

MIL-R-5632B

31 August 1972

SUPERSEDING**MIL-R-5632A**

20 April 1964

MILITARY SPECIFICATION**RODS AND WIRE, STEEL, WELDING
(FOR AIRCRAFT APPLICATIONS)**

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 **Scope.** This specification covers the requirements for bare filler rods and wire of low-alloy aircraft steels suitable for use with gas and arc welding processes.

1.2 **Classification.** Filler rods and wire shall be of the following types, as specified (see 6.2):

Type	For Welding Alloy Steels of	Type	For Welding Alloy Steels of
I	4130, 4115, 41XX alloys, etc.	V	8740, 8720, 8735, 87XX alloys, etc.
II	4140, 4135, 4137, 4150, 41XX alloys, etc.	VI	6130, 6150, 61XX alloys, etc.
III	4340, 4335 V, 4330 Si, 4330 V, 43XX alloys, etc.	VII	17-22 A (S), 17-22 A (V), etc.
IV	8630, 8615, 8620, 8650, 8660, 86XX alloys, etc.	VIII	D 6 AC, etc.

FSC 3439

MIL-R-5632B

2. APPLICABLE DOCUMENTS

2.1 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

Federal

QQ-S-626 Steel, Alloy, Plate

QQ-S-627 Steel, Alloy, Sheet and Strip, Hot Rolled

Military

MIL-T-5021 Tests; Aircraft and Missile Welding Operator's, Qualification

MIL-S-5626 Steel; Chrome - Molybdenum (4140) Bars, Rods, and Forging Stock (For Aerospace Practice)

MIL-I-6868 Inspection Process, Magnetic Particle

MIL-H-6875 Heat Treatment of Steels (Aircraft Practice, Process for)

MIL-S-7809 Steel, Low Alloy, High Strength, Plate, Sheet, and Strip (For Aircraft Applications)

MIL-S-8949 Steel Bars, Plates, Sheets, Billets and Reforging Stock Type D6AC

MIL-W-10430 Welding Rods and Electrodes, Preparation for Delivery of

MIL-S-18728 Steel Plate, Sheet, and Strip, Alloy, 8630, Aircraft Quality

MIL-S-18729 Steel Plate, Sheet, and Strip, Alloy, 4130, Aircraft Quality

MIL-S-18731 Steel, Alloy, Sheet and Strip, (6150), Aircraft Quality

STANDARDS

Federal

Fed. Test Method Metals; Test Methods
Std. No. 151

Military

MIL-STD-105 Sampling Procedures and Tables for Inspection
by Attributes

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-248 Qualification Tests for Welders (Other Than
Aircraft Weldments)

MIL-STD-418 Mechanical Tests for Welded Joints

MIL-STD-453 Inspection, Radiographic

MIL-STD-779 Reference Radiographs for Steel Welds, Volumes 1
and 2

(Copies of specifications, standards, drawings, and publications required by suppliers 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 documents form 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.

Society of Automotive Engineers Publications

AMS 6350 Steel Sheet, Strip, and Plate 0.95 Cr, 0.20 Mo
(0.28-0.33C) (SAE 4130)

AMS 6351 Steel, Plate, Sheet, and Strip 0.95 Cr, 0.20 Mo
(0.28-0.33C) (SAE 4130) Spheroidized

AMS 6358 Steel Sheet and Strip, 0.55 Ni, 0.5 Cr, 0.25 Mo
(0.38-0.43C) (SAE 8740)

AMS 6359 Steel Sheet and Strip, 1.8 Ni, 0.8 Cr, 0.25 Mo
(0.38-0.43C) (SAE 4340)

MIL-R-5632B

Society of Automotive Engineers Publications (Continued)

AMS 6385	Steel Sheet, Strip and Plate, Low Alloy, Heat Resistant 0.65 Si, 1.25 Cr, 0.50 Mo, 0.25 V (0.27-0.33C)
AMS 6434	Steel Sheet, Strip, and Plate, 0.80 Cr, 1.8 Ni, 0.35 Mo, 0.20 V (0.31-0.38C)
AMS 6436	Steel Sheet, Strip, and Plate, Low Alloy, Heat Resistant, 0.65 Si, 1.25 Cr, 0.50 Mo, 0.85 V (0.20-0.25C)
AMS 6438	Steel Sheet, Strip, and Plate, 1.05 Cr, 0.55 Ni, 1.0 Mo, 0.11 V (0.45-0.50C) Premium Quality, Consumable Electrode Melted
AMS 6455	Steel Sheet, Strip, and Plate, 0.95 Cr, 0.22 V (0.48-0.53C) (SAE 6150)

(Application for copies should be addressed to the Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, N. Y. 10001.)

American Society for Testing and Materials Publications

ASTM A370	Standard Methods and Definitions for Mechanical Testing of Steel Products
ASTM E 8	Standard Method of Tension Testing of Metallic Materials
ASTM E 23	Standard Methods for Notched Bar Impact Testing of Metallic Materials

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

American Welding Society Publication

AWS 3.0	Welding Terms and Definitions
---------	-------------------------------

(Application for copies should be addressed to the American Welding Society, 2501 N. W. 7th Street, Miami, Florida 33125.)

American National Standards Institute Publication

ANSI Z49.1

Safety in Welding and Cutting

(Application for copies should be addressed to either the American National Standards Institute 1430 Broadway, New York, N. Y. 10018 or the American Welding Society, 2501 N. W. 7th Street, Miami, Florida 33125.)

3. REQUIREMENTS

3.1 First article. The welding rods and wire furnished under this specification shall be a product(s) which has been inspected and has passed the first article inspection specified herein (see 4.5 and 6.2).

3.2 Material. The steel for welding rods and wire shall be of a uniform quality and condition and shall be free from piping, segregations, inclusions and other defects which will affect the weldability or the properties of the deposited material.

3.3 Chemical composition. Unless otherwise specified, the chemical compositions of the rods and wire shall be such that the deposited weld metal will match the analysis or the heat-treating characteristics of the low alloy steels (see 6.2). Unless otherwise specified, the rods and wire shall contain 0.015 percent phosphorous maximum and 0.018 percent sulphur maximum. The filler metal shall have a carbon content somewhat lower, approximately 0.06 percent, than normally specified for the alloy steel to be welded.

