NORTH ATLANTIC TREATY ORGANIZATION
ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD

MILITARY AGENCY FOR STANDARDIZATION (MAS)
BUREAU MILITAIRE DE STANDARDISATION (BMS)
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To : See MAS Distribution List No. 3

Subject : STANAG 4293 NAV (EDITION 1) - GUIDELINES FOR THE ACOUSTICAL ENVIRONMENT IN NATO SURFACE SHIPS

Reference : AC/141(IEG/6)SG/8-D/29 dated 2 February 1987

Enclosure : STANAG 4293 (Edition 1)

1. The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in page iii is promulgated herewith.

2. The reference listed above is to be destroyed in accordance with local document destruction procedures.

3. AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the STANAG and if they have not already done so, to advise the Defence Support Division, IS, through their national delegation as appropriate of their intention regarding its ratification and implementation.

A.J. MELO CORREIA
Major-General, POAF
Chairman, MAS



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ST4293A

STANAG 4293
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION
(N A T O)

MILITARY AGENCY FOR STANDARDIZATION
(M A S)

# STANDARDIZATION AGREEMENT

SUBJECT : GUIDELINES FOR THE ACOUSTICAL ENVIRONMENT IN NATO SURFACE SHIPS

Promulgated on 19 June 1990

A.J. MELO CORREIA
Major-General, POAF
Chairman, MAS

STANAG 4293
(Edition 1)

## RECORD OF AMENDMENTS

| No. | Reference/date of amendment | Date entered | Signature |
|---|---|---|---|
| 1 | | 10/07/02 | D.F |

## EXPLANATORY NOTES

### AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

### DEFINITIONS

4. Ratification is "The declaration by which a nation formally accepts the content of this Standardization Agreement".

5. Implementation is "The fulfilment by a nation of its obligations under this Standardization Agreement".

6. Reservation is "The stated qualification by a nation which describes that part of this Standardization Agreement which it cannot implement or can implement only with limitations".

### RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.

Agreed English/French texts

STANAG 4293
(Edition 1)
NAVY

# NATO STANDARDIZATION AGREEMENT (STANAG)

# GUIDELINES FOR THE ACOUSTICAL ENVIRONMENT IN NATO SURFACE SHIPS

Annexes: A. Maximum Noise Levels in Shipboard Spaces.
B. Noise Rating Curves.
C. Speech Interference Levels.

## AIM

1. This document specified the acoustical environment in NATO surface ships in terms of Maximum Noise Levels (MNL), Noise Rating Curves (NRC), and Speech Interference Levels (SIL). An adequate acoustical environment has to be maintained in order to avoid:

- loss of hearing and other damages to the health of personnel;
- interference with communications in operational and working spaces;
- reduction of efficiency of the crew;
- interference with the crew's recreation and sleep in accommodation spaces.

To achieve these objectives measures for noise abatement have to be taken in the design and operation of ships which meet the criteria contained within.

## AGREEMENT

2. Participating nations agree to follow the guidelines set forth within this STANAG in the design of NATO surface ships of 500 tons mission displacement and above. It shall apply to surface ships of less than 500 tons mission of displacement to the extent considered reasonable.

3. The following definitions apply.

3.1 Maximum Noise Level (MNL)

The MNL is the noise level normally acceptable within a space or a compartment as specified below and generated both from outside and from inside permanently installed equipment in its specified operational mode. MNLs are given in decibels on the A-weighted scale (dB(A)), the decibels relative to 2 x $10^{-5}$ Pa (Newtons/$m^2$), and laid down in Annex A.

3.2 Noise Rating Curve (NRC)

The NRC of ISO R 1996(1) of the International Standardization Organization (ISO), as shown in Annex B, shall be used when recorded levels exceed MNLs. In these cases recordings in the octave bands between 31.5 Hz and 8,000 Hz are necessary (see paragraph 2).

3.3 Speech Interference Level (SIL)

The SIL is an index for assessment of possible interference of noise with communication. It is an average of the sound pressure levels at the octave bands with centre frequencies 500, 1,000, 2,000 Hz. Examples are given in Annex C for different talker/listener distances and different voice levels.

GENERAL

4. To achieve the objectives commensurate with the aim of the STANAG measures for noise abatement have to be taken in the design and operation of ships which meet the criteria given below.

5. MEASURING PROCEDURE

5.1 Instrument Requirements

5.1.1 Type of instrument

Only instruments and transducers which meet the requirements of International Electrotechnical Commission (IEC) publication 651 (Precision Sound Level Meter) with respect to accuracy shall be used. Instruments employing linear and exponential averaging may be used.

