

Revised

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

**ISO RECOMMENDATION
R 82**

TENSILE TESTING OF STEEL

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BRIEF HISTORY

The ISO Recommendation R 82, *Tensile Testing of Steel*, was drawn up by Technical Committee ISO/TC 17, *Steel*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

At the first meeting of ISO/TC 17, held in London, in June 1950, the Secretariat submitted a first draft proposal for the tensile test, based on a document which had been drawn up by the former International Federation of the National Standardizing Associations (ISA).

The Technical Committee discussed this draft proposal in meeting, and instructed its Working Group No. 1, *Methods of Mechanical Testing for Steel*, to prepare a new version of it, taking into account the views expressed at the first meeting.

In August 1953, the Working Group submitted a second draft proposal, which was studied by the Technical Committee during its third plenary meeting, held in London, in December 1953. The ISO/TC 17 Secretariat was then assigned to draw up a third draft proposal, incorporating the changes voted during the meeting, and this was circulated in April 1954.

The comments of the Member Bodies on this third draft proposal were discussed at the fourth plenary meeting, held in Stockholm, in June 1955, and the Technical Committee decided to adopt it, subject to a few amendments, as a Draft ISO Recommendation.

On 31 October 1956, this Draft ISO Recommendation (No. 133) was distributed to all the ISO Member Bodies and was approved, subject to a few modifications of details, by the following Member Bodies:

*Canada	Japan	Sweden
Denmark	Netherlands	Turkey
France	Pakistan	*Union of
*Greece	Poland	South Africa
Hungary	Portugal	U.S.S.R.
*Ireland	Spain	Yugoslavia

One Member Body opposed the approval of the Draft: Germany

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1959, to accept it as an ISO RECOMMENDATION.

• These Member Bodies stated that they had no objection to the Draft being approved.

TENSILE TESTING OF STEEL

1. SCOPE

This ISO Recommendation applies to products of diameters equal to or greater than 4 mm (0.157 in) or thicknesses equal to or greater than 3 mm (0.118 in). For the tensile testing of certain products, such as sheets, strips, wires and tubes, particular specifications are applicable.

2. PRINCIPLE OF TEST

The test consists in subjecting a test piece to tensile stress, generally to fracture, with a view to determining one or more of the mechanical properties enumerated hereafter. The test is carried out at ambient temperature, unless otherwise specified.

3. DEFINITIONS

3.1 Gauge length. At any moment during the test, the prescribed part of the cylindrical or prismatic portion of the test piece on which elongation is measured. In particular, a distinction should be made between the following:

- (a) *the original gauge length (L_o).* Gauge length before the test piece is strained, and
- (b) *the final gauge length (L_u).* Gauge length after the test piece has been fractured and the fractured parts have been carefully fitted together so that they lie in a straight line.

3.2 Percentage permanent elongation. Variation of the gauge length of a test piece subjected to a prescribed stress (see clause 3.9) and, after removal of same, expressed as a percentage of the original gauge length. The symbol of this elongation is supplemented by an index indicating the prescribed stress.

3.3 Percentage elongation after fracture (A). Permanent elongation of the gauge length after fracture $L_u - L_o$, expressed as a percentage of the original gauge length L_o .

3.4 Percentage reduction of area (Z). Ratio of the maximum change in cross-sectional area, which has occurred during the test $S_o - S_u$, to the original cross sectional area S_o , expressed as a percentage.

3.5 *Percentage elongation factor at point of constriction (Z_u)*. Ratio of the maximum change in cross-sectional area, which has occurred during the test $S_o - S_u$, to the minimum cross-sectional area after fracture S_u , expressed as a percentage.

3.6 *Maximum load (F_m)*. The highest load which the test piece withstands during the test.

3.7 *Final load (F_u)*. Load imposed on the test piece at the moment of fracture.

3.8 *Load at yield point (F_e)*. Load at which the elongation of the test piece first increases without increase of load or with decrease of load.

3.9 *Stress* (actually "nominal stress"). At any moment during the test, load divided by the original cross-sectional area of the test piece.

3.10 *Tensile strength (R_m)*. Maximum load divided by the original cross-sectional area of the test piece, i.e. stress corresponding to the maximum load.

3.11 *Yield stress (R_e)*. Stress at yield point. If, in testing, a drop in the load is observed, the stress corresponding to the highest load is known as the "upper yield point" and the stress corresponding to the lowest load subsequently observed is known as the "lower yield point".

3.11.1 In assessing the values of the upper and lower yield points, the characteristics of the testing machine should be taken into consideration; for example, the inertia of the dynamometer of the testing machine may result in the load dropping below the true lower yield point.

3.12 *Stress at permanent set limit*. Stress at which, after removal of load, a prescribed permanent elongation, expressed as a percentage of the original gauge length, occurs; the prescribed value may frequently be 0.2 per cent (see Fig. 4 (a), page 7).

3.12.1 The symbol used for this stress is supplemented by an index giving the prescribed percentage of the original gauge length, e.g. 0.5.

3.13 *Stress at proof limit*. Stress at which a non-proportional elongation, equal to a specified percentage of the original gauge length, occurs. When a stress at proof limit is specified, the non-proportional elongation should be stated, e.g., proof limit 0.1 per cent or 0.2 per cent (see Fig. 4 (b), page 7).

3.13.1 The symbol used for this stress is supplemented by an index giving the prescribed percentage of the original gauge length, e.g. 0.1.