

INCH-POUND

MIL-T-82833(OS)
5 February 1990
SUPERSEDING
WS 22377
30 January 1985
(See 6.6)

MILITARY SPECIFICATION

TUNGSTEN, THORIATED, TWO PERCENT, FORGED AND CUPPED

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

1. SCOPE

1.1 Scope. This specification covers one type of forged and cupped two percent thoriated tungsten, referred to herein as the forging, for use in rocket motors.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

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, Standardization Branch (3730), Indian Head, MD 20640-5000, by using the self-addressed Standardization document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1340

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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STANDARDS

MILITARY

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-2154	Inspection, Ultrasonic, Wrought Metals, Process for

(Unless otherwise indicated, copies of federal and military specifications and standards are available from: Military Specifications and Standards, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094).

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS (CFRs)

49 CFR 100-199	Transportation
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(Application for copies of CFRs should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-0001.)

NAVAL SEA SYSTEMS COMMAND (CAGE Code 10001)

WR-43	Preparation of Quality Assurance Provisions (Including Classification of Characteristics)
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(Copies of WR-43 are available from the Commanding Officer, Naval Publications and Forms Center, Attn: 1053, 5801 Tabor Avenue, Philadelphia, PA 19120-5094).

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 8	Tension Testing of Metallic Materials (DoD adopted)
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials (DoD adopted)
ASTM E 112	Determining Average Grain Size (DoD adopted)

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(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

AMERICAN TRUCKING ASSOCIATION, INC.

National Motor Freight Classification

(Application for copies should be addressed to the American Trucking Association, Inc., Attn: Traffic Dept., 2200 Mill Road, Alexandria, VA 22314-4677.)

NATIONAL RAILROAD FREIGHT COMMITTEE

Uniform Freight Classification (UFC) 6000

(Application for copies should be addressed to the National Railroad Freight Committee, 222 South Riverside Plaza, Suite 1106, Chicago, IL 60606-5945.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample of the forging shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Material. The forging shall be manufactured from billets which have been isostatically pressed, utilizing hydrogen reduced tungsten powder and high temperature sintering. The minimum density of the as-sintered billets shall be not less than 17.8 grams per cubic centimeter (g/cc) (see 6.2).

3.2.1 Chemical and mechanical properties.

3.2.1.1 Chemical properties. The chemical properties of the preforged billets shall be in accordance with table I (see 6.2).

3.2.1.2 Mechanical properties. Sufficient working shall be applied to ensure that a wrought metal structure is obtained throughout the cross sectional area. Mechanical properties of the forgings shall be in accordance with table II. Individual and average values shall be recorded (see 6.2 and 6.3).

3.3 Product characteristics.

3.3.1 Internal defects. The forging shall have no defects or discontinuities which impair the quality of the forgings. Limits of acceptability of the forgings shall be Class AA in accordance with MIL-STD-2154 (see 6.2).

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TABLE I. Chemical properties.

Property	Limits	
	Minimum	Maximum
Tungsten, percent by weight	97.70	
Thoria, (thorium oxide), percent by weight	1.80	2.20
Carbon, percent by weight		0.005
Trace elements, total percent by weight		0.080

TABLE II. Mechanical properties.

Property	Limits	
	Minimum	Maximum
Density, g/cc at 20 degrees Celsius (°C)	18.5	19.2
Hardness, Rockwell C	35.5	44.5
Tensile stress at 0.2 percent offset, pounds per square inch (PSI) at 480 ± 10°C		
a. Hoop	44000 <u>1/</u>	
b. Axial	45950 <u>2/</u>	
Tensile strength, PSI at 480 ± 10°C		
a. Hoop	55650 <u>1/</u>	
b. Axial	57750 <u>2/</u>	
Elongation, percent at 480 ± 10°C		
a. Hoop	12.0 <u>1/</u>	
b. Axial	12.0 <u>2/</u>	

1/ Test properties are for the average of three tensile specimens removed from the forging in the hoop direction (see figure 1).

2/ Test properties are for the average of three tensile specimens removed from the forging in the axial direction (see figure 1).