3.4 Form. Materials shall be furnished in straight lengths as rods or as wire in coils or wound on spools, as specified (see 6.2).

3.4.1 Size. Welding rods and wire shall be furnished in the diameter shown in Table I as specified (see 6.2). Individual determinations of diameters shall not vary from the specified nominal diameter by more than ± 0.003 inch for rods and by more than ± 0.001 inch for wire. Burrs on cut wire may exceed the maximum permissible wire diameter by 0.002 inch.

3.4.2 Length. Unless otherwise specified (see 6.2), rods shall be 36 $\pm 1/4$ inches long. Wire furnished in coil or wound on spools shall be one continuous length.

3.4.3 Weight. Welding rods and wire shall be furnished in the weights shown in Table I as specified (see 6.2). The net weight of the rods or wire shall not vary from the specified weight by more than ± 10 percent.

3.5 Spoiled wire.

MIL-R-5632B

3.5.1 Layer winding. Spooled wire shall be continuous and closely wound in layers in such a manner that kinks, waves and sharp bends are avoided. The wire shall be free to unwind without restrictions caused by overlapping, wedging, tangling and bumping. Adjacent turns within a layer need not be touching. The outer end of spooled wire shall be readily located.

Table I. Form, Standard Size and Weight

Form	Specified Nominal Diameter, Inches	Weight, Pounds
Rod	0.045, 0.062, 0.094, 0.125	5, 10, 25 and 50
Wire in coils	0.030, 0.035, 0.045, 0.062, 0.094, 0.125	25, 50 and 65
Wire on spools	0.015, 0.020, 0.030, 0.035, 0.045, 0.062	1
	0.030, 0.035, 0.045, 0.062, 0.094, 0.125	5, 10, 20, 25, and 35

3.5.2 Cast. The cast of spooled wire shall be such as to have imparted to the wire a curvature such that specimen sufficient in length to form one loop when cut therefrom and tested in accordance with 4.6.2.5 shall form an unrestrained circle not less than 20 inches and not greater than 36 inches in diameter.

3.5.3 Helix. The helix of spooled wire shall be such as to have imparted to the wire a curvature such that a specimen sufficient in length to form one loop when cut therefrom and placed on a flat surface shall form an unrestrained circle with a vertical separation not greater than 4 inches between the overlapped ends (see 4.6.2.6).

3.6 Usability. Rods and wire shall be suitable for producing sound, dense weld deposits that are reasonably smooth and free from defects, such as undercutting, overlapping, lack of fusion, slag inclusion, porosity and cracks, when used with recommended welding processes and preheated where required or when specified. Welding rods and wire shall be capable of depositing single bead fillets with complete fusion and root penetration. Weld deposits shall be compatible with the parts to be welded.

3.6.1 Welding processes. Rods and wire shall be tested as to their suitability for use with the following processes:

- a. Gas welding by oxy-acetylene (OAW)
- b. Gas shielded tungsten-arc welding (GTAW)

c. Gas shielded metal-arc welding (GMAW)

d. Plasma arc welding (PAW)

Rods and wire not capable of producing satisfactory welds with all of these processes shall be restricted to usable welding process(es).

3.7 Mechanical properties of weld deposition.

3.7.1 Compatibility with base metal. Weld deposited on the indicated base metal (see Table III) shall exhibit mechanical properties that shall be within the limits of Table II after heat treatment when the specimens are prepared and tested in accordance with 4.7.3.1, 4.7.3.2 and 4.7.4.

Table II. Mechanical Properties

Filler Metal Types	Properties			
	Ultimate Tensile Strength-KSI	Yield Strength 0.2% Offset, Minimum-KSI	Elongation, 4 X Dia. Minimum-Percent	Charpy Impact Values Ft-Lbs, 0°F Minimum average
I, IV, VI and VII	125 to 145	100	11.0	47.0
	150 to 170	120	8.0	28.0
	180 to 200	145	6.0	15.0
II and V	125 to 145	100	11.0	47.0
	150 to 170	120	8.0	28.0
	180 to 200	145	6.0	15.0
	200 to 220	160	5.0	8.0
III	150 to 170	120	8.0	25.0
	180 to 200	145	6.0	12.0
	200 to 220	160	5.0	8.0
	260 to 280 ^{1/}	200	4.0	6.0
VIII	220 to 240 ^{2/}	190	12.0	7.0
	260 to 280 ^{2/}	220	9.0	6.0

^{1/} Tensile specimens with ultra high strength Type III weld deposits shall be austenitized at 1475 to 1525°F and tempered at 475°F.

^{2/} Tensile specimens with ultra high strength Type VIII weld deposits shall be austenitized at 1625 to 1675°F and tempered at 1000°F for the lower tensile range and at 500°F for the highest tensile range.

MIL-R-5632B

3.7.2 Tensile strength of welded joints. Tensile specimens prepared from weld deposits shall be heat treated in accordance with MIL-H-6875. They shall conform to the mechanical properties of Table II except that the yield strength and elongation requirements are not applicable to transverse weld specimens (see 4.7.3.1). Tensile specimens prepared from weld deposits made in the 220 to 280 KSI range shall be heat treated in accordance with Notes 1 and 2 of Table II.

3.8 Identification. Rods may be identified by tagging each 5- or 10-pounds of the particular type and diameter rather than by incised marking rolls or by imprinting. A metal tag, stamped or embossed with the type and diameter designation shall be securely wired to each coil of wire in lieu of stamping or imprinting the ends of wire. The spools used for wire shall conform to MIL-W-10430. The type and diameter size shall appear on the flange of the spool so as to be visible when the spool is positioned on the machine for welding. Such identification shall be placed in a manner that is not readily removable.

3.9 Finish. Welding rods and wire shall have clean surfaces, with no stains, discolorations, rust, scale, oxides, dirt, smut, die lubricants or other external defects. They shall be free from splices, slivers, laps, cracks, bursts, blisters, pitting, pipes and segregations, inclusions or other irregularities which will affect the welding characteristics, the operation of welding equipment or the properties of the deposited weld metal. As specified (sec 6.2), rod and wire shall be furnished bare or with a flash copper or copper-gold coating.

