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

MILITARY AGENCY FOR STANDARDIZATION (MAS)
BUREAU MILITAIRE DE STANDARDISATION (BMS)

1110 BRUSSELS
TEL : 241.00.40 - 241.44.00 - 241.44.90

MAS(76)75
18 February 1976

Original English/French translation

To : See distribution below

Subject : STANAG 4138 - VIBRATION RESISTANT EQUIPMENT - TESTING REQUIREMENTS

Enclosure: STANAG 4138

1. Enclosed is a copy of a NATO Standardization Agreement which has been ratified by nations as reflected in page iii.

2. AAP-4(Q) should be amended to reflect the latest status of the STANAG.

3. The distribution of this STANAG has been based on information available at the time of issue. If required, additional copies will be supplied on request to the Military Agency for Standardization.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the enclosure and, if they have not already done so, to advise the Defence Support Division, IS of their intention regarding ratification and implementation of the agreement.

(W.C. LEONARD)
Major-General, Canadian Forces
Chairman MAS

DISTRIBUTION:

Action : All members of the Naval Board, MAS except UK (for onward transmission to national authorities)
UK Director Standardization (STAN 2) MOD, London

Information : SECGENNATO (DS DIV),MC, SACEUR, SACLANT, CINCHAN, CINCNORTH COMNAVSOUTH, CINCEASTLANT, CINCWESTLANT, COMBALTAP, COMNAVBALTAP, COMSUBACLANT, COMIBERLANT, COMSTRIKFORSOUTH

STANAG No. 4138
NAVY

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)

MILITARY AGENCY FOR STANDARDIZATION
(MAS)

STANDARDIZATION AGREEMENT

SUBJECT: VIBRATION RESISTANT EQUIPMENT - TESTING REQUIREMENTS

Promulgated on 18 February 1976

(W. C. LEONARD)
Major-General, Canadian Forces,
Chairman, MAS

RECORD OF AMENDMENTS

Amdt. No.	Reference and date of amendment	Date entered	By whom entered - Signature and Rank	Remarks
1-4		15.6.05		

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 Defence Support Division. Nations may propose alterations at any time should they consider that the original has become obsolete or requires improvement. Such proposals should be submitted to the Defence Support Division where they are 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's forces concerned of their obligation under this Standardization Agreement'.

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

6. Page (iii) gives details of the state of ratification and implementation of this agreement by the NATO nations. If no details are shown in the 'ratification' and 'implementation' columns, it signifies that the nation has not yet notified the Defence Support Division, IS, of its intent : the appropriate Ministry of Defence is requested to do so as soon as possible.

7. Page (iv) (and page (v) etc. if necessary) gives details of any reservations and proprietary rights that have been stated by nations.

8. If an amendment of substance or a new edition (other than an editorially amended edition) is promulgated, all previous ratification, implementation and reservation/restriction details are deleted from pages (iii) and (iv) and the amendment or new edition is processed in the same manner as the original agreement.

Agreed English Text

STANAG 4138

Navy

NATO STANDARDIZATION AGREEMENT (STANAG)

VIBRATION RESISTANT EQUIPMENT - TESTING REQUIREMENTS

Annex A: Vibration Resistant Equipment - Testing Requirements

Related documents: None

AIM

1. The aim of this agreement is to describe test requirements for determining the ability of equipment to withstand vibrations normally existing onboard ships in order to ensure uniform performance of equipment purchased within NATO countries.

AGREEMENT

2. Participating nations agree to adopt the procedures set out in Annex A.

3. No proprietary rights would normally be involved.

DEFINITIONS (to be used for the purpose of this agreement only)

4. 'NATO Vibration Resistant Equipment'. Equipment fulfilling these tests without use of external vibration/shock isolators.

