

MIL-A-83376A(USAF)
28 June 1978
SUPERSEDING
MIL-A-83376 (USAF)
26 July 1972

MILITARY SPECIFICATION

ADHESIVE BONDED METAL FACED SANDWICH STRUCTURES,
ACCEPTANCE CRITERIA

This specification is approved for use by the Air Force Materials Laboratory, Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense

1 SCOPE

1.1 Scope This specification establishes the acceptance criteria and inspection requirements for adhesive bonded sandwich structures including the metal-to-metal bonding found in these structures (See 6.1)

1.2 Classification The classification of adhesive bonded structures specified in this specification shall be of the following types

Type I - Components which are fracture or fatigue critical as defined in MIL-I-6870 components, the single failure of which would cause significant danger to operating personnel or would result in an operational penalty. This includes loss of major components, loss of control, unintentional release, inability to release armament stores, or failure of weapon installation components.

Type II - All components not classified as type I

1.2.1 Structural classification The structural classification, Type I or Type II shall be specified on the engineering drawing. All structures shall be considered type I unless otherwise specified on the drawing.

1.2.2 Structural defects Structural defects specified in this specification shall be face-to-core voids and disbonds, metal-to-metal voids, bond voids, porosity, core splice voids, core splice gaps, dents and markoffs. These defects are defined in Section 6 of this specification.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to the Air Force Materials Laboratory, MXA, WPAFB, Ohio 45433 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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2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-I-6870 Inspection Program Requirements,
Nondestructive Testing, For Aircraft and
Missile Materials and Parts.

MIL-A-83377 Adhesive Bonding (Structural) for
Aerospace Systems, Requirements

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

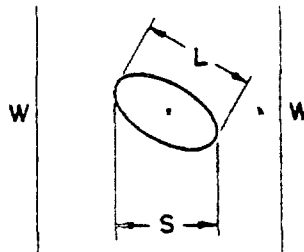
3. REQUIREMENTS

3.1 General. The contractor shall specify the allowable defects on the engineering drawing or in the process specification. If this is not so specified by the contractor, the requirements stated in Section 3 shall apply.

3.1.1 Adhesive bonded metal faced structure shall be inspected to the requirements as stated in 3.1.

3.2 Defects in Metal-to-Metal bonds in metal faced sandwich assemblies. The contractor shall specify the allowable defects on the engineering drawing or in the manufacturing process specification. If this is not so specified by the contractor the requirements stated in Section 3, herein shall apply.

3.2.1 Defect dimensions. When measured as shown in Figure 1, individual disbonds or voids shall not have any dimension greater than 15 times the thickness of the thinnest adherend, or 1 0 inch whichever is smaller or a "S" dimension greater than 15 percent of the shortest "W" through the defect.



S is the width of void in the "W" direction.
 L is the longest dimension of void.
 W is the smallest dimension of the metal-to-metal bond area containing the void.
 The width of void is in the "W" direction.
 When "W" is less than 2 inches, "S" shall be less than 0.25 inch.

Figure 1. Dimensions.

3 2 2 Permissible areas.

3 2 2.1 The maximum permissible area of an individual void or disbond is as follows

- (a) Type I structure 0.375 square inches, and
- (b) Type II structure 0.500 square inches.

3 2 2.2 The minimum permissible spacing distance as measured in Figure 2 between void boundaries is as follows:

- (a) Type I structure 4 times the largest void or disbond dimension measured on a line between the centers of the two voids
- (b) Type II structure minimum distance is 3 times the void or disbond dimension.

3 2 2.3 No voids, disbonds, or porosity shall be permitted within 0.125 inch of any bond joint edge.

3 2.2.4 The aggregate unbonded length of disbonds along any straight area, between two parallel lines 1/4 inch apart shall not exceed 15 percent of the length of the bond line, when measured along the direction of the parallel lines.