3.10 Workmanship. Rods and wire shall be uniform in composition, quality, size, true to form, smooth and free from scabs, blisters, pock-marks, bruises and other injurious defects. Rods, furnished in cut lengths, shall be straight. Wire, furnished in coils or wound on spools, shall be free from kinks.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. 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 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 Lot. An inspection lot shall consist of rods or wire of the same type, composition, form and diameter produced under the same conditions from the same master heat of steel, packaged as specified in the contract or order and offered for inspection at one time.

4.3 Sampling. Unless otherwise specified, sampling plans and procedures for inspection shall be in accordance with the provisions set forth in MIL-STD-105.

4.4 Classification of tests. The inspection and testing of welding rods and wire shall be classed as follows:

- a. First article inspection (see 4.5)
- b. Quality conformance inspection (see 4.6)

4.5 First article inspection. First article inspection shall consist of all inspection procedures of this specification (see 4.6.2 and 4.7). The responsibility for performance of first article inspection shall be specified by the procuring activity (see 6.2).

4.5.1 First article samples. First article test samples shall be obtained from the material to be furnished for each type. Samples shall be selected at random from materials which have been manufactured using the same production processes, procedures and equipment which will be used in filling the contract. The samples shall be selected from either filled unit containers or from the production line immediately prior to packaging (after coiling or spooling wire). If selected from the production line, the total sample shall be selected throughout the run so all parts of the run are represented. To verify compliance for visual and dimensional examinations, cast and helix of wire as well as compliance with Section 5, the test samples shall be selected in accordance with MIL-STD-105, Inspection Level II, Acceptable Quality Level 2.5 percent defective for rods or an Acceptable Quality Level 2.5 percent defects per 100 feet of wire (see 4.6.1.2). For all other tests, a random sample of sufficient quantity shall be selected in accordance with MIL-STD-105, Inspection Level S-1, acceptance number of zero.

4.5.2 Data to accompany test samples. Whether or not first article samples are required (see 4.5.3), the manufacturer shall supply a certified statement that the welding rod or wire complies with the requirements of 3.2 (see 6.3.1) as well as any restrictions as applicable to usable welding processes (see 3.6.1). The certificate shall also contain actual quantitative test results indicating the process and range of amperage employed (if applicable) in making the required usability test for each lot.

4.5.3 Prior approval. If a manufacturer has previously delivered a material of a specified type that conforms to all requirements of this specification and his material has been found to be satisfactory, the requirements for first article inspection for that product, in connection with any subsequent contract or order for that material, may be waived at the discretion of the procuring activity (see 6.2.3).

MIL-R-5632B

4.5.4 Further production. Any production of rod or wire by the manufacturer prior to approval by the procuring activity shall be at the contractor's risk.

4.6 Quality conformance inspection.

4.6.1 Sampling.

4.6.1.1 For filled containers. Samples for examination of filled containers, both shipping containers filled with unit containers and filled unit containers, shall be selected at random from each lot (see 4.2) in accordance with MIL-STD-105, Inspection Level II, Acceptable Quality Level 2.5 percent defective.

4.6.1.2 For visual and dimensional examinations. Samples for visual examination and for dimensional examination shall be selected at random from each lot (see 4.2) in accordance with MIL-STD-105, Inspection Level II, Acceptable Quality Level 2.5 percent defective for rods and an Acceptable Quality Level of 2.5 percent defects per 100 feet of coiled or spooled wire. For the coiled or spooled wire a sufficient number of coils or spools shall be selected from each lot so that the sample footage for inspection shall consist of approximately 50 feet of wire taken from the outer end of each sample coil or spool. The material selected in this sample shall be taken from packages selected in the packaging inspection sample (see 4.6.1.1) or from the production line (see 4.5.1).

4.6.1.3 For chemical analysis.

4.6.1.3.1 Ingot sampling. At least one sample shall be taken from each heat of the alloy poured from the same source of molten alloy by the producer for chemical analysis in accordance with 4.6.2.4.

4.6.1.3.2 Finished product sampling. When sampling has not been made in accordance with 4.6.1.3.1 or is not available, a random sample shall be selected from each lot in accordance with MIL-STD-105, Inspection Level S-1, acceptance number of zero as detailed in 4.6.1.2 for chemical analysis in accordance with 4.6.2.4.

4.6.1.3.3 Preparation. Samples for chemical analysis shall be prepared in accordance with Method 111 or Method 112 of Fed. Test Method Std. No. 151. The samples shall be free from dirt, oil, grit and other foreign matters.

4.6.1.4 For cast and helix spooled wire. Samples for the cast and helix tests in accordance with 4.6.2.5 and 4.6.2.6 shall be cut from the outside periphery of the spooled wire selected in accordance with 4.6.1.2. No more than one sample shall be taken from the same spool when a lot consists of more than one spool of wire.

4.6.2 Quality conformance examination and tests.

4.6.2.1 Containers. Each of the filled shipping containers and each unit package selected in accordance with 4.6.1.1 shall be examined for construction defects, unsatisfactory markings, closure, and for weight of contents to determine conformance with Section 5. Each filled unit container shall be weighed to determine conformance to 3.4.3 and Table I.

4.6.2.2 Visual examination. Sample rods and wire, selected in accordance with 4.6.1.2 shall be visually examined for conformance to 3.4 for form, to 3.5.1 for layer winding, to 3.9 for finish and to 3.10 for workmanship.

4.6.2.3 Dimensional examination. The sample rods or wire selected in accordance with 4.6.1.2 shall be measured for diameter to determine conformance to 3.4.1 and Table I, and for length to determine conformance to 3.4.2. The diameter shall be measured using standard micrometers methods or go-no-go gages.

4.6.2.4 Chemical composition. The sample selected from the ingot in accordance with 4.6.1.3.1 or the sample rod or wire selected in accordance with 4.6.1.3.2 shall be tested in accordance with Method 111 or Method 112 of Fed. Test Method Std. No. 151 to determine conformance to 3.3.

4.6.2.4.1 Chemical analysis may be waived at the discretion of the procuring activity provided the material can be positively identified as being part of a melt or heat previously analyzed and found to be in conformance with the chemical composition requirements specified herein, or manufacturer's method of composition control is acceptable to the procuring activity.

