International Standard

ISO 16630

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

This third edition cancels and replaces the second edition (ISO 16630:2017), which has been technically revised.

The main changes are as follows:

— correction of the definition of the limiting hole expansion ratio in 3.1;

— addition of the visual inspection on the surfaces of die and punch in the hole expanding test in 6.2.1;

— addition of the observation on the working surface of test piece to make sure no draw-in occurs in 8.4;

— modification of the observation method to detect the first crack in 8.5;

— modification of the condition on stopping the movement of the punch in 8.7;

— addition of the automated method of optical crack detection and measurement of the diameter in 8.7;

— addition of Annex A on the accuracy of original hole diameters.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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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.

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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, *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 terminology databases for use in standardization at the following addresses:

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

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

3.1
limiting hole expansion ratio
ratio of amount of hole expansion obtained in a circular punched hole to the original hole diameter 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

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

4 Symbols and designations

The symbols used in this document are given in Table 1.

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