

MIL-W-41B

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SUPERSEDING**JAN-W-41A**

25 SEPTEMBER 1945

MILITARY SPECIFICATION**WELDING OF ARMOR, METAL-ARC, MANUAL,
WITH AUSTENITIC ELECTRODES; FOR AIRCRAFT**

*This specification has been approved by the Department of Defense
for use of the Departments of the Army, the Navy, and the Air Force.*

1. SCOPE

1.1 This specification covers the requirements for manual metal-arc welding with austenitic electrodes of built-up metal structures, hereinafter designated as weldments, constructed of face-hardened or homogeneous armor, or both, in thicknesses $\frac{1}{8}$ to $1\frac{1}{8}$ inches, inclusive; and the attachment of brackets, clips, and other connecting members to armor by manual metal-arc welding (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 The following specifications and standards, of the issue in effect on date of invitation for bids, form a part of this specification.

SPECIFICATIONS**FEDERAL**

QQ-M-151 —Metals; General Specification for Inspection of.

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MIL-R-11468 — Radiographic Inspection; Soundness Requirements for Arc and Gas Welds in Steel.

MIL-R-11471 — Radiographic Inspection of Metals.

MIL-W-12683 — Welding; Joint Design; Data for.¹

MIL-E-13080 — Electrodes; Welding, Covered, Steel, Austenitic (For Special Applications).

STANDARDS**MILITARY**

MIL-STD-19 —Welding; Symbols for.

MIL-STD-20 — Welding; Nomenclature and Definitions.

MIL-STD-22 —Design of Joints for Arc- and Gas-welding Processes.²

MIL-STD-129 —Marking for Shipment and Storage.

3. REQUIREMENTS

3.1 Material.—The armor and other metals to be used in weldments under this specification shall meet the requirements of the applicable specification listed in the contract or on drawings.

3.2 Equipment.

3.2.1 *Welding equipment.*—The contractor shall demonstrate to the satisfaction of the inspector that the arc-welding equipment is

¹ Applicable only to Army and Air Force purchases.

² Applicable only to Navy purchases.

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capable of making satisfactory welds when operated by a qualified welder using a satisfactory electrode. Multiple-operator sets shall be tested while the maximum number of welders are welding. If, under these conditions, the applicable qualification requirements cannot be met, the equipment shall not be used until the necessary repairs, adjustments, or replacements have been made.

3.3 Contractor's recorded procedure for welding joints.

3.3.1 Drawings for joints.—The contractor shall prepare an isometric or perspective drawing (or other suitable sketch or drawing) of the structure, showing the location of each joint and shall establish the recorded procedure or procedures for welding joints required to cover all welding (including repair of welded joints) to be performed under this specification (see 3.3.4).

3.3.2 Each recorded procedure for welding joints, except for repair of welded joints, shall contain a reference to the location of the joints as shown in the isometric or perspective drawing (or other suitable sketch or drawing), shall include a detailed cross-section sketch of the joint, shall include the factors listed in table II, and shall be in accordance with a form approved by the procuring service involved (see 6.4 and form B).

3.3.3 Repair welding. — Recorded procedures for repair welding of welded joints shall include factors 5 to 11, as listed in table II, and in addition shall include the following:

- (1) Method used for removal of defect; i.e., grinding, etc.;
- (2) Contour of cavity prior to welding; i.e., minimum root dimension, included angle, etc.; and
- (3) Use of backing or spacer strip, in case of complete removal of weld, and statement whether packing, if used, is removed after repair.

3.3.4 Submittal.—Before starting qualification of procedures and welders, as required by paragraphs 3.4 and 3.5, drawings (see 3.3.1) and recorded procedures for welding joints (see 3.3.2) shall be submitted on an approved form to the Government service having cognizance of the contract (see 6.4 and form B). This form shall be distributed as follows:

- (1) For contracts under Army cognizance:
 - (a) Two copies to the office having technical cognizance of the item being manufactured,
 - (b) One copy to applicable proving ground or proof range,
- (2) For contracts under Navy cognizance, one copy each to:
 - (a) Chief, Bureau of Aeronautics, Navy Department, Washington 25, D. C. and
 - (b) Commander, U. S. Naval Proving Ground, Dahlgren, Va.
- (3) For contracts under Air Force cognizance:
 - (a) Two copies to Wright-Patterson Air Force Base, Dayton, Ohio,
 - (b) One copy to applicable proving ground or proof range.

Final approval of this welding procedure shall be based upon the acceptance of test-weld specimens submitted and tested in accordance with 4.2.1.

3.4 Procedure qualification.

3.4.1 Qualification.—Each procedure to be used, except for repair of welded joints, shall be qualified in accordance with paragraph 4.2.1.

3.4.2 Requalification.—When any factor of the recorded procedures for joints is changed, procedure requalification shall be required as indicated in table II.

3.5 Welder qualification.

3.5.1 Qualification.—Each welder shall be qualified in accordance with the requirements of 4.2.2.

3.5.2 Requalification.—When any factor of the recorded procedure for welding joints is changed, welder requalification shall be required as indicated in table II.

3.6 Limiting conditions.

3.6.1 Soundness.—All components shall be free of cracks and injurious buckles.

3.6.2 Temperature limits.—Post heat for relief of welding stresses shall not exceed the temperature of final draw to which the plate has been subjected. The welding of armor plate at a temperature below 60° F. shall not be permitted.

3.7 Welds.

3.7.1 Uniformity.—Welds shall be reasonably smooth and of uniform size.

3.7.2 Cleanliness.—Each layer or pass of a weld shall be cleaned to sound metal before additional passes are made. When cracks develop in any pass, they shall be removed before welding is continued. Before final inspection, all weldments shall be thoroughly cleaned by grit blasting or other method approved by the inspector. Cleaning shall be thorough on the weld and the area immediately adjacent thereto and shall be of such quality as to enable the detection of cracks or other defects. When joints are welded from both sides of the armor and complete fusion is required (see 3.7.3), the root pass shall be chipped, machined, or ground to sound metal before the opposite side of the joint is welded.

3.7.3 Completeness of fusion.—Except as may be indicated by drawings and paragraph 3.12.2, there shall be complete fusion between the weld metal and the base metal throughout the joint.

3.7.4 Edge preparation.—Edge preparation shall be done by machining or grinding, unless otherwise specified (see 3.10.3).

3.8 Marking for identification.

3.8.1 Identification.—All weldments shall be marked for identification in such a manner that the identity of the welder will not be lost during any subsequent heat-treatment or machining. Such marking shall be done in a manner that will not impair the properties of the weldment.

3.8.2 Approval. — Identification marking shall be approved by the inspector.

3.8.3 Permission for removal.—Removal of identification marking from the weldment without the permission of the inspector shall be cause for rejection.

3.9 Interchangeability.—All parts shall be within the dimensions and tolerances specified on the applicable drawings, in order to insure interchangeability of like components to be assembled in the structure.

3.10 Fabrication.

3.10.1 Attachments.—Brackets, clips, and all other connecting members shall be attached by welding to the soft side only of face-hardened armor.

3.10.2 Preheating. — Preheating shall not be permitted in excess of the temperature of boiling water for face-hardened armor in the finished hardened condition, or in excess of 300° F. less than the draw temperature for homogeneous armor when welded after heat treatment.

3.10.3 Flame cutting. — When specifically approved by the procuring service, flame cut-

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ting may be permitted on homogeneous armor. Flame cutting on face-hardened armor shall be permitted only where final edge finish is done by machining or grinding. Sufficient machining or grinding should be done to clean up the surface.

3.11 Reinforcement.—The thickness of all reinforcements on butt and bevel joints shall be not more than $\frac{3}{8}$ inch except as may be shown on the applicable drawing for each weldment.

3.12 Weld defects.

3.12.1 Rejectable defects.—The following defects shall be cause for rejection:

- (1) Cracks in weld metal or heat-affected zone of the armor;
- (2) Excessive undercuts alongside weld;
- (3) Insufficient penetration of the joint;
- (4) Incomplete fusion of weld metal, armor, and attachment material;
or
- (5) Excessive porosity and inclusions.

3.12.2 Standards for acceptance (radiographic). — Unless otherwise specified, in radiographic inspection of production weldments, the standards for acceptability shall be Specification MIL-R-11468, standard III (see 4.1.1.3 and 4.1.3.2).

3.13 Weld repairs.—All unacceptable weld defects shall be removed and the defective

area shall be repaired unless, in the opinion of the inspector, the defects are such as to warrant scrapping the weldment.

3.14 Root opening. — When groove welds are used the root opening shall be not less than that used in the procedure qualification test plates nor shall exceed that used in the procedure qualification test plates by more than $\frac{3}{16}$ inch.

