

**PROCEDURE FOR SEMI-GUIDED WRAP BEND FIXTURE
FOR TESTING AND ANALYSIS OF THE BENDABILITY OF ALUMINUM SHEET**

Application

Scope

This document covers the operation of a semi-guided wrap bend test fixture developed by Alcan International (Kingston Research and Development Centre in Ontario, Canada). The wrap bend fixture conforms to ASTM Standard E 290-97a and is used for the investigation of the bendability of various sheet aluminum alloys.

Significance and Use

This procedure describes the method for bend testing aluminum sheet with a semi-guided wrap bend test fixture and the analysis of test results. A standard bend test specimen of sheet is bent over the radius of a mandrel by a roller rotating about the mandrel. The resulting convex surface of the bend is rated as a function of the amount of damage incurred due to bending about the mandrel. With acceptable bend rating defined, the minimum mandrel producing a successful bend is determined. The results are typically quantified in terms of the bend radius divided by the sheet thickness (r/t).

Applicable materials

This test applies to the bend testing of aluminum sheet with application in automotive stamping.

Applicable Documents

ASTM Standard E 290-97a Test Methods for the Bend Testing of Material for Ductility
ISO 7438 Metallic Materials – Bend Test

Conflicts

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

Definitions

Orange Peel - A pebble-grained surface that develops in forming coarse-grained aluminum sheet. Orange peel roughening is linked with the less constrained deformation of individual grains, with different orientations, at a free surface. It is related to grain size and is not noticeable on fine-grained material, since the individual crystals produce only extremely fine slip lines¹.

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.

Date	Action	Revisions
2002 12 06	Activated	G. Luckey, P. Friedman, D. Houston

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Documents

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Sampling

Samples from a single production lot of alloy shall be used for the bendability evaluation of the alloy. The report for the bend test of the aluminum sheet shall contain as a minimum, the following information.

- (a) Generic and specific product description of each alloy including lot number and date alloy was made.
- (b) Baseline material properties for each aluminum alloy.
- (c) Material processing information.
- (d) Bend test ratings for each specimen tested.

Replicates

At least four replications per mandrel are required for statistical significance.

Data Reporting

All physical and mechanical data shall be submitted using the Supplemental Data Reporting Package (SDRP), which is comprised of the form in the reporting section. The SDRP serves as the required reporting format for submitting material data. All material data requested herein shall be manually recorded onto the reporting forms. Graphs and other requested materials shall be packaged and sent with the SDRP.

Apparatus Required

Semi-Guided Bend Test Fixture

Alcan International developed the semi-guided wrap bend fixture (Figure 1a & 1b) described within this document. The fixture was developed for bendability evaluation and quality control of aluminum sheet and conforms to ASTM Standard E 290-97a. The fixture clamps one end of an aluminum sheet specimen in place with the mandrel contacting the inside surface of the specimen at the location of the bend. The bending arm pivots about the radius of the mandrel and the roller applies the bending force against the opposite side of the specimen. The specimen is thus made to wrap around the mandrel producing a bend conforming to the mandrel's radius.

Maintenance

The bend mandrels should be cleaned with acetone periodically to remove oil and residue from bend test samples. Particular attention must be given to the radius of the mandrels. The mandrel radius must be kept clean, free of sold residue, and only aluminum is to be tested within the apparatus. Each mandrel bend radius must be inspected periodically to confirm the radius remains within testing tolerance. This inspection is to be conducted by the Metrology Lab of SRL. All threads, sliding blocks, and bearing must be kept clean and lightly lubricated.

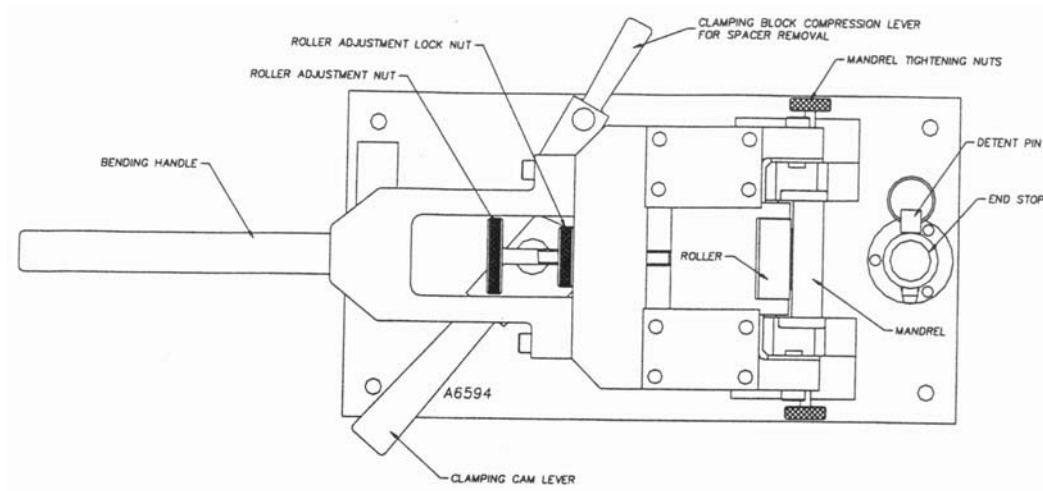


Figure 1a. Guided wrap bend fixture schematic

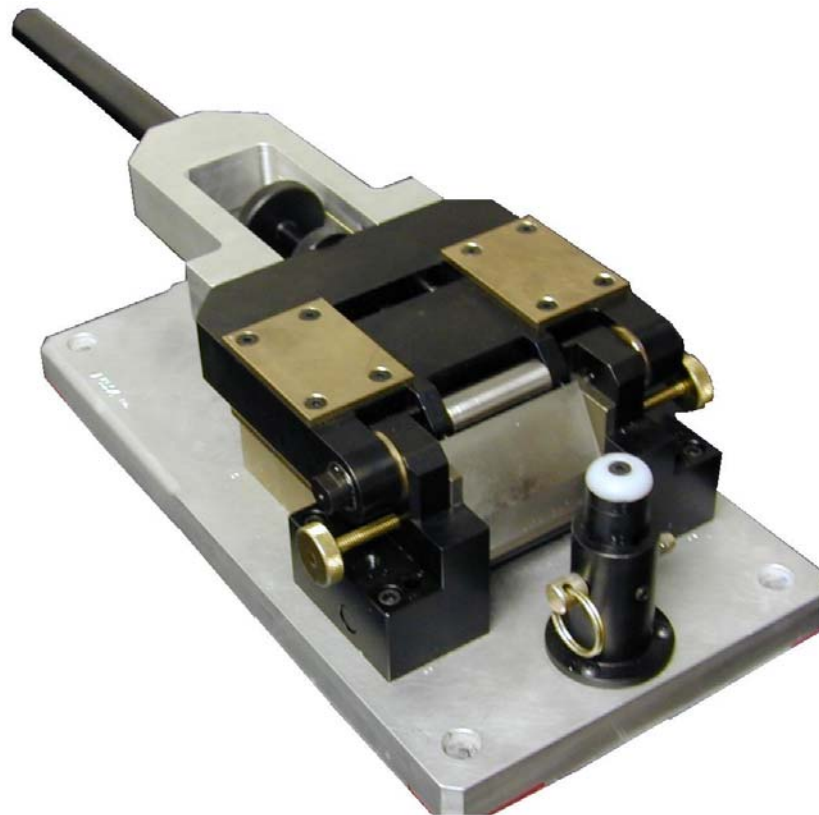


Figure 1b. Guided wrap bend fixture