

MIL-E-23765B(SH)
22 August 1985
SUPERSEDING
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10 May 1973
(See 6.6)

MILITARY SPECIFICATION

ELECTRODES AND RODS - WELDING, BARE, SOLID AND ALLOYED CORED, GENERAL SPECIFICATION FOR

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 the general requirements for solid bare and alloyed cored welding electrode and cut-length rods made from carbon steel, low alloy steel, chromium-nickel steel, nickel base and copper base alloys, aluminum, and aluminum alloys designed for use with the gas metal-arc (GMA), gas tungsten-arc (GTA), and the submerged-arc welding (SAW) processes, as applicable.

1.2 Classification. Electrodes and rods shall be furnished in the forms and sizes, specified in 1.2.1 and 1.2.2, and in the type specified in the applicable detail specification (see 6.2.1). Alloy cored electrodes for submerged arc welding shall be designated by a "C" suffix to the MIL type designation for the bare solid electrodes in the applicable detail specification.

1.2.1 Forms. Electrodes and rods shall be furnished in the following forms:

- Form 3a - Electrode on small spool (4-inch flange)
- Form 3b - Electrode on large spool (12-inch flange)
- Form 3c - Electrode wound on coils with support
- Form 3d - Electrode wound in coils (65 pounds and under)
- Form 3e - Electrode wound in coils (over 65 pounds)
- Form 4 - Electrode wound in drums
- Form 6 - Cut-length rods in containers

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 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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1.2.2 Sizes. Electrodes and rods shall be furnished in the sizes specified in table I.

TABLE I. Diameter sizes.

| Form | Diameter sizes (inch) |
|---------------------|---|
| 3a | 0.020, .025, .030, .035, .045 |
| 3b | 0.020, .025, .030, .035, .045, .052, 1/16, 5/64, 3/32, 1/8, 5/32, 3/16, 7/34, 1/4 |
| 3c, 3d, 3e and 4 | 0.030, 0.035, .045, .052, 1/16, 5/64, 3/32, 1/8, 5/32, 3/16, 7/32, 1/4 |
| 6 | 0.030, 0.035, .045, .052, 1/16, 5/64, 3/32, 1/8, 5/32, 3/16, 7/32, 1/4 |

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- PPP-B-566 - Boxes, Folding, Paperboard.
- PPP-B-636 - Boxes, Shipping, Fiberboard.
- PPP-B-676 - Boxes, Setup.
- PPP-B-1055 - Barrier Material, Waterproofed, Flexible.

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- MIL-W-10430 - Welding Rods and Electrodes; Packaging of.
- MIL-E-23765/1 - Electrodes and Rods - Welding, Bare, Solid, Mild and Low Alloy Steel.
- MIL-E-23765/2 - Electrodes and Rods - Welding, Bare, Solid, or Alloyed Cored, Low Alloy Steel.
- MIL-E-23765/3 - Electrodes, Welding, Bare, Copper and Copper Alloy.
- MIL-I-45208 - Inspection System Requirements.

STANDARDS

FEDERAL

- FED-STD-151 - Metals; Test Methods.

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-271 - Nondestructive Testing Requirements for Metals.

2.1.2 Government document and publication. The following Government document and publication form a part of this specification to the extent specified herein.

DEPARTMENT OF LABOR

Code of Federal Regulations, Title 29
Part 1910 - Occupational Safety and Health Standards

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

PUBLICATION

NAVAL SEA SYSTEMS COMMAND (NAVSEA)
0900-LP-003-9000 - Radiographic Standards for Production and Repair Welds.

(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting 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. The issues of the documents which are indicated as DOD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
E 29 - Standard Recommended Practice for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 191030,

AMERICAN WELDING SOCIETY (AWS)
A3.0 - Welding Terms and Definitions. (DoD adopted)
B4.0 - Standard Methods for Mechanical Testing of Welds. (DoD adopted)
z49.1 - Safety in Welding and Cutting.

(Application for copies should be addressed to the American Welding Society, Inc., 550 NW LeJeune Road, P.O. Box 351040, Miami, FL 33135.)

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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

Ew 1 - Electric Arc-Welding Apparatus. (DoD adopted)

(Application for copies should be addressed to National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., ATA TRAFFIC Dept., 1616 "P" Street, NW, Washington, DC 20036.)

UNIFORM CLASSIFICATION COMMITTEE AGENT

Uniform Freight Classification Ratings, Rules and Regulations

(Application for copies should be addressed to the Uniform Classification Committee Agent, Tariff Publication Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. The electrodes and rods furnished in accordance with MIL-E-23765/1 and MIL-E-23765/2 shall be products which are qualified for listing on the applicable qualified products lists at the time set for opening of bids (see 4.3 and 6.3).

3.3 First article. When specified (see 6.2.1), a sample of one set of copper alloy electrodes and cut-length rods in accordance with MIL-E-23765/3 shall be subjected to first article inspection (see 4.4 and 6.4).

3.4 Recovered materials. Unless otherwise specified herein, all material incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

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3.5 General requirements.

3.5.1 Finish. Electrodes and rods shall have smoothly finished surfaces, free from slivers, depressions, scratches (excluding seams for alloyed cored electrodes), and scale or foreign matter that would adversely affect the welding characteristics, operation of the equipment, or properties of the deposited metal.

3.5.2 Chemical composition. The chemical composition of bare electrodes (wire form) and rods or weld metal deposited by alloyed cored electrodes shall be as specified in the detail specification.

3.5.3 Mechanical properties. The deposited weld metal shall exhibit mechanical properties specified in the detail specification.

3.5.4 Soundness. Radiographs of groove welds shall show that the welds conform to class 1 production weld requirements in accordance with NAVSEA 0900-LP-003-9000.

3.5.5 Alloy identity. Each end of rod, strip or wire to be spliced during processing shall be sampled for alloy identity (see 4.7.5), except when splicing is done to repair a wire break without removing the wire from the process line. The sample shall be tested for alloy identity prior to shipment of the lot.