3.15 Applicable test requirements.

3.15.1 Ballistic requirements.—Test-weld specimens made by the manufacturer in accordance with figure 1 for welding procedure qualification shall be capable of withstanding ballistic shock test as prescribed in 4.2.1.6.

3.15.2 Shear test-weld requirements. — In qualification for welding procedure the contractor shall show in accordance with figure 2 that by using his procedure the specimen will pass the minimum requirements of table I.

TABLE I. Minimum shear strength of fillet welds

Clip thickness	Breaking load	Clip thickness	Breaking load
Inch	Pounds	Inch	Pounds
$\frac{3}{32}$	12,000	$\frac{5}{16}$	40,000
$\frac{1}{8}$	16,000	$\frac{3}{8}$	48,000
$\frac{3}{16}$	24,000	$\frac{7}{16}$	56,000
$\frac{1}{4}$	32,000	$\frac{1}{2}$	65,000

TABLE II. Factors in the recorded procedure for welding joints and changes which require procedure requalification and welder requalification

Factors included in recorded procedure for welding joints	When factor is changed, a recorded procedure for welding joints shall be revised and procedure requalified, as indicated	Welder shall be requalified, as indicated
1. Composition of armor or attachment materials.	Yes; when a change in composition outside of the steel producer's declared chemical range is made, unless a specific waiver is granted by the chief of the procuring service involved.	No.

TABLE II. Factors in the recorded procedure for welding joints and changes which require procedure requalification and welder requalification—(Continued)

Factors included in recorded procedure for welding joints	When factor is changed, a recorded procedure for welding joints shall be revised and procedure requalified, as indicated	Welder shall be requalified, as indicated
2a. Thicknesses of armor for each joint type.	Yes; when the maximum thickness for joint type is increased or decreased beyond thickness represented by the procedure qualification plate tested to represent that joint type. (See 4.2.1.1.)	Yes. (See 4.2.2.)
2b. Thicknesses of attachment materials.	Yes; for changes in thickness exceeding 1/8-inch from thickness qualified.	No.
3. Dimensions of root opening, root face, and included angle for each joint type. Each dimension shall have a tolerance specified.	Yes; when established limits are increased or decreased, i.e., basic dimensions plus tolerance.	Yes; when root opening or included angle is decreased or root-face dimension is increased.
4. Backing or spacer strip, if used.	Yes; when backing or spacer strip is added or removed; or basic type of material of backing or spacer strip is changed.	Yes; when backing or spacer strip is removed.
5. Source of power, a.c. or d.c., and polarity if d.c. is used.	Yes.....	Yes; when change is made from a.c. to d.c. or when polarity is changed.
6. Spatter compound if used on scarfed edges.	Yes; when spatter compound is added.....	No.
7. Electrode; grade, type, and class or brand if not qualified under MIL-E-13080.	Yes; when the brand used for procedure qualification has been qualified but does not meet the requirements of Specification MIL-E-13080, substitution of any other brand will require requalification of procedure. However, when the brand used for procedure qualification has met the requirements of Specification MIL-E-13080 for a specific grade, type or class and provided that all other factors remain the same, any other brand which has met the requirements of Specification MIL-E-13080 for the same grade and type and class may be substituted without requalification of procedure.	No.
8. Electrode; sizes for all passes. (For root-pass diameter or diameters of electrodes to be used for various root dimensions from minimum to maximum.)	Yes; when (for groove welds) the actual width of groove at which any given size of electrode is used is decreased; or (for fillet welds) when the diameter used at any given distance from the root of the weld is increased.	Yes; when (for groove welds) the actual width of groove at which any given size of electrode is used is decreased; or (for fillet welds) when the diameter used at any given distance from the root of the weld is increased.

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TABLE II. Factors in the recorded procedure for welding joints and changes which require procedure requalification and welder requalification—(Continued)

Factors included in recorded procedure for welding joints	When factor is changed, a recorded procedure for welding joints shall be revised and procedure requalified, as indicated	Welder shall be requalified, as indicated
9. Welding current and arc voltage range for all passes (see 6.3).	Yes; when the limits established in the welding procedure specification are exceeded.	No.
10. Position in which welding will be performed.	Yes.....	Yes. (See 4.2.2.4.)
11. Preheat temperature range (see 3.6.2 and 3.10.2).	Yes; when range is changed.....	No.
12. Location and approximate number of passes.	Yes; in case of change from beading to weaving, or annealing to nonannealing beads, or vice versa.	Yes; in case of change from beading to weaving only.
13. Method of preparing root of joint before welding second side.	Yes.....	No.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection.

4.1.1 Place of inspection.

4.1.1.1 *Inspection and tests.*— Inspection and tests, except ballistic tests, shall be made at the manufacturer's plant, unless otherwise specified (see 4.1.1.2 and 4.1.1.3).

4.1.1.2 *Ballistics tests.*—Ballistic tests shall be made, when the contract is under Army or Air Force cognizance, at a proof range selected by the Chief of Ordnance, and when under Navy cognizance at the Naval Proving Ground, Dahlgren, Va.

4.1.2 *Visual inspection.*—All welds shall be visually inspected for compliance with this specification.

4.1.3 Detail inspection.

4.1.3.1 *Sampling.*— Not less than 1 nor more than 5 percent of weldments from each

plant's production shall be selected by the inspector for detailed inspection by radiography unless otherwise authorized by the procuring service.

4.1.3.2 *Radiographic inspection.*— Weldments so selected for detail inspection shall be subjected to radiographic inspection. The location and number of exposures shall be as directed by the procuring service. The number of radiographs per day shall not exceed that required by the contract except when the contractor chooses to make additional radiographs at no expense to the Government in order to demonstrate acceptability of questionable weldments. Unless otherwise specified, the radiographic procedure used shall comply with Specification MIL-R-11471 and the radiographic equipment shall perform in accordance with Specification MIL-R-11471.

4.1.3.3 *Check on welders.*—When examination of a welder's production reveals unsatisfactory weld quality, additional production weldments from that welder, as deemed neces-

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sary by the inspector to assure satisfactory weld quality, shall be taken for examination at no cost to the Government. Additional inspection samples shall be kept to a minimum, compatible with assurance of satisfactory weld quality.

4.1.4 Inspection after repair.—All weldments requiring repair after inspection shall be reinspected after repairs have been completed and approved by the inspector before release for further processing (see 4.2.1.5).

4.2 Qualification tests.—The recorded procedure for welding joints shall be submitted through the inspector to the agencies designated in paragraph 3.3.4 before starting qualification of procedure or welders (see 3.3.1).

4.2.1 Qualification of welding procedure.

4.2.1.1 Test weldments (qualification for complete coverage).—A qualification test for complete coverage of the welding procedure to be used for the manufacture of weldments shall consist in making and ballistically testing a welded test plate as shown on figure 1, and in making and physically testing two filled-weld specimens in accordance with figure 2, for the minimum and the maximum thicknesses being manufactured at each plant. When welded joints involving two thicknesses of armor or two classes of armor are used in the manufacture of weldments, each test plate of the class shown in figure 1 shall be constructed, with the center panel consisting of that armor of the higher ballistic shock requirements.

Face-hardened armor shall have its soft side marked "soft", in white letters at least 1-inch high. The interpass temperature during welding of the test plate shall not exceed the preheat temperature, if any, by more than 100°F. The interpass temperature of the base metal shall be measured immediately before deposition of each bead at a point lying approximately at the intersection of a line 1½ inches from and parallel to the centerline of

each joint and a line perpendicular to and through the midpoint of the length of the joint. When both types of fabrication are not being performed, qualification for limited coverage shall be permitted in accordance with the requirements of 4.2.1.2.

4.2.1.2 Test weldments (qualification for limited coverage).—Procedure qualification shall be permitted under the following conditions (see 4.2.1.1):

- (a) When attachments only are being welded to armor plate (see figure 2); or
- (b) When armor to armor only is being welded (see figure 1).

4.2.1.3 Position for welding.—Procedure qualification test plates shall be welded with the same procedure and in the same positions as will be used in production welding. All positions used in production welding shall be used in the preparation of the qualification test plates. (See Standard MIL-STD-20 for "position" definition.)

4.2.1.4 Data form.—Data shall be furnished with each qualification test plate as prescribed on form A or on a form approved by the procuring service (see 6.2 and form A). This form shall be sent in single copy to the Army Proving Ground accompanying the test-weld specimen for Army or Air Force contracts, and to the Naval Proving Ground, Dahlgren, Va., for Naval contracts. In addition one copy each shall be sent to the Bureau of Aeronautics when under Naval contract.

