INCH-POUND

NOTICE OF CHANGE

MIL-STD-2149A(SH)
NOTICE 1
5 April 1993

STANDARD PROCEDURES FOR EXPLOSION TESTING FERROUS AND NON-FERROUS METALLIC MATERIALS AND WELDMENTS

TO ALL HOLDERS OF MIL-STD-2149A:

1. THE FOLLOWING PAGES OF MIL-STD-2149A HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
5	2 February 1990	5	REPRINTED WITHOUT CHANGE
6	5 April 1993	6	5 April 1993
7	5 April 1993	7	5 April 1993
8	5 April 1993	8	5 April 1993
21	2 February 1990	21	REPRINTED WITHOUT CHANGE
22	5 April 1993	22	5 April 1993
22a	5 April 1993	22	5 April 1993

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-2149A(SH) will verify that page changes and additions indicated above have been entered. This notice page will be retained as a checksheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military standard is completely revised or canceled.

Preparing activity:
Navy - SH
(Project THJM-N317)

AMSC N/A AREA THJM

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6.1.2 Castings. Contractor shall provide sufficient cast plate to produce a minimum of two 2 by 50 by 30 inch explosion/mechanical prolongation weldments and four 2 by 30 by 3- inch explosion weldments. The cast plate surfaces (both sides) shall be submitted machined to a 250 micro-inch finish or better to provide a uniform 2-inch thickness. Crack starter candidates shall be selected from the test specimens by the authorized Government laboratory.

6.1.3 Forgings and shapes. Contractor shall provide sufficient forged shaped plate to produce a minimum of two 2 by 50 by 30 inch explosion/mechanical prolongation weldments and four 2 by 30 by 30 inch explosion weldments. The forged or shaped plate surfaces (both sides) shall be submitted machined to a 250 micro-inch finish or better to provide a uniform 2 inch thickness. Crack starter candidates shall be selected from the test specimens by the authorized Government laboratory.

6.1.4 Maximum 1 inch thickness material. Where the maximum material thickness to be produced is 1 inch or less and explosion bulge testing is specified, the above applies except plate sizes shall be 20 inches wide by 60 inches long for explosion/mechanical prolongation weldments and 20 by 20 inches for explosion weldments.

6.2 Filler metals. When seeking approval to produce filler metals that require testing, the contractor, when not specifically directed by the Military specification, shall furnish sufficient filler metal to produce a minimum of two 2 by 50 by 30 inch explosion/mechanical prolongation weldments. If explosion bulge testing is to be performed, additional 2 by 30 by 30 inch explosion weldments may be required as specified by the authorized Government laboratory.

6.3 Welding procedure. When seeking approval for a welding process or procedure, the activity shall furnish sufficient rolled, forged or cast plate to produce two 2 by 50 by 30 inch explosion/mechanical prolongation weldments. If explosion bulge testing is to be perform, additional 2 by 30 by 30 inch explosion weldments may be required as specified by the authorized Government laboratory. The plates and filler metal shall be in accordance with the applicable Military specifications.

7. PREPARATION AND WELDING OF EXPLOSION TEST WELDMENTS WITH AND WITHOUT MECHANICAL PROLONGATION

7.1 Preparation of base metal for welding. Rolled plate material may be used in the as-rolled "mill finish" condition. Cast, forged, extruded material forms shall be machined or ground, both sides, to provide a uniform plate thickness. Unless otherwise specified, weld joints and approved double-V bevels shall be prepared in accordance with figure 6. Double-V groove bevels shall be applied by machining or oxy-fuel cutting provided the flame cutting operation produces a smooth uniform bevel. Bevel preparation residue (cutting oils or flame cutting scale remnant from the weld bevel preparation operation) shall be removed prior to welding. For wrought materials, the weld bevel shall be oriented parallel to the primary rolling or working direction of the base materials.

7.2 Welding of samples. Welding of samples shall be in accordance with 7.2.1 and 7.2.2.

7.2.1 Base metal. For base metal qualification, all samples shall be welded in accordance with an approved welding procedure incorporating the required applicable material or fabrication document requirements or both.

