

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 373

GENERAL PRINCIPLES FOR FATIGUE TESTING OF METALS

1st EDITION

August 1964

COPYRIGHT RESERVED

The copyright of ISO Recommendations and ISO Standards belongs to ISO Member Bodies. Reproduction of these documents, in any country, may be authorized therefore only by the national standards organization of that country, being a member of ISO.

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 373, *General Principles for Fatigue Testing of Metals*, was drawn up by Technical Committee ISO/TC 17, *Steel*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee began in 1958 and led, in 1961, to the adoption of a Draft ISO Recommendation.

In October 1962, this Draft ISO Recommendation (No. 516) 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:

Australia	France	Norway
Austria	Germany	Poland
Belgium	Greece	Portugal
Bulgaria	Hungary	Romania
Burma	India	Spain
Canada	Ireland	Sweden
Chile	Italy	Switzerland
Czechoslovakia	Japan	Turkey
Denmark	Morocco	United Kingdom
Egypt	Netherlands	U.S.S.R.
Finland	New Zealand	Yugoslavia

One Member Body opposed the approval of the Draft: U.S.A.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in August 1964, to accept it as an ISO RECOMMENDATION.

GENERAL PRINCIPLES FOR FATIGUE TESTING OF METALS

1. SCOPE

This ISO Recommendation consists mainly of general recommendations for the definitions of the terms used, for the preparation of fatigue test pieces, their subsequent testing procedure and the presentation of results. The recommendations are intended to apply mainly to fatigue tests under tension-compression (direct stress), bending or torsion of plain or notched test pieces of simple forms. It does not cover, for example, fatigue under repeated impact or thermal fatigue. In this ISO Recommendation, the term "fatigue" applies to changes in properties which can occur in a metallic material due to the repeated application of stresses or strains, although usually this term applies specially to those changes which lead to cracking or failure.

2. OBJECT

The object of fatigue testing is to provide data relating to the behaviour of materials or structural components, when subjected to stresses or strains which vary repeatedly with time.

3. DEFINITIONS AND SYMBOLS

3.1 General. Stresses in service may be of simple form, for example, tension-compression, bending or torsion, or they may occur in combination. According to the information required, the stresses applied in fatigue tests may similarly be one of those modes or a combination of two or more of them. Whatever the mode of stress, whether applied singly or in combination, the direct and/or shear stress to which the test specimen is subjected will usually vary approximately sinusoidally with time, as illustrated in Figure 1.

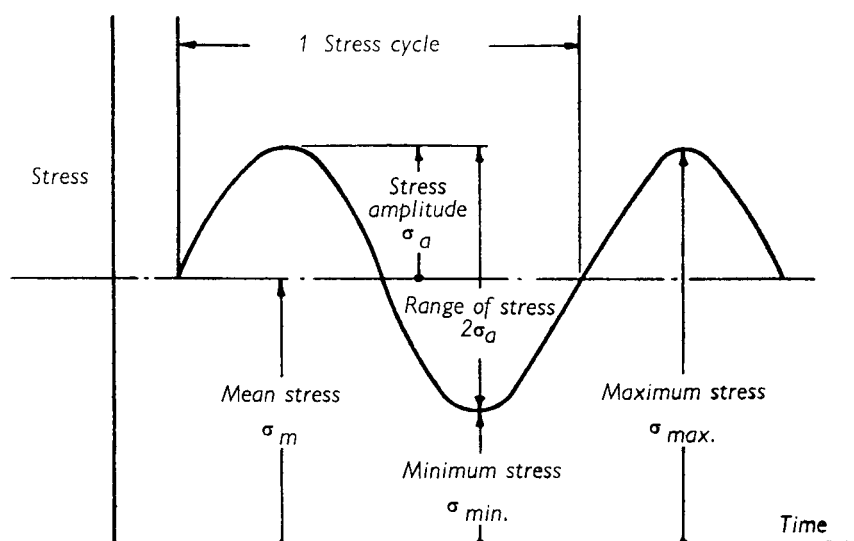


Fig. 1. — Fatigue stress cycle

NOTE. — Range of stress = 2 (Stress amplitude).

The statements in the following clauses are thus applicable whatever the mode of stressing, although, for reasons of simplicity, reference will be made generally to simple stress systems.

3.2 Stress. In general, the stress will be a nominal stress calculated by reference to the net area under consideration. It will usually be calculated by the use of conventional elastic formulae.