3.5.5.1 Both ends of each coil, drawn to finish size, shall be tested for alloy identity (see 4.7.5) before rewinding, spooling, or straightening and cutting into rods or electrodes.

3.5.5.2 When specified (see 6.2.1), each electrode or rod shall be tested for alloy identity in accordance with 4.7.5 after final marking. Identification of each spool, coil or container of electrodes tested after final marking and meeting the acceptance criteria of 4.7.5 shall include the words "Alloy tested".

3.6 Spooled and coiled electrodes.

3.6.1 Tolerance (diameter size). Diameter of electrode shall not vary from the nominal diameter by more than the limits specified in table II.

TABLE II. Dimensional tolerances.

| Nominal diameter (inch) | Tolerance (inch) |
|----------------------------|---------------------|
| 0.045 and smaller | Plus or minus 0.001 |
| Larger than 0.045 | Plus or minus 0.002 |

3.6.2 Winding. Each spool, coil and drum shall be wound of one continuous length of electrode made from a single lot of metal, as specified in the detail specification. The winding shall avoid producing kinks, waves, or sharp bends and shall be free to unwind without restriction. The starting end of spooled and coiled electrode shall be firmly fastened so that it is readily visible to the welder or welding operator and both ends of the electrode shall be accessible for inspection purposes.

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3.6.3 Spool and coil weights. Spools and coils shall be furnished in weights specified in the applicable electrode specification.

3.6.4 Cast and helix. The cast and helix of spooled and coiled electrodes shall be such as to have imparted to the electrode 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 within diametrical limits specified in table III.

TABLE III. Cast and helix requirements.

| Electrode form | Bare solid electrode | | | Alloyed cored electrode | |
|------------------------|----------------------|-----------|---|-------------------------|-----------|
| | Cast (inches) | | Helix (inches) ^{1/} (maximum) | Cast | Helix |
| | (minimum) | (maximum) | | | |
| 3a | 6 | 9 | 1/2 | | |
| 3b (0.030 and smaller) | 12 | 30 | — | <u>4/</u> | <u>4/</u> |
| 3b (0.035 and larger) | 15 | 36 | 1-1/2 | | |
| 3c, 3d, 3e, 4 | <u>2/</u> | <u>3/</u> | 2 | | |

^{1/} Vertical separation between overlapped ends.

^{2/} Not less than the original inside coil diameter.

^{3/} Not greater than 2.5 times original inside coil diameter.

^{4/} Alloyed cored electrodes shall be suitable for uniform uninterrupted feeding on automatic and semiautomatic welding equipment.

3.6.5 Spool and coil dimensions.

3.6.5.1 Form 3a. Spools used for form 3a electrode shall be as shown on figure 1 and the notes thereto.

3.6.5.2 Form 3b. Spools used for form 3b electrode shall be as shown on figure 2 and the notes thereto.

3.6.5.3 Forms 3c, 3d and 3e. Coil dimensions shall be as specified in table IV.

TABLE IV. Coil dimensions and accessories.

| Form | Width (maximum) (inches) | Outside diameter (maximum) (inches) | Inside diameter (inches) |
|------|--------------------------------|--|--------------------------------|
| 3c | 3 | 17 | 12 + 1/4 |
| 3d | 4-5/8 | 17 | 12 + 1/4 |
| 3e | 5 | 31-1/2 | 22-1/2 minimum |

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3.6.6 Identification.

3.6.6.1 Forms 3a and 3b. The specification number, MIL-type, size, date of processing and lot control number 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.

3.6.6.2 Forms 3c, 3d, 3e and 4. Tags made of material suitable for resisting effacement or destruction and bearing the specification number, MIL-type, size, date of processing and lot control number shall be firmly attached at inner end of the coiled filler metal. Coils wound on supports shall be identified with the above information placed directly on the support member in such a manner as not to be readily removable. Filler metal wound in drums shall be identified with the above information placed directly on the drum in such a manner as not to be readily removable.

3.7 Form 6 (cut-length rods).

3.7.1 Tolerance (diameter size). Rods shall not vary from the nominal diameter by more than plus 0.002 inch, minus 0.003 inch.

3.7.2 Length. The length of rods shall be 12, 18, or 36 inches plus 0, minus 1/2 inch except that for 36-inch length rods up to 10 percent of rods in any container may be shorter than 36 inches, but not shorter than 24 inches. Unless otherwise specified (see 6.2.1), the 36-inch length shall be furnished.

3.7.3 Identification. Cut-length rods shall be identified by positive and legible methods such as imprinting or indenting the applicable type designation number (see detail specification) at one or more locations on the rod surface approximately 1 inch from rod end, or shall be identified by pressure-sensitive, plastic-coated tape imprinted with applicable type number at one or more locations and attached to the rod approximately 1 inch from its end. Imprints on rods or on tape shall be with fade-proof ink and shall be resistant to oils, solvents, all atmospheric conditions, and to normal wear and tear encountered in shipping and handling.

3.7.4 Production equipment. When a change is made in a production run of one MIL-type rod to another, inspection shall be performed prior to starting the new run to assure that equipment and process lines are purged of material needed to be changed from the previous production run. This inspection shall be performed for all equipment used in manufacturing operations where the material is not segregated and positively identified (for example, cutting to length).

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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 Inspection system. The manufacturer (see 6.5.3) shall provide and maintain an Inspection system acceptable to the Government for supplies and services covered by this specification. The inspection system shall be in accordance with MIL-I-45208.

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

- (a) Qualification inspection (see 4.3).
- (b) First article inspection (see 4.4).
- (c) Quality conformance inspection (see 4.5).

4.3 Qualification inspection. Qualification inspection will be authorized only to the manufacturer (see 6.5.3) of welding electrodes and rods. Qualification inspection shall be conducted at a laboratory satisfactory to the Naval Sea items Command (NAVSEA). Qualification Inspection shall consist of the examinations specified in 4.6.1 and in the detailed inspection and the tests specified in the detailed specification.