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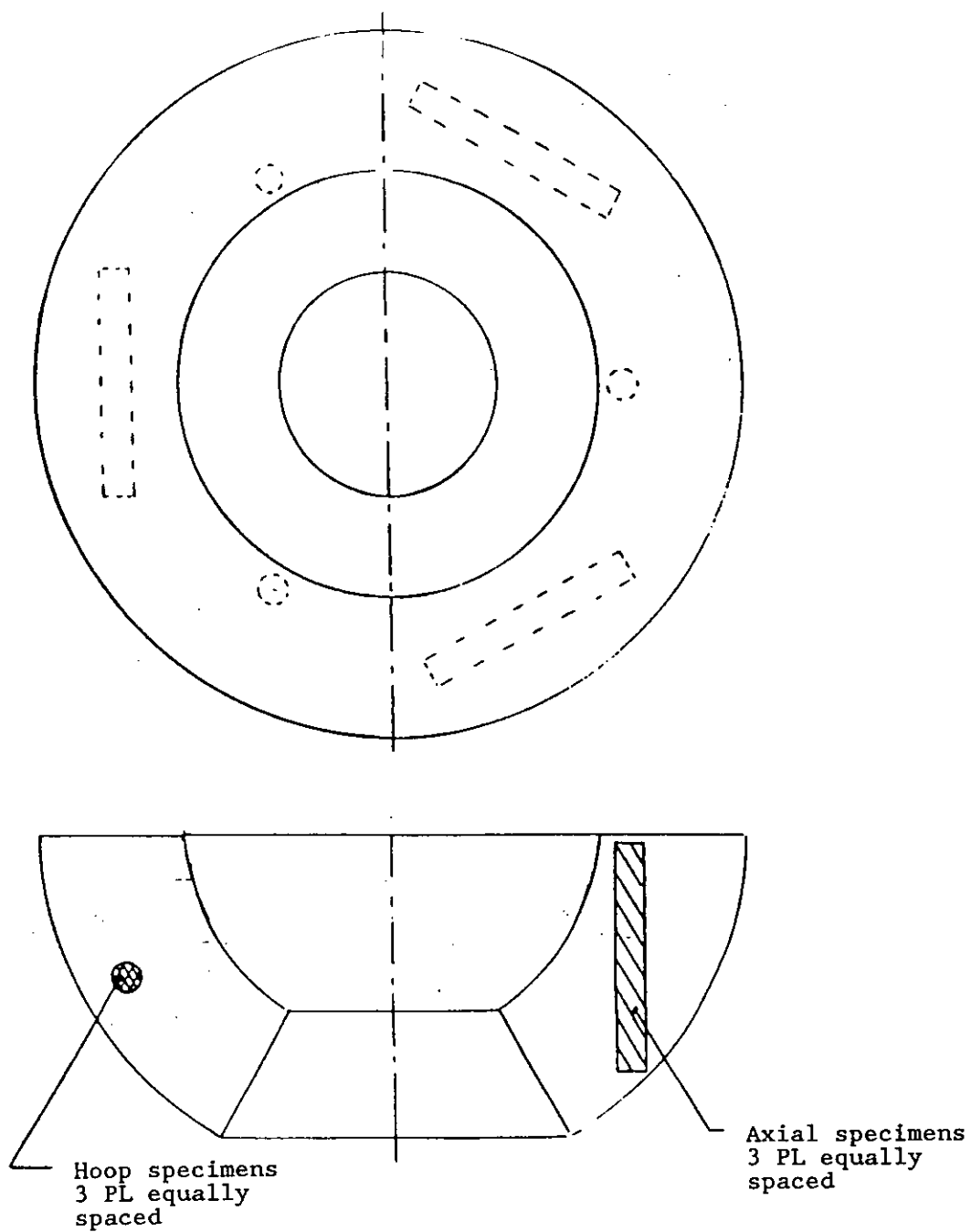


FIGURE 1. Test specimen locations.

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3.3.2 Stress relief. The forgings shall be supplied in a stress relieved condition. Stress relief for each powder blend shall be conducted at the temperature and time not to exceed the onset of recrystallization, as determined by metallographic examination (see 6.2).

3.3.2.1 Grain size. Grain size in the radial longitudinal plane shall not be greater than ASTM micro-grain size 7 as specified in ASTM E 112 (see 6.2).

3.4 Defects. The forging shall be free of cracks, laps, seams, or tears (see 6.2).

3.5 Workmanship. Workmanship shall be such that the forgings are uniform in quality and condition, clean, sound, and free from foreign materials or surface imperfections detrimental to fabrication or to performance of parts.

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 (examinations and tests) 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of the quality conformance inspection (see 4.4). Failure to meet all of the

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requirements specified herein shall be cause for rejection of the first article sample.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examination and tests specified in table III.

TABLE III. Quality conformance inspection.

Examination and Tests	Requirement	Test Method
Visual examination	3.5, and section 5	4.5.1
Chemical composition	3.2.1.1	4.5.2
Density	3.2.1.2	4.5.3
Hardness	3.2.1.2	4.5.4
Tensile strength and elongation (hoop and axial)	3.2.1.2	4.5.5
Internal defects	3.3.1	4.5.6
Grain size	3.3.2.1	4.5.7

4.4.1 Sampling for inspection.

4.4.1.1 Lot. A lot shall consist of a maximum of 12 forgings which are manufactured from billets made from a single powder blend and stress equalized using the same process.

