

MIL-E-82590(OS)  
9 September 1970

## MILITARY SPECIFICATION

### ENVIRONMENTAL REQUIREMENTS AND TESTS

(For Torpedo Mk 37 Components and Assemblies)

This specification has been approved by the Naval Ordnance Systems Command, Department of the Navy

#### 1. SCOPE

1.1 This specification establishes the environmental requirements and test procedures for all component parts and assemblies to be used in the Torpedo Mk 37. Individual specifications and NAVORD Drawings may reference this specification and invoke its procedures as necessary. However, exceptions may be taken to any section of this document that is not applicable.

#### 2. APPLICABLE DOCUMENTS

2.1 The following document of the issue in effect on the date of invitation for bids or request for proposals forms a part of this specification to the extent specified herein.

#### STANDARDS

##### Federal

FED-STD-101

Preservation, Packaging, and Packing Materials; Test Procedures

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

FSC 1355

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Department of Transportation

49CFR 171-178

## Hazardous Materials Regulations

(Applications for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

## 3. REQUIREMENTS

3.1 Definitions. For the purposes of this specification, the following definitions apply:

3.1.1 Component parts. Component parts consist of any items which are complete as procured and which cannot perform their intended functions when broken down into smaller parts; i.e., capacitors, resistors, nuts, bolts, etc.; or any item which may be assembled from smaller, functional parts by the vendor, but which is not normally intended to be disassembled by the user; i.e., relays, motors, etc.

3.1.2 Assemblies. An assembly is any unit made up of component parts and intended to perform a specific function.

3.1.3 Test unit. For brevity and convenience, any component part or assembly being tested shall be regarded as a test unit.

3.1.4 Component part or assembly conditions

3.1.4.1 Nonoperating. The condition of the component parts or assembly, either assembled or disassembled, when stored, transported, or handled.

3.1.4.2 Operating. The condition of the component part or assembly when performing its required function.

3.1.5 Vibration and shock axes. Vibration and shock axes are imaginary straight lines passing through the test unit, along which the test unit is being vibrated or shocked. The axes are specified in the individual specifications or NAVORD Drawings. See Figure 1.

3.1.6 Vibration. Vibration, as used herein, is a sinusoidal motion defined by amplitude and frequency. The amplitude may refer to displacement or acceleration. The displacement is given in inches, peak-to-peak, or in multiples of the acceleration of gravity. Frequency is given in Hertz (Hz).

3.1.7 Shock. As used herein, shock is an abrupt change in the motion of a body. This change may result from the sudden application of a large external force of short duration or from the sudden cessation of an existing state of motion. Shock is described herein as a pulse in units of gravitational acceleration (g's), including duration in milliseconds (ms) and some description of the shock wave form.

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3.1.8 Failure. The test unit shall have failed when it displays one or more of the following conditions:

3.1.8.1 Any measured characteristic falls outside the tolerance limits specified in the individual specification or applicable NAVORD drawing.

3.1.8.2 The test unit becomes inoperative.

3.1.8.3 Deterioration or corrosion appears on the test unit which could adversely affect the operation of the torpedo.

3.1.8.4 Mechanical failure; e.g., fractures, chipping, or distortion, which could adversely affect the operation of the torpedo.

3.2 Test conditions. The component or assembly under test is required to operate during exposure to some or all of the environments described herein. The test unit is also required to operate after exposure to all the environments described herein, unless otherwise specified in its individual specification or NAVORD drawings.

3.3 Additional requirements. Requirements additional to those of this specification may be specified for the test unit. Such requirements shall be detailed in the individual specification or NAVORD drawings.

3.4 Combinations and sequences. The test unit shall be capable of withstanding, in any sequence, all of the tests specified in Section 4. At the conclusion of each test, the test unit shall be capable of performing in accordance with its individual specification or NAVORD drawings. After measuring its performance as specified, the test unit shall be transferred, without delay, from test to test until all tests are completed, unless otherwise specified in the individual specification or NAVORD drawing.

3.5 Environmental requirements. When tested as specified in Section 4, the test unit shall be capable of performing as specified in its individual specification or NAVORD drawing, after being subjected to the following conditions:

3.5.1 Vibration. The test unit shall meet the following vibration requirements:

3.5.1.1 Vibration, nonoperating. The test unit, less pack and packaging, shall be capable of withstanding the vibrations of Schedule I (4.3.1.1) within the frequency range of 10-100 Hz in each of three mutually perpendicular axes. Thereafter, the unit shall show no damage and shall be capable of meeting all the performance requirements and product characteristics of its specification or NAVORD drawing.