4.6.2.5 Cast. The samples, 6 to 8 feet in length, selected in accordance with 4.6.1.4, shall be tested for the cast of spooled wire by being suspended freely from its approximate middle. The diameter of the circle formed shall be measured to determine conformance to 3.5.2. If the curvature of the wire results in a coil of more than 1-1/2 turns, the excess shall be clipped off and the wire re-suspended from its new approximate mid-length and re-measured.

4.6.2.6 Helix. The sample of spooled wire on which the cast was determined (see 4.6.2.5) shall be laid on a flat surface and measured between the adjacent turns to determine conformance to 3.5.3.

4.6.2.7 Welding characteristics. The manufacturer shall submit a notarized certification signed by a responsible official of its management attesting that the welding rod or wire is the same as that complied with by first article inspection (see 4.5), and will meet all requirements of this specification as specified in 3.6 for usability and in 3.7 for mechanical properties of weld deposition. Processing limitations (see 3.6.1) shall also be stated.

MIL-R-5632B

4.7 Welding tests.4.7.1 Conditions applicable to welded specimens.

4.7.1.1 Welders. Welding of test joints shall be accomplished by welders qualified in accordance with specifications or standards applicable to the procuring activity (see MIL-T-5021 and MIL-STD-248).

4.7.1.2 Materials. Sheet and plate materials used for specimens to be welded with the rods and wire shall be in accordance with Table III.

4.7.1.3 Preheating and post heating. Use of preheating and post heating shall be optional. However, it is recommended that sheets and plates to be used in the preparation of welded test samples should be preheated and postheated in accordance with the schedules stated in Table III.

Table III. Sheet and Plate Materials

Filler Metal Types	Sheet and Plate Conforming to	Preheating and Post heating Schedules		
		Preheat °F	Post heat	
			°F	Time, Minutes
I	MIL-S-18729, AMS 6350 or AMS 6351	200	300	30
II	QQ-S-626, QQ-S-627 or MIL-S-5626	550 to 600	550 to 600	30
III	AMS 6359 or AMS 6434	550 to 600	550 to 600	30
IV	QQ-S-626, QQ-S-627, MIL-S-18728 or AMS 6351	200	300	30
V	QQ-S-626 or AMS 6358	550 to 600	550 to 600	30
VI	QQ-S-627, MIL-S-18731, or AMS 6455	550 to 600	550 to 600	30
VII	AMS 6385 or AMS 6436	550 to 600	550 to 600	30
VIII	AMS 6438 or MIL-S-8949	550 to 600	550 to 600	30

MIL-R-5632B

4.7.1.4 Usability characteristics. The operating characteristics of the rods and wire for conformance to 3.6 shall be observed during fabrication of welded test specimens. Welds shall be examined externally for smoothness of surface, surface porosity, cracking, undercutting and overlapping. In addition, welds shall be examined for the presence of internal defects by visual inspection of the fractured surfaces of transverse weld tensile specimens after fracture in tension. Test plates welded as specified in 4.7.2 shall be examined magnetically and radio-graphically in accordance with MIL-I-6868 and MIL-STD-453 respectively after removal of the weld reinforcement and backing plate by machining flush with the adjacent plate surfaces. Magnetic indications definitely established as cracks shall be cause for rejection. Indications of defects exceeding those shown in MIL-STD-779, Volumes I and II for Grade 1, Fine Scattered Porosity in size and frequency shall be cause for rejection of welded test plates.

4.7.2 Weldability test. Double fillet welded T-joint assemblies conforming to Figure 1 shall be welded in the horizontal position only. The weld shall be visually examined for characteristics which are indicative of filler metal usability (see 4.7.1.4) to determine conformance to 3.6. The weld shall not show excessive convexity or concavity. At a point approximately 1 inch back from the crater end of the deposit made with the first rod or wire (on the first fillet), the specimen shall be sectioned (see Figure 1). One surface of each section shall be polished and examined for cracking, gas pockets, incomplete root fusion or presence of weld defects. The presence of any of these defects shall be cause for rejection.

4.7.3 Tensile tests. The type of tensile test, thickness of the base metal and number of specimens required to determine conformance to 3.7.1 and 3.7.2 shall be as shown in Table IV.

Table IV. Tensile Tests

Nominal Diameter-- Inch of Rod or Wire	Transverse Tensile Test (see 4.7.3.1)		All-Weld Metal Test (see 4.7.3.2)	
	Base Metal- Thickness- Inch	Number of Specimens <u>1</u> /	Base Metal- Thickness- Inch	Number of Specimens <u>1</u> /
0.020 to 0.045, incl	0.125 ±0.008	3	-	-
0.062 to 0.094, incl	0.25 ±0.008	3	-	-
0.125 or more	-	-	0.500 ±0.008	4

1/ For each strength level.

MIL-R-5632B

4.7.3.1 Transverse tensile specimens. Test plates shall be prepared in accordance with Figure 2 and the notes applied thereto from materials in accordance with 4.7.1.2 and Table III. Test plates shall be welded on one side only in the flat position as defined in AWS 3.0 using the indicated base metal thickness for the rod or wire size under test. Test plates may be preheated and post heated in accordance with 4.7.1.3 and the schedule indicated in Table III. After welding, the test plates shall be heat-treated in accordance with 3.7.2 to conform to the notes of Table II. Tensile specimens shall be cut from the locations indicated by Figure 2 and machined to the stated dimensions.

4.7.3.2 All-weld metal tensile specimens. Test plates shall be prepared in accordance with Figure 3 and the notes thereto from materials in accordance with 4.7.1.2 and Table III. The test plates shall be welded on one side only in the flat position as defined in AWS 3.0. The beveled edges of the base metal plates and the surface of the backing plate shall be clad with a layer of weld metal (not less than 3/16 inch thick) deposited with the rod or wire being tested. The plate edges shall be clad, using a stringer bead technique, and machined or ground smooth before assembly of the test plate. The plate shall be insulated from the bench by 1/2 inch of asbestos during welding. Plates may be preheated and post heated in accordance with 4.7.1.3 and schedule indicated in Table III. After welding, the test plates shall be heat treated in accordance with 3.7.2 to conform to the requirements specified in notes of Table II prior to testing.