4.2.1.5 Inspection for defects.—Welds for procedure qualification tests shall be visually and radiographically inspected for defects. To be acceptable, they shall meet the requirements specified in Section 3 except that the standards for acceptability on radiographic examination shall be Specification MIL-R-11468, standard II. No weld repair exceeding 4 inches shall be made on procedure qualification test plates after initial radiographic

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inspection. The same area shall not be repaired more than once. All weld repairs shall be radiographed.

4.2.1.6 Ballistic tests.—The qualification test plate of figure 1 shall be subjected to ballistic shock tests involving high-explosive or nonpenetrating projectiles in general agreement with the requirements of the specification under which the armor is procured. The method of support, impact location, number of impacts, and requirements for acceptability shall be as directed by the Chief of Ordnance in the case of contracts under the cognizance of the Army or Air Force or by the Bureau concerned in the case of contracts under the cognizance of the Navy.

4.2.1.7 Shear test for clips.—Two fillet-weld specimens in accordance with figure 2 shall be subjected to tension tests for the purpose of determining the shear strength of the welds (see 3.15.4).

4.2.1.8 Retest.—Failure of any test specimen to meet the ballistic, radiographic, or physical requirements shall be cause for rejection of the procedure represented, subject to retest at the option of the contractor. For retest, twice the number of required test plates shall be submitted, all of which shall pass the visual and radiographic requirements and the ballistic or physical tests, as applicable. Failure of any retest plate shall be cause for rejection of the welding procedure used. No weldments rejected by one department or agency shall be submitted to another department or agency for acceptance.

4.2.2 Qualification of welders.

4.2.2.1 Proof of qualification.—Each welder shall be qualified by the contractor as specified in 4.2.2.2. The contractor shall prove to the inspector by the submission of properly identified radiographs or other evidence that each welder has been so qualified. When required by the inspector, the qualification test shall be performed in his presence.

4.2.2.2 Method of qualification for complete coverage.—To qualify, each welder shall prepare test plates using the same material that he will use in production welding. Test plates shall consist of the following for qualification for complete coverage (for qualification for limited coverage, see 4.2.2.3).

- (a) One plate made by joining with a butt weld two pieces each at least 4 inches by 12 inches by $\frac{3}{8}$ -inch where maximum thickness being welded is not over $\frac{5}{8}$ -inch (fig. 3). When maximum thickness being welded is greater than $\frac{5}{8}$ -inch, the thickness of the two pieces shall be 1-inch (fig. 4), and
- (b) One test-weld specimen at least 8 inches by 12 inches on the base and 4 inches by 12 inches on the leg made in accordance with figure 5 when maximum thickness being welded is not over $\frac{5}{8}$ -inch, and in accordance with figure 6 when maximum thickness being welded is greater than $\frac{5}{8}$ -inch.

4.2.2.3 Welder qualification for limited coverage shall be permitted when the following conditions exist (see 4.2.2.2):

- (a) When attachments only are being welded to armor plate not exceeding $\frac{5}{8}$ -inch thickness (fig. 5); or
- (b) When attachments only are being welded to armor plate exceeding $\frac{5}{8}$ -inch thickness (fig. 6); or
- (c) When the maximum thickness of armor to armor being welded does not exceed $\frac{5}{8}$ -inch (fig. 3); or
- (d) When the maximum thickness of armor to armor being welded exceeds $\frac{5}{8}$ -inch (fig. 4).

4.2.2.4 Inspection.—The weld shall be visually and radiographically inspected for defects. To be acceptable, the welds shall meet

the requirements of Section 3, except that the standards for acceptability on radiographic examination shall be Specification MIL-R-11468, standard I. Qualification by welders for positions indicated in left-hand column of table III shall qualify them for positions shown opposite in right-hand column.

TABLE III. Qualification for welders

Test passed for	Qualified for
Flat position.....	Flat position.
Horizontal position.....	Flat and horizontal positions.
Vertical position.....	Flat and vertical positions.
Overhead position.....	Flat, horizontal, and overhead positions.

5. PREPARATION FOR DELIVERY

5.1 Shipment.--(See 6.5.)

5.1.1 Marking.—Shipments shall be marked with the class of armor, plate number, and name of contractor. Any interior packages and exterior shipping containers used shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Intended use.—This specification is intended for use in welding of aircraft armor structures principally; however it may be used to weld other structures when armor is being supplied under Specifications JAN-A-256 or JAN-A-784.

6.2 Form A.—Army Ordnance Form SIP-13 may be substituted for form A. It is available to all procuring services and contractors and may be obtained from any Army Ordnance District Office.

6.3 Current values.—It is suggested that in order to obtain accurate measurements of welding current, a tong-type tester should be used. The voltmeter should be placed as close

to the electrode as practicable. The current variations for electrode sizes are suggested as follows:

Electrode size (inch):	Tolerance, plus or minus (percent)
$\frac{5}{32}$	15
$\frac{3}{16}$	10
$\frac{1}{4}$	10
$\frac{5}{16}$	5
$\frac{3}{8}$	5

6.4 Illustration of recorded procedures for welding joints.

6.4.1 Foreword.

6.4.1.1 Approved form.—Under the provisions of this specification, a contractor must establish the recorded procedure or procedures for welding joints required to cover all welding to be performed under this specification, and submit those recorded procedures for welding joints through the Government inspector to the Government service (Army, Navy, or Air Force) having cognizance of the contract (see 3.3.4). Since it is required that the recorded procedures for welding joints be submitted on an approved form, the following material has been prepared to illustrate an approved form for submitting recorded procedures for welding joints (see form B as illustrated herein.)

6.4.1.2 Optional forms.—It is emphasized that the forms and arrangements shown herein represent suggestions only. Other forms or variations of these forms will be acceptable; provided they contain all the required information and provided the information is conveyed in a readily understandable manner.

6.4.1.3 Fictitious material in form B.—The question is likely to arise: How much of the material shown herein is the contractor at liberty to adopt? He may adopt any of the formats illustrated, i.e., the formats for the tables shown on sheets 3 to 5 and the format for recorded procedures for welding joints

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as illustrated on sheets 6 to 14. However, he will not be able to adopt the data shown thereon as they are purely fictitious and intended simply to illustrate how they should be filled in.

6.4.2 Explanatory notes.—(See form B.)

6.4.2.1 Sheets 1 and 2.—Although paragraph 3.3.1 of this specification requires the preparation of an isometric or perspective drawing or a suitable sketch of the structure showing the location of each welded joint, it is realized the fulfilment of this requirement is not always possible for welded structures as encountered in aircraft construction. Consequently, there are shown illustrations of typical joints that may be used in the welding of aircraft armor. The submission of a cross-section of the welded joint that it is proposed to use will be considered as meeting this requirement.

6.4.2.2 Sheet 3.—A summary of the type illustrated on this sheet, although not required by the specification, is nevertheless almost indispensable. It provides in one place a complete picture of the different joints involved, the classes of armor in each joint, and the exact status of procedure qualification. This summary serves the following purposes:

- (a) It indicates, for each joint in the structure, the joint type as defined in Specification MIL-W-12683, and illustrated on sheets 1 and 2. (Qualification of the welding procedures is based on these joint types.)
- (b) It provides an index of the recorded procedures for welding each joint.
- (c) It indicates the kind of armor and clip attachment material in each joint.
- (d) It simplifies the problem of determining the minimum number of ballistic test plates required to

qualify all welding of the armor being installed in the airplane.

- (e) It provides space for recording the results of procedure qualification tests.
- (f) It indicates whether a given procedure has been qualified, whether it has been qualified in more than one welding position, and provides supporting evidence by stating exactly what test plates effected the qualification.

6.4.2.3 Sheet 3, general remarks.—The following paragraphs 6.4.2.3.1 to 6.4.2.3.4, inclusive, cover general remarks concerning the table on sheet 3 and illustrate some of the provisions of the specification relating to the qualification of welding procedures.

6.4.2.3.1 Welding, positions.—Two ballistic test plates as shown in figure 1 are required for each welding position, one for the maximum plate thickness and one for the minimum requirements of table I (see 3.15.4 and types A, B, C, D, E, and F (see 4.2.1.1 and 4.2.1.2.1)).

6.4.2.3.2 Plate thickness.—When the thickness of attachment materials is less than three-fourths that of the armor, it will be necessary for the contractor to demonstrate in accordance with figure 2 that by using his procedure the weldments will pass the minimum requirements of Table I (see 3.15.4 and 4.2.1.1). The number of test plates necessary to qualify will be dependent upon the thickness of armor and clip attachments involved. When one thickness of armor only is used, one test plate will be sufficient provided the thickness of all clip attachments being welded do not vary more than $\frac{1}{8}$ inch between the minimum and maximum. When the thicknesses of the clip attachments vary by more than $\frac{1}{8}$ inch two test plates are required, one each for the minimum and maximum thicknesses involved. When more than one thickness of armor is involved, the number

of ballistic test plates required for qualification will be doubled, plates being required for both the minimum and maximum thicknesses of armor used. (See factors 2a and 2b, table II, and 4.2.1.1 and 4.2.1.2.)