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3.5.1.2 Vibration, operating. The test unit shall be capable of withstanding the vibrations of Schedule II (4.3.1.2) within the frequency range of 20-150 Hz in each of three mutually perpendicular axes. During and thereafter, the unit shall show no damage and shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

3.5.1.3 Vibration transportation. The test unit, after being subjected to the test specified in 4.3.1.3, shall show no damage and shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

3.5.2 Shock transportation. The test unit, after being subjected to the test specified in 4.3.2, shall show no damage and shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

### 3.5.3 Temperature and humidity

3.5.3.1 High temperature and humidity, nonoperating. The test unit, less pack and packaging, shall be capable of withstanding a temperature of plus 160 degrees plus or minus 5 degrees F for a period of 48 hours at a relative humidity of 90 to 95 percent. Thereafter, the unit shall show no damage and shall be capable of meeting all the performance requirements and product characteristics of its specification or NAVORD drawing.

3.5.3.2 High temperature, operating. The test unit shall be capable of meeting the performance requirements of its specification or NAVORD drawing while being maintained at a temperature of plus 130 degrees F.

3.5.3.3 Low temperature, nonoperating. The test unit, less pack and packaging, shall be capable of withstanding a temperature of minus 65 plus or minus 5 degrees F for a period of 48 hours. Thereafter, the unit shall meet all performance requirements and product characteristics of its specification or NAVORD drawing.

3.5.3.4 Low temperature, operating. The test unit shall be capable of meeting the performance requirements of its specification or NAVORD drawing while being maintained at a temperature of plus 28 degrees F.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspections. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or

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any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Sampling. Selection of samples to be environmentally tested shall be as specified in the individual specification.

#### 4.3 Environmental test procedures

4.3.1 Vibration. The test unit, mounted securely to a vibration device, shall be subjected to vibration testing as specified in 4.3.1.1, 4.3.1.2, and 4.3.1.3.

4.3.1.1 Vibration, nonoperating condition. The test unit, including vibration isolators or mounting devices, if any, as specified in the individual specification or NAVORD drawing, shall be vibrated according to the vibration testing of Schedule I in each of the three mutually perpendicular axes shown in Figure 1. Thereafter, the unit shall show no damage and shall meet all performance requirements and product characteristics of its specification or NAVORD drawing.

#### SCHEDULE I

<u>Frequency Range</u>	<u>Amplitude</u>	<u>Minimum Test Duration Room Temperature</u>
10 - 30 Hz	0.060 $\pm$ 0.006 in.	60 min.
31 - 60 Hz	3g $\pm$ 0.3g	60 min.
61 - 100 Hz	3g $\pm$ 0.3g	60 min.

The frequency shall be continuously varied, between each of the limits given, at a uniform rate over a three- to five-minute period for the duration of the test.

As an alternate method, the test unit shall be vibrated at specific frequencies differing by not more than five Hz in each of the test axes and covering the entire frequency range and amplitudes of Schedule I. The total test time shall be not less than that of Schedule I and the test times at the specific frequencies shall be equally divided.

4.3.1.2 Vibration operating. The test unit, including vibration isolators or mounting devices, if any, as specified in the individual specification or NAVORD drawing, shall be subjected to the vibration scheduling of Schedule II in each of three mutually perpendicular axes. During and thereafter, the unit shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

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## SCHEDULE II

<u>Frequency Range</u>	<u>Amplitude</u>	<u>Minimum Test Duration Room Temperature</u>
20 - 60 Hz	1g $\pm$ 0.1g	15 min.
61 - 150 Hz	1g $\pm$ 0.1g	15 min.

The frequency shall be continuously varied, between each of the limits given, at a uniform rate over a three- to five-minute period for the duration of the test.

As an alternate method, the test unit shall be vibrated at specific frequencies differing by not more than five Hz in each of the test axes and covering the entire frequency range and amplitudes of Schedule II. The total test time shall be not less than that of Schedule II and the test times at the specific frequencies shall be equally divided.