7.2.2 Electrodes and welding procedures. For testing electrodes and qualifying welding processes and procedures, the welding parameters shall be established by the prospective contractor or qualifying activity.

7.3 Nondestructive evaluation of test weldments. When 48 hours have elapsed after completion of welding, the following nondestructive tests in accordance with 7.3.1 through 7.3.3 shall be conducted with the weld reinforcement in place except for the hold-down areas.

7.3.1 Visual inspection. Weldments shall be evaluated in accordance with MIL-STD-271 and meet visual inspection acceptance criteria in accordance with NAVSEA 0900-LP-003-8000, class 1. Additionally, the weldments shall be checked for flatness. Base plate rotation due to weld metal shrinkage shall not exceed 5 degrees. Maximum joint offset due to fit-up shall not exceed 1/8 inch.

7.3.2 Radiographic inspection (RT). Weldments shall be radiographed in accordance with MIL-STD-271 and meet the acceptance criteria of NAVSEA 0900-LP-003-9000, class 1.

7.3.3 Magnetic particle inspection (MT). Weldments shall be inspected in accordance with MIL-STD-271 and meet the acceptance criteria of NAVSEA 0900-LP-003-8000, class 1.

8. PREPARATION OF TEST ASSEMBLIES FOR EXPLOSION TESTING

8.1 Crack starter specimen preparation. The explosion crack starter test assembly is modified explosion test specimen on which brittle Murex Hardex N or equivalent crack starter beads have been placed. The deposits may be oriented one of two ways depending on the intent of the test; base metal evaluation (see 8.1.1); or weld metal or weld procedure evaluation (see 8.1.2 and figure 7).

8.1.1 Base metal evaluations. For base metal evaluations incorporating weld joint, the Hardex N or equivalent weld deposits shall be placed directly on the weld joint parallel to the axis of the weld as specified on figure 7A (plan view). On 2-inch thick specimens, two beads shall be deposited an equal distance from the weld centerline and 1/16 to 3/32 inches from the edge of the weld fusion lines. On 1-inch thick specimens, one bead shall be deposited along the weld centerline. The beads shall be 2 to 3 inches long and shall be placed midway between the extremities of the weld joint. For base metal evaluations without a weld joint, the beads shall be placed transverse to the plate primary working direction (cast plates have no primary working direction) at the center of the test specimen as specified on figure 7B. Where two beads are deposited, the beads shall be spaced 5/8-inch from each side of the plate centerline.

8.1.2 Weld metal and weld procedure evaluations. For weld metal and weld procedure evaluations, the Hardex N or equivalent weld deposits shall be placed directly on the weld joint transverse to the axis of the weld as specified on figure 7C (plan view). On 2-inch thick specimens, two beads shall be deposited 5/8-inch from each side of the plate centerline. On 1-inch thick specimens, one bead shall be deposited on the plate centerline. The beads shall be 2 to 3 inches long and extend 1/4-inch beyond both weld fusion lines. Where the weld joint is wider than 2-1/2 inches, allowance shall be made to increase the bead length to achieve the minimum 1/4-inch extension beyond the weld fusion lines. This may require increasing the distance from the weld centerline to the reduction of thickness point of measurement.

8.1.3 Crack starter bead application. The government laboratory authorized to perform the testing shall be responsible for the crack starter bead application. The required welding parameters are as follows:

(a) Process:	Shielded metal arc, direct current, reverse polarity (DCRP)
(b) Electrode:	3/16-inch diameter
(c) Position:	Flat, down hand
(d) Welding current and voltage:	180-190 amps: 22-23 volts
(e) Travel speed:	4.5 - 5.0 inches per minute

Welding shall be performed using a stringer bead technique. Bead width shall not exceed 5/8 inch. Welding progression shall be as specified on figure 7. Before breaking the arc, back-fill the crater to assure adequate weld metal for grinding of the crack starter notch.