6.4.2.3.3 Classes of armor. — When two classes of armor (face-hardened and homogeneous) are involved in joints A to F, inclusive, each ballistic test plate of the design shown in figure 1 will be prepared using one class of armor for the center portion and the other class for the two outside portions. Under these circumstances, it is required that the armor used in the outside portions of the ballistic test plate be that class possessing the lower shock test requirement for acceptance.

6.4.2.3.4 Selection of thickness. — When armor of two thicknesses are involved in joints A to F inclusive, each ballistic test plate of the design shown in figure 1 will be prepared using the thicker plate for the center portion and the thinner plate for the two outside portions.

6.4.2.4 Sheet 4.—Space is provided in the last column of table II (Sheet 4) for recording the draw temperature employed by the armor manufacturer in heat-treating the armor. It is desirable that this information be available for ready reference since the specification prescribes that "preheating for homogeneous armor shall not be done above a temperature 300° F. below the draw temperature used in the heat treatment of the plate" and for face-hardened armor in the finished hardened condition, "preheating shall not be done above the temperature of boiling water."

6.4.2.5 Sheet 5.

6.4.2.5.1 Tables A and B.—It will be noted that the summary of electrodes has been broken down into two tables, table A for those electrodes which conform with Specification MIL-E-13080 and table B for those electrodes which do not conform with those

specifications. Table A does not include the type of covering or chemical composition range, as these factors are controlled by the grade, type and class designations.

6.4.2.5.2 Table C.—This table sets forth the ranges of current and voltage to be used with each size of electrode. This tabulation simplifies the welding procedure analyses (see sheet 5, for example) by making it possible to refer to the table rather than state the current and voltage range for each pass. (See factor No. 7 of table II.)

6.4.2.5.3 Current ranges. — The current ranges given in table C correspond to the suggested tolerances stated in the specification (see 6.3).

6.4.2.6 Sheet 6.—This form represents an attempt to devise the simplest possible form for recording a procedure for welding joints for complete coverage. It will be noted that all of the factors listed in table II of the specification have been included (see 3.3.2).

6.4.2.7 Options on electrodes.—If the contractor so desires, he may in his recorded procedure for welding joints designate only two electrodes such as B and C, whereas electrode F could also be used under the provisions of this specification without requalification of the procedure since it is also of the same grade, type, and class. This point is brought out to illustrate the principle that a contractor may wish to restrict a given procedure to limitations within a narrower range than that prescribed by the specification.

6.4.2.8 Sheet 7.—It will be noted that the sketch of the joint designates the thickness of armor for each part. This should be done whenever a given joint involves more than one thickness of armor.

6.4.2.9 Sheet 9.—It will be noted that the sketch of the joint designates the kind of armor for each part. This should be done

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whenever a given joint involves more than one class of armor.

6.4.2.10 Sheets 13 and 14.—When a given joint is welded in two or more positions, it may be desired as here illustrated to designate the different procedures by letter subscripts, such as 8_a, 8_b, 8_c, etc. Separate recorded welding procedure and separate qualifications are required for each welding position even though the joint is the same type. (See factor 10, table II.)

6.4.2.11 Orientation of sketch.—When recorded welding procedures relate to the same joint but differ with respect to the position of welding, it is desirable to orient the sketch under "*Location and sequence of passes*" in such a way as to convey the idea of the welding position. Thus it can be readily seen that sheets 13 and 14 cover the flat and horizontal positions, respectively. Similar treatment will readily identify the overhead position, and a different orientation can be selected as a conventional way of representing the vertical position.

6.4.3 Steps in establishing recorded procedures for welding joints and qualifying welding procedures.

6.4.3.1 Step 1.—When practical, make an isometric or perspective drawing of the complete structure or subassembly, showing locations of welded joints. (Example: An isometric or perspective drawing or other approved sketch of a welded pilot's seat back.)

6.4.3.2 Step 2.—Make a chart assigning a recorded welding procedure number to each joint and providing spaces for indicating the status of procedure qualification (illustrated on sheet 3).

6.4.3.3 Step 3.—Make charts showing the pertinent data for each kind of armor and clip attachment material incorporated in the structure (illustrated on sheet 4).

6.4.3.4 Step 4.—Make charts showing the pertinent data for each brand of electrode to be used in fabricating the structure and showing the ranges of current and voltage to be used with each size of electrode (illustrated on sheet 5).

6.4.3.5 Step 5.—Prepare a recorded procedure for welding each joint, including all of the factors listed in table II of this specification (illustrated on sheets 6 to 14, inclusive).

6.4.3.6 Step 6.

6.4.3.6.1 Title for Army purchase. — For contracts under cognizance of the Army, submit in quadruplicate copies of all the material described in steps 1 to 5 above, including the uncompleted chart described in step 2. Two copies are to be forwarded through the Government inspector to the Office having technical cognizance of the item being manufactured.

6.4.3.6.2 For Navy purchase. — For contracts under cognizance of the Navy Department submit in triplicate copies of all material, one copy to be forwarded through the Naval inspector to each of the following:

- (a) Chief, Bureau of Aeronautics, Department of the Navy, Washington 25, D.C.
- (b) Commander, U. S. Naval Proving Ground, Dahlgren, Va.

6.4.3.6.3 For Air Force purchase. — For contracts under cognizance of the Air Force, submit in quadruplicate copies of all the material described in steps 1 to 5 above, including the uncompleted chart described in step 2. Two copies are to be forwarded through the Air Force inspector to Wright-Patterson Air Force Base, Dayton, Ohio.

6.4.3.7 Step 7.—Determine, by reference to 4.2.1, the minimum number of ballistic test plates required to qualify all of the welding

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procedures to be used on the structure (illustrated by the test plate numbers shown in the table on sheet 3).

6.4.3.8 Step 8.—Conduct the required procedure qualification tests as specified in 4.2.1.

6.4.3.9 Step 9.—Note the results of the procedure qualification tests in the appropriate spaces of the chart mentioned in step 2 (illustrated on sheet 3) and submit copies of the completed chart in the manner directed in step 6 above.

6.4.3.10 Step 10.—Await notification from the cognizant agency that all welding procedures have been qualified before proceeding with the construction of the welded structures.

6.5 Identification.—Test plates and sample specimens, noted in 5.1, are for use only in establishing procedures and manufacturing techniques. Hence precautions are necessary

to assure identification only during periods covering manufacture up to acceptance of vehicles under a given contract.

Patent notice.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army—Ordnance Corps
Navy—Bureau of Aeronautics
Air Force

Other interest:

Army—E
Navy—Or.