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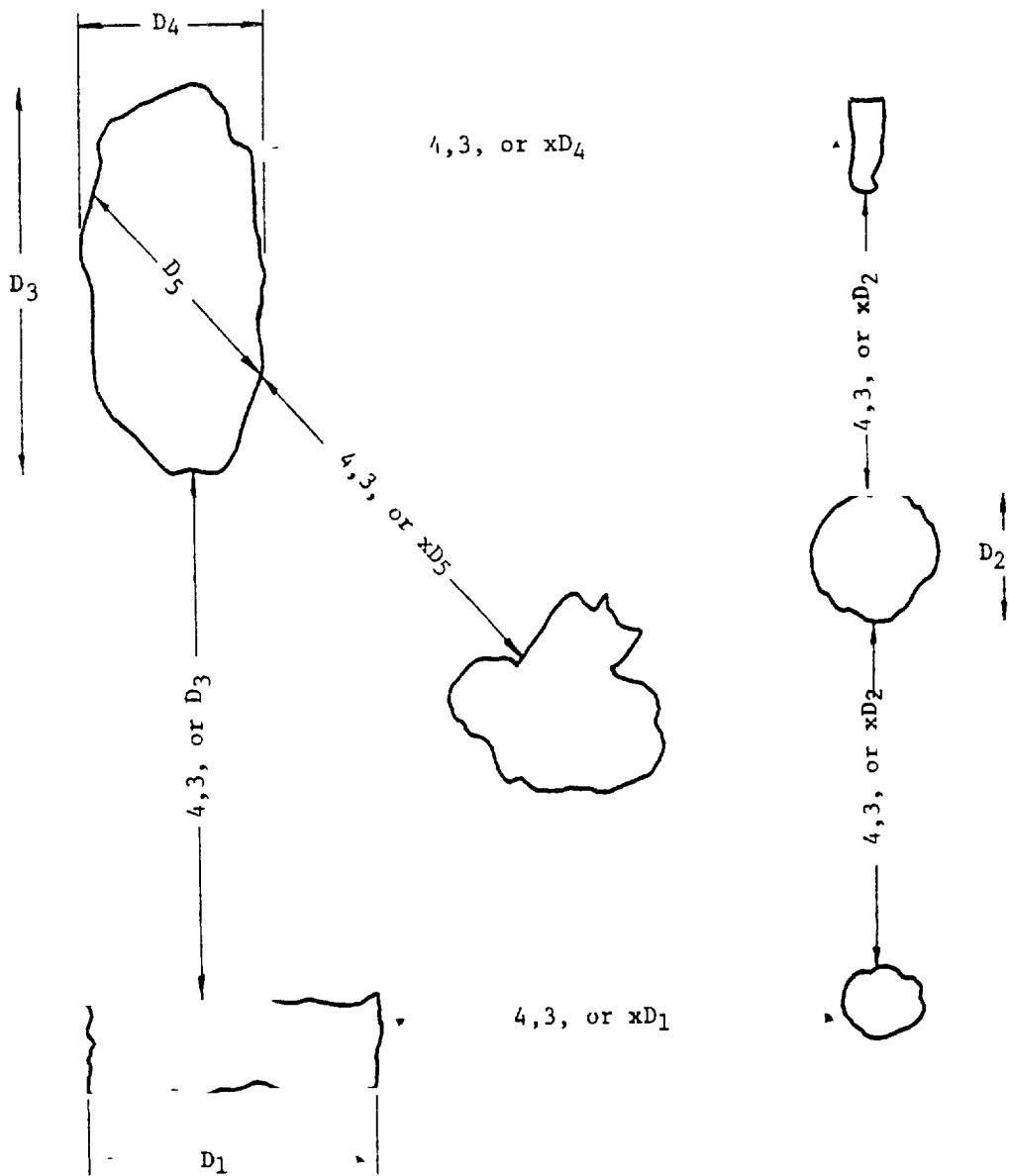


Figure 2. Measuring disbond spacing.

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3.2.2.5 The maximum permissible void or disbond area of the metal-to-metal bond area within an assembly is 1 percent on Type I structure, and 2 percent on Type II structure

3.2.2.6 The maximum permissible disbond area of the metal-to-metal bond area contained within a 6 inch diameter circle is 8 percent of that area so contained for Types I and II structures.

3.3 Face-to-core bonds. Voids or disbonds shall be limited to 0.5 inch diameter for Type I and 0.75 inch diameter for Type II face-to-core or doubler-to-core bonds.

3.4 Core splice, core-to-edgemember, or core-to-insert bonds.

3.4.1 The maximum permissible core gap that is filled with adhesive or the equivalent shall be equal to 0.125 inch for Type I structure and one cell diameter of the largest cell common to the core joint or 0.25 inch, whichever is smaller for Type II structure, as shown in Figures 3, 4, and 5

3.4.2 The maximum permissible core joint void or disbond dimension shall be 0.5 inch or 3 adjacent cells, whichever is smaller, per linear foot and shall not exceed 5 percent of core to core bond area (splice height times splice length)

