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Metallic materials — Dynamic force calibration for uniaxial fatigue testing —

Part 1:
Testing systems

Matériaux métalliques — Étalonnage de la force dynamique uniaxiale pour les essais de fatigue —

Partie 1: Systèmes d'essai

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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 4965-1 was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 5, *Fatigue testing*.

This first edition of ISO 4965-1, together with ISO 4965-2, cancels and replaces ISO 4965:1979, which has been technically revised.

ISO 4965 consists of the following parts, under the general title *Metallic materials — Dynamic force calibration for uniaxial fatigue testing*:

— *Part 1: Testing systems*

— *Part 2: Dynamic calibration device (DCD) instrumentation*

Introduction

In a dynamic test, the force experienced by the test-piece (F_t) might differ significantly from the force indicated by the testing system (F_i). The dynamic errors result from inertial forces acting on the force transducer and any dynamic errors in the electronics of the force indicating system. Inertial forces equate to the grip mass (interposed between the force transducer and the test-piece) multiplied by its local acceleration, and therefore depend on

a) the amplitude of motion

b) the frequency of motion, and

c) the grip mass.

The amplitude of motion will, in turn, depend on the applied force and the mechanical configuration of the testing system, including the compliances of the load train, the test-piece, the reaction frame, and the base mounting. For a given frequency and over a given force range, different combinations of compliance values will result in different amplitudes of motion [the motion of a grip holding a very compliant test-piece may even be in the opposite direction (anti-phase) to that of the same grip holding a much stiffer test-piece].

For the purpose of this part of ISO 4965, there must be a linear relationship between the applied force and the displacement of the actuator. Using Method A and the calculated correction factor, the force measurement system will be dynamically calibrated to within 1 % of the applied force range. Using Method B and two dynamic calibration devices (DCDs) of different compliance, the force measurement system will be dynamically calibrated to within 1 % of the applied force range, if the actual test-piece has a compliance between those of the two DCDs.

Method A (Replica test-piece method) – This method is used for calibrating a dynamic testing system with a DCD, allowing errors of up to 10 % in the indicated force range to be corrected for, using a generated correction factor. The DCD must have the same compliance and mass as the specimens to be tested and the entire load train must be the same as that to be used for the actual testing. Before commencing a new series of dynamic tests, the correction factor relating the indicated force range (ΔF_i) to the test-piece force range (ΔF_t) can be determined using a strain gauged replica test-piece. This factor can be applied either as a correction to the results or to modify the force applied by the testing system, reducing the dynamic force error to less than 1 %. This correction factor is dependent on test frequency, and therefore will have to be determined over the entire range of anticipated test frequencies.

Method B (Compliance envelope method) – This method is used to calibrate a dynamic testing system for use with varying test-piece configuration, using two DCDs of different compliance. The low compliance DCD should have a compliance lower than that of any test-piece to be tested, and the high compliance DCD should have a compliance above that of any test-piece. An operating envelope of test-piece compliance versus frequency can be established for the testing system, within which dynamic errors are maintained to within 1 % of the applied force range. It is assumed that the compliance of the load train is insignificant when compared with the compliance of either DCD. If this is not the case, and the machine is to be used with varying load train compliance values, additional calibration runs will need to be performed.