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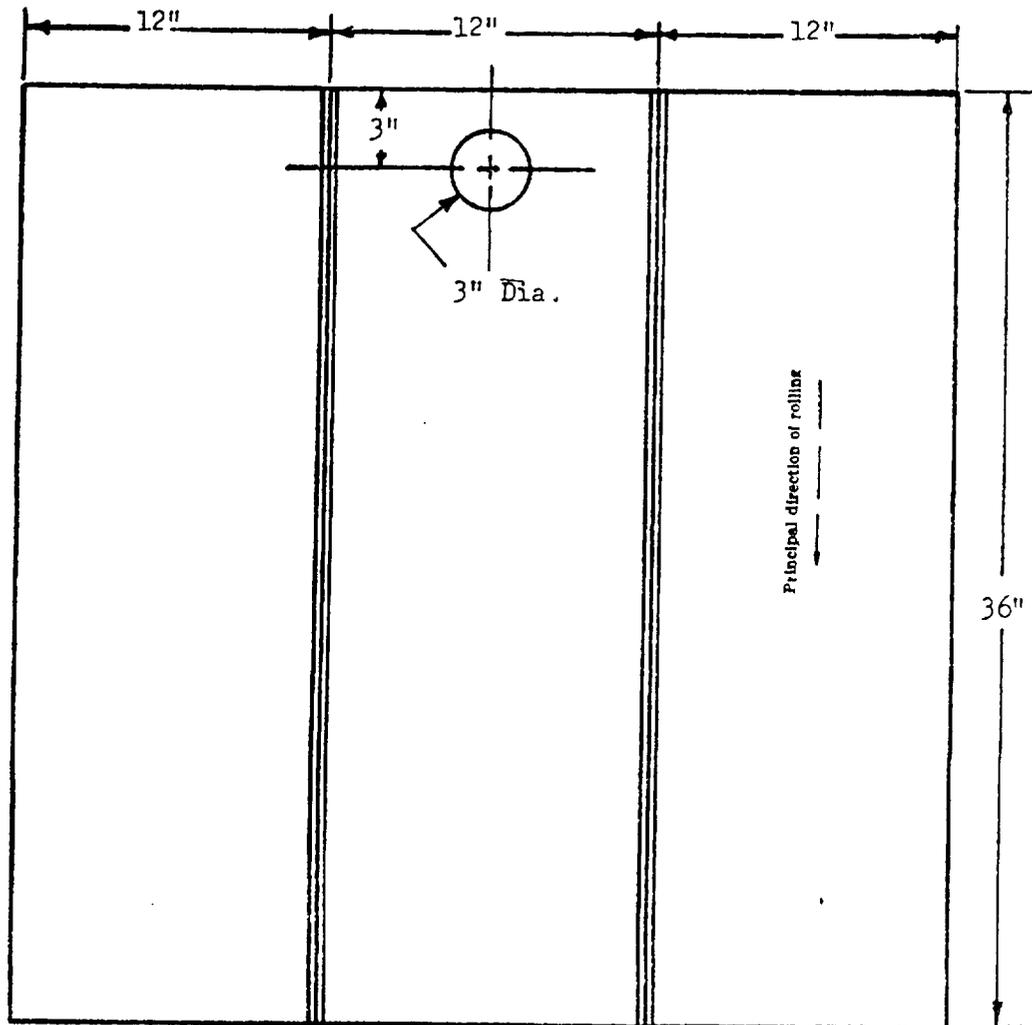
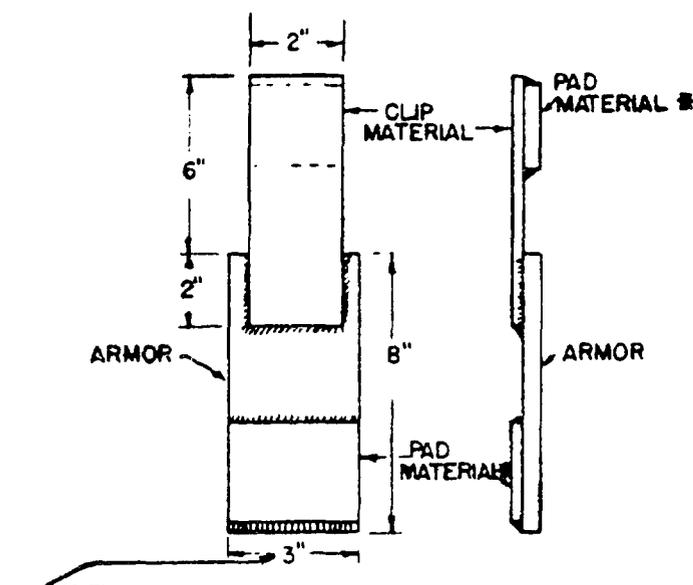


FIGURE 1.—Ballistic shock test-weld specimen.

Joint design shall be minimum included angle, minimum root opening, and maximum root face for each fabricator's welding procedure for each class and thickness of plate submitted for qualification test.

"Principal direction of rolling" means that direction of rolling during which the greatest reduction occurred.

PROCEDURE QUALIFICATION TEST (BUTT WELD)



This dimension may be reduced back from end sufficiently to fit jaws of available test apparatus.

FIGURE 2.—Shear test-weld specimen.

*Low-carbon steel plates may be welded to armor to facilitate shear testing.

PROCEDURE QUALIFICATION TEST (FILLET WELD)

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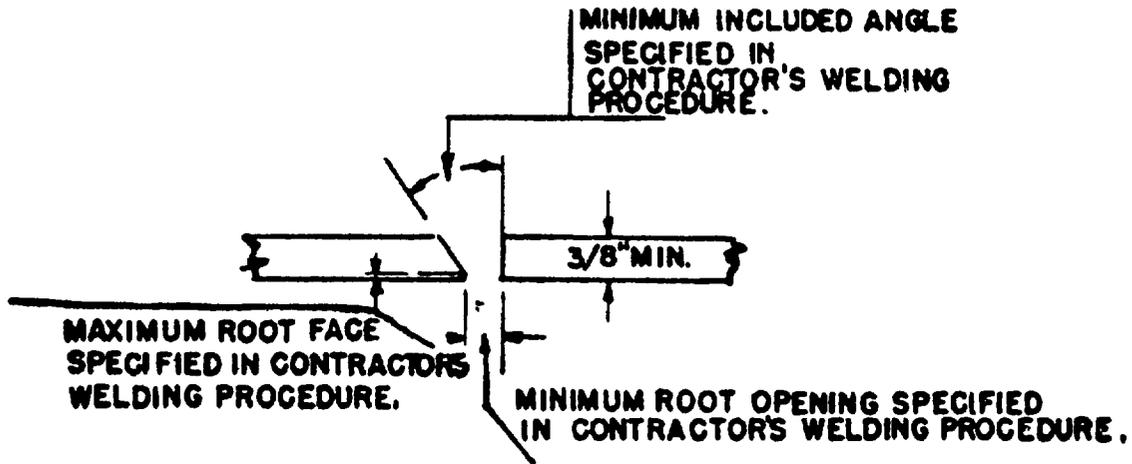


FIGURE 3.—Test-weld specimen (butt joint) ($\frac{5}{8}$ -inch or less).

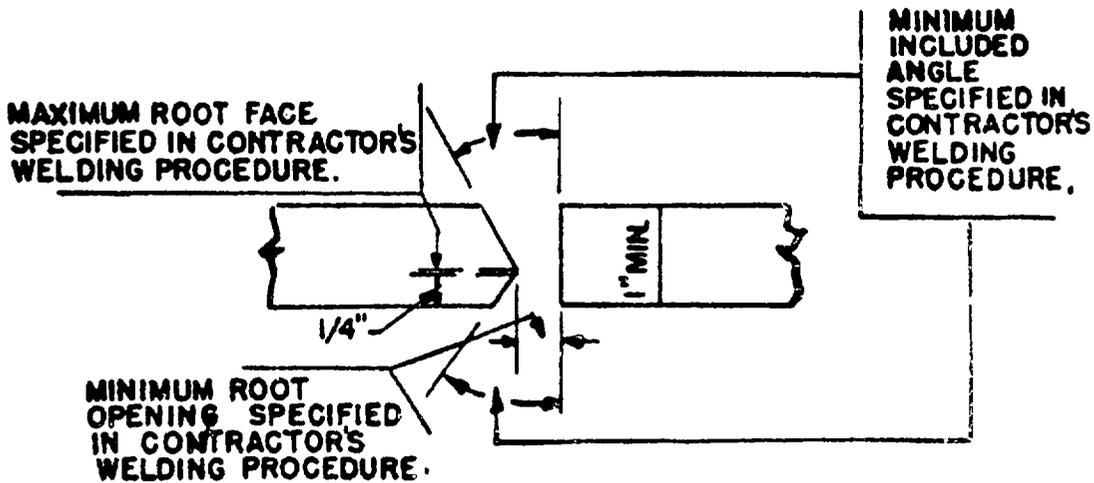
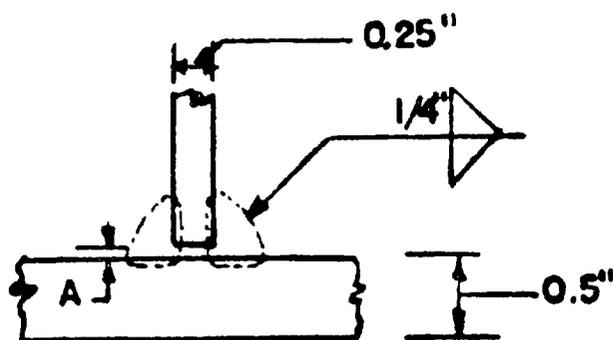


FIGURE 4.—Test-weld specimen (butt joint) (greater than $\frac{5}{8}$ -inch).