4.3.1 Special instructions. When applying for test authorization, or after tests have been authorized and when samples are submitted, the manufacturer (see 6.5.3) shall furnish the following information. (This information, together with test results obtained with the sample, shall form a part of the qualification test. All information will be held in confidence by the Government.)

4.3.1.1 For bare solid electrode, where lot identification is by heat of wire (see 4.5.1.1.1), the following information shall apply:

- (a) MIL-type and size under which approval is desired.
- (b) Composition of wire in terms of nominal percentages for each constituent.
- (c) Composition of the deposited weld metal.
- (d) Recommended amperages for each weld test.
- (e) Brand name of electrode and when applicable, brand name of flux.

4.3.1.2 For bare solid electrode, where lot identification is by controlled wire chemical composition (see 4.5.1.1.2), in addition to 4.3.1.1, the following shall be furnished for approval of the command or agency concerned (see 6.5.1):

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- (a) Chemical composition control limits in wire of each MIL-type electrode.
- (b) Method of determining wire chemistry.
- (c) Production line methods used to produce electrodes from chemically controlled core wire.

4.3.1.3 For alloyed cored electrode, where lot identification is by a dry batch or dry blend of filler material and heat of metal, the following information shall apply:

- (a) Type and size range (each size manufactured shall be specified) for which qualification is desired (see 1.2.2).
- (b) Composition of tube, or strip, and flux ingredients in terms of nominal percentages for each constituent.
- (c) Composition of deposited weld metal.
- (d) Recommended amperage for each weld test and size of electrode to be qualification tested.
- (e) Brand name.

4.3.1.4 For alloyed cored electrode, where lot identification is by chemically controlled dry batches of filler material and chemically controlled mill coils, the following information shall apply:

- (a) The type and size range (each size manufactured shall be specified) for which qualification is desired.
- (b) Chemical composition control limits for mill coil.
- (c) Method of determining chemical composition of the mill coil.
- (d) production line quality control methods used in producing electrodes from chemically controlled mill coil.
- (e) Percent allowable variation (disclosed) from standard (not disclosed) for each formulated chemical element in the mix of "chemically controlled filler material for each MIL-type electrode.
- (f) Method of determining chemical composition of the mix chemically controlled filler material.
- (g) production line quality control methods used in producing electrodes from chemically controlled flux material.
- (h) Recommended amperage for each weld test, and size of electrode to be qualification tested.
- (l) Brand name.

4.3.1.5 For SAW granular neutral flux, where lot identification is by the manufacturer^s control number, the following information shall apply:

- (a) The type of flux for which qualification is desired.
- (b) Percentage allowable variation (disclosed) from standard (not disclosed) for each formulated chemical element in the chemically controlled flux for each MIL-type.
- (c) Method of determining chemical composition of the chemically controlled flux.
- (d) Production line quality control methods used in producing the chemically controlled flux.
- (e) Brand name.

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4.3.2 Samples for qualification tests.

4.3.2.1 Electrode samples. Unless otherwise specified in the detail specification, the electrode selected for testing shall be one spool of form 3b, or one coil of form 3d, 1/16- or 1/8-inch diameter size of each MIL-type for which the manufacturer desires to qualify, provided the form and size is representative of the cleaning method used for all forms and sizes of that alloy. The 1/16-inch size shall be used for the GMA welding process and the 1/8-inch size shall be used for the SAW welding process. If more than one cleaning method is used for various other diameter forms and sizes of any electrode alloy, qualification applications shall give complete details. The manufacturer shall furnish one spool of form 3b or one coil of form 3d electrode of the MIL-type to be qualified. When an electrode is to be qualification tested for the SAW process, the manufacturer shall furnish a sample of the flux. The samples shall be selected in the presence of the Government representative.

4.3.2.1.1 Bare solid electrode sample. Approval obtained for the 1/16-inch size electrode qualifies all sizes smaller than 3/32 inch of the same MIL-type. Approval obtained for the 1/8-inch size electrode qualifies all sizes 3/32 inch and larger for the same MIL-type.

4.3.2.1.2 Alloyed cored electrode sample. Alloyed cored electrodes shall be used with the SAW process. Approval obtained for the 1/8-inch size electrode qualifies all sizes 3/32 inch and larger for the same MIL-type that are made to the same formulation.

4.3.2.2 SAW flux sample. Unless otherwise specified in the detail specification, the flux selected for testing shall be one 100-pound of flux. When schedule A and schedule B tests are to be conducted, two 100-pound bags of flux shall be selected at the same time, one bag shall be used for schedule A tests and the other bag shall be used for schedule B tests. The bag or bags of flux shall remain unopened until the start of welding.

4.4 First article inspection. First article inspection shall consist of the examinations and tests in accordance with MIL-E-23765/3.

4.4.1 First article inspection report. A first article inspection report shall be prepared in accordance with the data ordering document (see 6.2.2).

4.4.2 Sample for first article inspection. The electrode selected for testing shall be one spool of form 3b, or one coil of form 3d, 1/16-inch diameter size of each MIL-type for which the manufacturer desires to qualify, provided this form and size is representative of the cleaning method used for all forms and sizes of that alloy. If more than one cleaning method is used for various other diameter forms and sizes of any electrode alloy, first article applications shall give complete details. The manufacturer shall furnish one spool of form 3b or one coil of form 3d electrode of the MIL-type to be inspected. When an electrode is to be first article tested for the SAW process, the manufacturer shall furnish a sample of the flux. The samples shall be selected in the presence of the Government representative.

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4.5 Quality conformance inspection4.5.1 Lot definition of bare solid electrodes.

4.5.1.1 Lot. For the purpose of sampling and inspection, unless otherwise specified in the detail specification, a lot of electrodes or rods shall be the quantity of one type alloy produced as specified in either 4.5.1.1.1 or 4.5.1.1.2.

4.5.1.1.1 Lot identification by heat of metal. Where manufacturing processes are such that wire is identified by a heat of metal, the lot in addition to 4.5.1.1 shall be the quantity produced from a single heat of metal.

