

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 952

TENSILE TESTING
OF LIGHT METAL AND LIGHT METAL ALLOY TUBES

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 952, *Tensile testing of light metal and light metal alloy tubes*, was drawn up by Technical Committee ISO/TC 79, *Light metals and their alloys*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question led, in 1966, to the adoption of a Draft ISO Recommendation.

In March 1967, this Draft ISO Recommendation (No. 1132) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Belgium	Israel	Switzerland
Canada	Italy	Thailand
Chile	Japan	Turkey
Czechoslovakia	Netherlands	U.A.R.
France	New Zealand	United Kingdom
Germany	Norway	U.S.A.
Greece	Poland	U.S.S.R.
Hungary	South Africa, Rep. of	Yugoslavia
India	Sweden	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in January 1969, to accept it as an ISO RECOMMENDATION.

TENSILE TESTING

OF LIGHT METAL AND LIGHT METAL ALLOY TUBES

1. SCOPE

This ISO Recommendation relates to the tensile testing of light metal and light metal alloy tubes.

2. PRINCIPLE OF TEST

The test consists in subjecting a length of tube of full section, or a longitudinal strip of full thickness, cut from the wall of a tube, or a round proportional test piece machined from the wall of a tube, to tensile stress, generally to fracture, with a view to determining one or more of the mechanical properties enumerated in clauses 6.1, 6.5, 6.6 and 6.7.

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 length of the test piece on which elongation is measured. In particular a distinction should be made between the two following lengths :
 - 3.1.1 *Original gauge length* (L_0). Gauge length before the test piece is strained.
 - 3.1.2 *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 3.7) and, after removal of the same, expressed as a percentage of the original gauge length. If a symbol is used for this elongation, it should be supplemented by an index indicating the prescribed stress.
- 3.3 *Percentage elongation after fracture* (A). Permanent elongation of the gauge length after fracture, $L_u - L_0$, expressed as a percentage of the original gauge length, L_0 .
- 3.4 *Percentage reduction of area* (Z). Ratio of the maximum change in the cross-sectional area which has occurred during the test, $S_0 - S_u$, to the original cross-sectional area S_0 , expressed as a percentage.
- 3.5 *Maximum load* (F_m). The highest load which the test piece withstands during the test.
- 3.6 *Final load* (F_u). Load imposed on the test piece at the moment of complete fracture.
- 3.7 *Stress* (actually "nominal stress"). At any moment during the test, load divided by the original cross-sectional area of the test piece.
- 3.8 *Tensile strength* (R_m). Maximum load divided by the original cross-sectional area of the test piece, i.e. the stress corresponding to the maximum load.
- 3.9 *Permanent set stress* (R_r). Stress at which, after removal of load, a prescribed permanent elongation, expressed as a percentage of the original gauge length, occurs (see clause 3.2 and Fig. 4a).
- 3.10 *Proof stress (non-proportional elongation) or yield strength (offset)** (R_p). Stress which produces, while the load is still applied, a non-proportional elongation equal to the specified percentage of the original gauge length, L_0 .

When a proof stress or a yield strength is specified, the non-proportional elongation should be stated; e.g. proof stress or yield strength 0.2 % (see Fig. 4b).

The symbol used for this stress should be supplemented by an index giving the prescribed percentage of the original gauge length, e.g. 0.2 %.

* This last term is used in the United States of America and in Canada.

4. SYMBOLS AND DESIGNATIONS

Reference number*	Symbol	Designation
1	D	External diameter of round tube
2	d	Internal diameter of round tube
3	a	Thickness of tube
4	b	Width of longitudinal strip or parallel portion of test piece
5	L_o	Original gauge length **
6	L_c	Parallel length
7	L_t	Total length of test piece
8	—	Gripped ends
9	S_o	Original cross-sectional area of the gauge length
10	L_u	Final gauge length
11	S_u	Minimum cross-sectional area after fracture
12	F_m	Maximum load
13	R_m	Tensile strength **
14	F_u	Final load, i.e. at moment of complete fracture
15	$L_u - L_o$	Permanent elongation after fracture
16	A	Percentage elongation after fracture $A = \frac{L_u - L_o}{L_o} \times 100$
17	Z	Percentage reduction of area $Z = \frac{S_o - S_u}{S_o} \times 100$
18	R_r	Permanent set stress
19	—	Specified permanent set
20	R_p	Proof stress (non-proportional elongation) or yield strength (offset)
21	—	Specified non-proportional elongation

* See Figures 1 to 4.

** In correspondence and where no misunderstanding is possible, the symbols L_o and R_m may be replaced by L and R respectively.