IMPLEMENTATION OF THE AGREEMENT

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

VIBRATION RESISTANT EQUIPMENT - TESTING REQUIREMENTS

CONTENTS: Paragraphs:

GENERAL

1. The object of this STANAG is to describe test requirements for determining the ability of equipment (which includes machinery) to withstand vibrations normally existing aboard ships. The vibration is simulated in the test laboratory by using specially designed vibration testing machines.

2. Equipment shall be tested with all internal elastic mountings inherent in the design (i.e. supporting sub-units, sub-assemblies or individual components). External mountings are not to be fitted.

3. Equipment passing the tests described herein may be classed as Vibration Resistant Equipment according to this specification and may be labeled as such.

VIBRATION TESTS, GENERAL REQUIREMENTS

4. The test equipment used is to comply with the tolerances for operation quoted by IEC, Publication No. 68-2-6, as far as these are applicable to the test conditions specified herein.

5. The calibration procedure adopted shall comply with generally accepted good practice and be specified in the test report, including a statement on calibration results.

6. The equipment in its correct orientation is to be attached rigidly to the vibration table, through its normal points of attachment, or if necessary, to a specifically designed rigid mounting fixture.

7. The equipment is to be tested for vibration in three mutually perpendicular directions. Amplitude and acceleration are to be measured at the equipment's point of attachment to the vibration table (or to the mounting fixture).

8. Equipment to be qualified for vibration resistance must satisfy both sections 3 and 4 of this specification.

9. The vibration severity in test for Vibration Resistant Equipment is defined as follows:

   a. General Equipment

      (1) For test machines that can be operated at a constant acceleration rate, the minimum required test severity is as tabulated: (See also Fig. 1, page A-7)

Frequency	Vibration
4-12.5 Hz	± 1.0 mm
12.5-50 Hz	.63 g

(2) For test machines that can be operated at a constant displacement rate only, the range within which the steps should fall is as tabulated: (See also Fig. 1, page A-7).

Frequency	Severity level range
4-12.5 Hz	± .63 mm - ± 1.6 mm
12.5-50 Hz	.4 g - 1.0 g

For constant amplitude, steps in the frequency range 12.5-50 Hz may extend to ± 20% of the given frequency range limits with minimum average vibration acceleration of .63 g.

b. Mast-mounted Equipment

(1) For test machines that can be operated at a constant acceleration rate, the minimum required test severity is as tabulated: (See also Fig. 2, page A-8).

Frequency	Vibration level
4-8 Hz	± 2.5 mm
8-33 Hz	.63 g

(2) For test machines that can be operated at a constant displacement rate only, the range within which the steps should fall is as tabulated: (See also Fig. 2, page A-8).

Frequency	Severity level range
4-10 Hz	± 2.5 mm
10-33 Hz	.4 g - 1.0 g

For constant amplitude, steps in the frequency range 10-33 Hz may extend to ± 20% of the given range limits with minimum average vibration acceleration of .63 g.

Devices mounted in special areas such as directly on rotating machinery or high slender masts may be exposed to an ambient vibration severity not catered for in this test specification.

RESONANCE SEARCH AND FUNCTIONAL TEST

10. The object of this test is to determine the presence of resonances in the equipment under test, and ascertain that the equipment will function and can be operated continuously to specification, over the whole frequency range, responding to controls as specified.

11. The frequency is to be varied continuously over the specified ranges between the lowest and highest values, and at the given test vibration severity (cf. see 2.b). The rate of change shall not

AMENDMENT NO. 3

exceed one half octave per minute, so the resonances can be easily detected. The maximum amplitude may be approached progressively in order to avoid premature damage to the equipment, but this period not being considered part of the test period.

12. Significant resonance frequencies, e.g. dynamic magnifier greater than approximately 3, which can be detected, in any part of the equipment, are to be noted for use in the endurance test.

13. All principal functions of the equipment are to be controlled in accordance with its specified operational performance data.

14. Maloperation and damage which affects, or ultimately affects equipment functions, shall cause the design to be rejected.