4.5.1.1.2 Lot identification by controlled wire chemical composition. Where manufacturing processes are such that wire is identified by controlled chemical composition of each MIL-type (see 4.3.1.2), in addition to 4.5.1.1, a lot of electrodes shall be the quantity produced from one or more chemically tested mill coils from one or more heats of metal conforming to the approved chemistry control limits for that type electrode. The following additional conditions shall apply:

- (a) Each continuously rolled mill-coiled rod furnished by mill prohibiting spliced-coil practice, shall be chemically analyzed by approved methods (see 4.3.1.2). Mill-coiled rod furnished by mills permitting spliced-coil practice, shall have no more than one splice per coil, and both ends of every coil received from such mills shall be chemically analyzed before processing.
- (b) Chemical analyses shall be certified by the laboratory and made available to the Government representative.
- (c) Mill coils conforming to established wire chemistry control for a specific MIL-type electrode shall be appropriately identified and segregated to avoid mix-ups.

4.5.2 Lot definition of alloyed cored electrodes.

4.5.2.1 Lot. A lot of electrodes shall be the quantity of any size and type produced from the following:

- (a) One dry batch (see 4.5.2.2) or one dry blend (see 4.5.2.3) and one heat of metal (see 4.5.2.4) not to exceed 25,000 pounds of electrodes, or
- (b) Chemically controlled dry batches of alloy material (see 4.5.2.6) and chemically controlled mill coils (see 4.5.2.7) not to exceed 100,000 pounds of electrodes.

4.5.2.2 Dry batch. A dry batch of alloy mixture shall be the quantity of dry alloy ingredients mixed at one time in one mixing vessel. The dry batch may be used singly or subsequently subdivided.

4.5.2.3 Dry blend. A dry blend shall be one or more dry batches mixed in a mixing vessel and combined proportionately to produce a uniformity of mixed ingredients equal to that obtained by mixing the same total amount of dry ingredients at one time in one mixing vessel.

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4.5.2.4 Heat of metal. A heat of metal shall be that material obtained from one furnace melt.

4.5.2.5 Chemically controlled materials. The procedure for manufacturing alloyed cored electrodes using chemically controlled material shall be as specified in 4.5.2.6 for flux material and 4.5.2.7 for mill coil.

4.5.2.6 Flux material. Each dry batch (see 4.5.2.2) shall be chemically analyzed for conformance to the percent allowable variation (disclosed) from standard (not disclosed) for each formulated chemical element for each MIL-type electrode, (see 4.3.1.4). The following conditions shall apply:

- (a) Identification of each dry batch as to the Intended use based on the results of the chemical analysis.
- (b) Maintain record of chemical analysis.
- (c) Chemical analysis report of allowable variation from standard shall be available to the Government representative upon request.
- (d) Maintain traceability to each dry batch in lot identification of the electrodes

4.5.2.7 Mill coil. Each continuously rolled mill coil shall be chemically analyzed for conformance to the approved chemical composition control limits (see 4.3.1.4). The mill coils used for the production of one lot of electrodes shall be the product of one or more heats of metal. The following conditions shall apply:

- (a) One end of each mill coil furnished by mills prohibiting spliced-coil practice shall be sampled for the above chemical analysis. Both ends of each mill coil furnished by mills permitting one splice per coil shall be sampled for the above chemical analysis. Mill coils with more than one splice in each coil shall not be used.
- (b) chemical analysis shall be Certified by the laboratory and made available to the Government representative.
- (c) Mill coils, conforming to the established chemical composition control limits for a specific MIL-type electrode, shall be appropriately identified and segregated to avoid mixups.

4.5.3 Lot definition of submerged arc welding flux.

4.5.3.1 Inspection lot. For purposes of sampling and quality conformance inspection, a lot shall consist of all flux of one type offered for delivery at one time.

4.5.3.2 Lot identification. Each lot of flux shall be uniquely identified by the manufacturer's control number or other marking which shall appear on each unit and shipping container.

4.5.4 Sampling for rods and electrodes.

4.5.4.1 Sampling for Inspection of filled containers. Unit packages and shipping containers shall be sampled and inspected in accordance with MIL-W-10430.

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4.5.4.2 Sampling for visual examination or rods and electrodes. Sample rods and electrodes shall be selected either from the production line immediately prior to packaging or from filled unit packages. If selected from the production line, the total sample shall be in accordance with table V and the electrodes or rods shall be selected throughout the run so that all parts of the run are represented. If selection is made after the packaging operation, the total sample shall be in accordance with table V and approximately the same number of electrodes or rods shall be selected from each of the sample unit packages (five cut-lengths (rods) of each package) and sufficient electrode to form one complete circle shall be taken from each sample spool, coil and drum.

TABLE V. Sampling for visual examination.

| Lot size, number of spools, coils or drums of electrodes or boxes of rods in lot | Sample size, number of spools, coils, drums or boxes selected at random for examination | Acceptance number, maximum number spools, coils, drums or boxes containing defective electrodes or rods for acceptance of the lot |
|--|---|---|
| 2 to 8 | 2 | 0 |
| 9 to 15 | 2 | 0 |
| 16 to 25 | 3 | 0 |
| 26 to 50 | 3 | 0 |
| 51 to 90 | 5 | 0 |
| 91 to 150 | 5 | 0 |
| 151 to 280 | 8 | 1 |
| 281 to 500 | 8 | 1 |
| 501 to 1,200 | 13 | 2 |
| 1,201 to 3,200 | 13 | 2 |
| 3,201 to 10,000 | 20 | 3 |
| 10,001 to 35,000 | 20 | 3 |

4.5.4.3 Any sample coil, spool, drum or box which contains any nonconforming material shall be counted as defective. If in any sample the number of coils, spools, drums or boxes which do not conform to this specification exceeds the acceptance number specified in table V, this shall be cause for rejection of the lot.