4.3.1.3 Vibration, transportation. The test unit, packaged and packed in accordance with Section 5 of its individual specification, shall be subjected to the following test (see 4.4 and 4.5):

4.3.1.3.1 Low order repetitive shock (vibration). This test shall be run prior to running other standard shock tests. This test shall be run in accordance with Method 278 of Federal Test Method Standard No. 101 with the following clarifications:

(a) If circular input motion is used, the table frequency shall be adjusted to ensure that one edge of the container leaves the table on each cycle by 3/16 inch.

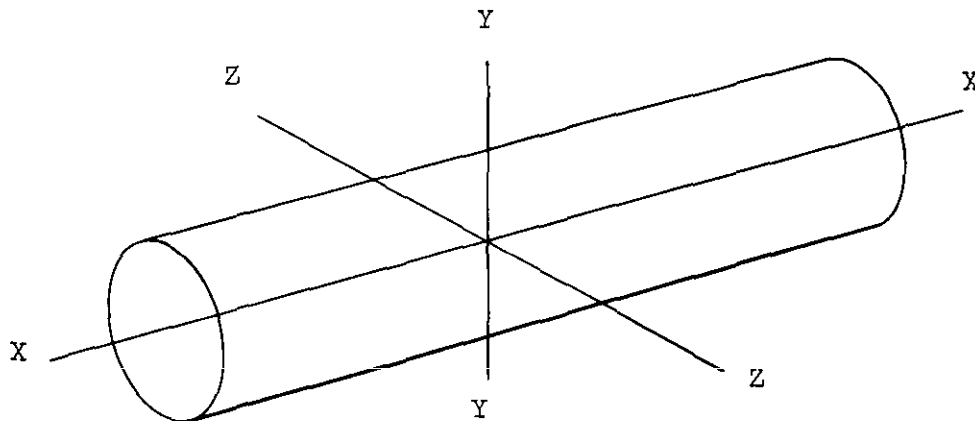
(b) If vertical linear input motion is used, all points of the container shall leave the table by 1/16 inch at some instant during each cycle.

(c) If neither of the above is attainable with equipment at hand, the table shall be operated at 270 plus or minus 2 rpm for the stipulated time period.

4.3.1.3.2 Vibration isolation. Where, for shock isolation purposes, more than one inch of cushioning material is used or shock isolators (such as elastomeric mounts, collapsing column rubber "mats," hydraulic struts, air springs or conventional springs) are used, the following design criteria apply:

(a) Peak transmissibility shall not exceed 5 in the frequency range 5 to 20.0 Hz and 8 in the frequency range 20.1 to 60 Hz.

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X-X Longitudinal Axis  
 Z-Z Perpendicular and Transverse to X-X  
 Y-Y Mutually Perpendicular to X-X and Z-Z

- NOTES: (1) For vibration, orientation of test item with respect to earth's gravitational field shall be maintained for all test directions.
- (2) For shock, orientation of the test item can be changed as needed to accomplish all directions of test.
- (3) The test fixture shall not alter the inputs from shock or vibration exciter to the mounting points of test item.

Figure 1. Test Axes

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(b) Where satisfaction of shock isolation requirements would produce an isolator natural frequency less than approximately 30 Hz, the isolator system should be designed for a vertical translational natural frequency in the range 7.5 to 12 Hz, if consistent with overall dimensional limitations established by the logistic study.

(c) The isolator system shall pass the vibration fatigue test.

4.3.1.3.2.1 Vibration fatigue test. The container shall be suitably instrumented to discern input (at the container base) and response (at the item c.g.) acceleration and suitably fastened in its normal storage position to a sinusoidal vibration generator of appropriate capacity. The container shall then be cycled from 5 to 60 Hz in 15 minutes with a logarithmic sweep rate. Input acceleration amplitude shall be a consistent 1 g. As an alternate for use with reaction type machines, the search syllabus of Table I may be followed.

Table I

## Alternate Resonant Sweep Test Syllabus

Frequency Band Hz	Input Double Amplitude, Ins.	Minimum Sweep Time in Band, Mins.
5 - 15	0.125	6.0
16 - 25	0.040	3.0
26 - 35	0.030	2.5
36 - 60	0.020	3.5

Peak transmissibility and the associated frequency shall be determined from the accelerometer records.

Set the frequency of the vibration generator at the peak transmissibility frequency disclosed by the survey sweep and vibrate at that frequency for 15 minutes at 1 g input acceleration. Upon completion of the test, evaluate the isolator system for excessive heat damage, breakage and continued ability to function. Excessive looseness in cushioned packs, evaluated one hour after completion of tests, shall be cause for rejection.

