

MILITARY SPECIFICATION

MUZZLE BORESIGHT DEVICE 11785384
(M26 FOR M105MM GUN TUBE)

This specification is approved for use by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification establishes the requirements and quality assurance provisions for the cased series of the Muzzle Boresight Device 11785384 (M26 for M105MM Gun Tube), herein referred to as MBD.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-F-13926	-	Fire Control Material, General Specifications Governing the Manufacture and Inspection of
MIL-P-14232	-	Parts, Equipment, and Tools for Army Material, Packaging and Packing of
MIL-I-45607	-	Inspection Equipment, Acquisition, Maintenance, and Disposition of

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	-	Quality Assurance Terms and Definitions
MIL-STD-810	-	Environmental Test Methods

FSC 1240

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Armament Research and Development Center, Attn: AMSMC-QA Dover, New Jersey 07801-5001 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

DRAWINGS

AMCCOM

11785384	Muzzle Boresight Device (M26 for 105MM Gun Tube).
9364922	Test and Alignment Fixture for M26 MBD (105MM).

Packaging Data Sheet

P11785384	Packaging of Muzzle Boresight Device (M26 for 105MM Gun Tube).
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(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Fabrication. The MBD shall be manufactured in accordance with Drawing 11785384 and drawings pertaining thereto and, when assembled, shall meet the requirements of this specification.

3.2 General specification. The provisions of MIL-F-13926 apply.

3.2.1 Ambient conditions. Standard Ambient conditions shall be as follows:

- | | |
|-------------------------|-------------------------|
| a. Temperature | 73° ± 18° F |
| b. Relative humidity | 50 percent ± 30 percent |
| c. Atmospheric pressure | 28.5 + 2.0- 3.0 in. Hg. |

3.3 First article inspection. This specification contains technical provisions for first article inspection. Requirements for the submission of first article samples by the contractor shall be as specified in the contract.

3.4 Cleanliness.

a. Defects. There shall be no evidence of moisture, grease, condensates, fractures, and adhesive separations on any glass component when viewing either through the eyepiece or objective end.

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b. Dirt. When viewing through the eyepiece there shall be no more than three (3) particles of dirt or foreign material (classed as dirt) appearing within a 50 Mil diameter central field of view. There shall be no more than three dirt particles appearing outside the specified field of view. The angular separation between dirt particles shall be at least 15 Mils. Dirt particles smaller than 1/4 reticle dot width shall be ignored regardless of distribution. The size of any particle shall not exceed the apparent width of the reticle dot.

3.5 Performance.

3.5.1 Collimation. Collimation error shall not exceed 50 seconds.

3.5.2 Parallax. Maximum allowable parallax shall not exceed 10 seconds.

3.5.3 Collimation repeatability. The collimation repeatability error shall not exceed 30 seconds. All measurements must meet the collimation requirements of 3.5.1.

3.5.4 Transmission measurement. Transmission shall be 60 percent minimum when measured using a photopic filter.

3.5.5. Resolution measurement. The resolution of the system shall not exceed 8 seconds.

3.5.6. Eyepiece focus measurement. The eyepiece setting shall be -0.75 ± 0.25 diopters.

3.5.7. Magnification. The requirement for magnification is 7X plus or minus 0.14X.

3.5.8. Field of view, FOV. The FOV shall be 6 degrees minimum.

3.6 Purging. The MBD shall be purged with dry nitrogen for a period of time until it is determined that the dew point is at least -25 degrees F at atmospheric pressure. The unit shall be sealed immediately after purging.

3.7 Sealing. Care will be utilized to keep MBD internal atmosphere purged. The MBD shall show no evidence of leakage in excess of 0.1 PSI when subjected to an internal pressure of 5 PSIG plus or minus 0.1 PSI for a period of one hour. The interior atmosphere of the accepted MBD shall contain nitrogen having a dew point at least as low as minus 25°F at a pressure of between 0.25 and 0.50 PSIG.

3.8 Interchangeability verification. All MBD's shall be interchangeable (see 4.7.6.1).

3.9 Workmanship.

3.9.1 Optical inspection. The MBD shall be viewed with the unaided eye from the objective end against a background of approximately 300 foot candles. There shall be no cracks, chips or bond separation. When a focused target is viewed through the eyepiece end, there shall be no scratches, chips, dirt or coating deterioration which would be a distraction to the observer,

3.9.2 Mechanical inspection. The mechanical parts of the unit shall be inspected for broken parts, completeness, workmanship and functionability. The locating block shall be checked for freedom and smoothness of operation. Paint chips or nicks which do not affect the function of the instrument shall be touched up. All burrs and excess material shall be removed from castings and forgings. All surfaces, including threads, shall be free from burrs and sharp edges.

