

Fibre-reinforced plastics — Determination of fatigue properties under cyclic loading conditions

ICS 83.120

National foreword

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The UK participation in its preparation was entrusted to Technical Committee PRI/42, Fibre reinforced thermosetting plastics and prepregs, which has the responsibility to:

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Fibre-reinforced plastics — Determination of fatigue properties under cyclic loading conditions

*Plastiques renforcés de fibres — Détermination des propriétés de
fatigue en conditions de chargement cycliques*



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Foreword

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13003 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

Fibre-reinforced plastics — Determination of fatigue properties under cyclic loading conditions

1 Scope

This International Standard defines the general procedures for fatigue testing of fibre-reinforced plastic composites under cyclic loading conditions of constant amplitude and constant frequency. Although these general procedures are applicable to all modes of testing and test machine control, care will be required in their application in each case. Prior experience has been mainly with tensile and flexural fatigue testing based on the equivalent static (monotonic) test methods. Fatigue tests on unidirectionally reinforced carbon-fibre systems in the fibre direction are particularly difficult to perform.

In some cases, such as fracture toughness crack propagation, specific tests may exist that should be used in preference to this International Standard.

2 Normative references

The following referenced documents are indispensable for the application 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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 527-5, *Plastics — Determination of tensile properties — Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

ISO 1268 (all parts), *Fibre-reinforced plastics — Methods of producing test plates*

ISO 14125, *Fibre-reinforced plastic composites — Determination of flexural properties*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

stress (induced in test specimen)

σ

nominal stress calculated, using the relevant equation given in the monotonic (static) test method used, from the measured load

NOTE It is expressed in megapascals.

3.2

strain (imposed on test specimen)

ε

fractional elongation of the highest-loaded portion of the test specimen (e.g. the outer surface of a flexure specimen)

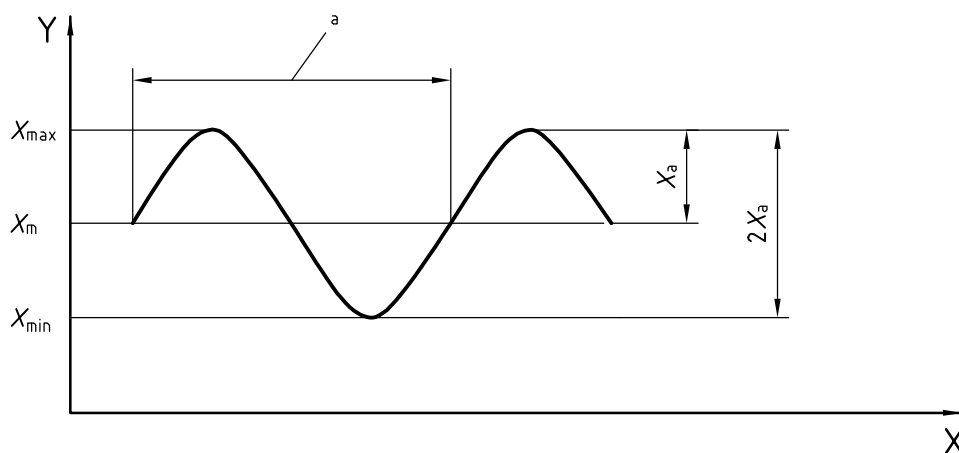
NOTE It is calculated from the relevant equation given in the test method used and expressed as a dimensionless ratio.

3.3

waveform

shape of the cyclic variation of the applied stress (load) or strain (displacement) between constant maximum and minimum values

NOTE The default waveform shape is a sine waveform. Figure 1 gives an example of a constant-amplitude, constant-frequency sine wave. Other waveform shapes, such as square, triangular and saw-tooth, are also used.



Key

X time
Y applied stress or strain X

$X_{\max}$ maximum (or peak) value of X
 X_m mean value of X [$X_m = (X_{\max} + X_{\min})/2$]
 $X_{\min}$ minimum (or trough) value of X
 X_a amplitude of X
 $2X_a$ extent of variation of X (peak-to-peak amplitude)
 a 1 cycle

Figure 1 — Example of sine waveform cycle

3.4

cycle

single completed waveform from any point on the waveform (e.g. mean, peak) to the next occurrence of the same point

3.4.1

type of cycle

the type of cycle is defined by the position of the signal in relation to zero stress (load) or strain (displacement)

NOTE Figure 2 gives examples of stress cycles. For strain or deflection displacement cycles, strain or displacement terms replace stress terms.