

INTERNATIONAL STANDARD



3800 / I

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Threaded fasteners — Axial load fatigue testing — Part I : Test methods

*Éléments de fixation filetés — Essais de fatigue sous charge axiale —
Partie I : Méthodes d'essai*

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3800/1 was developed by Technical Committee ISO/TC 2, *Fasteners*, and was circulated to the member bodies in May 1975.

It has been approved by the member bodies of the following countries :

Australia	Ireland	Spain
Belgium	Italy	Sweden
Chile	Japan	Switzerland
Czechoslovakia	Mexico	Turkey
Denmark	Netherlands	United Kingdom
Finland	New Zealand	U.S.A.
France	Norway	U.S.S.R.
Germany	Poland	Yugoslavia
Hungary	Romania	
India	South Africa, Rep. of	

No member body expressed disapproval of the document.

Threaded fasteners — Axial load fatigue testing — Part I : Test methods

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the conditions for carrying out axial load fatigue tests on threaded fasteners. ISO 3800/II¹⁾ specifies methods of statistically determining fatigue strengths. The tests specified are of the fluctuating tension type as defined in ISO/R 373, sub-clause 3.2.3, and are carried out at room temperature, in air, the loading applied being along the longitudinal axis of the fastener. These methods allow the fatigue strength of threaded fasteners in open joints (clamped parts are not in contact) to be determined independently of their application.

Since the test fixtures can introduce variables in results, minimum requirements are specified to reduce their effect. Calibration and alignment control methods are included.

2 REFERENCES

ISO/R 80, *Rockwell hardness test (A and B scales) for steel*.

ISO/R 273, *Clearance holes for metric bolts*.

ISO/R 373, *General principles for fatigue testing of metals*.

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*.

ISO 885, *General purpose bolts and screws — Metric series — Radii under head*.

ISO 1099, *Metals — Axial load fatigue testing*.

ISO 1101, *Tolerances of form and of position*.

3 PRINCIPLE

Tests are made on threaded fasteners to determine fatigue properties such as those shown by the *S/N* curve (Wöhler curve) described in ISO/R 373.

Test threaded fasteners are mounted in an axial load fatigue testing machine and subjected to fluctuating tension type loading as defined in ISO/R 373, sub-clause 3.2.3.

Tests with constant mean stress σ_m or constant stress ratio $R_s = \sigma_{min}/\sigma_{max}$ may be used.

The test is continued until the test piece fails, or until a predetermined number of stress cycles has been exceeded. Generally the number of test cycles is determined by the material or by the endurance fatigue strength of the test specimen. For threaded steel fasteners, the test may be discontinued at 5×10^6 cycles in general. The definition of failure is given in ISO/R 373.

1) In preparation.

4 DEFINITIONS AND SYMBOLS

In this International Standard the following symbols are used :

Symbol	Definition
d_a	Diameter at the point of tangency of the fillet
D	Major diameter of nut thread
D_h	Through hole diameter
P	Pitch
R_m	Minimum tensile strength
R_s	Constant stress ratio $\sigma_{min}/\sigma_{max}$
s	Width across flats of hexagons
σ_a	Stress amplitude
σ_A	Stress amplitude at endurance fatigue limit
σ_m	Mean stress
σ_{min}	Minimum stress
σ_{max}	Maximum stress
σ_{Min}	Minimum stress at endurance fatigue limit
σ_{Max}	Maximum stress at endurance fatigue limit
σ_{AN}	Fatigue strength at N cycles

In general, the stress amplitude as well as the high of low stress are related to the area at the basic minor diameter, but the mean stress is related to the nominal stress area. In the interests of uniformity, and also in view of the possibility of comparisons being made, the area at the basic minor diameter shall be chosen for the mean stress as well as for the stress amplitude.

Further symbols and definitions relating to fatigue testing are given in ISO/R 373.

5 APPARATUS

5.1 Testing machine

The testing machine shall be capable of maintaining the loads within $\pm 2\%$ of the required values and shall be equipped with a device for counting and recording the total number of cycles per test. The testing machine shall be calibrated periodically to ensure this accuracy. The frequency range of testing shall be between 4,2 and 250 Hz. The testing machine shall induce a sinusoidal fluctuation in load in the test piece.

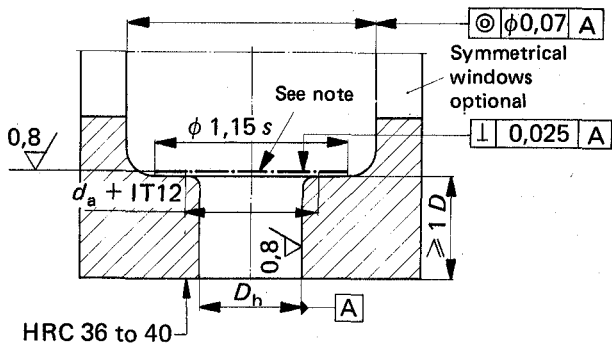
5.2 Test fixtures

The test fixtures shall be capable of transmitting an axial load to the test piece. Figures 1 and 2 give basic requirements. Self-aligning devices are not recommended; if they are used, alignment shall be checked carefully.

5.3 Test alignment

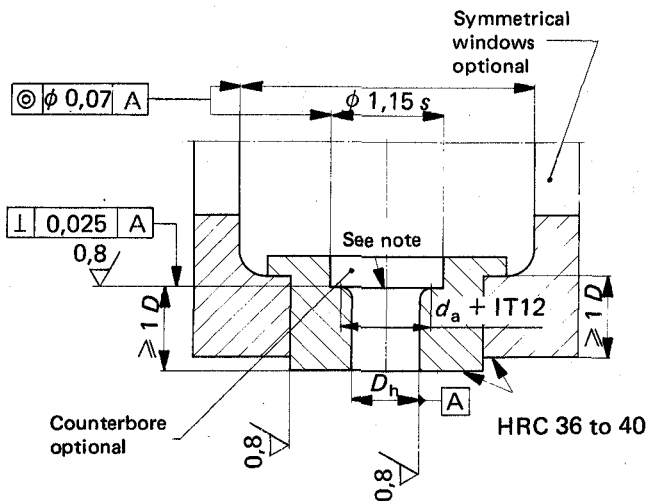
Periodically, the alignment of the test setup shall be verified to ensure that the difference between the maximum stress and the average stress in a test specimen does not exceed 6 % of the average stress when measured at 50 % of the load range used on the machine. This may be determined by using a load cell with strain gauges located at 90° on a common centre line around the axis.

The free length of the strain gauged stud used to check the alignment shall be 4 times the diameter for comparison of possible bending stresses. Other equivalent methods for the alignment of the test setup are permissible.



D_h = Through hole diameter according to ISO/R 273, fine series
 d_a = Transition diameter according to ISO 885, finished products

FIGURE 1 – Fixture without insert



D_h = Through hole diameter according to ISO/R 273, fine series
 d_a = Transition diameter according to ISO 885, finished products

FIGURE 2 – Fixture with insert

NOTE – Surface may be case-hardened 0,25 to 0,5 mm deep : maximum hardness HRC 60; minimum hardness 5 points HRC greater than test part.