3.10 Environmental.

3.10.1 Storage temperature. The MBD shall show no evidence of cement separation, glass breakage or other physical failure and shall meet all the requirements of this specification at standard temperature (Plus 15 degrees C to 32 degrees C) after having been exposed and thermally stabilized at temperatures of plus 71 degrees C and minus 62 degrees C.

3.10.2 Operating temperatures. The MBD shall be mechanically operable while thermally stabilized at plus 65 degrees C and minus 40 degrees C. The rate of temperature change shall not exceed 10 degrees C/hour.

3.10.3 Vibration. The cased MBD shall be capable of withstanding vibration when subjected to Test Method 514.2 Procedure X, Curve AV, Equipment Category G of MIL-STD-810.

3.10.4 Shock. The MBD shall withstand shock in accordance with Test Method 516.2, Procedure I, Figure 516.2-2, time duration 11 milliseconds of MIL-STD-810. except that the peak acceleration shall be 40 g's.

3.10.5 Humidity. The MBD shall operate as specified herein at up to 100 percent relative humidity. (see 4.7.10.7)

3.10.6 Dust. The MBD shall operate as specified herein after exposure to moving dust for not less than 12 hours at velocities up to 1750 feet per minute. (see 4.7.10.8)

3.10.7 Salt fog. The MBD shall operate as specified herein after exposure to a 5 percent sodium chloride atomized spray for not less than 48 hours. (see 4.7.10.9)

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 General provisions. The component and subassembly inspection requirements of MIL-F-13926 form a part of the quality assurance provisions of this specification. Definitions of inspection terms shall be as listed in MIL-STD-109.

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

1. First article inspection (see 4.4).
2. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the quality assurance provisions of MIL-F-13926 and the conditions of 3.2.1.

4.4 First article. The requirement for first article approval and the designation of responsibility for first article inspection to either the Government or the contractor shall be specified in the contract.

4.4.1 Sample. The first article sample shall be three assemblies selected at random by the Government representative from the first 15 production assemblies.

4.4.2 Inspection. The sample shall be subjected to all the inspections specified in Table 1.

4.4.3 Failure. Failure of any assembly to meet any requirement shall be cause for refusal to grant first article approval. The Government reserves the right to terminate first article inspection upon any failure of any assembly to comply with any stated requirement.

4.4.4 Responsibility. The contractor, whether or not responsible, shall inspect the sample for conformance to all contractual

The Government

reserves the right to witness inspections performed by the contractor.

TABLE I. First article tests.

Item	Characteristic	Requirement	Test procedure
1	Fabrication	3.1	Applicable visual drawings
2	General specifications	3.2	MIL-F-13926 - Visual
3	Performance	3.5	4.7.4
4	Sealing	3.7	4.7.8
5	Shock	3.10.4	4.7.10.3
6	Vibration	3.10.3	4.7.10.2
7	High temperature	3.10.1 & 3.10.2	4.7.10.4
8	Low temperature	3.10.1 & 3.10.2	4.7.10.5
9	Temperature cycling	3.10.1 & 3.10.2	4.7.10.6
10	Humidity	3.10.5	4.7.10.7
11	Dust	3.10.6	4.7.10.8
12	Salt fog	3.10.7	4.7.10.9

4.5 Quality conformance inspection. Inspection plans A anti B of 4.5.1 and 4.5.2 shall apply.

4.5.1 Inspection plan A.

4.5.1.1 General sample and tests. One assembly, as a control sample, shall be selected at random by the Government representative from each 100 assemblies produced and shall be subjected to all the tests in Table III.

4.5.1.2 Environmental sample and tests. Two assemblies, as a control sample, shall be selected at random by the Government representative from each 100 assemblies produced or from each month's production, whichever occurs first. All the tests in Table IV shall be applied separately to each assembly in the sample.

4.5.1.3 Acceptance. Where any one assembly of either sample fails to meet any specified requirement, the lot shall be rejected. Rejected lots shall be subjected to the provisions of MIL-STD-105.

