

MIL-M-19595C(OS)  
02 August 1978  
Superseding  
MIL-M-19595B(OS)  
11 January 1971 and  
Amendment 1  
24 February 1971

MILITARY 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 for essentially nonmagnetic equipment used in the proximity of magnetic influence ordnance. This specification covers finished equipment. If it is used for replaceable accessories, components, or raw material intended for use on finished equipment, the special test conditions of 6.2(d) and (e) must be specified. Approval of components of raw materials shall in no case be construed as a guarantee of the acceptance of the finished equipment.

2. APPLICABLE DOCUMENTS

2.1 Not applicable.

3. REQUIREMENTS

\* 3.1 Testing facility. The Naval Explosive Ordnance Disposal Facility, Indian Head, Maryland is designated as the only Department of Defense (DOD) facility authorized to test and accept equipment and material for compliance with this specification. This includes testing first article samples as well as production equipment and material. Accordingly, all cognizant procuring activities requiring equipment and material to comply with this specification shall contact the Naval Explosive Ordnance Disposal Facility, Code 45, Indian Head, MD. 20640 for the following:

(a) Contract data:

1. Consignment instruction for NAVBODFAC after testing.
2. Testing time and test schedule.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Ordnance Station (611) Indian Head, MD 20640 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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MIL-M-19595C(OS)

(b) Funding for services:

1. Cost to perform testing and repackaging.

\* 3.2 First article. When specified (see 6.2), the contractor shall furnish not less than three sample units of each equipment type for first article inspection and approval (see 4.1 and 6.2) to the Naval Explosive Ordnance Disposal Facility (see 3.1). Items shall be manufactured using the same methods and procedures and at the same plant location to be used for the regular production. These items will be tested as specified in 4.2, herein, and are for the purpose of determining that the production item meets the requirements of this specification.

3.3 Method I - Magnetic effects limits. The change in flux density of the background magnetic field shall not exceed 0.05 millioersteds (5 gamma) when the equipment is tested in accordance with 4.4.1. and 4.4.2.

3.4 Method II - Eddy current generated field limits. Eddy current generated field shall not exceed 0.05 millioersteds (5 gamma) when the equipment is tested in accordance with 4.4.3.

3.5 Method III - Total magnetic effects and eddy current generated field. The total of the magnetic effects, as measured in accordance with 4.4.1 and 4.4.2, and the eddy current generated field, as measured in accordance with 4.4.3 along any axis, shall not exceed 0.05 millioersteds (5 gamma).

3.6 Demagnetization. All equipment shall be demagnetized after completion of the tests of 4.4, in accordance with 4.5.

\* 3.7 Identification. After the inspection acceptance of 4.2 and 4.3, the Naval Explosive Ordnance Disposal Facility shall permanently and legibly mark the low  $\mu$  symbol " $\mu$ " on each item of equipment that conforms to the requirements of 3.3, 3.4 and 3.5. A Nitinol stamping tool shall be used whenever possible; electric etching may be used on hard materials. Equipment that is too small or cannot otherwise be marked shall be tagged or placed in envelopes that are appropriately marked.

4. QUALITY ASSURANCE PROVISIONS

\* 4.1 Responsibility for inspection. Final acceptance testing, first article sample and production shall be performed by the agency specified in 3.1. Insuring that material and equipment produced meets the requirements of this specification is the responsibility of the supplier. Except as otherwise specified in the contract, the contractor may use his own or 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 this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

MIL-M-19595C(OS)

\* 4.2 First article inspection. The first article sample shall be examined and tested in accordance with 4.4 to determine compliance with the requirements of 3.3, 3.4 and 3.5. Accepted first article items will become the property of the procuring activity and shall be included in the quantity of items specified in the contract.

\* 4.2.1 First article test results. When tests are completed on the first article sample, the Naval Explosive Ordnance Disposal Facility shall notify the Government inspector, who in turn shall immediately notify the contractor of the test results and of any specific deficiencies. If any item fails to comply with the requirements of this specification and the contract and applicable documents referenced therein, the contractor shall correct the deficiencies and submit additional items until an entire set of satisfactory items has been submitted. These items shall be accompanied by a description of the changes made to correct the faults of the previous submissions. Further production of equipment by the contractor prior to the approval of the procuring activity or completion of inspections and tests on the first article samples shall be at the contractor's risk.