4.7.3.2.1 Welding techniques. Welds shall be deposited in multi-pass layer buildup shown in Figure 3. The passes or layers shall not exceed a thickness of approximately 1/8 inch, and shall be deposited in such a manner that the final layer include a reinforcement of standard proportions (1/32 to 1/8 inch).

4.7.3.2.2 Machining of tensile specimens. The all weld-metal tensile specimens shall be machined from locations indicated in Figure 3. All specimens shall be machined 0.020 inch oversize prior to heat treatment. Heat treated specimens shall be finished to the final dimensions for round tension specimen R3 as detailed in MIL-STD-418.

4.7.3.3 Testing of tensile specimens. Tests of specimens prepared in accordance with 4.7.3.1 and 4.7.3.2 shall be conducted in accordance with the applicable requirements of ASTM E 8.

4.7.4 Impact test. The impact properties of welded specimens shall be determined by tests in triplicate, of Charpy V-notched specimens, heat treated to each strength level of the respective base material for conformance to 3.7 and Table II.

4.7.4.1 Preparation of specimens. The impact specimens shall be prepared in accordance with ASTM E 23. The test plates shall be prepared as shown in Figure 4 from plate material conforming to MIL-S-7809. The beveled edges of

the base metal plates and the surface of the backing plate shall be clad with a layer of weld metal (not less than 3/16 inch thick) deposited with the rod or wire being tested. The plate edges shall be clad, using a stringer bead technique, and machined or ground smooth before assembly of the test plate. The plate shall be insulated from the bench by 1/2-inch of asbestos during welding. Plates shall be preheated and post heated in accordance with the schedule indicated in Table III. After welding the test plates shall be heat treated in accordance with 3.7 and Table II prior to testing.

4.7.4.2 Machining. Specimens shall be machined from the locations shown in Figure 4. Unnotched specimen blanks shall be machined 0.020 inch oversize prior to heat treatment. After heat treatment, the impact specimens shall be finished machined to the final dimensions and notch machined as indicated in Figure 11 of ASTM A 370 for simple beam charpy V-notch impact test specimens. Precautions should be observed during machining of the notch, so that no excessive heat is generated which might affect the structural properties of the weld metal.

4.7.4.3 Method of tests. Testing of the specimens shall be conducted at 0°F. The three impact values obtained shall be averaged and no individual specimens shall show an impact value which varies from the average by more than 25 percent. The weld metal shall be considered unsatisfactory if the average impact value does not conform to Table II. A second set of specimens shall be retested if the first set fails to conform to this specification.

4.8 Rejection and retests.

4.8.1 Rejection. When one or more test specimens fails to meet any of the tests required by this specification, the lot represented by the specimen or specimens shall be subjected to rejection, except as otherwise provided by MIL-STD-105.

4.8.2 Resubmitted lots. Paragraph 6.4 of MIL-STD-105 shall apply except that a resubmitted lot shall be inspected using tightened inspection. For visual examination where the original acceptance number was zero, a sample size represented by the next higher sample size code letter shall be chosen.

5. PREPARATION FOR DELIVERY

5.1 Packaging. The level of packaging shall be Level A or Level C unless otherwise specified (sec 6.2).

5.1.1 Level A.

5.1.1.1 Rods. Unless otherwise specified in the contract or order, rods shall be packaged in accordance with MIL-W-10430. A unit package shall contain one class, type (if applicable) and size as specified by the procuring activity. Rods in

MIL-R-5632B

straight lengths shall be unit packaged in 5-, 10-, 25-, or 50-pound quantities net weight as specified. Unit containers shall be Class 6, 6b, 6c or 7 of MIL-W-10430.

5.1.1.2 Coils. Unless otherwise specified in the contract or order, welding wire as coils shall be packaged in accordance with MIL-W-10430. A unit package shall contain one continuous length of the class, type and size specified. Wire in coil shall be unit packaged in 25-, 50-, or 65-pound quantities as specified. Unit containers shall be Class 3d of MIL-W-10430.

5.1.1.3 Spools. Unless otherwise specified in the contract or order, welding wire wound on spools shall be packaged in accordance with MIL-W-10430. A unit package shall contain one continuous length of the class, type and size specified. Continuous wire wound on spools shall be unit packaged in 1-, 5-, 10-, 20-, 25-, or 35-pound quantities net weight as specified in the contract or order. Unit containers shall be Class 3a or 3b of MIL-W-10430 as applicable.

5.1.2 Level C. The welding rods and wire shall be packaged in accordance with Level C requirements of MIL-W-10430 to afford the minimum degree of protection necessary to prevent deterioration or damage during shipment under normal environmental conditions and commercial modes of transportation.

5.2 Packing. Packing shall be Level A, Level B, or Level C as specified (see 6.2).

5.2.1 Level A. Welding rods and wire, packaged as specified shall be packed for overseas shipment in accordance with MIL-W-10430.

5.2.2 Level B. Welding rods and wire, packaged as specified shall be packed for domestic shipment in accordance with MIL-W-10430.

5.2.3 Level C. Welding rods and wire that require overpacking by the carrier shall be packed in exterior type shipping containers in a manner that will ensure safe transportation at the lowest rate to the point of delivery, and shall meet as a minimum, the requirements of the rules and regulations applicable to the mode of transportation selected.

5.3 Marking. In addition to any special markings required by the contract or order, interior packages, exterior shipping containers and palletized unit loads shall be marked in accordance with MIL-W-10430 and MIL-STD-129.

5.3.1 Unit containers. Unit containers shall bear a printed label in a conspicuous location on or near the manufacturer's label and on any special instructions which may be enclosed as follows:

CAUTION

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. See American National Standard Z49.1, Safety in Welding and Cutting.

5.4 Shipping container tests. Tests on shipping containers as specified in MIL-W-10430 shall apply to Levels A and B packing only.

6. NOTES

6.1 Intended use. The welding rods and wire, covered in this specification are intended for use in the welding of aircraft structures and accessories by gas, gas tungsten-arc and gas metal-arc processes. The rods and wire are intended for use in welding stressed joints in low alloy steel structures which are heat treated after welding to obtain high mechanical properties. The rods and wire detailed herein may be used with low alloy steel of similar heat response and hardenability such as 4130, 4140, 4340, 6130, 8630, 4335 (V), D 6 AC, 17-22 A (S), NAV 9115 AC, etc.