WELDER QUALIFICATION TEST (BUTT WELD)



-Test-weld specimen (T-joint) ($\frac{5}{8}$ -inch or less) A = $\frac{1}{16}$ -inch minimum

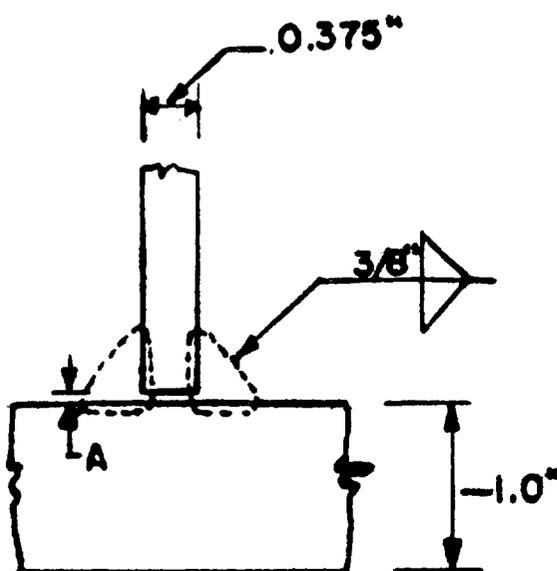


FIGURE 6. Test-weld specimen (T-joint) (greater than $\frac{5}{8}$ -inch).
WELDER QUALIFICATION TEST (DOUBLE-FILLET WELD)

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FORM "A" PART 1 WELDED ARMOR DATA SHEET of SHEETS

Report No.

Date Submitted by
 Plate No. Address
 Class Contract No.
 Thickness
 Specification
 Material concerned
 Welded by of
 Object

On a dimensioned sketch of the groove and weldment (1) indicate the deposit sequence—
 (2) additional sketch of spacer strip or back-up.

WELDING DATA

Plate preparation, flame cutting, flame softening, grinding, machining, position of plate during welding

Polarity-Str. or Rev.; a. c. or d. c.

Total welding time Total chipping or grinding time

Preheat Postheat

Peening Buttering

Temperature of plate at time of welding

Pass	Electrode size	Type pass ¹	Amperes	Volts	Crack- ing	Chip or grind	Speed in feet per minute	Interpass temper- atures		
								A	B	C
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

¹ B = Bead, W = Weave.

FORM "A" (Cont'd) PART 2

SHEET of SHEETS

WELDED ARMOR DATA

Report No.

Chemical composition (percent)											Hardness— BHN	
Elements	C	Mn	Si	S	P	Cr	Ni	Mo	V	Cu	Front	Back
Plate No.												
Plate No.												
Spacer strip												
Clip metal												

HEAT TREATMENT

Heat Treated by

ARMOR DATA

	Plate A	Plate B
Plate number		
Manufacturer		
Class		
Thickness		
Heat No.		
Lot		
Process	O. H. Elec., Acid, Basic	O. H. Elec., Acid, Basic

Clip metal data

Thickness

Radiographed by

Radiograph serial No.

ELECTRODE DATA

Size	Manufacturer	Trade name	Grade	Type	Class	Core wire

Manufacturer, Trade Name, Size	Chemical analysis									
	C	Mn	Si	S	P	Cr	Ni	Mo	Covering	
Core Wire										
Weld Metal										
Core Wire										
Weld Metal										

.....
Fabrication Representative

Signed.....
Govt. Inspector

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FORM B — SHEET 1 of 14

(Company name and address)

(Date)

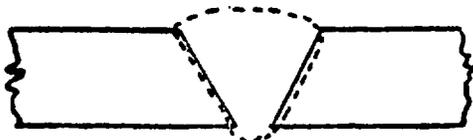
FOR INFORMATION ONLY

Recorded Procedures for Welding Joints, Aircraft Structures

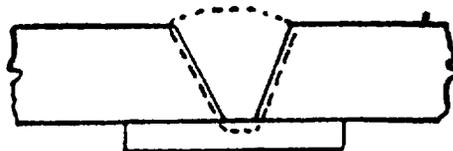
Contents:

Typical types of joints encountered in welding aircraft armor. (An isometric or perspective drawing of a welded structure may be substituted.)	Sheets 1 & 2
Summary of welding procedure qualification tests.....	Sheet 3
Summary of armor classes, clip attachment materials and compositions.	Sheet 4
Summary of electrodes and welding currents and voltages.	Sheet 5
Recorded procedures for welding joints.....	Sheets 6 to 14

TYPICAL TYPES OF JOINTS ENCOUNTERED IN WELDING OF AIRCRAFT ARMOR

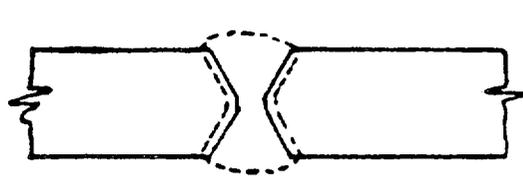


A. Single-V butt joint, welded both sides (type B-14).

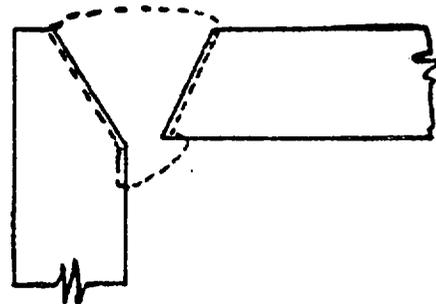


B. Single-V butt joint, welded on backing (types B-11, B-41, and B-46).

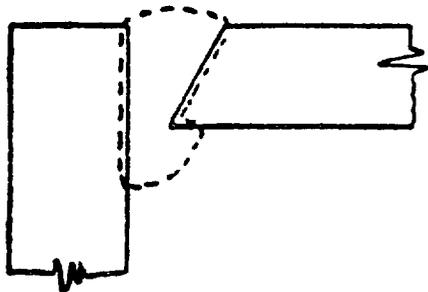
FORM B (Cont'd) — SHEET 2 of 14



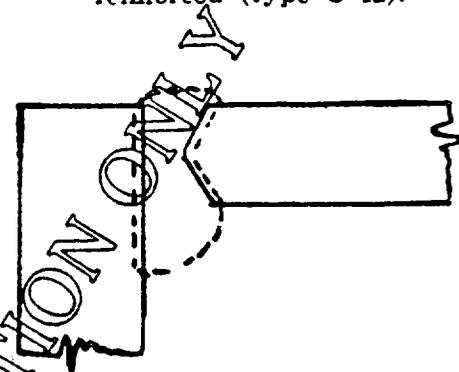
C. Double-V butt joint, welded both sides (type B-31).



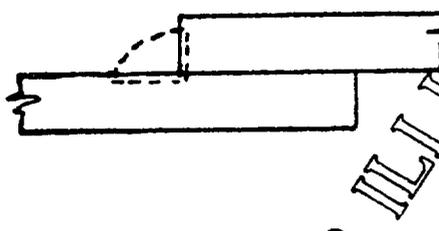
D. Single-V corner joint, fillet-reinforced (type C-12).



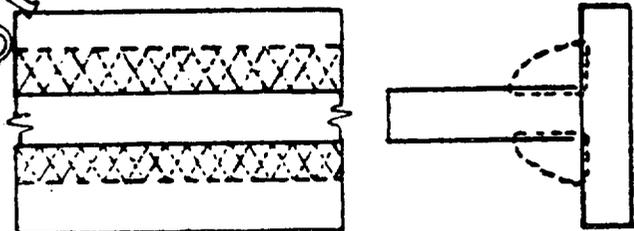
E. Single-beveled corner joint, fillet-reinforced (type C-15).



F. Double-beveled corner joint, fillet-reinforced (type C-32).



G. Single-fillet-welded lap joint (type L-1).



H. Double-fillet-welded (continuous) tee joint (type T-1).

Types refer to joint numbers as listed in Specification MIL-W-12683, Welding; Joint Design.

TABLE I.—Summary of welding procedure qualification tests

Joint No.	Joint type ¹	Joint welding procedure record No.	Armor and lin material, reference designation ²	Status of procedure qualification		
				Flat	Vertical	Horizontal
A	B-14	1	I (2 thicknesses)	Passed (plates 1 and 2)	Not tested	Not tested.
A	B-14	2	I	Passed (plates 3, 4, 5, and 6)	do	Do.
C	B-31	3	I	Passed (plates 7 and 8)	do	Do.
C	B-31	4	I and II	Passed (plates 9 and 10)	do	Do.
D	C-12	5	I	Passed (plates 11 and 12)	do	Do.
F	C-32	6	I and II	Passed (plates 13 and 14)	do	Do.
G	L-1	7	I CM-A	Passed (plates 15 and 16)	do	Do.
H	T-1	8	I and II CM-A	Passed (plate 17)	do	Do.

¹ Joint type is that defined in Specification No. MIL-W-12683.

² See "Summary of Armor Classes and Compositions" (See sheet 4).