4.5.4.4 Sampling for cast and helix tests. Specimens shall be cut from spools and coils selected in accordance with 4.5.4.2 and table V and shall be tested and evaluated as specified in 3.6.4. If any specimen fails the tests, the tests shall be performed on every spool or coil of the lot (see 4.5.1.1 as applicable), and all failures shall be rejected.

4.5.4.5 Sampling for chemical analysis. One specimen shall be selected from the lot (see 4.5.1 or 4.5.2) and chemically analyzed to verify conformance to the required chemical composition specified in the detail specification. When more than one production line is being used to deposit copper coating on a single lot of electrodes, the following procedure shall be conducted in addition to the usual chemical composition conformance test:

- (a) Sample the product of each line at least once each shift.
- (b) Analyze for copper coating and record each result.
- (c) Identify the product of each line.
- (d) Purge nonconforming material prior to shipment.

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4.5.4.6 Sampling for weld tests. Sufficient quantity of electrodes or rods shall be selected from each lot (see 4.5.1.1) for use in the preparation of such welds as may be required in the detail specification.

4.5.5 Sampling for SAW flux.

4.5.5.1 Sampling for examination of filled containers. A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105, inspection level I, acceptable quality level (AQL) of 2.5 percent defective, to verify compliance with this specification regarding fill, closure, marking, and any other requirements not involving tests.

4.5.5.2 Sampling for weld test. Sufficient quantity of flux shall be selected from each lot (see 4.5.3.1) for use in the preparation of such welds as may be required in the detail specification.

4.6 Inspection procedures.

4.6.1 Visual and dimensional examination. Sample lengths and pieces selected in accordance with 4.5.4.2 shall be examined to verify conformance to visual and dimensional requirements specified in section 3 herein and in the detail specification.

4.6.2 Quality conformance tests. Samples selected in accordance with 4.5.4.4, 4.5.4.5 and 4.5.4.6 shall be used to perform such tests as may be required in the detail specification to verify conformance to the temper requirements for the electrode, chemical composition of electrode or rod, soundness of weld deposit and mechanical properties of welded joints. Samples of flux selected in accordance with 4.5.5.2 shall be used for SAW welds.

4.6.3 Certification of tests. Results or examinations and tests (see 4.6.1 and 4.6.2) shall be certified by a responsible company official and furnished to the consignee, as required in the detail specification. Except for controlled mill coil chemical composition lots (see 4.5.1.1.2), the contractor shall report the heat number and material source (melting), for lots identified by heat of metal (see 4.5.1.1.1). The certification report shall be prepared in accordance with the data ordering document (see 6.2.2).

4.7 Test procedures.

4.7.1 Preparation of welds.

4.7.1.1 Welding equipment. Manual, semi-automatic or machine equipment shall be used with either the GMA or GRA processes for testing electrode or cut-length rod. The equipment used for SAW shall be a standard commercial type with automatic welding head, designed for use with and capable of a uniform and controlled feed of granular flux and bare wire, a uniform and controlled speed of travel, and of sufficient power capacity for the welding operations required in the detail specifications. Equipment shall be supplied with welding current from either motor generator or rectifier in accordance with NEMA EW 1.

4.7.1.2 Shielding gas. Shielding gas shall be as specified in the detail specification.

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4.7.1.3 Welding current. Welding current used in all weld tests shall be as specified in the detail specification.

4.7.1.4 Base Plate. Base plate used in the preparation of welded joints shall be as specified in the detail specification.

407.105 Flux. The flux used in depositing test welds with the SAW process shall be a suitable neutral flux as specified in the detail specification.

4.7.2 Weld tests.

4.7.2.1 Radiographic examination. Groove welds shall be radiographed **in** accordance with MIL-STD-271, using sensitivity level 2-2T.

4.7.2.2 Mechanical tests. When required in the detail specification, tensile and bend test specimens shall be prepared and tested in accordance with AWS B4.0, and impact test specimens in accordance with FED-STD-151. For purposes of determining conformance with this specification, an observed or calculated value shall be rounded off to the nearest 1,000 pounds per square Inch tensile and yield strength and "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value for other values in accordance with the rounding-off method in accordance with ASTM E 29.

4.7.3 Chemical analysis. Chemical composition of the solid bare electrode or rod (un-deposited) or weld metal deposited by alloyed cored electrodes shall be determined in accordance with FED-STD-151.

4.7.4 Cast and helix. Cast and helix shall be determined as specified in 3.6.4.

4.7.5 Alloy identity.

4.7.5.1 Procedure. The alloy identity test method may include chemical analysis, metal sorting devices, other approved methods, or a combination of methods. The test method shall be submitted for approval to NAVSEA.

4.7.5.2 Acceptance criteria. If the test demonstrates that the material is not of the type specified, the material shall be rejected.

4.7.6 Unsatisfactory weld metal test results. If the results of the first tests involving weld metal are determined to be unsatisfactory, one retest involving twice the number of specimens originally required may be permitted. The results of all tests shall comply with the weld metal test requirements. The retest weldments shall be made using electrodes from the same sampling or test as those of the initial test. If the retest is conducted to correct welding operator error, only the kind of tests that failed need to be retested but the welding procedure shall be the same as that of the initial test. If the retest is conducted to correct welding procedure error, all of the weld metal tests originally required shall be retested.

4.8 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

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5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.2.1).

5.1.1 Level A.

5.1.1.1 Wrapping forms 3a and 3b spools. Each spool shall have the periphery of electrodes wrapped with paper backed aluminum foil, minimum 0.0035-inch thick laminated to 30-pound basis weight kraft paper. Wrapping shall be held in place with tape. In lieu of wrapping, individual spools may be placed in an extruded gusseted polyethylene bag which shall be 12 by 5 by 20 inches, 0.004-inch thick. The bottom and top of the bag shall be heat sealed after loading.

5.1.1.2 Packaging form 3a spools. Each spool shall be placed in a set-up or folding paperbox conforming to PPP-B-676 or PPP-B-566 respectively, at the option of the contractor. Twenty spools shall be then placed in a fiberboard box in accordance with class 3 container of MIL-W-10430. Box closure, reinforcement and waterproofing with tape shall be in accordance with the appendix to PPP-B-636.

