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Metallic materials — Sheet and strip — Hole expanding test

Matériaux métalliques — Tôles et bandes — Essai d'expansion de trou

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 2, *Ductility testing*.

This second edition cancels and replaces the first edition (ISO 16630:2009), which has been technically revised.

The main changes compared to the previous edition are:

— “through-thickness crack” (3.3) and “microcrack” (3.4) have been added;

— the statement regarding an inspection of the punching tool in 7.5 has been revised and a note has been added;

— the requirement during the punching process has been added as 7.6;

— the test procedures in 8.6 and 8.7 have been revised;

— it has been revised that the average limiting hole expansion ration, $\overline{\lambda}$, shall be rounded to an integer value. Also, the method of rounding-off has been revised from ISO 497 to ISO 80000-1:2009 (Clause 2 and 9.4).

Introduction

In automotive parts manufacturing, sheet metal is primarily processed by shearing, bending and stretch-drawing operations.

Included with these processes are the bending up (plunging) of flanges (rims) around punched holes, and this can result in rupture of the material.

Various test methods are available to establish the suitability of the sheet metal for the forming processes involved. The hole expanding test is one of the best methods for evaluating the suitability of the sheet metal for forming such “flanges” because it closely resembles the process used under production conditions to form such flanges (plunged rims) starting with punched holes.

Because of the details given in this document, the relevance of the test will be immediately apparent. By adhering to the procedures laid down in this document, scatter in the test results is minimized.

Metallic materials — Sheet and strip — Hole expanding test

1 Scope

This document describes a method of determining the hole expansion ratio in metallic sheets and strips with a thickness range of 1,2 mm to 6,0 mm inclusive and a width of at least 90 mm.

NOTE This test is normally applicable to sheet metal and is used to assess the suitability of the product for forming flanges.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
limiting hole expansion ratio
amount of hole expansion obtained in a circular punched hole of a test piece when a conical expanding tool is forced into the hole until any one crack in the hole edge extends through the test piece thickness

Note 1 to entry: The limiting hole expansion ratio is expressed as the ratio of hole diameter expansion to the original hole diameter.

3.2
clearance
gap between the die and the punch, present when punching a hole in a test piece

Note 1 to entry: Clearance is expressed as the ratio of the gap to the test piece thickness.

3.3
through-thickness crack
crack that has extended through the sample thickness

3.4
microcrack
crack that has not extended through the sample thickness