6.1.1 Rods. The term "rods", as applicable to the materials, detailed herein, refers to straightened-and-cut lengths of wire which are intended essentially for gas (OAW) or gas tungsten-arc (GTAW) welding processes.

6.1.2 Wire. Wire, coiled or on spools, is intended for use with automatic or semiautomatic welding machines employing continuous feed devices. Gas metal-arc welding (GMAW) uses a continuous feed wire as the electrode, whereas gas tungsten-arc welding (GTAW) may have the wire added manually or by means of feeding mechanism when machine welding is used.

6.2 Ordering data.

6.2.1 Procurement documents should specify the following:

- a. Title, number and date of this specification
- b. Type (for welding with alloy steels) (see 1.2)
- c. Chemical composition, if other than specified (see 3.3)
- d. Form, as rods or wire (see 3.4)

MIL-R-5632B

- e. Wire, if applicable in coil or wound on spools (see 3.4)
- f. Size, nominal diameter (see 3.4.1 and Table I)
- g. Length of rod, if other than 36 inches long (see 3.4.2)
- h. Weight of rods or wire (see 3.4.3, 5.1.1.1, 5.1.1.2 and 5.1.1.3)
- i. Lot size (see 4.2)
- j. Responsibility for performance of First Article inspection (see 4.5)
- k. Level of packaging required (see 5.1)
- l. Level of packing required (see 5.2)
- m. Additional markings, if required (see 5.3)

6.2.2 Welding rod and wire shall be ordered by the pound. When ordering filler wire for use with automatic welding machines, the net weight, the coil dimensions and the dimensions of any spools which may be required for use with the feed mechanism of the respective welding machines should be specified.

6.2.3 Contracts or orders shall specify the following provisions for First Article inspection.

6.2.3.1 Whether First Article inspection is required. When a manufacturer is in continuous production of welding rod and wire from contract to contract, consideration should be given to waive the First Article inspections. If inspection is required, indicate:

- a. Where the First Article inspection is to be conducted (at the manufacturer's plant or Government or commercial laboratory).
- b. That the approval of First Article samples or the waiving of the First Article inspection shall not relieve the contractor of his obligation to fulfill all other requirements of the specifications and contract.

6.3 Data. For the information of manufacturers and Contracting Officers, any of the data specified in (a) subparagraphs below, (b) applicable documents

listed in Section 2 of this specification, or (c) referenced lower-tier documents need not be prepared for the Government and shall not be furnished to the Government unless specified in the contract or order. The data to be furnished shall be listed on DD Form 1423 (Contractor Data Requirement List), which shall be attached to and made a part of the contract or order.

6.3.1 First Article data. When First Article samples are submitted (see 6.2), they should be accompanied by a complete inspection report showing the results of the manufacturer's inspections. The inspection report shall include the following:

- a. Report of inspections together with a detailed statement indicating compliance or extent of noncompliance with all requirements of this specification, referring specifically to paragraph numbers. Wherever a requirement is considered to be not applicable, the report shall so state.
- b. A complete description of inspection equipment and inspection procedures.
- c. Reproducible outline and description conditions. Where inspections specified in this specification are not considered applicable, the reason, and the substituted inspection should be clearly described.
- d. Copies of inspection log sheets.

6.4 Supersession data. When Class 1, plain carbon steel welding rods and wire, as specified on drawings, in accordance with revision A of this document, materials conforming to AMS 5030, Steel Wire, Welding, Low Carbon; AWS A 5.18, Mild Steel Electrodes for Gas Metal-Arc Welding or MIL-E-23765/1, Electrode and Rod, Welding, Base, Solid, Mild Steel may be used.

MIL-R-5632B

Custodians:

Army - WC
Navy - AS
Air Force - 11

Preparing activity:

Navy - AS
(Project No. 3439-0177)

Review activities:

Army - GL
Air Force - 84

User activities:

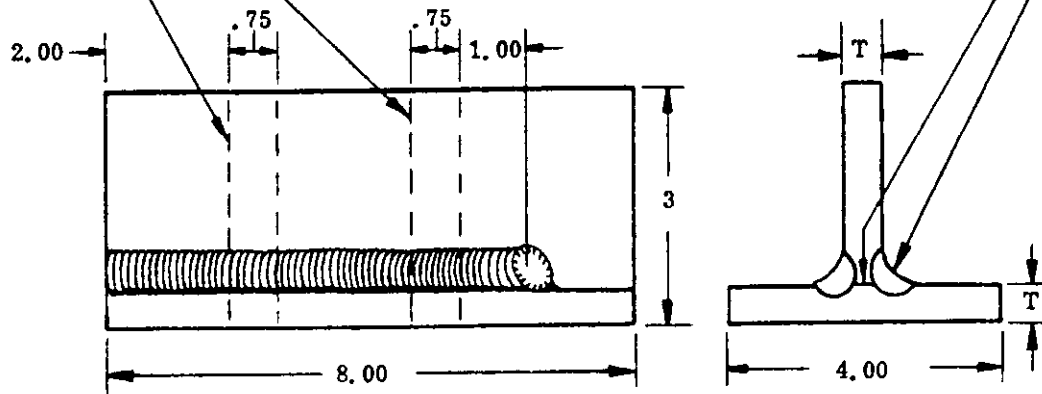
Army - AT, MI

NOTICE - Review/user information is current as of date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DOD Standardization Documents.

CUT TWO SECTIONS AT VERTICALLY DOTTED LINES FOR
MACROSCOPIC INSPECTION OF WELD QUALITY AND ROOT
FUSION.