1) ISO 1996/1 Edition 1982
ISO 1996/2 Edition 1987
ISO 1996/3 Edition 1987

5.1.2 Calibration

Prior to the measurements the sound level meter shall be calibrated with a reliable calibrator of at least one frequency.

5.1.3 Meter damping and averaging time

The measurements shall be carried out with meter damping slow and the mean value of the maximum pointer deflections shall be recorded. Measurements with instruments employing linear averaging shall be carried out with an integration time no less than 8 seconds for 31.5 and 63 Hz octave bands and 4 seconds for the remaining octave bands.

5.1.4 Frequency analysis, quality of filter, sound level meter

Frequency analysis shall be carried out in all cases specified in paragraph 2.4 by means of a sound level meter equipped with octave band filter, and which satisfy the requirements laid down in IEC publication No. 225, and ISO-226.

5.2 Measuring Conditions

5.2.1 Measuring conditions underway

Noise measurements shall be made underway with the following conditions:

- at maximum permanent speed;
- at normal cruising conditions.

5.2.2 Measuring conditions dockside (at anchor)

Dockside measurements (at anchor) shall be taken with the auxiliary engines and the ventilation running at normal speed and with maximum available load.

5.3 Measuring Positions

5.3.1 General

In any room for which noise level requirements exist measurements shall be taken in at least three positions as specified below.

All measurements are to be made 1.2 m above the floor. Microphone positions shall be chosen at least 0.4 m away from reflecting surfaces (bulkhead, etc.), from air in- and outlets, and from the measuring person in order to minimise the effects of reflections and airflow. If space configuration permits, the distance from bulkheads and air in- and outlets shall be 1 m. The distance between two measurement positions shall be approximately 2 m.

In living quarters and work spaces no more than normal occupancy shall be present.

Ventilation and air conditioning installation shall be in normal operation. During the measurements doors and windows are to be kept closed.

Noise levels shall be measured in decibels on the A-weighted scale (dB(A)). Noise spectra have to be recorded by means of measuring the sound pressure levels in the octave bands with centre frequencies from 31.5 Hz to 8,000 Hz in the cases specified below (paragraph 5.4).

5.3.2 Work spaces

At any work space measurements shall be carried out at the operator's ear position.

5.3.3 Living quarters

In living quarters one additional measurement shall be carried out at the head of the berth with the highest noise level.

5.3.4 Engine Room

In the engine room the measurements shall be carried out at the manoeuvering position for the main machinery and in other places where work is regularly carried out, as well as in passageways and in rooms regularly occupied or passed through.

5.3.5 Pilothouse

In the pilothouse measurements shall be made in at least three places, one at the helmsman's ear position and the others for instance at the radar and manoeuvering positions. During the process of measurements in the pilothouse the lee side door shall be open (except for permanently closed down ships). All navigational instruments such as radar, echo sounder, gyro compass as well as window wipers, clear view screens, etc. shall be in operation.

5.3.6 Bridge wings, fly bridge, weather deck duty stations

Measurements shall be carried out on the bridge wings, fly bridge and weather deck duty stations. On the bridge wings, the measurements shall be carried out at the operator's ear position near the repeater compasses or in a similar position and also at the pilothouse bulkhead. On weather deck duty stations, the measurements shall be made at normal positions of work. When measuring outdoors, the microphone shall be protected by a windscreen in order to minimise wind induced noise. The relative wind speed shall not exceed the limit specified by the manufacturer.

5.4 Noise Spectra Analysis

Measurements in the octave bands with centre frequencies from 31.5 Hz to 8,000 Hz shall be taken in the following cases:

(a) when the dB(A) criterion is not met and therefore the NRC have to be applied;

(b) for one measurement position in any room (e.g. important working condition, berth with highest noise level);

(c) for all working positions in which speech intelligibility is of importance.

6. NOISE SURVEY

6.1 Noise Measurements

When the construction of the vessel has been completed, a survey of airborne noise levels at the operating conditions given in paragraph 5.2 shall be carried out.