4.4.1.2 Selection of samples. Samples of the forging shall be selected at random from each lot for the inspections specified in 4.5.1 through 4.5.4.

4.4.1.3 Sample material. Sufficient material shall be selected at random from each sample to perform all of the inspections specified in 4.5.1 through 4.5.4.

4.4.1.4 Noncompliance of samples. Failure of one or more of the sample of material to meet all of the specified requirements shall be cause for rejection of the lot.

4.4.2 Density, hardness and internal defects. Each forging shall be tested for density, hardness and internal defects.

4.4.3 Chemical composition, tensile properties and grain structure. The chemical composition of the powder blend for each lot of forgings shall be

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determined. One forging from each lot shall be sectioned and tested for tensile properties and examined for grain structure.

4.4.4 Classification of characteristics. The characteristics verified by tests and examinations herein are classified as Critical, Major or Minor in accordance with WR-43. Tests and examinations that verify critical characteristics shall be identified by the symbol (C), and major characteristics shall be identified by the symbol (M). The number following the classification symbol indicates the serial number of the test or examination. When the classification does not apply to the complete paragraph, the portion to which the classification is applicable is enclosed in brackets. Tests and examinations which are not annotated with a classification code shall be classified minor.

4.5 Inspection methods. The following inspection methods shall be used. Unless otherwise specified in the method, all weights, volumes, temperatures, and times shall be measured to the nearest specified unit or decimal.

NOTE: Reagent grade chemicals shall be used for chemical reactions in the conduct of all tests defined herein. Solvents and indicators may be commercial nonreagent grade materials.

4.5.1 Visual examination. All containers shall be visually examined for conformance to section 5. All forgings shall be visually examined for conformance to 3.5.

4.5.2 Chemical composition. (M101) The chemical composition of each powder blend used to produce a lot of forgings shall be analyzed by spectrographic analysis.

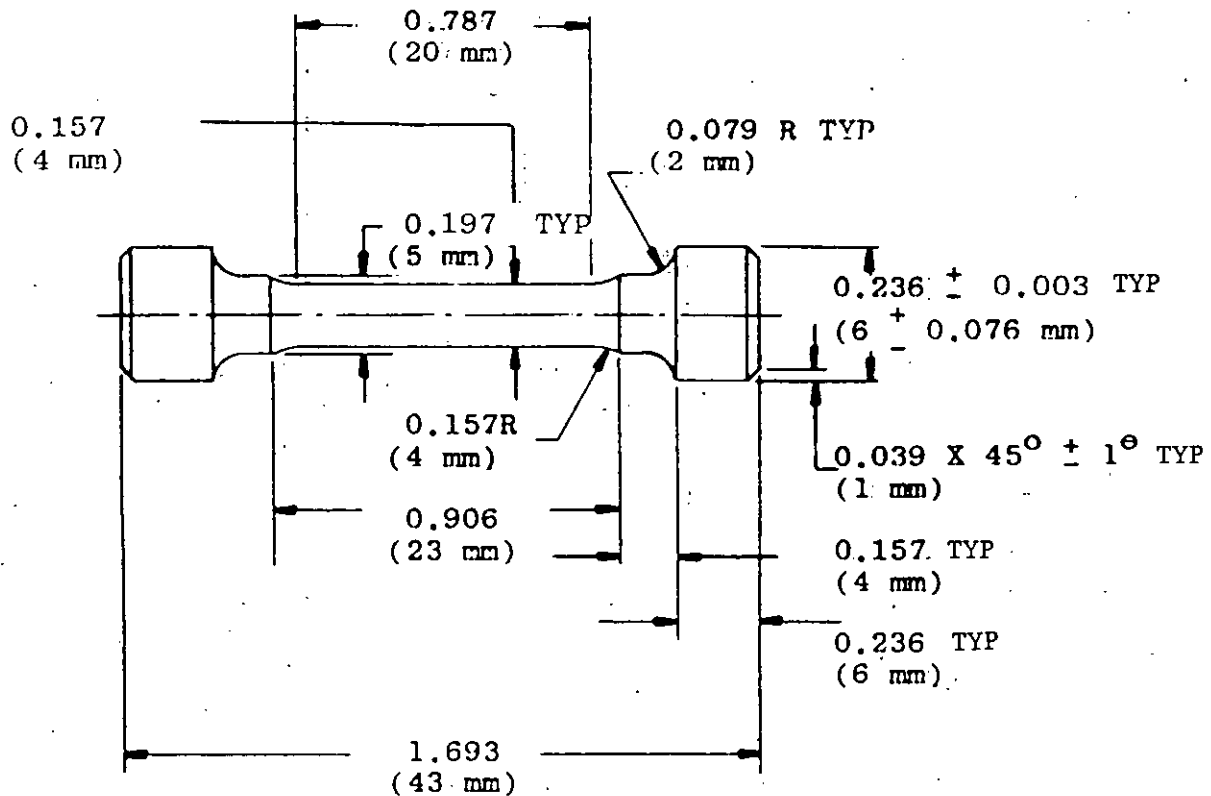
4.5.3 Density. (M102) Density shall be measured by the water or mercury immersion method.