4.5.2 Inspection plan B.

4.5.2.1 Sample and tests. Each assembly in every lot shall be subjected to all the tests in Table II and shall be examined visually for completeness, improper assembly and evidence of poor workmanship.

4.5.2.2 Acceptance. Where any one assembly fails to meet any specified requirement, the defective assembly shall be removed from the lot and resubmitted only after all defects have been corrected.

4.5.3 Inspection equipment. Except as otherwise provided for by the contract, the contractor shall supply and maintain inspection equipment in accordance with the applicable requirements of MIL-I-45607.

4.5.4 Packaging inspection. The sampling and inspection of the preservation - packaging, packing and container marking shall be in accordance with the provisions of packaging data sheet P11785384.

4.6 Inspection provisions.

4.6.1 Submission of product. Unless otherwise specified by the contracting officer, inspection lot size, lot formation and presentation of lots shall be in accordance with "Submission of Product" provisions of MIL-STD-105.

4.7 Examination and tests.

4.7.1 Components and subassemblies. All components and subassemblies shall be inspected in accordance with the applicable Quality Assurance Provisions of MIL-F-13926.

4.7.2 Boresight collimator. Examination and tests herein shall be performed on a single defect (individual characteristics) basis in accordance with MIL-STD-105 and the sampling plans specified in Tables II and III herein. Examination and tests for packaging, packing and marking shall be in accordance with MIL-P-14232, Level B. Tables I, II, and III shall constitute the minimum inspection to be performed by the supplier prior to Government acceptance or rejection by item or lot.

4.7.3 Inspection characteristics.

4.7.3.1 100 Percent inspection. The following requirements and related tests shall be subjected to 100 percent inspection.

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TABLE II. Performance tests.

Item	Characteristic	Requirement	Test procedure
101	Collimation	3.5.1	4.7.4.1
102	Parallax	3.5.2	4.7.4.2
103	Repeatability/collimation	3.5.3	4.7.4.3.2
104	Resolution	3.5.5	4.7.4.5
105	Eyepiece focus	3.5.6	4.7.4.5
106	Optical inspection	3.9.1	4.7.5.2
107	Mechanical inspection	3.9.2	4.7.5.3
108	Interchangeability	3.8	4.7.6
109	Purging	3.6	4.7.7
110	Sealing	3.7	4.7.8

TABLE III. Classification of defects.

Class

Critical: None

Major: AQL 0.65% Defective

Item	Characteristic	Requirement	Test procedure
201	Magnification	3.5.7	4.7.4.6
202	Field of view, FOV	3.5.8	4.7.4.7
203	Transmission	3.5.4	4.7.4.4

Minor: None

Note: Tests in Table II and III shall be conducted at a temperature between 15 degrees C and 32 degrees C, ambient temperatures.

TABLE IV. Environmental tests.

Item	Characteristic	Requirement	Test procedure
301	Storage temperature	3.10.1	4.7.10.1
302	Operating temperature	3.10.2	4.7.10.1
303	Vibration	3.10.3	4.7.10.2
304	Shock	3.10.4	4.7.10.3
305	High temperature	3.10.1 and 3.10.2	4.7.10.4
306	Low temperature	3.10.1 and 3.10.2	4.7.10.5
307	Temperature cycling	3.10.1 and 3.10.2	4.7.10.6

4.7.4 Performance tests.

4.7.4.1 Collimation test method. Collimation error shall be measured by viewing through the eyepiece of the MBD and comparing the coincidence of the reticle boresight reference to the projected reticle image of the Collimation/Parallax test fixture. The accuracy is determined by comparing the MBD reticle reference point to the projected reticle pattern. Collimation is met when collimation error is within 50 seconds.

4.7.4.2 Parallax test method. Parallax shall be measured by viewing through the eyepiece of the MBD and observing the apparent displacement between the MBD reticle and the projected reticle image of the Collimation/Parallax test fixture as the observer moves his eye from side to side or up and down. The accuracy is determined by comparing the displacement to the reticle pattern marking. Maximum allowable parallax error is 10 seconds.

4.7.4.3 Repeatability/collimation.

4.7.4.3.1 Repeatability/collimation test fixture. The collimation/parallax test fixture or gun tube is to be used for the image repeatability test.

4.7.4.3.2 Repeatability/collimation measurement. The collimation error is noted with the MBD inserted in the Collimation/Parallax Test Fixture. Unit will be withdrawn then reinserted into gun tube or test fixture. The collimation error is noted and compared to the initial reading. Repeatability within 30 seconds is acceptable. Both measurements must meet the collimation requirement of 3.5.1.