3.4.3 The maximum core to beveled edge member voids, disbonds and gaps shall be as shown in figure 6.

3.5 Sandwich face dents

3.5.1 Dents Dents shall not exhibit creases, sharp edges, or wrinkles as shown in Figure 7.

3.5.1.2 The dent area shall be inspected for disbonds in accordance with MIL-A-83377.

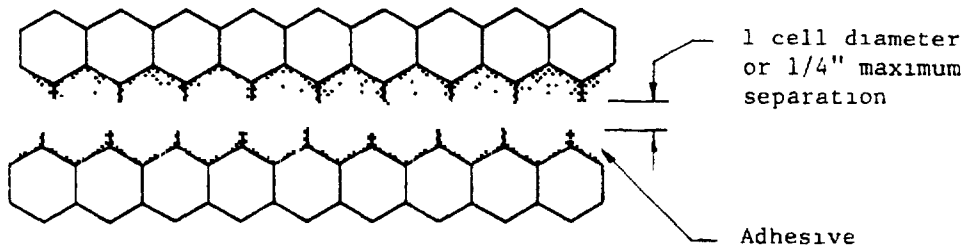


Figure 3. Core splice (Type II structure)

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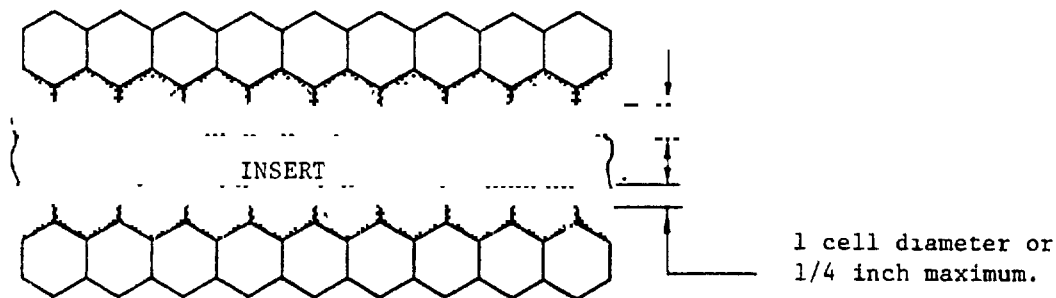


Figure 4. Core to insert (Type II structure).

- NOTE:
1. The maximum void or disbond 1/2 inch or 3 adjacent cells, whichever is smaller, per linear foot.
 2. Total void or disbond must not exceed 5 percent of total core to insert bond area.

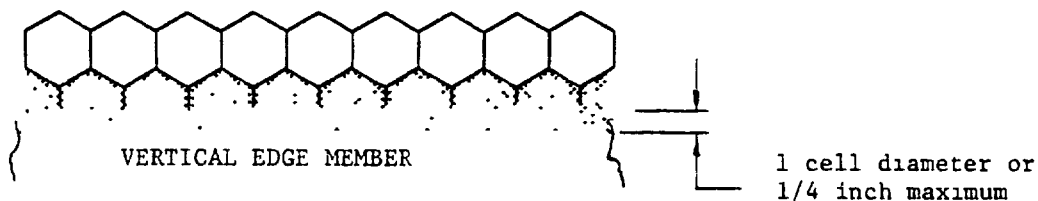


Figure 5. Core to vertical edge member (Type II Structure).

- NOTE:
1. Adhesive maximum void or disbond 1/2 inch or 3 adjacent cells, whichever is smaller, per linear foot.
 2. Total disbond must not exceed 5 percent of total core to edge member bond area.