It should be noted that in some instances tests may be conducted and the results expressed entirely in terms of strain; in particular, where strains beyond the elastic limit are employed, it is undesirable to calculate stresses from them.

3.2.1 Applied stress cycle. It will be seen from Figure 1 that the smallest section of the stress-time function which is repeated periodically is *the stress-cycle*. Any stress varying periodically over a given range can be regarded as comprising a variable stress component alternating between two values opposite in sign but equal in magnitude (the stress amplitude) and a static stress component (the mean stress) superimposed. The recommended notation is algebraic as in Figure 2.

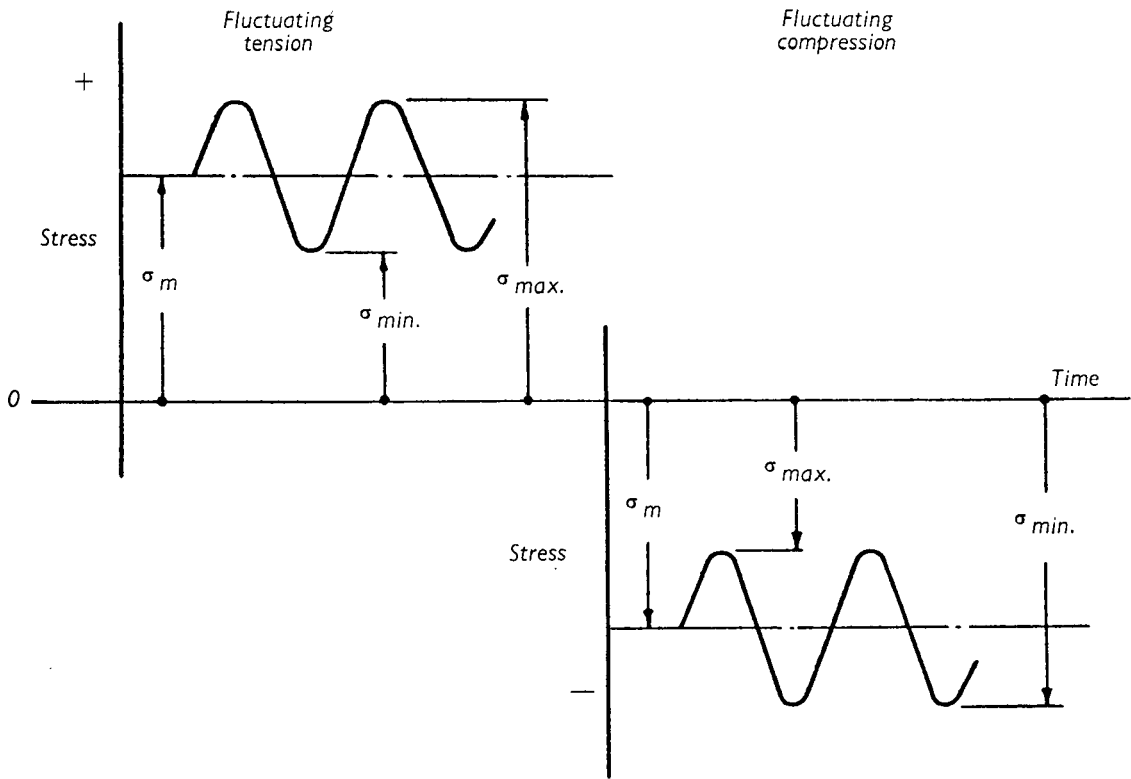


Fig. 2. — Stress cycle with algebraic notation

3.2.2 Symbols, designations and definitions

Symbol	Designation	Definition
$\sigma_{\max.}$	Maximum stress	The highest algebraic value of stress in the stress cycle; tensile stress is considered positive and compressive stress negative.
$\sigma_{\min.}$	Minimum stress	The lowest algebraic value of stress in the stress cycle; tensile stress is considered positive and compressive stress negative.
σ_m	Mean stress	Static component of the stress. It is one half of the algebraic sum of the maximum and minimum stresses.
σ_a	Stress amplitude	Variable component of stress. It is one half of the algebraic difference between the maximum stress and the minimum stress.
$2\sigma_a$	Range of stress	Algebraic difference between the maximum stress and the minimum stress in the stress cycle.

NOTE. — For shear stress, the symbol τ will be used instead of σ .