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FORM B (Contd) — SHEET 4 of 14

TABLE II.—Summary of armor classes and compositions

Armor, reference designation	Class	Specification No.	Manu- fac- turer	Chemical composition range (percent)										Draw temperature ¹
				C	Mn	Si	S	P	Cr	Ni	Mo	V	Zr	
I	Rolled homogeneous.	AXS-188	"X"	0.35 .45	0.40 .70	0.20 .40	0.040 Max.	0.040 Max.	0.90 1.20	0.90	0.50 .80	0.15 .30	900	
II	Face hardened.	AXS-190	"Y"	.15 .25	.40 .70	.20 .40	.035 Max.	.035 Max.	4.75 5.25	4.75 5.25	.20 .40	300		
III	Nonmagnetic.	ANOS-3		.60 .70	12.0 14.0	1.10 1.30	.050 Max.	.050 Max.	2.50 3.00	2.50 3.00				

¹ Draw temperature employed by the armor manufacturer in heat-treating the armor.

TABLE III.—Summary of clip attachment materials and compositions

Clip material, reference designation	Class	C	Mn	Si	S	P	Ni	Mo	V	Zr	Condition of material (heat treatment)
B	Rolled armor homogeneous	.35 .45	.40 .70	.20 .40	.040 Max.	.040 Max.	.90 1.20	.50 .80	0.15 .30		Quenched and tempered.

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FORM B (contd) - SHEET 5 of 14

Summary of electrodes and welding currents and voltages

A. ELECTRODES CONFORMING WITH SPECIFICATION MIL-E-13080

Electrode reference designation	Manufacturer	Brand name	Grade	Type	Class
A.....	"X"	Bestweld.....	V	1	1
B.....	"X"	Superweld.....	VI	1	1
C.....	"Y"	Bestalloy.....	VI	1	1
D.....	"Y"	Superloy.....	VI	3	2
E.....	"Z"	Bestarc.....	V	1	1
F.....	"Z"	Superarc.....	VI	1	1

B. ELECTRODES NOT CONFORMING WITH SPECIFICATION MIL-E-13080

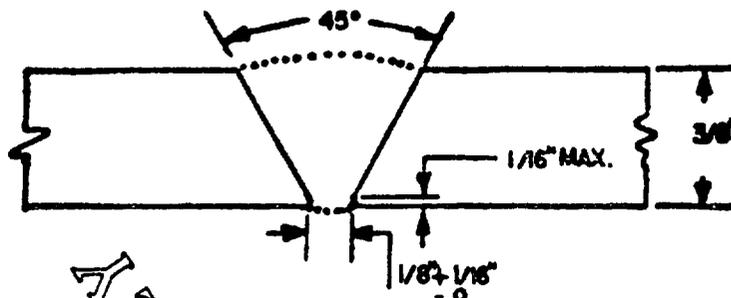
Electrode reference designation	Manufacturer	Brand name	Type	Chemical composition range (percent)										
				C	Mn	Si	S	P	Cr	Ni	Mo	V	Others	
G.....	"Q"	Excelweld...	Lime.....	Core wire.....	0.15	3.50	0.25	0.03	0.04	19.5	9.0			
				Max.	4.50	.60	Max.	Max.	21.5	10.5				
H.....	"R"	Wonderweld	Titania.....	Deposited weld metal.....	.17	3.00	.80			18.0		0.50		
				Max.	4.50	Max.			20.5		1.00			
				Core wire.....	.15	1.50	.25	.03	.04	19.5	9.0			
				Max.	2.00	.60	Max.	Max.	21.5	10.5				
				Deposited weld metal.....	.17	1.25	.80			18.0		1.80		
				Max.	2.00	Max.			20.5		2.25			

C. RANGES OF CURRENT AND VOLTAGE TO BE USED WITH EACH SIZE OF ELECTRODE:

Diameter of electrode	Current range (amperes)			Voltage range		
	Flat position	Vertical position	Horizontal position	Flat position	Vertical position	Horizontal position
3/32.....	85-115	75-100	80-105	21-28	20-26	20-26
1/16.....	150-185	135-165	145-175	23-29	22-27	22-27
1/8.....	200-245		190-230	24-30	23-28	23-28
3/16.....	310-340			25-32	24-30	24-30

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FORM B (Cont'd) — SHEET 6 of 14

Procedure for
Welding Joint A
Record No. 1

Welding Procedure—General:

Armor (reference designation) *I* (table II, sh. 4).Electrode (reference designation) *B*, *C*, or *F*.Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.

Welding current and arc voltage range, as specified in table C, sh. 5.

Use of spatter compound on scarfed edges, *none*.Backing, *none*.Preheating, *none*.Position of welding, *flat*.

Details of Welding Procedure:

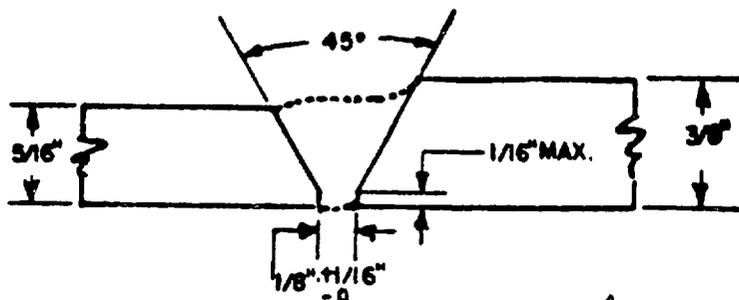
Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	$\frac{5}{32}$	Stringer	
2	$\frac{3}{16}$	Weave	
3	$\frac{3}{16}$	Weave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 2.

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FORM B (Contd) —SHEET 7 of 14

Procedure for
Welding Joint A
Record No. 2



Welding Procedure—General:

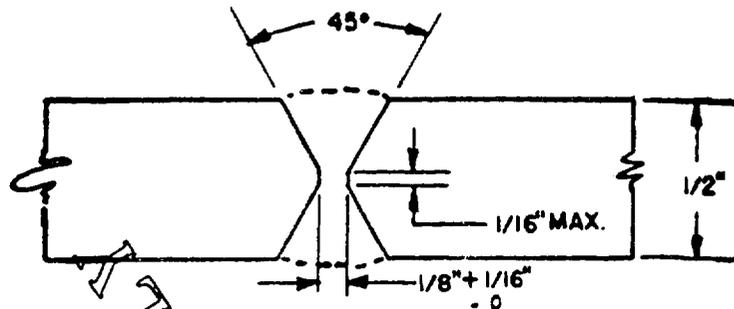
- Armor (reference designation) *I* (table I, sh. 4).
- Electrode (reference designation) *B, C or F*.
- Power source (a. c. or d. c.) and polarity, if d. c., *d. c. reverse*.
- Welding current and arc voltage range, as specified in table C, sh. 5.
- Use of spatter compound on scarfed edges, *none*.
- Backing, *none*.
- Preheating, *none*.
- Position of welding, *flat*.

Details of Welding Procedure:

Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	5/32	Stringer	
2	3/16	Wave	
3	3/16	Wave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 2

FORM B (Cont'd) — SHEET 8 of 14

Procedure for
Welding Joint C
Record No. 3

Welding Procedure—General:

Armor (reference designation) *I* (table II, sh. 4).

Electrode (reference designation) *B, C, or F*.

Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.

Welding current and arc voltage range, as specified in table C, sh. 5.

Use of spatter compound or scarfed edges, *none*.

Backing, *none*.

Preheating, *none*.

Position of welding, *flat*.

Details of Welding Procedure:

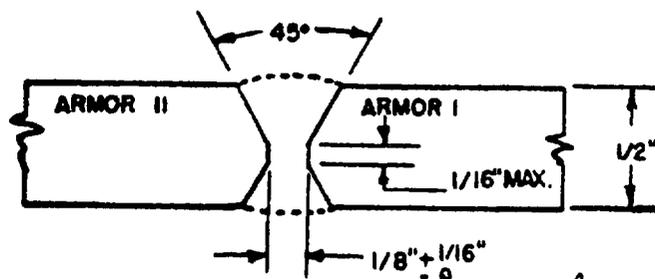
Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	$\frac{5}{32}$	Stringer	
2	$\frac{3}{16}$	Weave	
3	$\frac{5}{32}$	Stringer	
4	$\frac{3}{16}$	Weave	
5, 6	$\frac{3}{16}$	Full weave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 3

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FORM B (Cont'd) — SHEET 9 of 14

Procedure for
Welding Joint C
Record No. 4



Welding Procedure—General:

Armor (reference designation) *I and II* (table II, sh. 4).

Electrode (reference designation) *B, C, ...*

Power source (a. c. or d. c.) and polarity (if d. c., *d. c. reverse*).

Welding current and arc voltage range, as specified in table C, sh. 5.

Use of spatter compound on scarfed edges, *none*.

Backing, *none*.

Preheating, *none*.

Position of welding, *flat*.