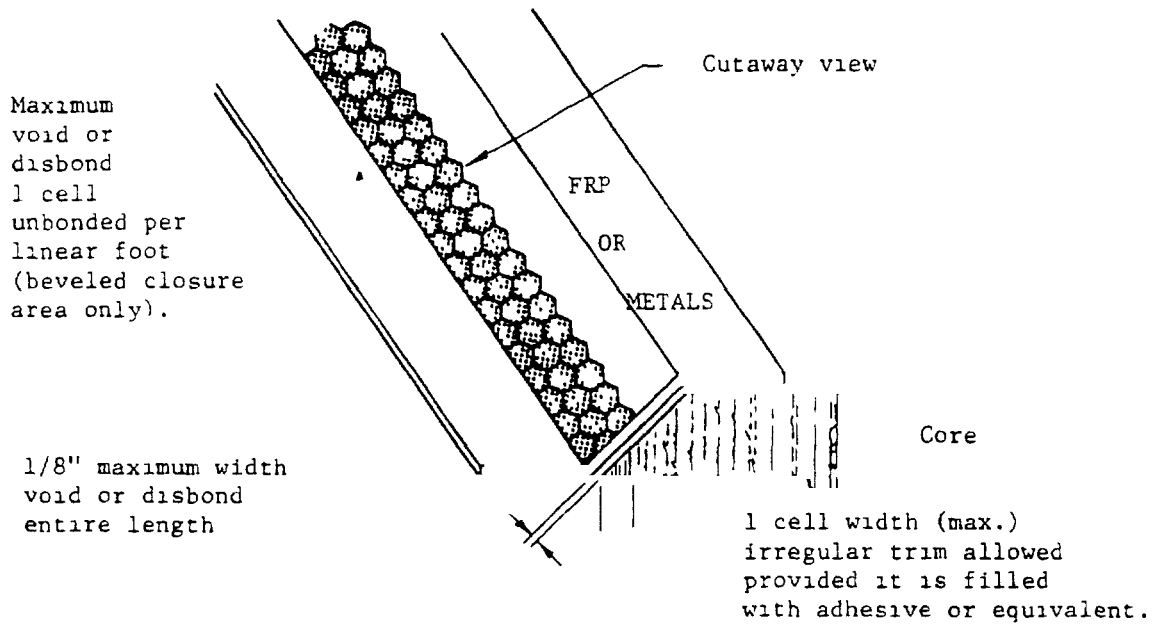


Figure 6. Core to beveled edge member.

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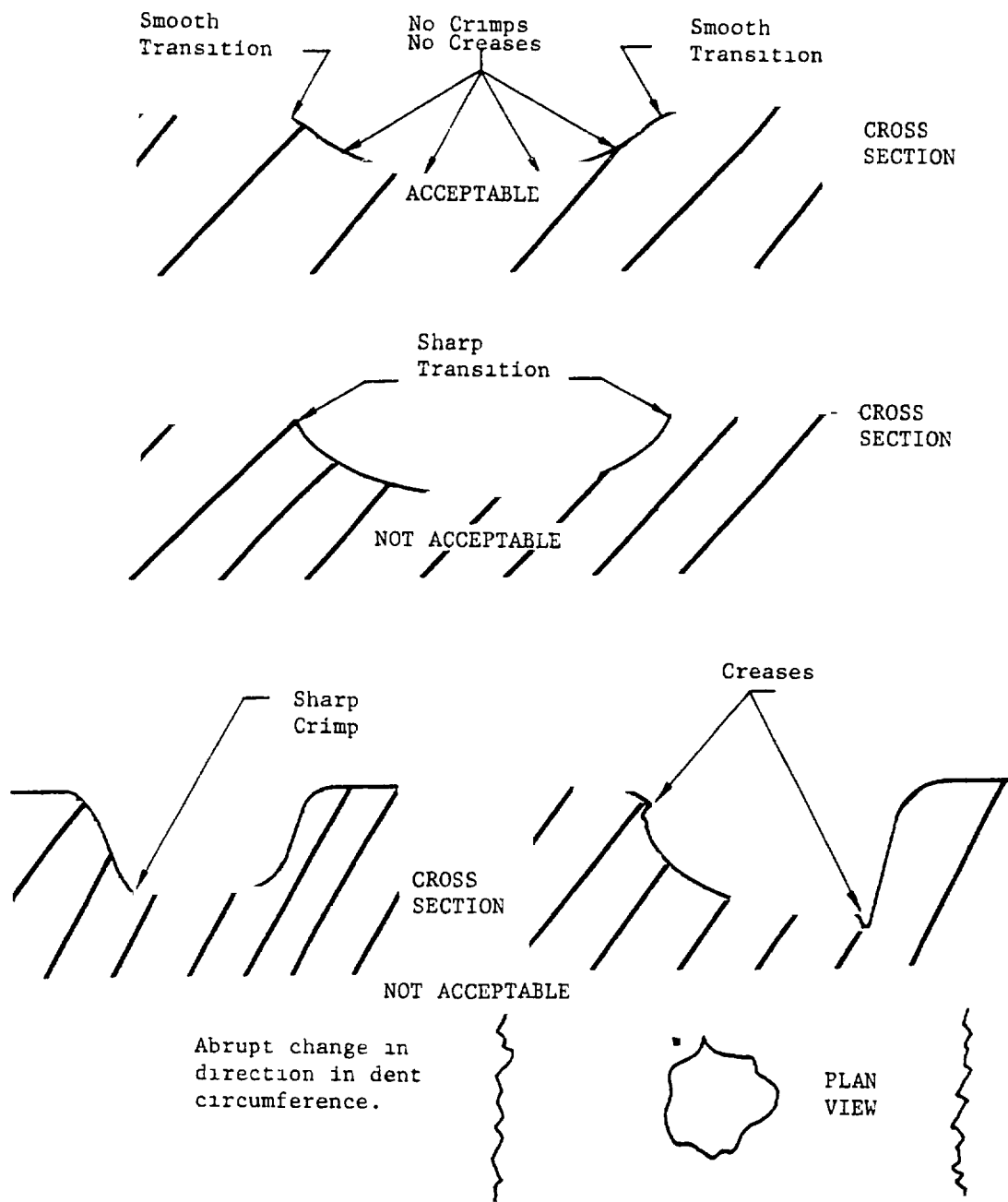


Figure 7. Sandwich face dents.

