

INCH-POUND

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SUPERSEDING
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DETAIL SPECIFICATION

MAGNETIC EFFECT LIMITS FOR NONMAGNETIC EQUIPMENT USED IN THE PROXIMITY OF MAGNETIC INFLUENCE ORDNANCE

This specification is approved for use by the Naval Sea Systems Command (OS), and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the magnetic effect limits and testing methods for nonmagnetic equipment used in the proximity of magnetic influence ordnance. This specification covers finished equipment (final assemblies). Testing (Pre-screening) of sub-assemblies, components and raw materials will not guarantee acceptability of the final assemblies.

2. APPLICABLE DOCUMENTS

2.1 Documents. This section is not applicable to this specification.

3. REQUIREMENTS

3.1 Authorized Testing Facility. The Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV), Equipment Management Department, Indian Head, Maryland is designated as the facility authorized to test and accept equipment and material for compliance with this specification. This includes testing first article and production lot items. Accordingly, all cognizant procuring activities requiring equipment and material to comply with this specification shall contact the Naval Explosive Ordnance Disposal Technology Division, Equipment Management Department, Indian Head, Maryland, 20640 for the following:

- (a) Test Facility, Labor, and Shipping.
- (b) Test Facility Scheduling.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Indian Head Division, Naval Surface Warfare Center, Engineering Documentation Branch (Code 4230), 101 Strauss Avenue, Indian Head, MD 20640-5035, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by sending a letter.

AMSC N/A

FSC NDTI

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3.2 First Article. As specified in the contract, the contractor shall furnish first article items of each equipment type for first article testing and acceptance to the Naval Explosive Ordnance Disposal Technology Division (see 3.1). First article items shall be tested 100% in accordance with the test methods specified herein.

3.3 Production Lot. All production lot items shall meet the test limits of this specification, prior to acceptance by the Government. 100% of production lot items shall be tested by NAVEODTECHDIV.

3.4 Magnetic Effects of Non-Electrical Items. The change in flux density of the background magnetic field shall not exceed 5 gamma, also referred to as 5 nT (nanoTeslas), for each test when the items are tested in accordance with 4.2.1 and 4.2.3.

3.5 Magnetic Effects of Electrical Items. If the final assembly (operating item) has electrical circuits, the change in flux density of the background magnetic field shall not exceed 5 gamma for each test when the items are tested in accordance with 4.2.1, 4.2.2 and 4.2.3.

3.6 Eddy Current Generated Field Limits. Eddy current generated field shall not exceed 5 gamma when the item is tested in accordance with 4.2.3. For electrical items, eddy current tests will be conducted with the items powered on and off.

3.7 Station Magnetometer. A calibrated, model HSM-2 Station Magnetometer shall be used to conduct magnetic effects testing specified in paragraphs 4.2.1.2 and 4.2.3.1. The test distances specified in this document are the distances from the center of the HSM-2 Station Magnetometer's active sensor element to the surface of the test item. When establishing the test distance, the maximum variation is " 0.25 inch.

3.8 Magnetic Idealization Generators. The MK 21 Mod 1 or MK 79 Mod 0 Magnetic Idealization Generator shall be used to perform Magnetic Idealization and Demagnetization functions as specified in paragraphs 4.2.1.1 and 4.3.

3.9 Item Categorization. All test items are categorized as either contact or non-contact and further categorized as a component, special test distance component or an assembly. The item categorization determines the HSM-2 Magnetometer sensor's standoff test distances.

3.10 Rejection and Resubmission. If the magnetic effect of any item exceeds the limits of 3.4, 3.5 or 3.6, it shall be rejected. If the contractor can correct the rejected item, the item may be resubmitted for acceptance testing.

3.11 Identification. Each item that meets the requirements of this specification shall be permanently marked with the low-mu symbol, test date (month/year), and facility identification, by the approved, authorized test facility (see 4.1). Equipment that is too small or cannot otherwise be permanently marked shall be tagged or placed in sealed bags that are appropriately marked.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are as follows:

- a. First article inspection (see 4.1.2)
- b. Quality conformance inspections (see 4.1.3)

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4.1.1 Responsibility for Testing. All initial acceptance testing, first article and production lot items, shall be performed by an authorized test facility. The Naval Explosive Ordnance Disposal Technology Division, Equipment Management Department, Indian Head, Maryland, is currently the only authorized test facility. Naval EOD Technology Division is the certifying agent of additional Military test facilities authorized to conduct re-certification and initial testing of limited locally procured items. The Government reserves the right to perform any of the tests set forth in this specification where such tests are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.2 First article inspections. The first article sample shall be subjected to the tests and inspections of 4.2. The rejection of any sample unit shall be cause for rejection of the first article sample.