5.1.1.3 Packaging form 3b spools. Each spool shall be placed in a fiberboard box in accordance with class 3 container of MIL-W-10430. Box closure, reinforcement and waterproofing with tape shall be in accordance with the appendix to PPP-B-636.

5.1.1.4 Packaging form 3C coils with support. Coils with support shall be expendable and of construction sufficient to carry the specified weight of wound material during handling, shipment, storage and use. Each coil shall be packaged in a fiber box conforming to PPP-B-636, class weather-resistant, type CF. Center and edge seams and manufactured joints shall be sealed with tape in accordance with the appendix to PPP-B-636.

5.1.1.5 Packaging forms 3d and 3e coils. Form 3d coil shall be either individually packaged in class 3 unit containers in accordance with MIL-W-10430 or individually spiral-wrapped with one or more layers of waterproof material conforming to PPP-B-1055 and secured with a double tie of 5/64 inch minimum diameter, medium or soft temper, steel wire. An alternate method shall consist of placing form 3d coil directly into a fiber drum for the level of packing specified. Form 3e coils shall also be placed in fiber drums for the level of packing specified.

5.1.1.6 Packaging form 4 electrode (wound in drums). Form 4 electrode shall be individually packaged in class 4 containers in accordance with MIL-W-10430.

5.1.1.7 Packaging form 6 rods (cut-length). Rods of like type shall be furnished in 10- to 50-pound net weight per container, as specified. Containers shall conform to class 2, class 3 or class 5 of MIL-W-10430. Fiberboard containers shall have all center and edge seams and manufacturer's joint sealed with tape in accordance with the appendix to PPP-B-636.

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5.1.1.8 Packaging for flux. Flux shall be suitably packaged to ensure against damage during shipment and storage under normal conditions. Flux in its original unopened containers, shall withstand storage under normal conditions for at least 6 months without damage to its welding characteristics or the properties of the weld. Heating of the flux may be necessary to assure dryness.

5.1.2 Level C packaging

5.1.2.1 All classes of electrode and rod. Packaging shall be sufficient to afford protection against physical damage during shipment from the contractor to the using activity (see 6.5.4) and until early use.

5.2 Packing Packing shall be level A, B, or C as specified (see 6.2.1).

5.2.1 Level A. Electrodes and rods shall be packed in accordance with level A of MIL-W-10430.

5.2.2 Level B. Electrodes and rods shall be packed in accordance with level B of MIL-W-10430,

5.2.3 Level C. Packing shall be accomplished in a manner which shall ensure acceptance by common carrier and afford protection against physical or mechanical damage during direct shipment from the contractor to the using activity for early use. The shipping containers or method of packing shall conform to the Uniform Freight or National Motor Freight Classification Rules or other carrier rules as applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required by the contract or order (see 6.2.1) or herein, interior containers (packages) and exterior shipping containers shall be marked in accordance with MIL-STD-129.

5.3.1 Special marking.

5.3.1.1 Interior packages. Shipment marking information for electrodes and granular flux shall be provided on interior packages. The information shall include lot identification, type, size when applicable, specification number, manufacturer^s or distributor^s name, manufacturer's or distributor's brand or type designation. In addition, all packages or the smallest integral unit within a shipping container, shall carry the following warning label, or equivalent, prominently displayed in legible type on the package:

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"WARNI NC : Protect yourself and others. Read and understand this label.

FUMES AND GASES can be dangerous to your health. ARC RAYS can injure eyes and skin. ELECTRIC SHOCK can kill.

- 1 Read and understand the manufacturer's instructions and your employer's safety practices
- 1 Keep your head out of the fumes.
- 1 Use enough ventilation exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.
- . Wear correct eye, ear, and body protection.
- 1 Do not touch live electrical parts.
- 1 See American National Standard 249.1, 'Safety in Welding and Cutting-', published by the American Welding Society, 550 NW LeJeune Road, P.O. Box 351040, Miami, FL 33135: OSHA Safety and Health Standards, 29 CFR 1910, available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

DO NOT REMOVE THIS LABEL"

5.3.1.2 Exterior shipping containers and palletized unit loads. In addition to the marking information required for interior packages as specified in 5.3.1.1, except the caution label, the information shall include shipping destination, stock number furnished with contract or order, customer's order number, customer's item number, and customer's name.

6. NOTES

6.1 Intended use. Solid bare and alloyed cored welding electrodes and cut-length rods are intended for use with the GMA, GTA and SAW welding processes.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Title, number and date of the applicable detail specification.
- (c) Types, forms and sizes required (see 1.2).
- (d) When first article is required (see 3.3).
- (e) Whether alloy identity testing of each electrode or rod after final marking is required (see 3.5.5.2).
- (f) Whether 12 or 18 inch rods are required (see 3.7.2).
- (g) Level of packaging and packing required (see 5.1 and 5.2).
- (h) Special marking required (see 5.3).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of FAR ..227-7031 are invoked and the DD Form 1423 is not used, the data specified

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below shall be delivered by the contractor In accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

| <u>Paragraph no.</u> | <u>Data requirement title</u> | <u>Applicable DID no.</u> | Option |
|----------------------|---------------------------------|---------------------------|--------|
| 4.4.1 | First article inspection report | DI-T-4902 | — |
| 4.6.3 | Certification report | UDI-A-23264 | — |

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L., Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List QPL-23765 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3.1).

6.3.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 First article inspection. Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection as 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.

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6.5 Definitions. For the purpose of this specification the welding terms **nd** definitions contained in AWS A3.0 shall apply. In this specification and the detail specifications, the terms electrode and rod are used interchangeably with the term wire and denotes a filler-metal wire with no coating other than that incidental to its manufacturer or preservation, as specified in the detail specifications for coating.

6.5.1 Command or agency concerned. Command or agency concerned is the Government or prime contractor or authorized representative who has design or acquisition responsibility acting under contract to the Government.

6.5.2 Contractor. The contractor is the seller under the contract or purchase order which incorporates this specification.