4.3.2 Shock, transportation. The test unit, packaged and packed in accordance with Section 5 of its individual specification, shall be subjected to the following test (see 4.4 and 4.5):



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4.3.2.1 Free drop test (shock). This test shall be conducted from the heights stipulated in Table II. Drop container, in succession, on corners 5-1-2, 6-3-4, 5-2-3, and 6-1-4. Then drop on face 3 and face 5 (see Figure 2). Suitable test rigging is described in Method 216 of Federal Test Method Standard No. 101.

#### 4.3.3 Temperature and humidity

4.3.3.1 High temperature and humidity, nonoperating. The test unit shall be subjected to a temperature of plus 160 degrees F plus or minus 5 degrees F at 90 to 95 percent relative humidity for a period of 48 hours plus or minus 5 hours. At the conclusion of this test period and after returning to normal room temperature the unit shall show no damage or corrosion and shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing. Prior to conducting the performance tests, wiping or air drying may be performed. Drying by heating or baking is not allowed.

4.3.3.2 High temperature, operating. The test unit shall be placed in a test chamber whose temperature shall be raised to plus 130 degrees F plus or minus 5 degrees F and maintained long enough for the unit to stabilize at this temperature. While still at the test temperature of plus 130 degrees F, the unit shall meet all performance requirements and product characteristics of its specification or NAVORD drawing.

4.3.3.3 Low temperature, nonoperating. The test unit shall be placed in a test chamber whose temperature shall be lowered to minus 65 degrees F plus or minus 5 degrees F and maintained at this temperature for a period of 48 hours plus or minus 5 hours. At the conclusion of this test period and after returning to normal room temperature, the unit shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

4.3.3.4 Low temperature, operating. The test unit shall be placed in a test chamber whose temperature shall be lowered to plus 28 degrees F plus or minus 5 degrees F and maintained long enough for the unit to stabilize at this temperature. While at plus 28 degrees F, the unit shall meet all the performance requirements and product characteristics of its specification or NAVORD drawing.

4.4 Waiver of tests. Tests specified in 4.3.1.3 and 4.3.2 above may be waived by the procuring agency for Level C packs only, provided the contractor guarantees safe delivery to the using activity.

4.5 Functional tests. At the conclusion of the tests specified in 4.3.1.3 and 4.3.2 above, functional and other tests, as applicable, shall be conducted on the test unit to determine freedom from operational malfunction and compliance with all performance requirements and product characteristics of its specification or NAVORD drawing.

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TABLE II

## Shipping Container Shock Test Selector

Container Gross Wt.(W) lbs <u>/1</u>	Container Length (L) ins. <u>/1</u>	Type Test	Domestic Only <u>/2</u>		Universal	
			Ht. of Drop (ins.)	Impact Velocity (fps)	Ht. of Drop (ins.)	Impact Velocity (fps)
$W \leq 25$	Any	Free Drop	30	N.R. <u>/3</u>	48	N.R.
$25 < W \leq 50$	$L \leq 36$	Free Drop	30	N.R.	36	N.R.
$25 < W \leq 50$	$L > 36$	Rotation & Impact	30	7	36	12-1/2
$50 < W \leq 150$	$L \leq 36$	Free Drop	14	N.R.	30	N.R.
$50 < W \leq 150$	$L > 36$	Rotation & Impact	27	7	30	10
$150 < W \leq 500$	Any	Rotation & Impact	18	7	24	10
$500 < W \leq 4000$	Any	Rotation & Impact	12	7	18	10
$W > 4000$	Any	Rotation & Impact	9	7	12	10

/1 Use both columns to determine the applicable test conditions.

/2 This column may not be used if the contents are AEEDA (Ammunition, Explosives and other Dangerous Articles). Containers for AEEDA developed under direct military control shall be designed and tested to the universal level. Bulk materials and commercially developed AEEDA must be shipped in containers meeting Department of Transportation Regulations, including all performance test requirements, unless specific waiver is granted by NAVORD. Where such waiver exists, the shipper may assume that the waiver has been coordinated with appropriate regulatory agencies.

/3 N.R. means not required.

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## 5. PREPARATION FOR DELIVERY

5.1 General. Requirements for packaging, packing, and marking for shipment shall be as specified by the individual specification or NAVORD drawing.