ROOT FUSION SHALL BE COMPLETE AT THE
THEORETICAL THROAT OF THE WELD

THIS EDGE OF STANDING MEMBER MACHINED
AND IN CONTACT WITH PLATE THROUGHOUT



SIZE - ROD AND WIRE	THICKNESS (T)	FILLET WELD SIZE
TO 0.062 INCL.	1/8	1/8
0.094	1/4	3/16
0.125 AND GREATER	3/8	1/4

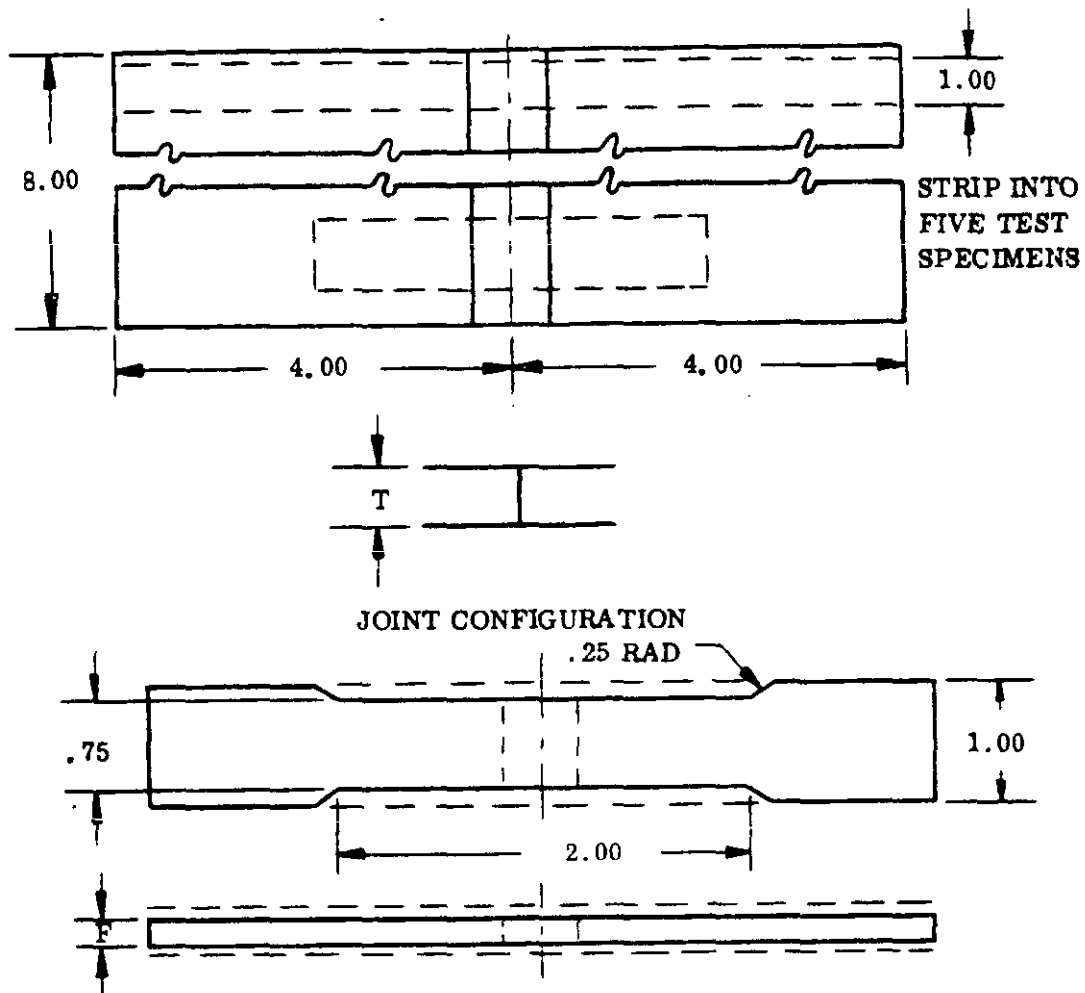
AFTER MAKING ONE FILLET, COOL TO ROOM TEMPERATURE BEFORE
MAKING FILLET ON OPPOSITE SIDE.

USE PREHEAT AND POSTHEAT AS RECOMMENDED.

DIMENSIONS IN INCHES.

FIGURE 1. FILLET WELD SPECIMENS

MIL-R-5632B



DIMENSIONS FOR MECHANICAL PROPERTIES - TENSILE SPECIMEN

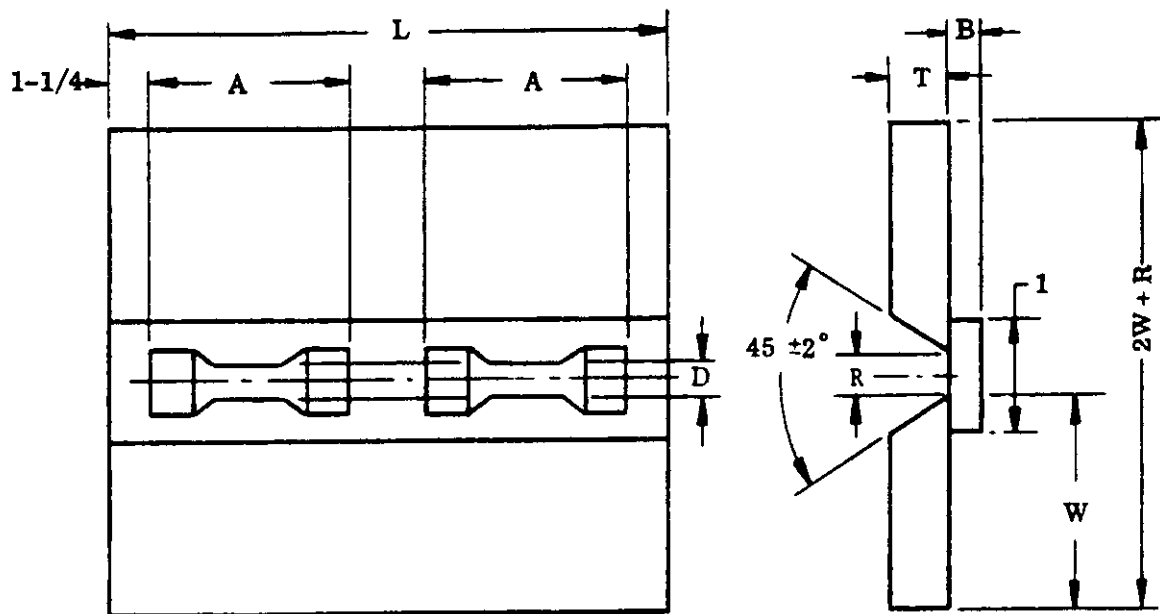
SIZE - ROD AND WIRE	PLATE THICKNESS (T)	FINISHED SPECIMEN THICKNESS (F)
0.020 TO 0.045, INCL.	1/8	0.10
0.062 TO 0.094, INCL.	1/4	0.20

SPECIMENS SHALL BE TESTED IN THE CONDITION SPECIFIED IN TABLE II.