6.5.3 Manufacturer. The manufacturer is the actual processor of the welding electrodes and rods, engaged in the final cleaning, spooling, cutting to length, affixing rod identification, marking and packaging operations.

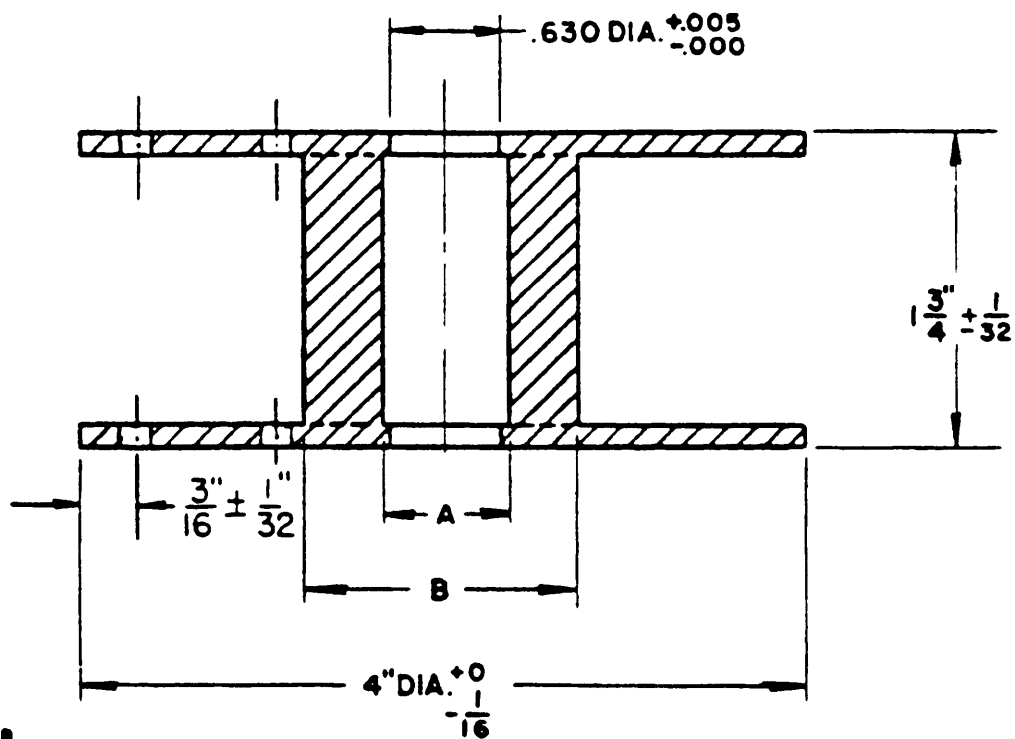
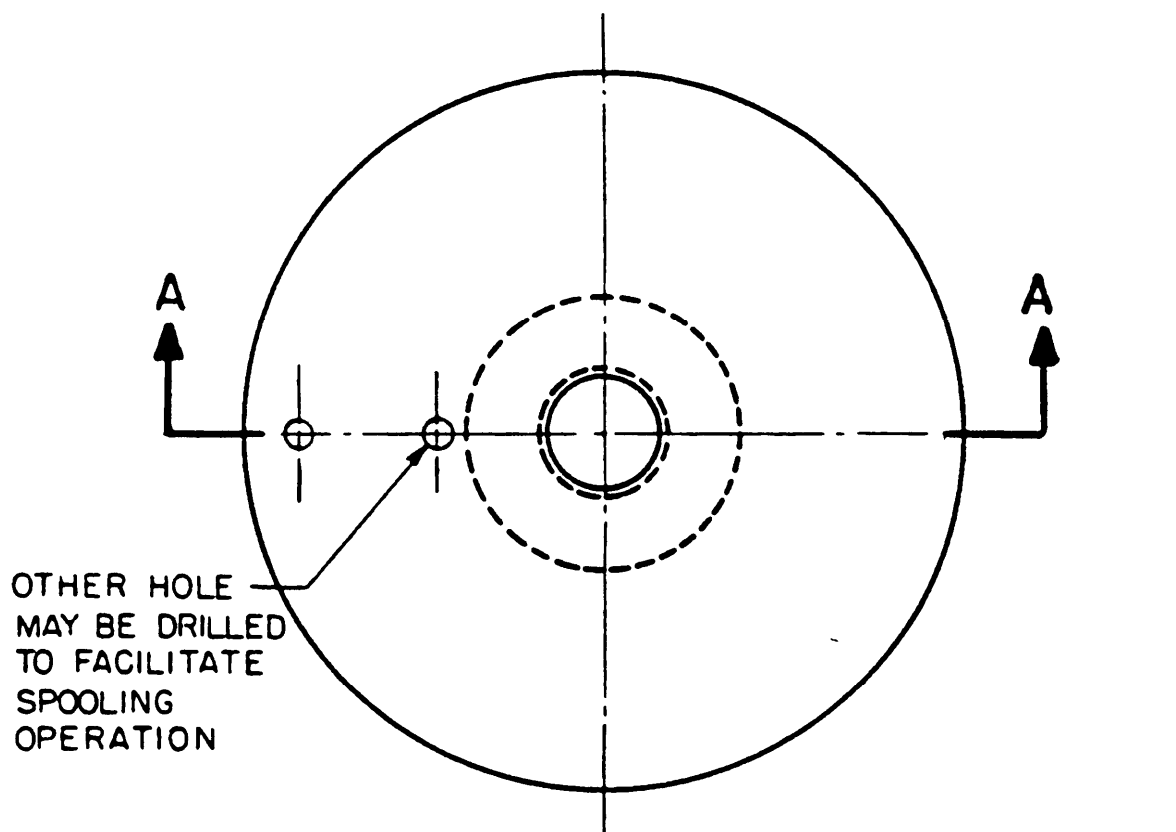
6.5.4 Using activity. The using activity is the organization acquiring welding electrodes, rod or wire from the contractor.