4.1.3 Quality conformance inspections. All production lot items sample shall be subjected to the tests and inspections of 4.2. The rejection of any sample unit shall be cause for rejection of the production lot.

4.2 Test Procedures.

4.2.1 **TEST PROCEDURE 1. Magnetic Effects Test**. Each item shall be idealized as in 4.2.1.1 and then measured for magnetic effect as in 4.2.1.2. The procedure of 4.2.1.1 and 4.2.1.2 shall be sequentially followed for each of the three reference axes selected as in 4.2.1.5. The magnetic effect of the item is the largest of the three measurements.

4.2.1.1 Magnetic Idealization. Idealization shall consist of placing each test item in a uniform magnetic field of five gauss, with the item's reference axis aligned parallel to the field. A cycled, pulsed magnetic field is superimposed parallel to the five gauss field. A six second cycle shall consist of the following: a two second square positive pulse, one second off, a two second square negative pulse of equal amplitude, and finally one second off. The amplitude of the positive pulse of the first cycle shall be between fifty and sixty gauss. The amplitude of the positive pulse of the each successive cycle shall be reduced by no more than one gauss per cycle. The cycling shall continue until the amplitude is reduced to zero. The purpose of idealization is to attempt to temporarily magnetize the test item to provide a worst case condition.

4.2.1.2 Magnetic Effects Measurement. The HSM-2 Magnetometer detection sensor shall be aligned parallel to the earth's magnetic field. Measurements are taken by introducing the test item to the sensor along the earth's field to the specified test distance. While the test item is at the test distance, it is rotated through all axes to identify the highest positive and negative readings. All planes of the test item are introduced to the sensor at the specified test distance. The magnetic effect measurement is the sum of the absolute values of the highest positive and negative readings.

4.2.1.3 Test Distances/Item Categorization.

4.2.1.3.1 Contact Component. The contact component test distance shall be 2.00 inches from the center of the active element in the HSM-2 Magnetometer sensor to the surface of the item.

4.2.1.3.2 Contact Assembly. The contact assembly test distance shall be 4.50 inches from the center of the active element in the HSM-2 Magnetometer sensor to the surface of the item.

4.2.1.3.3 Non-Contact Component. The non-contact component test distance shall be 5.00 inches from the center of the active element in the HSM-2 Magnetometer sensor to the surface of the item.

4.2.1.3.4 Non-Contact Assembly. The non-contact assembly test distance shall be 12.00 inches from the center of the active element in the HSM-2 Magnetometer sensor to the surface of the item.

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4.2.1.3.5 Special Component Test Distance. A special component test distance is the distance from the center of the active element in the HSM-2 Magnetometer sensor to the surface of the item as specified in the applicable engineering drawings and/or specifications.

4.2.1.4 Standard Test Temperature and Earth's Magnetic Field Limits. Magnetic effect measurements shall be performed at a temperature of 70 " 10EF and in an earth's magnetic field of 44,000 - 56,000 gamma. The field strength is measured when the test item and all other magnetic materials are removed from the vicinity of the magnetometer sensor.

4.2.1.5 Selection of Reference Axes. Three mutually perpendicular reference axes shall be selected for each item. The primary reference axis shall be the longest axis of the item, and the secondary reference axis shall be the longest axis perpendicular to the primary axis. The third reference axis shall be perpendicular to the primary and secondary axes.

4.2.2 **TEST PROCEDURE 2**. Test for Magnetic Effects of Electrical Items. The item shall be demagnetized per 4.3 before testing. The magnetic effects of electrical items shall be measured for each operational mode. The magnetic effect measurement is the highest reading obtained from any operational mode. Testing shall be in accordance with 4.2.1.2 and 4.2.2.1.

4.2.2.1 Electrical Item Test Conditions. Fully charged batteries shall be used for these tests. All controls shall be adjusted for maximum current flow.

