the fitting of sound insulating enclosures or partial enclosures to engines or machinery producing sound pressure levels in excess of the limits set out in 4.2 of the Code.

4.2 Where the noise level produced by engines or machinery installed in spaces as in 4.1 above falls within the criteria of 5.3.1 of the Code and zone A of figure 5.1, it is essential that noise reduction measures are provided.

4.3 When sound insulating enclosures are fitted, it is important that they entirely enclose the noise source.

5 Reduction of noise in the aft body

To reduce the noise influence in the aft body of the ship, especially to the accommodation spaces, consideration may be given to noise emission problems during the design procedures relating to the aft body, propeller, etc.

6 Enclosure of the operator

6.1 In most machinery spaces it would be desirable and advisable to protect operating or watchkeeping seafarers by providing a sound reducing control room or other similar space (see 2.1 of this Appendix).

6.2 In continuously manned machinery spaces of small ships and of existing ships where noise levels are in excess of 85 dB(A), it would be desirable to provide a noise refuge at the control station or manoeuvring platform where the watchkeeper might be expected to spend the major part of the time.

7 Controls in accommodation spaces

7.1 To reduce noise levels in accommodation spaces it may be necessary to consider the isolation of deckhouses containing such spaces from the remaining structure of the ship by resilient mountings.

7.2 Consideration may also be given to the provision of flexible connexions to bulkheads, linings and ceilings and the installation of floating floors within accommodation spaces.

7.3 The provision of curtains to sidescuttles and windows and the use of carpets within accommodation spaces assists in absorbing noise.

8 Selection of machinery

8.1 The sound produced by each item of machinery to be fitted should be taken into account at the design stage. It may be possible to control noise by using a machine producing less airborne, fluid-borne or structure-borne sound.

8.2 Manufacturers should be requested to supply information on the sound produced by their machinery and also to provide recommended methods of installation in order to keep noise levels to a minimum.

9 Inspection and maintenance

All items of machinery, equipment and associated working spaces should be regularly inspected with respect to noise by a competent person. Should such inspection reveal defects in the means for noise control, or other defects causing excessive noise, these should be rectified as soon as practicable.

10 Vibration isolation

10.1 Where necessary, machines should be supported on correctly designed and fitted resilient mountings.

10.2 Where structure-borne sound from auxiliary machinery, compressors, hydraulic units, generating sets, vents, exhaust pipes and silencers produces unacceptable noise levels in accommodation spaces or on the navigating bridge, resilient mountings should be fitted.

10.3 When sound insulating enclosures are fitted it is desirable that the machine should be resiliently mounted and that all pipe, trunk and cable connexions to it be flexible.