4.5.4 Hardness. (M103) Tests for hardness shall be in accordance with ASTM E 18. The individual forging shall be acceptable if the average of three readings meets the requirements specified herein.

4.5.5 Tensile strength and elongation. (M104) One forging from each lot shall be tested for tensile strength (hoop and axial). Three specimens shall be tested. The lot shall be acceptable if the average of the three tests meets the requirements specified herein. Tensile testing shall be in accordance with the following:

- a. Tensile tests shall be in accordance with ASTM E 8.
- b. Tensile specimens shall conform to figure 2. Alternate specimen styles are acceptable provided the gage area dimensions conform to the 0.157 inch diameter by 0.787 inch length within applicable tolerances.
- c. The test shall be conducted at $480 \pm 10^{\circ}\text{C}$.

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Tolerance ± 0.005 (± 0.127 mm) except as noted.

All dimensions are in inches except as noted.

Metric dimensions are in parentheses.

FIGURE 2. Tensile test sample configuration.

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- d. The strain rate shall be 0.003 - 0.007 inch-per-inch-per-minute to the 0.2 percent offset yield strength and then at a crosshead speed of 0.05 inch-per-inch-per-minute to failure.
- e. The location of the test specimen shall be as shown on figure 1.

4.5.6 **Internal defects.** The forgings shall be ultrasonically inspected in accordance with MIL-STD-2154.

4.5.7 **Grain structure.** The grain structure of the forging, which is sectioned for tensile properties, shall be microscopically photographed (see 6.3).

5. **PACKAGING**

5.1 **Packaging.** Unless otherwise specified in the contract or order (see 6.2), packaging shall be level C as specified herein.

5.1.1 **Level C.** The forging shall be packaged to afford adequate protection against loss, contamination, deterioration, and damage during shipment from the supply source to the first receiving activity. Containers in the same shipment shall be of the same size. The packaging shall conform to UFC 6000, National Motor Freight Classification, 49 CFR 171-178, or to other rules and regulations as applicable to the mode of transportation.

5.2 **Marking.**

5.2.1 **Standard marking.** In addition to the marking requirements required by the contract or order (see 6.2), interior and exterior containers shall be marked in accordance with MIL-STD-129.

5.2.2 **Special marking.** In addition to the marking requirements of 5.2.1, each container marking shall include the following information:

- a. Title, number and date of this specification.
- b. Manufacturer's name and address.
- c. Container identification number.
- d. Purchase document number.
- e. Contractor's name, lot number and material name.

6. **NOTES**

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

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6.1 Intended use. The forging specified herein is intended for use in the Standard Missile Mk 104 Dual Thrust Rocket Motor.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- c. Whether first article inspection is required (see 3.1 and 6.3).
- d. DOD FAR 52.246-15 (see 3.2, 3.2.1.1, 3.2.1.2, 3.3.1, 3.3.2, 3.3.2.1 and 3.4).
- e. Special marking if other than as specified in 5.2.2.
- f. Forging size and quantity.

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>
3.2.1.2	DI-T-2072	Test Reports
4.5.7	UDI-A-20174	Photographic Requirements

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production item, a sample selected from the first production items or a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition for first articles.

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Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Subject term (key word) listing.

Rocket Motor, Dual Thrust, Mk 104
Standard Missile

6.6 Supersedure information. MIL-T-82833 incorporates the following engineering change proposal (ECP) and notice of revision (NOR):

ECPNOR

MTA064 (5/24/88)

MTA064.1 (5/24/88)

Preparing Activity
NAVY-OS
(Project 1340-N807)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-T-82833	2. DOCUMENT DATE (YYMMDD) 5 February 1990
3. DOCUMENT TITLE TUNGSTEN, THORIATED, TWO PERCENT, FORGED AND CUPPED		
4. NATURE OF CHANGE <i>(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)</i>		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
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) AUTOVON <i>(If applicable)</i>	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY NAVAL ORDNANCE STATION (CODE 3730) INDIAN HEAD, MD 20640-5000		
a. NAME	b. TELEPHONE <i>(Include Area Code)</i> (1) Commercial	(2) AUTOVON
c. ADDRESS <i>(Include Zip Code)</i>	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	