VIBRATION ENDURANCE TEST

15. The object of this test is to determine the ability of the equipment to operate over a given period of time when vibrated at resonance frequencies and/or at other prescribed frequencies, without sustaining material damage or disturbances sufficiently severe to affect the performance and operation of the equipment. The equipment to be subjected to the endurance test should be operating and performing its normal function during the stated test period, as prescribed by the commissioning authority or the inspecting agency.

16. The equipment is to be subjected to vibration at the resonance frequencies of the most damaging vibration severities (regardless of direction) at which non-removable resonances have been observed, (Sec. 3), for a minimum total period of 2 hrs. and a maximum total period of 4 hrs. In the case of more than one major resonance the 4 hrs. period is to be divided equally between the resonance frequencies, or alternatively an equal number of cycles may be allotted to each resonance frequency.

17. In cases where no natural frequencies are detected in the equipment, the endurance test is to be run for a 2 hrs. period at the maximum testing frequency.

18. The vibration severity for the endurance test is to comply with paragraph 9 for the given test frequency.

19. At the end of the test the equipment is to be examined for mechanical damage. A final performance test is to be carried out (without applied vibration). Equipment sustaining damage which affects operation out of functional specification has not attained the designation "Vibration Resistant Equipment".

VIBRATION RESISTANT EQUIPMENT

20. Equipment capable of withstanding the vibration tests specified in paragraphs 11-20 without sustaining mechanical damage and being able to perform its specified functions during

and after these tests, will have attained the designation "Vibration Resistant Equipment" according to this specification, and may be labeled thus.

21. Minor damage or distortion may be permitted provided such failure does not in any way impair the ability of the equipment to perform its specified functions. Failures are to be considered as follows:

a. A major failure is in general one which would cause significant malfunction of the equipment, or which is likely to reduce the lifetime of the equipment.

b. A minor failure is in general a non-repetitive failure of such part as vacuum tubes, condensers and wiring which can easily be repaired. In such cases the repair may be made and the tests repeated with no penalty to the remainder of the equipment.

22. The classification of equipment and limits of acceptability rests in each case with the commissioning activity. Particular requirements should be stated in the test report.

TEST REPORT

23. A test report is to be submitted to the commissioning authority for approval. The report shall include information and a description of the equipment and the tests performed, as outlined in the following:

a. General Description

(1) Type of equipment, its principal functions, location onboard, overall dimensions, weight and approximate location of the centre of gravity.

(2) Type of vibration machine used, including calibration performance.

(3) A sketch or photograph showing the methods used in mounting the equipment on the test machine.

b. Resonance Search and Functional Test

(1) Detectable resonance frequencies, part of the equipment in which resonance occurs for magnification factors greater than approximately 3, and where collision or contacting occurs, are to be noted.

(2) A list of the equipment functions controlled. Any change is performance, together with the shaker frequency responsible, if any, shall be described.

(3) Mechanical damage, if any, shall be described and if possible, photographs included. Corrected damage, if any, shall be noted.