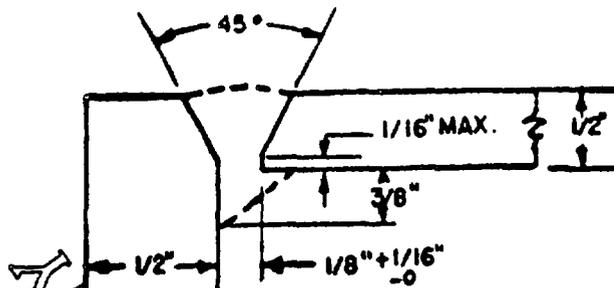
Details of Welding Procedure:

Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	5/32	Stringer	
2	3/16	Weave	
3	5/32	Stringer	
4	3/16	Weave	
5, 6	3/16	Full weave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 3.

FORM B (Cont'd) —SHEET 10 of 14

Procedure for
Welding Joint D
Record No. 5



Welding Procedure—General:

- Armor (reference designation) *I* (table II, sh. 4).
- Electrode (reference designation) *B, C, or F*.
- Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.
- Welding current and arc voltage range, *as specified in table C, sh. 5*.
- Use of spatter compound on scarfed edges, *none*.
- Backing, *none*.
- Preheating, *none*.
- Position of welding, *flat*.

Details of Welding Procedure:

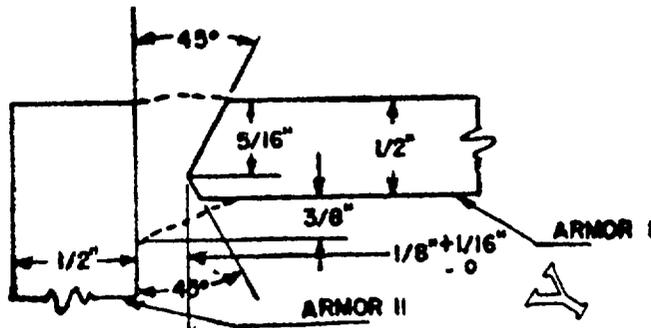
Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	5/32	Stringer	
2	3/16	Weave	
3	5/32	Stringer	
4 to 8	3/16	Weave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 3.

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—SHEET 11 of 14

Procedure for
Welding Joint F
Record No. 6



Welding Procedure—General:

- Armor (reference designation) *I, II* (table II, sh. 4).
 Electrode (reference designation) *B, C, or F*.
 Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.
 Welding current and arc voltage range, as specified in table C, sh. 5.
 Use of spatter compound on scuffed edges, *none*.
 Backing, *none*.
 Preheating, *none*.
 Position of welding, *flat*.

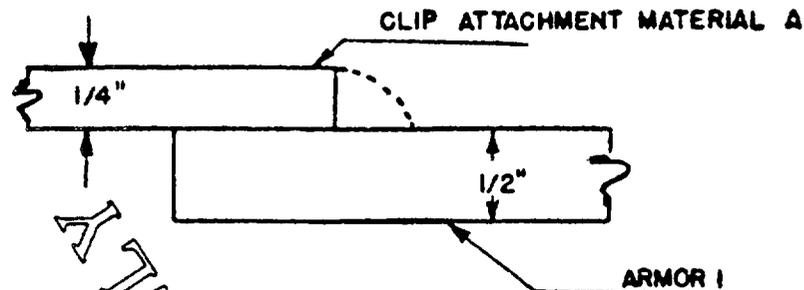
Details of Welding Procedure

Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	$\frac{5}{32}$	Stringer	
2	$\frac{3}{16}$	Weave	
3	$\frac{5}{32}$	Stringer	
4	$\frac{3}{16}$	Weave	
5, 6	$\frac{3}{16}$	Full weave	
7 to 9	$\frac{3}{16}$	Weave	

NOTE: Root of Weld shall be ground to sound metal before depositing pass No. 3.

FORM B (Cont'd) — SHEET 12 of 14

Procedure for
Welding Joint G
Record No. 7



Welding Procedure—General:

Armor (reference designation) *I* (table II, sh. 4).

Clip material (reference designation) *A* (table III, sh. 4).

Electrode (reference designation) *A* or *E*.

Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.

Welding current and arc voltage range, as specified in table C, sh. 5.

Use of spatter compound on scarfed edges, *none*.

Backing, *none*.

Preheating, *none*.

Position of welding.

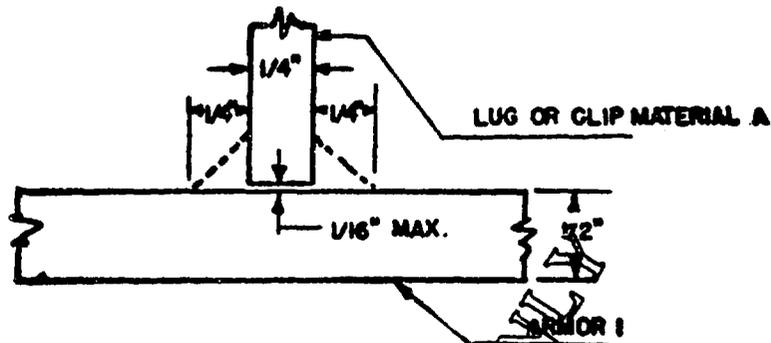
Details of Welding Procedure:

Pass No.	Electrode size	Type of passes	Location and sequence of passes
1	$\frac{3}{16}$	Weave	

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—SHEET 13 of 14

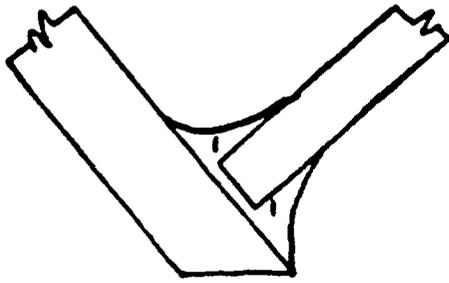
Procedure for
Welding Joint H
Record No. 8a



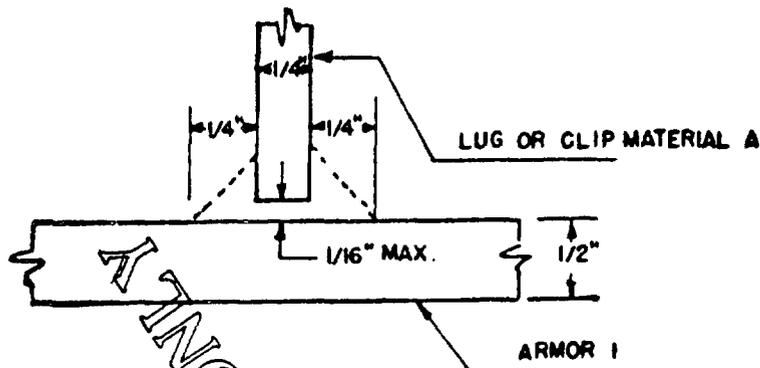
Welding Procedure—General:

- Armor (reference designation) *I* (table II, sh. 4).
 Lug or clip material (reference designation) *A* (table III, sh. 4).
 Electrode (reference designation) *A* or *E*.
 Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.
 Welding current and arc voltage range, as specified in table C, sh. 5.
 Use of spatter compound on scarfed edges, *none*.
 Backing.
 Preheating, *none*.
 Position of welding, *flat*.

Details of Welding Procedure:

Pass No.	Electrode size	Type of passes	Location and sequence of passes
1	$\frac{3}{16}$	Weave	

Procedure for
Welding Joint H
Record No. 8b



Welding Procedure—General:

- Armor (reference designation) *I* (table II, sh. 4).
- Lug or clip material (reference designation) *A* (table III, sh. 4).
- Electrode (reference designation) *A* or *E*.
- Power source (a. c. or d. c.) and polarity if d. c., *d. c. reverse*.
- Welding current and arc voltage range, as specified in table C, sh. 5.
- Use of spatter compound on scarfed edges, *none*.
- Backing.
- Preheating, *none*.
- Position of welding, *horizontal*.

Details of Welding Procedure:

Pass No.	Electrode size	Type of pass	Location and sequence of passes
1	3/16	Weave	<p>The diagram shows a cross-section of the welded joint with a single weld pass applied to the top surface of the lug. The pass is a 'Weave' type, indicated by a dashed line in the previous column. The weld metal is shown filling the gap between the lug and the armor.</p>

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004	
<u>INSTRUCTIONS</u>			
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).			
SPECIFICATION			
ORGANIZATION (Of submitter)		CITY AND STATE	
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$	
MATERIAL PROCURED UNDER A			
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT			
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?			
A. GIVE PARAGRAPH NUMBER AND WORDING.			
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.			
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID			
3. IS THE SPECIFICATION RESTRICTIVE?			
<input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?			
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)			
SUBMITTED BY (Printed or typed name and activity)			DATE

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