



PROCEDURE FOR TESTING THE INTEGRITY OF WELD-LINES IN EXTRUDED STRUCTURAL ALUMINUM TUBES USING TUBE FLARE TEST METHOD

Application

Scope

This procedure is used to determine the integrity of longitudinal extrusion weld-lines on aluminum extrusion structural / porthole tubes.

Significance and Use

This procedure describes the method for flare testing extruded structural/porthole aluminum tubes using a test fixture and the analysis of test results. A standard specified conical mandrel is forced into the test specimen using a hydraulic press until failure or calculated minimum expanded diameter is reached (per ISO 8493). Any resulting split propagation pattern and edge appearance are used to pass or scrap the tubes based on the criteria defined in this document. The rating standard assigns an acceptable or not acceptable split condition for assessing the integrity of the weld-line in a structural / porthole tube.

Applicable Materials

This test applies to the flare testing (drift testing) of extruded structural aluminum tubes for automotive body-in-white applications.

Applicable Documents

Standard ISO 8493 for metallic materials – Tube

Conflicts

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

Definitions

Quality Assurance Requirements

Unless otherwise specified, the users of this procedure are responsible for all inspection and the test requirements specified herein, and may use internal testing facilities as long as they meet the requirements of this procedure and any other test agencies acceptable to Ford Motor Company.

Sampling

Samples from a single production lot of extruded tubes shall be used for the flare test evaluation.

Data Reporting

Flare test acceptance shall be recorded on production documents with inspection sign-off indicating that all tubes on the order passed the flare test.

Date	Action	Revisions	Rev. 0
2013 11 20	Released		



Documents

G. Mracna, NA

Document Sharing Hub



Apparatus Required

Test Equipment

1. Variable speed hydraulic press or universal testing machine with sufficient capacity.
2. Polished conical hardened steel mandrel, with a specified angle and sufficient hardness. Preferred angles for the conical mandrel are 30°, 45°, and 60°.
3. Lubricant for the conical mandrel surface. The lubricant shall be a light machining oil, WD-40, or equivalent.

Maintenance

The conical mandrels should be cleaned periodically to remove any dirt / dust and residue from flare test samples. The mandrel must be kept clean, free of solid residue, and only aluminum is to be tested with the apparatus. Each mandrel must be inspected periodically to confirm the dimensions remain within both equipment and testing tolerances.

Test Specimen Dimensions

The round / circular extruded aluminum tube test specimens are to have length between 125 - 400 mm (5 - 16 inches). Both ends of the test specimen should be in plane perpendicular to the axis of the tube. The edges of the end to be tested may be rounded by filing or chamfered by other methods. Prior to testing the samples should be cleaned to remove dirt/dust built up on the tube surfaces during the extrusion process.

Test Specimen Preparation

Test specimens are to be fabricated using in-line production cutting equipment. Both ends of the test specimen should be plane perpendicular to the axis of the tube.

Number of Test Specimens

It is recommended that each billet, but no fewer than four (4) non-consecutive billets, be tested for each extruded tube lot.

Procedure

1. Align the vertical axis of the conical mandrel in the hydraulic press with the vertical axis of the test specimen.
2. Apply load using the hydraulic press until test specimen failure or mandrel has moved to the end of its travel.
3. Stop the hydraulic press and retract the conical mandrel to its initial position.
4. Remove the test specimen and record the results.
5. When finished with the apparatus, retract the conical mandrel fully back to its initial position to avoid any accidents.

Analysis

Flare Test Rating Standard

By assessing the cracking edge location and edge pattern of the flare test specimen a pass or fail rating is assigned. The limits of acceptability are to be established in raw material supplier PFMEA, documented in the process control plan and visually posted at the location of flare testing within the extruder facility. Examples are provided below:

Acceptable:

Tear out with jagged or rough edge surface, possibly a spiral shaped tear of the test specimen. This is considered a pass condition.

Not acceptable:

Split with a straight, semi-smooth, 'clean' break along the weld-line of the test specimen. This is considered a fail condition as the welds fail before the parent metal.