c. Vibration Endurance Test

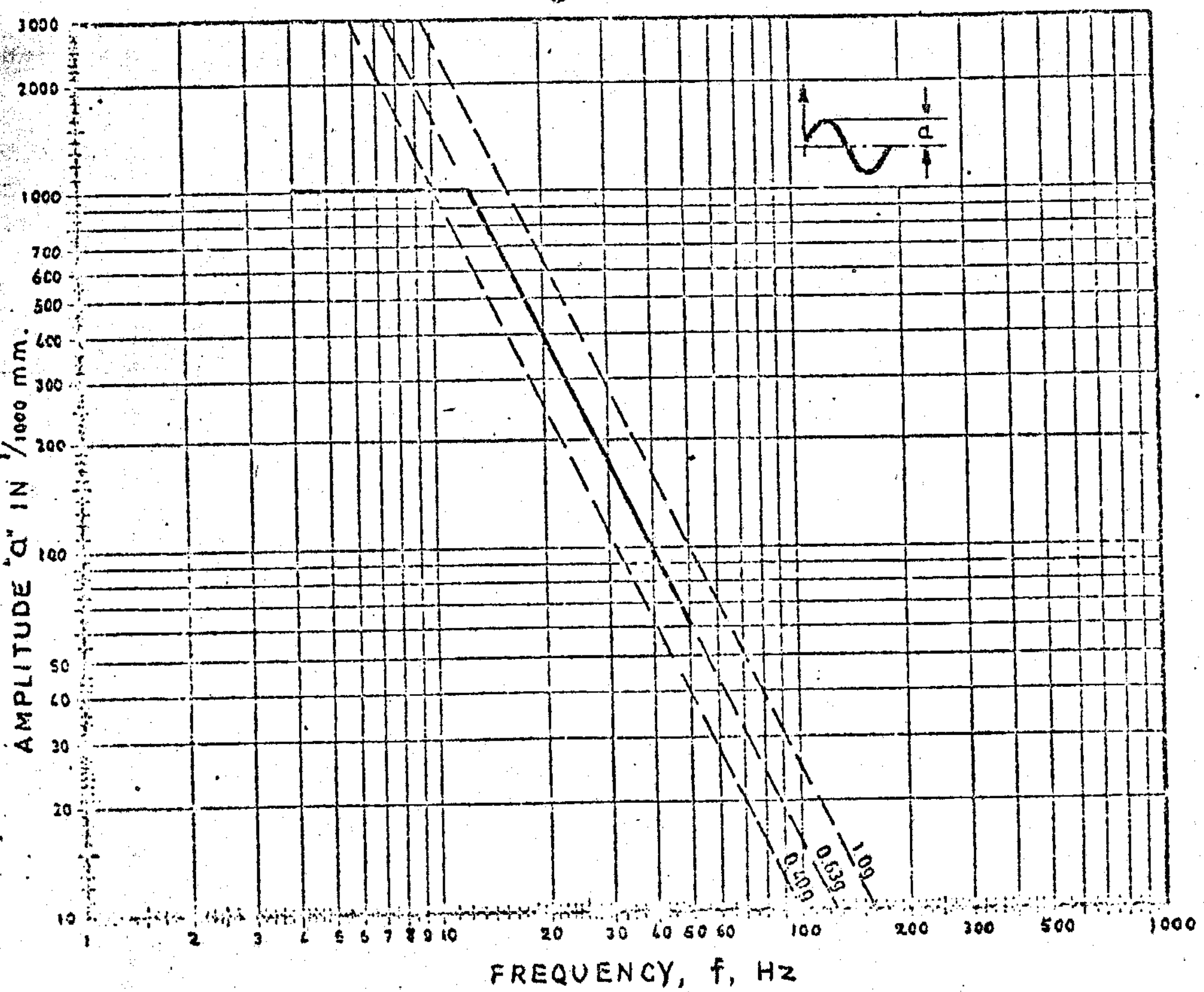
(1) For each frequency tested, the direction of vibration and time exposure shall be noted. All equipment functions controlled, and any changes in performance observed, shall be described.

(2) Mechanical damage, if any, shall be described and if possible, photographs included. Corrected damage, if any, shall be noted.

(3) Performance tests on equipment or any of its components carried out at the end of the tests shall be described, including all functions controlled and any changes in performance.

d. Summary and Results

A short summary describing the performance of the equipment according to this specification.