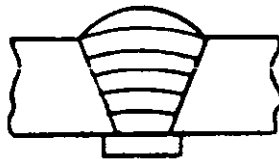
THE MINIMUM MECHANICAL PROPERTIES OF TENSILE TEST SPECIMENS SHALL NOT BE LESS THAN THE VALUES SPECIFIED IN TABLE II.

DIMENSIONS IN INCHES.

FIGURE 2. TRANSVERSE TENSILE SPECIMEN



TYPICAL PASS SEQUENCE

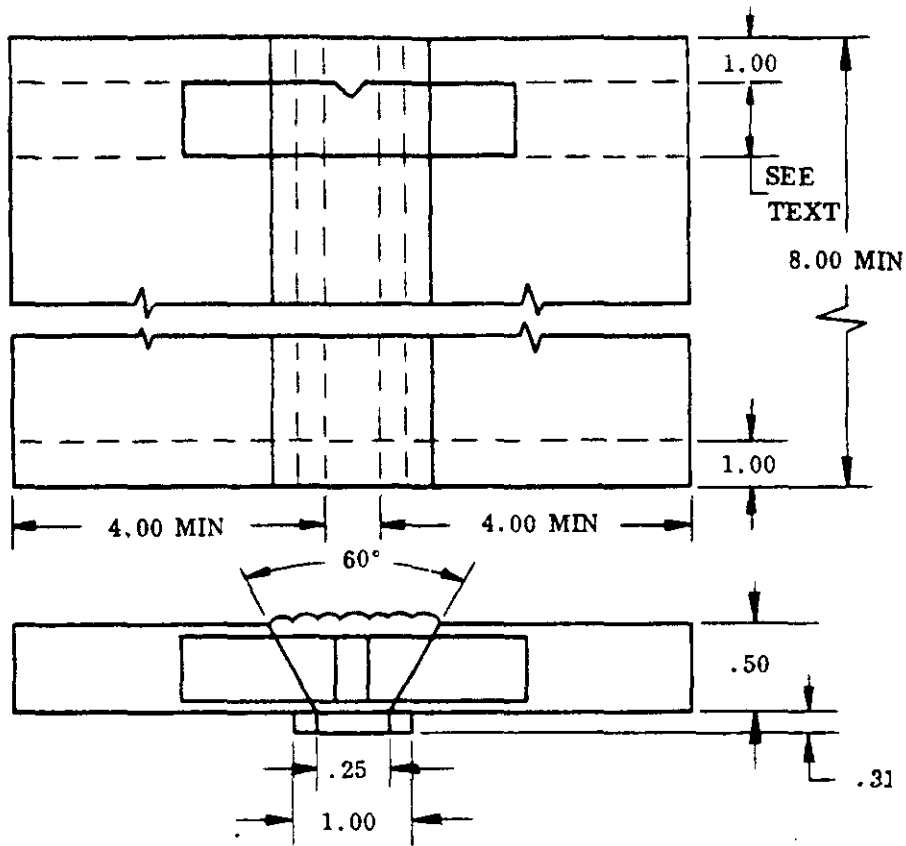


TEST PLATE FOR CHECKING USABILITY CHARACTERISTICS OF RODS AND WIRE AND PROPERTIES OF WELD DEPOSITS.
 BACKING STRIP SHALL BE OF THE SAME NOMINAL COMPOSITION AS BASE METAL.
 DIMENSIONS IN INCHES.

DIMENSIONS FOR TENSILE TEST SPECIMENS		SIZE - ROD AND WIRE - 0.125
DIMENSION		
PLATE - LENGTH	(L)	9-3/4
PLATE - WIDTH	(W)	5
PLATE - THICKNESS	(T)	1/2
BACKING STRIP - THICKNESS	(B)	3/16
GROOVE WELD OPENING	(R)	1/4
TENSILE SPECIMEN - DIAMETER	(D)	0.252 ± 0.005
TENSILE SPECIMEN - LENGTH	(A)	3

FIGURE 3. ROD AND WIRE TEST PLATES

MIL-R-5632B



TEST PLATE FOR CHECKING IMPACT PROPERTIES OF WELD DEPOSITS.

BACKING STRIP SHALL BE OF THE SAME NOMINAL COMPOSITION AS BASE METAL.

DIMENSION FOR IMPACT TEST SPECIMENS SHALL CONFORM TO ASTM A370, FIGURE 11 OF TYPE A, CHARPY V-NOTCH.

DIMENSIONS IN INCHES.

FIGURE 4. TEST PLATES FOR IMPACT TEST SPECIMENS

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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY



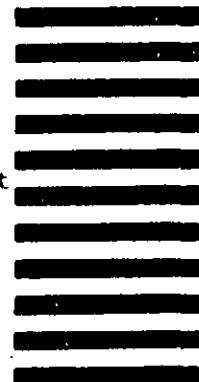
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

Engineering Specifications & Standards Department
(Code X)
Naval Air Engineering Center
Philadelphia, PA 19112



STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
<p>3a. NAME OF SUBMITTING ORGANIZATION</p> <p>b. ADDRESS (Street, City, State, ZIP Code)</p>	<p>4. TYPE OF ORGANIZATION (Mark one)</p> <p><input type="checkbox"/> VENDOR</p> <p><input type="checkbox"/> USER</p> <p><input type="checkbox"/> MANUFACTURER</p> <p><input type="checkbox"/> OTHER (Specify): _____</p>

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

<p>7a. NAME OF SUBMITTER (Last, First, MI) - Optional</p>	<p>b. WORK TELEPHONE NUMBER (Include Area Code) - Optional</p>
<p>c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional</p>	<p>8. DATE OF SUBMISSION (YYMMDD)</p>

TO DETACH THIS FORM, CUT ALONG THIS LINE.