8.1.4 Notching the Hardex N or equivalent weld bead. Final preparation of the crack starter specimen shall consist of notching the crack starter beads as specified on figure 7. For base metal evaluations, the crack starter beads shall be notched mid-length. For weld metal and weld procedure evaluation, the crack starter beads shall be notched at mid-length and over each fusion line. Notching may be accomplished with a thin 1" diameter abrasive disk. Notches shall be cut normal to the specimen and across the full width of the bead to a depth such that 0.070 to 0.100 inch remains between the bottom of the notch and the surface of the underlying weldment or plate to be tested. The notch shall not be cut into either the underlying weld joint or base plate.

8.2 Explosion bulge preparation. Explosion bulge test assemblies shall be prepared in accordance with figure 4 and the fabrication and inspection parameters outlined in section 7.

8.3 Explosion tear test specimen. Explosion tear test assemblies shall be prepared in accordance with figure 5 employing the fabrication and inspection parameters outlined in section 7. To date, principally 1-inch thick tear test weldments have been tested. For this reason the dimensions for a 1-inch teat assembly are illustrated.

8.4 Grinding for die fit and drilling thermocouple holes. Test assembly types listed above shall be prepared for die fit. Because of weld reinforcement, or possible unusual test specimen irregularities, preparation of the test assembly shall consist of grinding the weld reinforcement flush for approximately 6 inches in from the assembly edges (see figure 4). Explosion tear test assemblies shall be ground from the test assembly edges to the slots. Additionally, to facilitate temperature monitoring of the explosion test specimen, both while normalizing in the cooling medium and when setting on the explosion test die, thermocouple holes shall be drilled in the edges of each explosion test specimen. The holes shall be approximately 1/8 inch in diameter by 1 inch deep located at the specimen edge, that is, thickness centerline, a minimum of 1 inch away from any corner of the plate.

9. MECHANICAL AND EXPLOSION TESTING

9.1 Mechanical test assembly requirements. The requirements for obtaining the mechanical specimens, as specified on figure 2, from the prolongations to the explosion crack starter weldments shall be in accordance with 9.1.1 through 9.1.4. Specimens shall be taken for conformance testing to the requirements of the Military specification that initiated the explosion testing.

9.1.1 Tensile test specimens. Weld metal tensile specimens shall be the 0.505 inch diameter size when permitted by the weld joint configuration and base material thickness; otherwise, they shall be the maximum size possible. Two-inch thick test weldments will have both base material and weld metal thickness to permit the removal of two type R-1, 0.505-inch diameter tensile specimens. Tensile specimens shall be prepared and tested in accordance with AWS B4.0.

9.1.2 Charpy V-notch specimens. Charpy V-notch (CVN) specimens shall be taken so that the surface of the specimen nearest the surface of the test assembly is 3/16 to 5/16 inch from the test assembly surface. The specimens shall be notched as specified on figure 2. For the weld metal specimens, light chemical etching of the specimen is recommended to locate the notch within the weld metal. The CVN specimens shall be machined and tested in accordance with AWS B4.0.