6.5.5 Alloy cored electrode. An alloy cored electrode is a composite filler metal electrode consisting of a metal tube or other hollow configuration containing alloying ingredients. It has a formulation designed especially for the submerged arc welding process using a neutral granular flux.

6.6 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 3439-N568)

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SH 44348

SECTION A-A

FIGURE 1. Details for form 3a spools.

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Notes to figure 1:

1. Flange and barrel material shall be nonconductive, and of such construction to carry the net weight of specified electrode and retain stability under handling, shipment, storage, and use. Spools shall be constructed of hardboard flanges and cardboard barrels. Plastic spools may be used.
2. All dimensions in inches.
3. Dimension A, inside diameter of barrel, shall be such that swelling of the barrel or misalignment of the barrel and flanges does not result in the core of the spool being less than the inside diameter of the flanges.
4. Dimension B, outside diameter of barrel, shall be such as to permit proper feeding of the electrode.
5. Spooled electrode alloy shall be labeled and identified as to type and size of electrode in accordance with commercial practice.
6. The ends of the electrode shall be securely fastened to the hub and either flange by any means that permits accessibility to the starting end, while satisfactorily retaining the electrode on the spool until used and, moreover, does not interfere with unspooling operation during welding.

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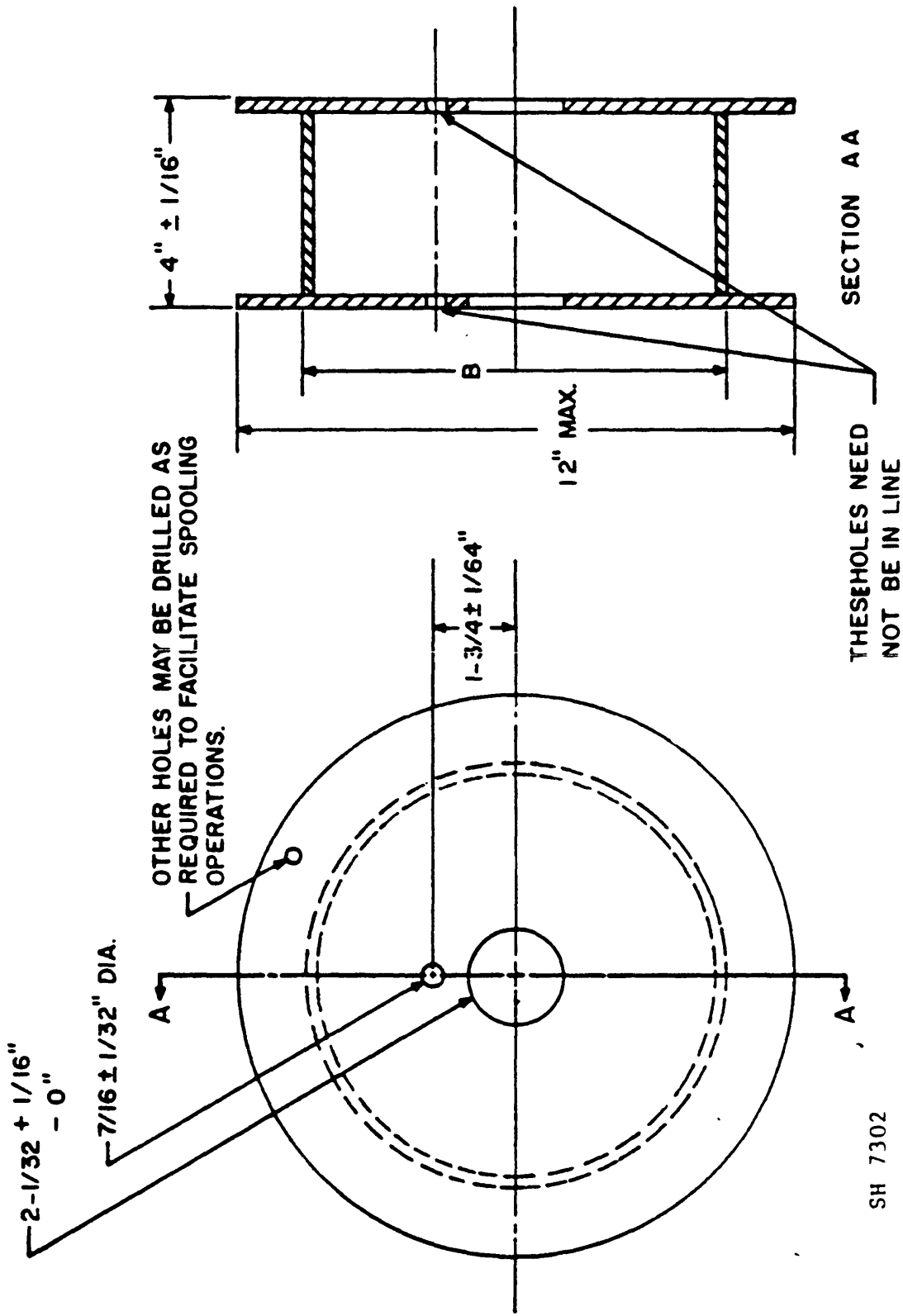


FIGURE 2. Details for form 3b spools.

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Notes to figure 2:

1. Flange and barrel material shall be nonconductive, and of such construction to carry the net weight of the specified electrode and retain stability under handling, shipment, storage, and use. spools shall be constructed of hardboard flanges and cardboard barrels. Plastic spools may be used.
- 2* All dimensions in inches.
- 30 Dimension B shall be such as to permit proper feeding of electrode.
4. Flanges shall not be out of parallel more than 3/16 inch. Flanges shall not toe in.
5. The ends of the electrode shall be securely fastened to the hub and either flange by any means that permit accessibility to the starting end, while satisfactorily retaining the electrode on the spool until used and, moreover, does not interfere with unspooling operation during use.
6. Spooled electrode shall be labelled and identified as to type and size of electrode in accordance with commercial practice.
7. Spool rim may be provided with a removable plug (one side only).

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