

Constant amplitude dynamic force calibration —

Part 1: Calibration and verification of non-resonant uniaxial dynamic testing systems — Method

ICS 29.040

Confirmed January 2010

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ISE/NFE/4, Mechanical testing of metals, upon which the following bodies were represented:

- British Non-Ferrous Metals Federation
- Copper Development Association
- GAMBICA Association Ltd.
- National Physical Laboratory
- Network Rail
- Railway Industry Association
- Society of British Aerospace Companies Ltd.
- UK Steel Association
- United Kingdom Accreditation Service
- University College London

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 27 September 2004

© BSI 27 September 2004

The following BSI references relate to the work on this British Standard:
Committee reference ISE/NFE/4
Draft for comment 04/30111204 DC

ISBN 0 580 44478 3

Amendments issued since publication

Amd. No	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Principle	2
5 Apparatus	2
6 General requirements	3
7 Procedure	4
8 Calculation of results	5
9 Report	6
Figure 1 — Example of a conversion function	5
Figure 2 — Typical calibration envelope	6
Annex A (normative) Guidance on re-calibration to be supplied to the user	8
Bibliography	9

Foreword

This part of BS 7935 has been prepared under the authority of Technical Committee ISE/NFE/4. It supersedes Draft for Development DD 2:1971, which is withdrawn.

It specifies a method for determining the relationship between the true force range applied to a test-piece subject to constant amplitude uniaxial sinusoidal loading and the force range indicated by the testing system.

BS 7935-2 describes a method for performing the calibration of the calibration device instrumentation used in the method given in this standard.

This British Standard describes methods of constant amplitude dynamic force calibration of non-resonant uniaxial testing systems only, and should not be used or quoted as a specification for resonant test machines. References to this standard should indicate that the methods of dynamic force calibration used are in accordance with BS 7935-1.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Introduction

In a dynamic test, the true force experienced by the test-piece might differ significantly from the force indicated by the testing system. This error results from inertia force acting on the loadcell and any errors in the electronics of the dynamic force indicating system. Inertia forces equate to the grip mass (interposed between the loadcell and test-piece) multiplied by its local acceleration. Inertia forces depend on:

- a) the amplitude of motion;
- b) the frequency;
- c) the grip mass;
- d) the compliance of the test-piece;
- e) the configuration of the testing system e.g. frame compliance and type of mounting.

For the purpose of this standard dynamic verification is carried out using either Method A or Method B as described below.

Method A (Replica Test-Piece Method): This method is used for calibrating a dynamic testing system with a single test-piece configuration, correcting for errors of up to 5 % in the machine using a conversion function generated by this method. Before commencing a new series of dynamic tests, the conversion function can be determined relating indicated dynamic force range to true force range for a gauged replica test-piece. This can be applied either as a correction to the results or to modify the force applied by the testing system, to reduce the error to less than 1 %.

Method B (Compliance Envelope Method): This method is used for calibrating a dynamic testing system for use with varying test piece configuration. An operating envelope of test-piece compliance versus frequency can be established for the testing system, within which force errors are maintained to less than 1 %. This applies only to situations where the load train has the same mass as, or less mass than, the load train used for the dynamic calibration.

1 Scope

This part of BS 7935 describes two methods (see Introduction) for determining the relationship between the true dynamic force range applied to a test-piece in a uniaxial sinusoidal constant-amplitude test and the force range indicated by the testing system.

These methods are applicable to servo controlled testing systems operating outside system resonant frequencies and are relevant to testing systems where the inertia force is unknown or where it is expected to exceed 1.0 % of the true force range.

NOTE Annex A gives guidance on when the system should be re-calibrated by methods described in this 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.

BS 7935-2, *Constant amplitude dynamic force calibration — Part 2: Calibration of the calibration device instrumentation to be used for the dynamic calibration of non-resonant uniaxial dynamic testing systems — Method.*

BS EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force measuring system.*