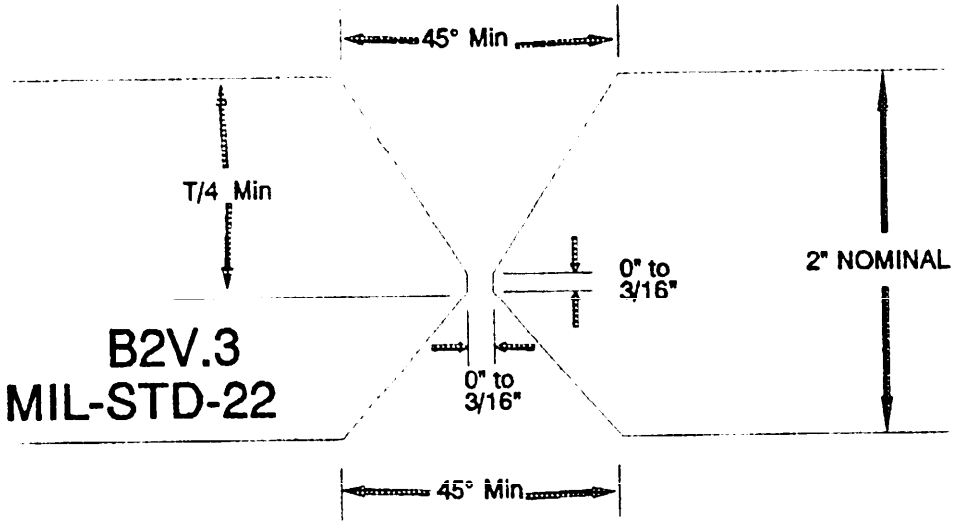

Figure 6a Typical joint configurations for explosion test weldments.

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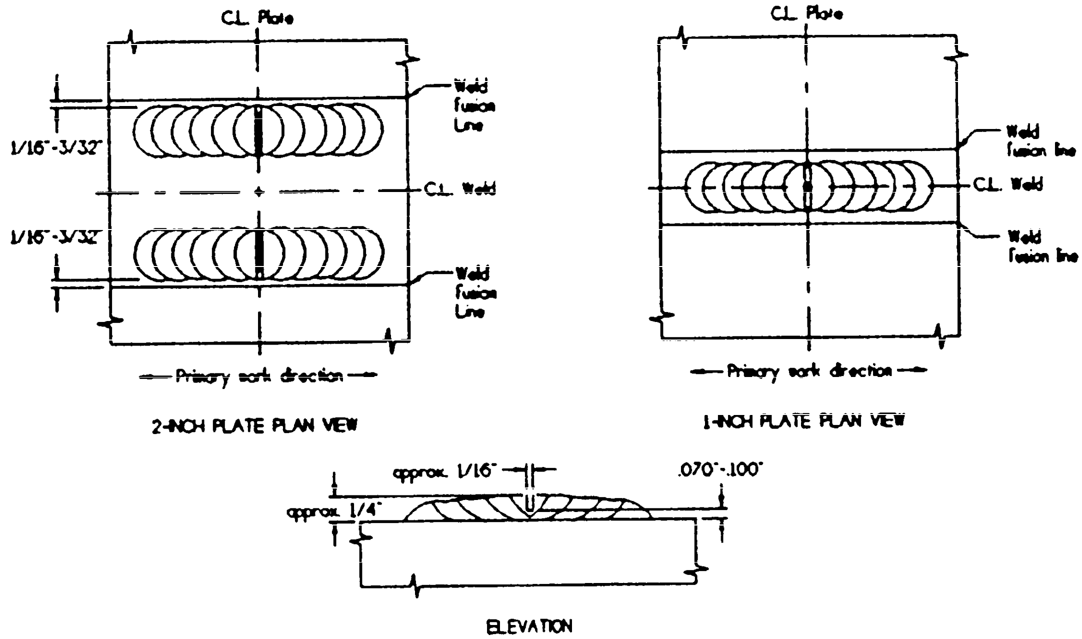