4.3 Acceptance inspection. The equipment and procedure used to measure the magnetic effect in 4.4.1.2 must be approved by the Naval Sea Systems Command.

4.3.1 Magnetic effect inspection. Every item submitted for acceptance shall be tested in accordance with 4.4.1 in order to ascertain compliance with the requirements of 3.3.

4.3.1.1 Rejection and resubmission. If the magnetic effect of any item exceeds the limit of 3.3, it shall be rejected. The rejected item will be inspected to determine why it failed to pass the limit set forth in 3.3. If the rejected item can be corrected by means other than demagnetization, the item may be resubmitted for acceptance testing. A determination shall be made as to the cause of the increase in the magnetic effect from that of the first article samples, and the production process shall be corrected to eliminate this increase.

4.3.2 Inspection of the magnetic effect of electric circuits. Every item submitted for acceptance shall be tested in accordance with 4.4.2 in order to ascertain compliance with the requirements of 3.3.

4.3.2.1 Rejection and resubmission. If the magnetic effect of any item exceeds the limit of 3.3, it shall be rejected. The rejected item will be inspected to determine why it failed to pass the limit set forth in 3.3. If the rejected item can be corrected, the item may be resubmitted for acceptance testing. A determination shall be made as to the cause of the increase in the magnetic effect from that of the first article samples, and the production process shall be corrected to eliminate this increase.

## MIL-M-19595C(OS)

4.3.3 Eddy current generated field inspection. Every item submitted for acceptance shall be tested for eddy current generated field in accordance with 4.4.3 in order to ascertain compliance with the requirements of 3.4.

4.3.3.1 Rejection and resubmission. If the eddy current generated field of any item exceeds the limit of 3.4, it shall be rejected. Rejected items, after correction of defects, may be resubmitted for acceptance. A determination shall be made as to why there was an increase in the eddy current generated field from that of the first article samples, and the production process shall be corrected to eliminate this increase.

#### 4.4 Test procedures.

4.4.1 Magnetic effect test. Each item shall be idealized as in 4.4.1.1 and then measured for magnetic effect as in 4.4.1.2. The procedure of 4.4.1.1 and 4.4.1.2 shall be sequentially followed for each of the three reference axes selected as in 4.4.1.4. The magnetic effect of the item is the largest of the three measurements.

4.4.1.1 Magnetic idealization. Idealization shall consist of placing each item in a uniform magnetic field of five oersteds, with the reference axis aligned parallel to the field, and of superimposing a cycled pulsed magnetic field parallel to the uniform constant background field. A cycle shall consist of a square positive pulse of minimum duration of one second, a minimum of one off, a square negative pulse of equal amplitude and of minimum duration of one second, and finally a minimum of one second off. The amplitude of the positive pulse of the first cycle shall be between forty and sixty oersteds at the start. The pulse amplitude shall be reduced between successive cycles by a maximum of two oersteds. The cycling shall continue until the amplitude is reduced to zero.

4.4.1.2 Magnetic effect measurement. Unless otherwise specified, the detection point (the center of the active element in the magnetometer sensor) for each magnetic effect measurement shall be  $4.50 \pm 0.25$  inches from the surface of the item. The detection sensor shall be aligned parallel to the background field. At the start of the measurement, the item shall have its reference axis aligned parallel to the background magnetic field and passing through the point at which the magnetic field change is measured. The initial distance between the item and detection point shall be at least two feet. The item is then brought to 4.50 inches from the detection point. It is next rotated  $360^\circ$  about an axis perpendicular to the reference axis, in such a manner so that the closest point of the item to the detection point is kept at 4.50 inches throughout the entire rotation. After completing the  $360^\circ$  rotation, the item is removed to the starting point. The magnetic effect measured for a given axis is the maximum variation of the magnetic field at the detection point during this motion i.e., the magnetic effect is the sum of the absolute values of the largest plus and minus variations as measured during the test.

MIL-M-19595C(OS)

4.4.1.3 Standard test temperature and background magnetic field limit. Magnetic effect measurements shall be performed at a temperature of  $80 \pm 20^\circ\text{F}$  and in a minimum background magnetic field of 450 millioersteds. (The background field level is measured when the test-object and all other magnetic materials are removed from the vicinity of the detection point).

4.4.1.4 Selection of reference axes. Three mutually perpendicular reference axes shall be selected for each equipment type. In general, one reference axis shall be the longest axis of the equipment type, and another reference axis shall be the longest axis perpendicular to the preceding axis.