## 6. NOTES

6.1 Intended use. This specification is intended for use in the testing of component parts and assemblies of the Torpedo Mk 37.

6.2 Limitations. Environmental conditions more extreme than the requirements of this specification may occur; however, because the frequency of their occurrence has not been adequately established, their use here in a general specification cannot be justified. Where appropriate, more severe requirements shall be specified in the individual specification or NAVORD drawings.

Preparing Activity  
Navy - OS  
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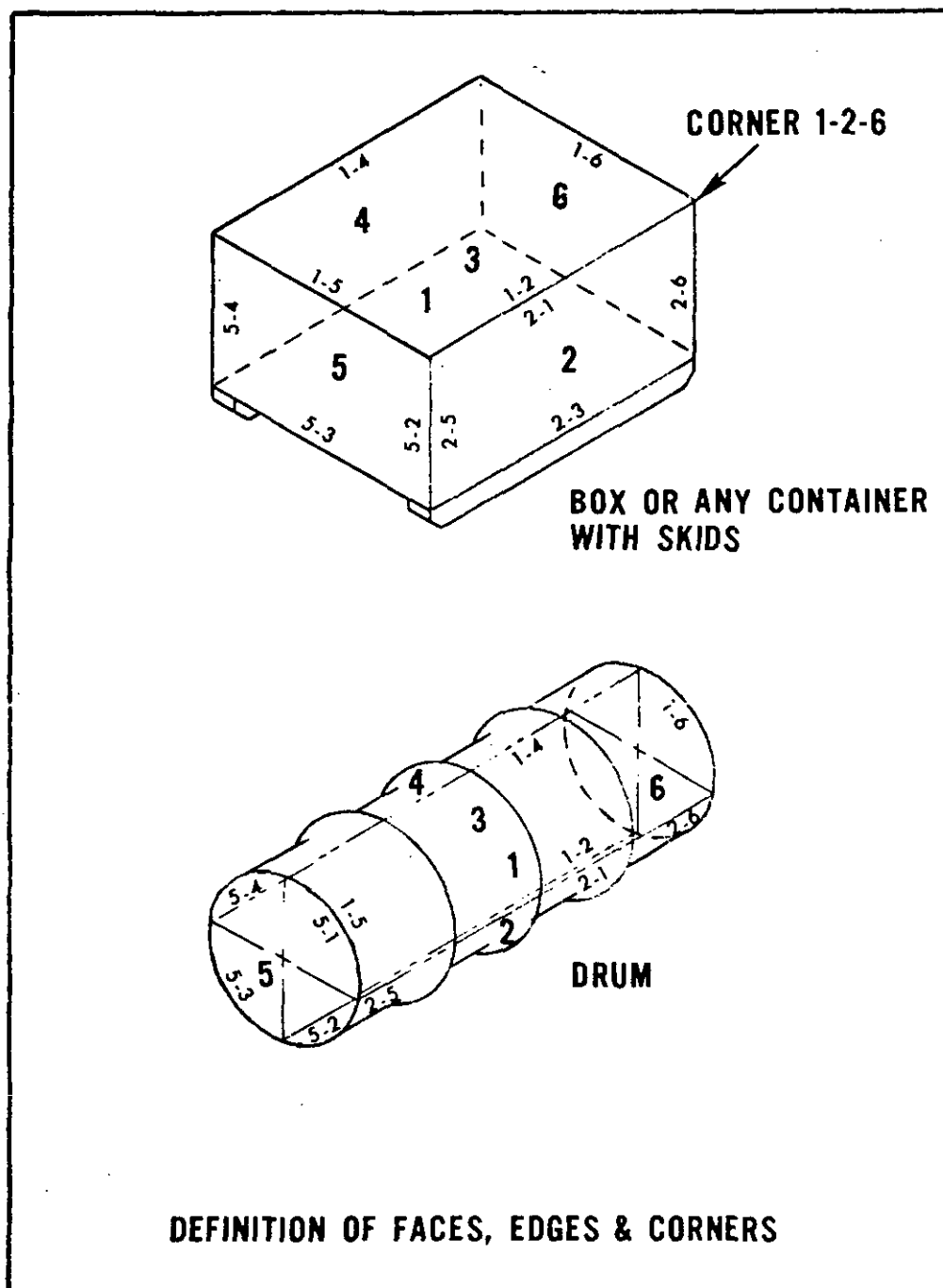


Figure 2