4.2.3 **TEST PROCEDURE 3**. Eddy Current Generated Field Test. The item shall be demagnetized per 4.3 before testing. Each item shall be measured for eddy current generated field as in 4.2.3.1. Procedure 4.2.3.1 shall be performed for each of the three reference axes selected as in 4.2.1.5. The eddy current generated field measurement is the highest reading obtained from any of the three idealized axes.

4.2.3.1 Eddy Current Generated Field Measurements. The HSM-2 Magnetometer sensor shall be aligned perpendicular to the earth's magnetic field. At the start of the measurement, the item shall have its reference axis aligned perpendicular to the earth's magnetic field and passing through the point at which the eddy current generated field is measured. The initial distance between the item and sensor shall be at least two feet. It is then moved in a nutational and oscillating motion, about the center of the reference axis, so that one end of the item moves toward the detector while the other end moves away from the sensor. The movement will be through an angle of 30E, 15E in each direction from the original position of the item at the sensor. The rate of movement will be such that 15 complete oscillating cycles occur in 10 seconds. The item is then brought to test distance. This is repeated for the other two reference axes. After completing the nutational and oscillating cycles, the item is removed to the starting point. The eddy current generated field is the sum of the absolute values of the largest plus and minus variations as measured during any cycle.

4.3 Demagnetization. The test item is placed in the same cycled, pulsed magnetic field used for idealization (see 4.2.1.1) except that the five gauss field is not present. The square wave is centered about zero gauss, instead of the five gauss field. The same six second cycle is repeated until the amplitude is reduced to zero. The test item shall be aligned with the last axis of magnetic idealization. The purpose of demagnetization is to cancel any magnetically induced fields.

5. PACKAGING

5.1 Packaging. This section is not applicable to this specification.

6. NOTES

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6.1 Intended Use. Tests described in this document are intended to be applied to items, equipment and materials used in the proximity of magnetic influence ordnance. Examples of such items are nonmagnetic tools and equipment used by military, civilian, contractor and other personnel tasked with explosive ordnance disposal missions. These items are not intended for common usage.

6.2. Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.

6.3 Definitions. When used in conjunction with this specification, the following terms are defined.

6.3.1 Contact Items. Contact items are intended to be placed in direct contact with magnetic influence ordnance. Examples include: energetic tools, hand tools, lifting shackles, etc.

6.3.2 Non-Contact Items. Non-contact items are not intended to be placed in direct contact with, but in proximity to magnetic influence ordnance. Examples include: sonars, underwater breathing apparatus, swim fins, etc.

6.3.3 Assemblies. Assemblies are complete and functional end items capable of performing an operational task. Examples include: screwdrivers, AN/PQS-2A sonar, underwater breathing apparatus, etc.

6.3.4 Components. Components are all other items not considered assemblies. Examples include: screws, brackets, batteries, valves, gauges, etc.

6.3.5 Units of Measure. $1 \text{ gamma} = 10^{-5} \text{ gauss} = 10^{-5} \text{ oersted} = 10^{-9} \text{ webers/M}^2 = 10^{-9} \text{ tesla} = 1\text{nT}$

6.4 Subject Term (Key Word) Listing.

EOD;
Man rated

6.5 Changes from Previous Issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

Custodians:
Navy - OS

Preparing Activity:
Navy - OS
(Project NDTI-N289)

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3. DOCUMENT TITLE
MAGNETIC EFFECT LIMITS FOR NONMAGNETIC EQUIPMENT USED IN THE PROXIMITY OF MAGNETIC INFLUENCE ORDNANCE

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

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| a. NAME (<i>Last, First, Middle Initial</i>) | b. ORGANIZATION | |
| c. ADDRESS (<i>Include Zip Code</i>) | d. TELEPHONE (<i>Include Area Code</i>) (1) Commercial (2) DSN (<i>If applicable</i>) | 7. DATE SUBMITTED (YYMMDD) |

8. PREPARING ACTIVITY

| | |
|--|---|
| a. NAME Commander, Indian Head Division Naval Surface Warfare Center | b. TELEPHONE (<i>Include Area Code</i>) (1) Commercial 301-744-1973 (2) DSN 354-1973 |
| c. ADDRESS (<i>Include Zip Code</i>) Standardization Team (Code 840M) 101 Strauss Avenue Indian Head, MD 20640-5035 | IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888 |