4.4.2 Test for magnetic effect of electric circuits. If the equipment has electric circuits, its magnetic effects shall be measured with each circuit on and with each possible combination of two or more circuits on as per 4.4.1.2. The same reference axes selected in 4.4.1.4 shall be used for the measurements. The equipment shall be demagnetized per 4.5 before this test. The magnetic effect of electric circuits is the largest magnetic effect measured.

4.4.2.1 Electric circuit test conditions. The maximum rated operating voltages shall be applied, and where applicable, fresh batteries shall be used for these tests. All controls shall be adjusted for maximum current flow.

4.4.2.2 Standard test temperature and background magnetic field limit. Magnetic effect measurements shall be performed at a temperature of  $80 \pm 20^\circ\text{F}$  and in a minimum background magnetic field of 450 millioersteds. (The background field level is measured when the test object and all other magnetic materials are removed from the vicinity of the detection point).

4.4.3 Eddy current generated field test. Each item shall be measured for eddy current generated field as in 4.4.3.1. The procedure of 4.4.3.1 shall be sequentially followed for each of the three reference axes selected as in 4.4.1.4. The item shall be demagnetized per 4.5 before this test. The eddy current generated field of the item is the largest of the three measurements.

4.4.3.1 Eddy current generated field measurement. Unless otherwise specified, (see 6.2), the detection point (the center of the active element in the magnetometer sensor) for each eddy current generated field measurement shall be  $4.50 \pm 0.25$  inches from the surface of the item. The detector sensor shall be aligned perpendicular to the background field. At the start of the measurement, the item shall have its reference axis aligned perpendicular to the background field and passing through the point at which the eddy current generated field is measured. The initial distance between the item and the detection point shall be at least two feet. The item is then brought to 4.50 inches from the detection point. It is then

MIL-M-19595C(OS)

moved in a rocking or nutational 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 detector. The movement will be through an angle of  $30^\circ$ ,  $15^\circ$  in each direction from the original position of the item at the detection point. The rate of movement will be such that 15 complete rocking or nutational motions occur in 10 seconds. (Rate of movement is equivalent to 15 RPM). After completing the rocking or nutational movements, the item is removed to the starting point. The eddy current generated field measured for a given axis is the maximum variation of the magnetic field at the detection point during this motion i.e., the eddy current generated field is the sum of the absolute values of the largest plus and minus variations as measured during the test.

4.4.3.2 Standard test temperature and background magnetic field limit. Eddy current generated field measurements shall be performed at a temperature of  $80 \pm 20^\circ\text{F}$  and in a minimum background field of 450 millioersteds. (The background field level is measured when the test object and all other magnetic materials are removed from the vicinity of the detection point).

4.5 Demagnetization. Demagnetization shall consist of passing each item through more than a one hundred oersted peak alternating magnetic field, to a point sufficiently removed where the ambient field is less than one oersted. The motion shall be slow relative to the alternating frequency (several seconds at sixty Hertz). The alternating frequency shall be sixty Hertz or less. An alternate demagnetization procedure is to slowly reduce to zero the amplitude of the alternating field with the object not moving. No test for demagnetization is required.

\* 4.6 Identification. The Naval Explosive Ordnance Disposal Facility shall assure that each item of equipment is properly and correctly identified in conformance to 3.7.

## 5. PACKAGING

5.1 Not applicable.

## 6. NOTES

6.1 Intended Use. Tests described in this document are intended to be applied to items to be used in the proximity of magnetic influence ordnance and such items must not affect magnetic influence ordnance. Examples of such items are nonmagnetic tools and equipment used by the Navy in explosive ordnance disposal. These items are not intended for common usage where normal commercial products will suffice.

MIL-M-19595C(OS)

6.2 Ordering data. The procuring activity shall forward 2 copies of contracts specifying this specification to the agency specified in 3.1 and shall specify the following:

- (a) Title and number of this specification
- (b) Whether a first article sample is required (see 3.1)
- (c) Quantity of first article samples if other than three (see 3.2).
- (d) Special test distance if the tested item is not a complete item (see 1.1) (Two inches for replacement items unless otherwise specified).
- (e) Dimensions of material tested if this specification is used for ordering raw material (see 1.1).

6.3 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the previous issue.

Preparing Activity:  
Navy - OS

(Project No. NDTI-N010)



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