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3.5.2 Dimensions.

3.5.2.1 Diameter. The maximum permissible dent diameter is 1.5 inches for Type I structure and 2 inches for Type II structure.

3.5.2.2 Depth. The maximum permissible dent depth is 0.006 inches for Type I structure and 0.020 inches for Type II structure.

3.5.2.3 Areas. The maximum permissible dent area within an assembly is 1 percent on Type I structure and 2 percent on Type II structure.

3.5.2.4 Spacing. The minimum permissible distance between dent centers is 6.0 inches for Type I structures and 4.0 inches for Type II structure

3.5.2.4.1 The minimum permissible distance between dent center and the edge of solid members is 10.0 inches for Type I structure, and 6 inches for Type II structure.

3.5.3 Dent limitations. Dent limitations as required for cosmetic purposes shall be established by the contractor's quality assurance.

3.6 Face markoff. Markoff requirements shall be in accordance with Figure 8

3.7 Nondestructive inspection.

3.7.1 Assemblies shall be nondestructive inspected for adherence to the requirements of this specification and in accordance with MIL-A-83377.

3.7.2 Nondestructive inspection physical standards shall be constructed to incorporate acceptance criteria. Standards shall be of similar construction as the parts to be inspected, and shall contain voids or disbonds of the maximum allowed sizes. Nondestructive process procedures shall be approved as specified in MIL-A-83377.

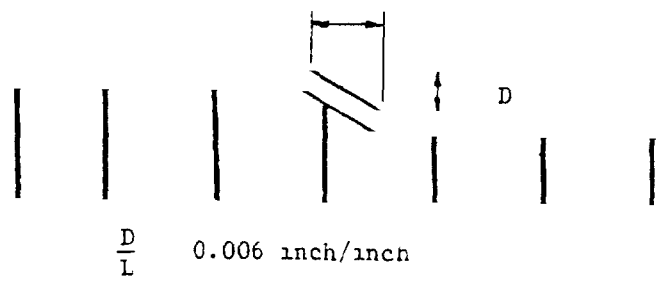
3.8 Destructive inspection.

3.8.1 Destructive inspection of an assembly shall be conducted as specified in MIL-A-83377 to ensure that the bonded components meet the criteria contained in this specification.

4 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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

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Maximum markoff allowed Type I. 0.006 inch/inch

Figure 8. Markoff.

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specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 An effective quality assurance system shall be provided to ensure inspection operation performance by personnel who have demonstrated their ability to apply this criteria to the assemblies being inspected, as specified in MIL-A-83377.

4.1.2 Method of sampling for inspection shall be in accordance with MIL-A-83377.

4.2 Tests. Testing shall be in accordance with MIL-A-83377, where applicable.

5. PREPARATION FOR DELIVERY

(Not applicable.)

6. NOTES

6.1 Intended use. This specification is intended to define acceptance criteria of bonded metal faced sandwich assemblies used on aerospace structures.

6.2 Definitions. The defects covered in this specification are defined as follows.

6.2.1 Face-to-core voids and disbonds. Voids are areas in which adhesive is not present. Disbonds are any unbonded areas occurring between the facing and the honeycomb core or between doublers and core.

6.2.2 Metal-to-metal voids or disbonds. Any unbonded areas occurring between two solid, nonporous members that are joined by an adhesive bondline.

6.2.3 Porosity. A series of small discontinuities or voids closely spaced. The outer peripheral edges of porosity areas shall be outlined and the porosity areas treated as an unbonded area of similar size and shape.

6.2.4 Core splice void or disbond. Any unbonded area existing in the plane of a bond between two core segments.

6.2.5 Core splice gap. That distance between core segment edges and other core segments or solid members that is filled with core splice adhesive or equivalent.

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6.2.6 Dents. Local depressions in sandwich faces.

6.2.7 Markoff. A step occurring in the facing of a bonded sandwich.

Custodian:
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Preparing Activity:
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Project No. 8040-F092

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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