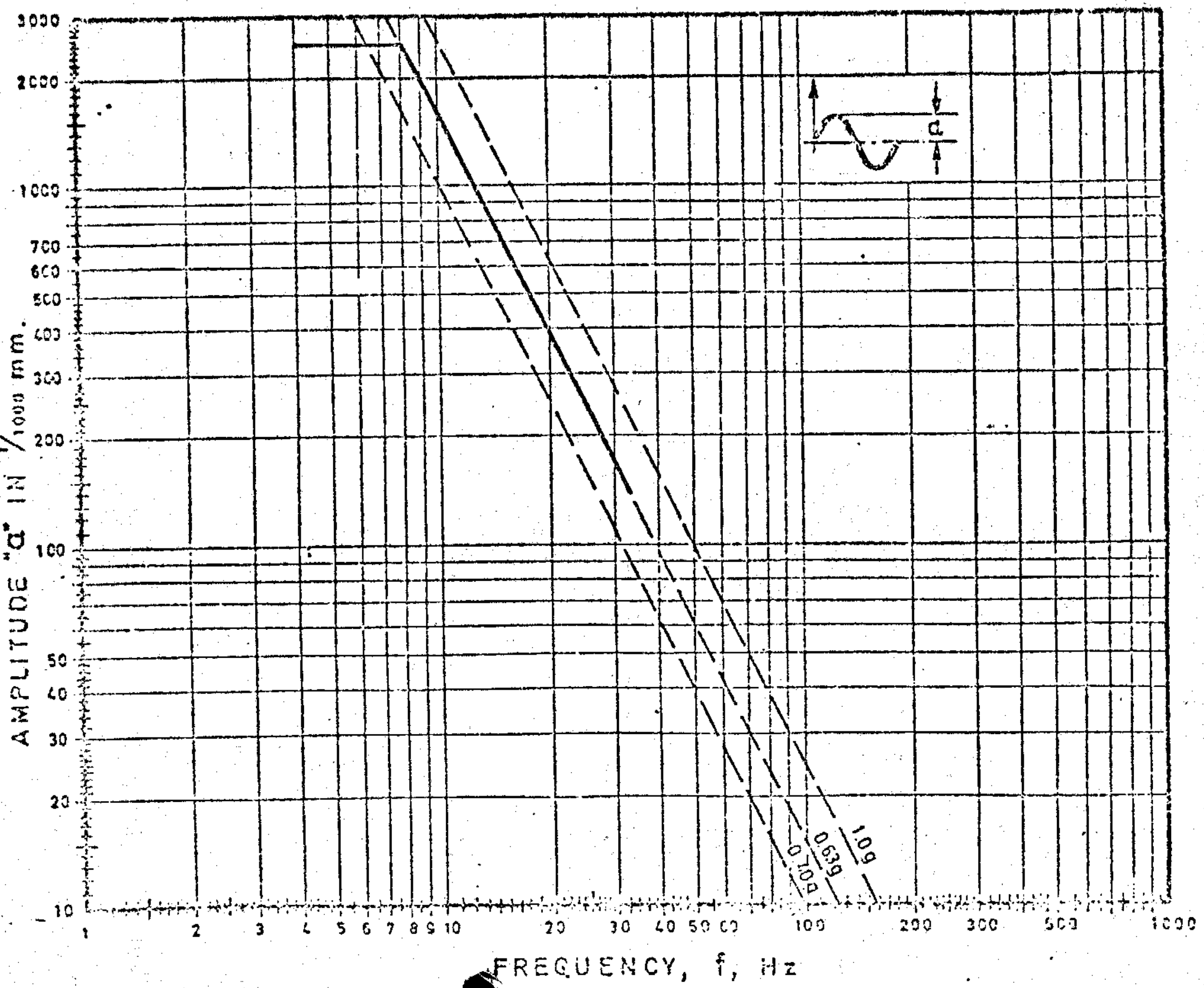


NATO UNCLASSIFIED

STANDARD TEST AMPLITUDE

TEST AMPLITUDE	FREQUENCY Hz
± 1.0mm	4-12.5
0.63g	12.5 - 50

FIG. 1



TEST AMPLITUDE FOR MAST-MOUNTED EQUIPMENT

TEST AMPLITUDE	FREQUENCY Hz
± 2.5mm	4 - 8 Hz
0.63g	8 - 33 Hz

FIG. 2