6.2 Noise Measurement Report

Measurement results shall be presented in the form of a plan of the vessel, where the measurement values and measurement positions are indicated. Readings of the noise levels in dB(A) and, where appropriate, for the sound pressure levels in the octave bands with centre frequencies ranging from 31.5 Hz to 8,000 Hz shall be recorded for all microphone positions, according to the following specifications:

- the noise level in dB(A) is to be presented in tabular form together with octave band levels for measuring positions according to paragraph 2.4(a). For these positions the octave

band levels shall be presented in tabular form and graphically for direct comparison with the appropriate noise rating curve;

- for any room on average dB(A) value shall be computed in order to give a single index for the acoustical environment in that room. This average is to be computed if the highest and the lowest noise level in that room does not exceed 8 dB(A). If the highest noise level is measured in a berth or at a work space this has to be reported separately;

- for all cases specified in paragraph 5.4(c) the sound pressure levels in the octave bands have to be reported graphically and in tabular form. The SIL are to be presented in tabular form.

6.3 Additional Information

In addition to the plan other factors of importance to evaluation of noise conditions shall also be stated. The following information shall always be given:

- date of voyage;

- loading condition (draught fore and aft);

- weather conditions (sea state and estimated relative wind speed);

- depth of water under the vessel;

- speeds;

- the output power and rotational speed of the main and auxiliary machinery during the measurements;

- other important sources of noise in operation, e.g. ventilation of engine room, ventilation of accommodation, instruments in operations rooms, etc;

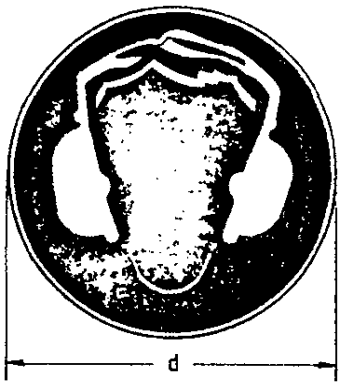
- make and type of measuring instrument and microphone;

- weighting curve of dB;

- measuring personnel.

7. WARNING SIGNS WHERE NOISE LEVEL EXCEEDS 85 dB(A)

At the entrance to any room or space with a noise level exceeding 85 dB(A) in any one of the operating conditions a sign, as shown in Fig. 1, shall be posted.




Colours
Figure: white
Ground: blue
Colours conforming to CIE system

Recommended size: d = 100, 200, 315, 400 or 630 mm, according to space available

Figure 1

8. REQUIREMENTS

8.1 Maximum noise levels are given in Annex A.

8.2 Noise rating curves are given in Annex B.

8.3 Speech interference levels are given in Annex C.

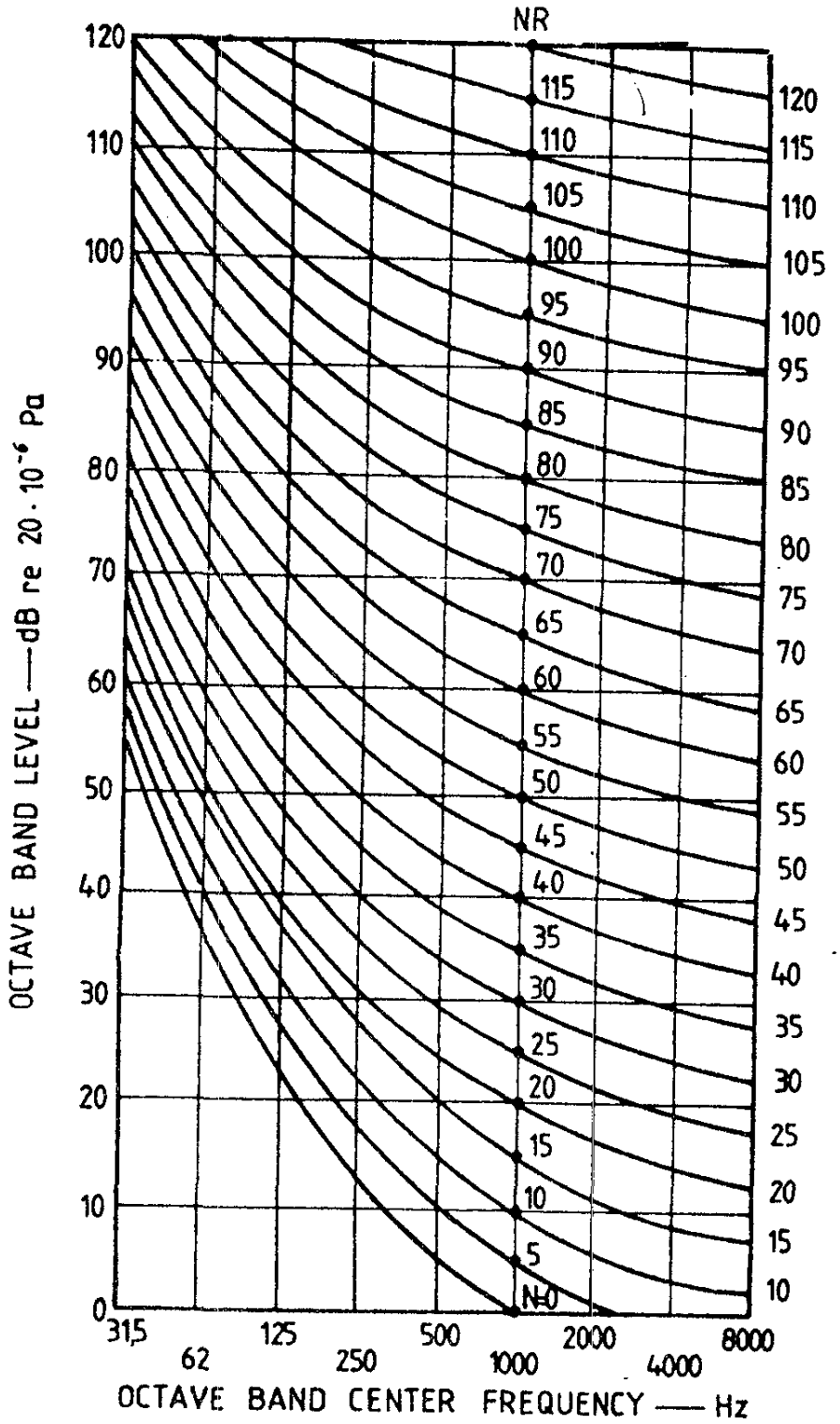
8.4 Maximum noise levels as specified in Annex A are composed of the noise levels generated by (1) machines, by (2) air conditioning equipment, and by (3) electronic apparatus. The noise levels of each of these groups shall be at least 5 dB lower than the noise levels in the respective spaces.