4.7.4.4 Transmission.

4.7.4.4.1 Transmission test fixture. The test fixture consists of a light source and intergrating sphere, mount and calibrated telephotometer.

4.7.4.4.2 Transmission measurement. The telephotometer is set to view the light emitted from the light source and normalized. Light from the light source is back lighted through the eyepiece of the MBD. When the MBD is placed in the light path it shall be positioned so that light exit of the light source is at the focal point of the MBD's eyepiece. The telephotometer is moved to view the objective of the MBD and the transmission is measured. Transmission shall be 60 percent minimum when utilizing a photopic filter.

4.7.4.5 Resolution/eyepiece focus measurements.

4.7.4.5.1 Resolution/eyepiece focus test equipment. A four (4) quadrant eight (8) second pattern on the collimator reticle must be discernable when viewed through the eyepiece of the MBD with the aid of a dioptometer.

4.7.4.5.2 Resolution/eyepiece focus measurement. A dioptometer setting of -0.75 plus or minus 0.25 diopters must register when best focus of the reticle is obtained when viewed through the eyepiece with the aid of a dioptometer.

4.7.4.6 Magnification. The magnification is measured by dividing the objective clear aperture, or entrance pupil, by the diameter of the exit pupil. The exit pupil diameter is measured with a calibrated dinameter. The requirement for magnification is $7X$ plus or minus $0.14X$.

4.7.4.7 Field of view, FOV. The FOV is measured by observing the minimum separation, S , on a target at a distance, D , from the MBD. $FOV = 2 \text{ arc tan } (S/2D)$.

4.7.5 Mechanical.

4.7.5.1 Optical/mechanical workmanship.

4.7.5.2 Optical/inspection. The MBD shall be viewed with the naked eye from the objective end against a background of approximately 300 foot candles. There shall be no cracks, chips or bond separation. When a focused target is viewed through the eyepiece end, there shall be no scratches, chips, dirt or coating deterioration which would be a distraction to the observer. The presence of an anti-reflective coating, where required, shall be verified during in-process inspection.

4.7.5.3 Mechanical inspection. The mechanical parts of the MBD shall be inspected for broken parts, completeness, workmanship and functionability. The locating block shall be checked for freedom and smoothness of operation. Paint chips or nicks which do not effect the function of the instrument shall be touched up. All burrs and excess material shall be removed from castings and forgings. All surfaces including threads, shall be free from burrs and sharp edges.

4.7.6 Interchangeability.

4.7.6.1 Interchangeability fixture. The ability to insert the MBD into the test fixture P/N 9364922 barrel or gun tube confirms the interchangeability of the device.

4.7.7 Purging. This portion of the test shall be performed utilizing dew point tester, type 7000 or equivalent. The MBD shall be purged with dry nitrogen for a period of time until it is determined that the dew point is at least -25 degrees at atmospheric pressure. Suitable valve adapters shall be used to facilitate this test. The unit shall be sealed immediately after purging.

4.7.8 Sealing. This test shall be performed utilizing a suitably calibrated pressure gage. Suitable valve adapters shall be used to facilitate the test. Care will be utilized to keep the MBD internal atmosphere purged. The MBD shall be pressurized with dry nitrogen to 5 plus or minus .1 psi for a minimum of one hour. There shall be no evidence of leakage in excess of 0.1 psi. Prior to shipment the unit will be sealed at a pressure of between 0.25 and 0.50 PSIG.

4.7.9 Environmental sampling. Three MBD's shall be selected at random from each 50 produced, or from each months production, whichever occurs first. Each sample shall meet the requirements and tests in Table IV.

4.7.10 Test methods and procedures.

Note: Prior to environmental, the MBD shall have met the examination and tests in Table II.

4.7.10.1 Storage and operating temperature. The test equipment utilized in this test shall be in accordance with "Test Facilities*" requirements of MIL-F-13926. The uncased MBD shall be placed in the test chamber and the temperature of the test chamber raised gradually (rate of temperature change in the test chamber shall not exceed 10 degrees C per hour throughout the temperature cycling test) to 65 degrees C. The MBD shall remain at this temperature for a minimum of three hours. At the completion of this period and while at 65 degrees C, the MBD locating block shall be depressed three times and observed to return to its original position each time. Upon completion of this test, the temperature of the test chamber shall be gradually raised (see above rate of temperature change) to 71 degrees C.