Figure 7a BASE METAL EVALUATION INCORPORATING A WELD JOINT

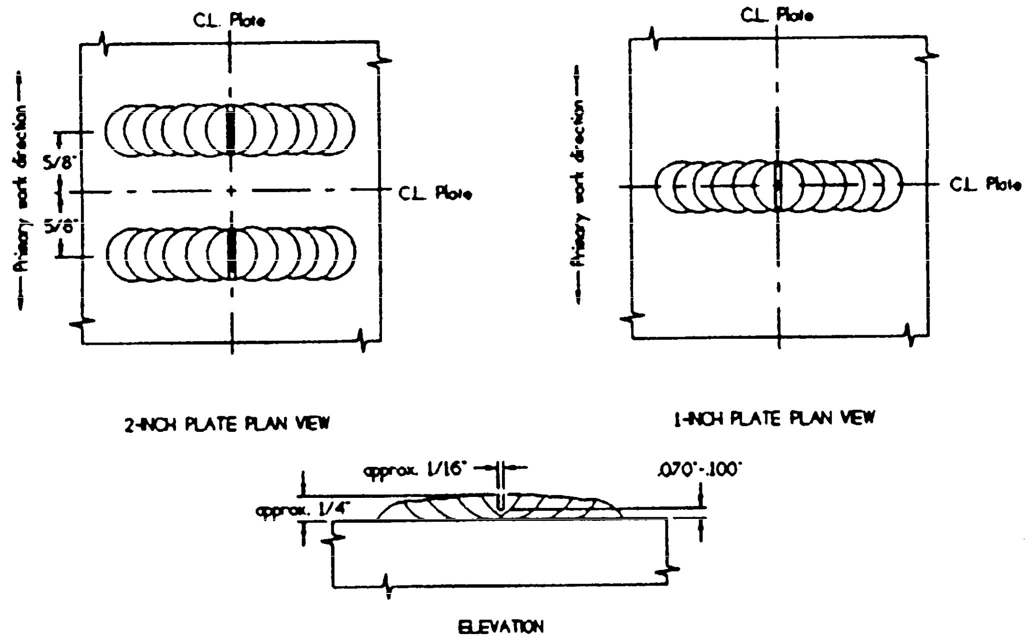

Figure 7b BASE METAL EVALUATION WITHOUT A WELD JOINT

FIGURE 7. CRACK STARTER BEAD CONFIGURATION.

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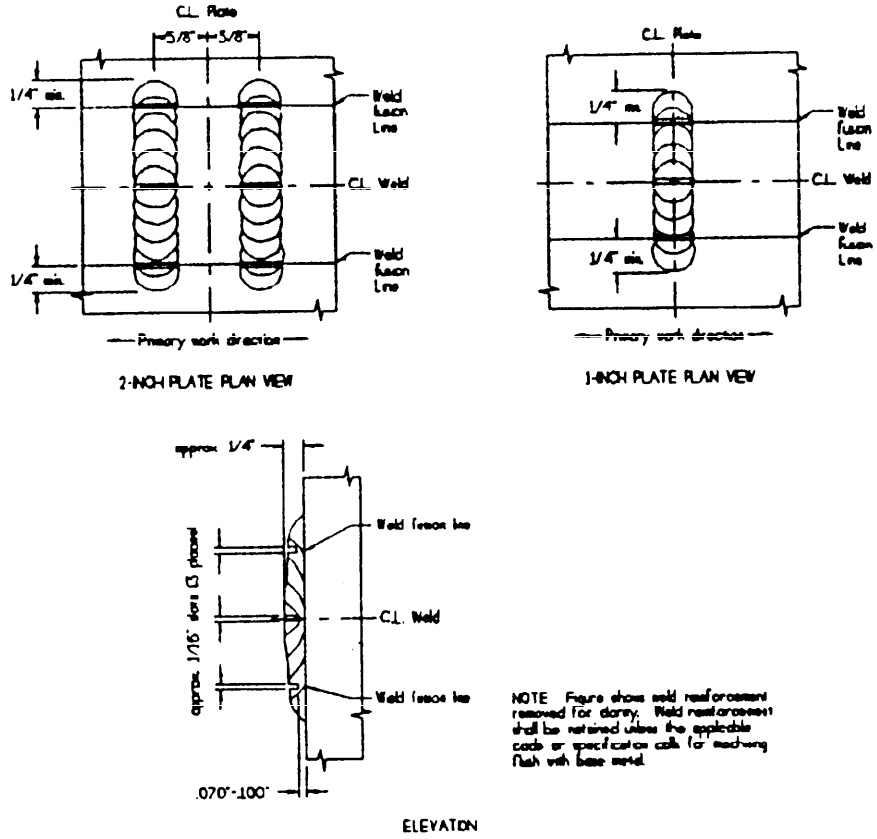

Figure 7c WELD METAL AND WELD PROCEDURE EVALUATION
FIGURE 7 (CONTINUED). CRACK STARTER BEAD CONFIGURATION.

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