9. IMPLEMENTATION OF THE AGREEMENT

This STANAG is considered to be implemented when a nation has issued the necessary orders/instructions to the forces concerned, putting the guidelines detailed in this agreement into effect.

MAXIMUM NOISE LEVELS IN SHIPBOARD SPACES

| space/space category | at anchor with own electrical supply | | normal cruising | | maximum permanent speed | |
|---|---|---|---|---|---|---|
| | dB(A) | NRC | dB(A) | NRC | dB(A) | NRC |
| medical spaces (sick bay) | 50 | 45 | 60 | 55 | | |
| berthing areas | 50 | 45 | 60 | 55 | | |
| messrooms (also used as battle dressing station) | 50 | 45 | 65 | 60 | | |
| offices, libraries | 65 | 60 | 65 | 60 | | |
| galley, pantry, hobby, gymnasium, wash rooms, stores | 70 | 65 | 75 | 70 | | |
| engine and auxiliary machinery rooms permanently occupied by personnel, control stations in the room | 90 | 85 | 90 | 85 | | |
| engine and auxiliary machinery rooms temporarily occupied by personnel for inspection purposes, control station outside the room | 110 | 105 | 110 | 105 | | |
| central engine control room, damage control room | | | 70 | 65 | 70 | 65 |
| workshops except electronic workshops | 80 | 75 | 80 | 75 | | |
| electronic workshops | 70 | 65 | 70 | 65 | | |
| ammunition room | 75 | 70 | | | | |
| ship control station (pilot house), chart room, fire control room, combat information center and adjoining rooms belonging to CIC and occupied by personnel, sonar control room, electronic counter measure room | 60 | 55 | 60 | 55 | 60 | 55 |
| spaces for equipment associated with communication, navigation and detection (not permanently occupied by personnel) | | | 70 | 65 | 70 | 65 |
| bridge wings | | | 70 | 65 | 70 | 65 |
| weather deck stations permanently occupied by personnel | | | 75 | 70 | 75 | 70 |




Noise Rating Curves

| SPEECH INTERFERENCE LEVELS | | | | |
|---|---|---|---|---|
| Distance from listener (m) | normal voice | raised voice | very loud voice | shouting |
| .15 | 74 | 80 | 86 | 92 |
| .3 | 68 | 74 | 80 | 86 |
| .6 | 62 | 68 | 74 | 86 |
| .9 | 58 | 64 | 70 | 76 |
| 1.2 | 56 | 62 | 68 | 74 |
| 1.5 | 54 | 60 | 66 | 72 |
| 1.8 | 52 | 58 | 64 | 70 |
| 3.6 | 46 | 52 | 58 | 64 |

Speech interference levels for different talker-listener distances and different voice outputs.