The MBD shall remain at this temperature for a minimum period of three hours. The temperature of the chamber shall be gradually reduced (see above rate of temperature change) to minus 40 degrees C. The MBD shall remain at this temperature for a minimum of three hours.

At the completion of this period and while at minus 40 degrees C, the MBD locating block shall be depressed three times and observed to return to its original position each time. Failure of the locating block to return to its original position at the operating temperature minus 40 degrees C and plus 65 degrees C constitutes failure of the test. Upon completion of this test the temperature of the test chamber shall be gradually reduced (see above rate of temperature change) to minus 62 degrees C. The MBD shall remain at this temperature for a minimum period of three hours.

The temperature chamber shall be gradually raised (see above rate of temperature change) to ambient temperature plus 15 degrees to plus 32 degrees C. Note: Tolerance on constant temperature is plus or minus 2.8 degrees C. The MBD shall be removed and subjected to the examination and tests in Table II.

4.7.10.2 Vibration (secured cargo). The cased MBD shall be vibrated in accordance with Test Method 514.2, Procedure X, Curve AV, Equipment Category G of MIL-STD-810, Vibration shall be applied along each of three mutually perpendicular axes of the MBD. Vibrating equipment capable of providing the test level and frequency ranges specified in the above test method shall be utilized for this test. Unless otherwise specified, the test equipment shall be in accordance with the "Test Facilities" requirements of MIL-F-13926. The MBD shall be removed and subjected to the examination and tests in Table II.

4.7.10.3 Shock. The MBD shall be shocked in accordance with Test Method 516.2, procedure I, Figure 516.2-2, time duration 11 milliseconds, of MIL-STD-810, except that the peak acceleration shall be 40 g's. The MBD shall be removed from the shock fixture and subjected to the examination and tests in Table II.

4.7.10.4 High temperature. Subject the MBD to the high temperature test specified in MIL-STD-810. Method 501.1, Procedure I. The highest operating temperature shall be plus 71 degrees C. The performance tests of Table II shall be applied.

4.7.10.5 Low temperature. Subject the MBD to the Low temperature test specified in MIL-STD-810 Method 502.1, Procedure I. The storage temperature shall be minus 62 degrees C. The lowest operating temperature shall be minus 40 degrees C. The performance tests of Table II shall be applied.

4.7.10.6 Temperature cycling. The rate of temperature change in the test chamber shall not exceed 10 degrees C per hour throughout the temperature cycling test of 4.7.10.1. The performance tests of Table II shall be applied.

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4.7.10.7 Humidity. Place the MBD in a humidity chamber and subject it to the humidity test specified in MIL-STD-810, Method 507.1, Procedure IV. During steps 4, 6 and 8 of Procedure IV, subject the MBD to the performance tests of 4.74. After exposure, subject the assembly to the performance tests of Table II.

4.7.10.8 Dust. Subject the MBD to the dust test specified in MIL-STD-810, Method 509.1, Procedure I. At the conclusion of this test, subject the MBD to the performance tests of Table II.

4.7.10.9 Salt fog. Subject the MBD to the corrosion test specified in MIL-STD-810, Method 509.1, Procedure I. At the conclusion of this test, subject the MBD to the performance tests of Table II.

5. PACKAGING

5.1 Packaging, packing and marking. Packaging, packing and marking shall be in accordance with Packaging Data Sheet P11785384. The level of protection shall be as specified in the procurement document (see 4.1.3).

6. NOTES

6.1 Intended use. The MBD 11785384 is specifically used for precise sight alignment facilities required by modern high performance gun barrels.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and data of this specification.
- b. Selection of applicable levels of preservation, packaging and packing.
- c. Applicable packaging data (see 5.1)
- d. Applicable stock number.
- e. Provisions for first article testing.

Custodian:

Army - AR

Preparing Activity:

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(Project 1240-A836)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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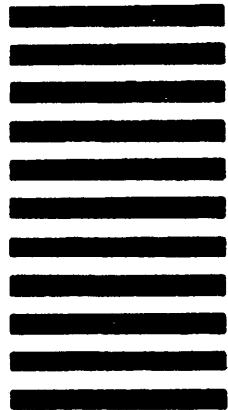
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

MTL-M-70542

2. DOCUMENT TITLE

MUZZLE BORESIGHT DEVICE 11785384 (M26 FOR 105MM GUN TUBE)

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)