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British Standard Method for

Brinell hardness test and for verification of Brinell hardness testing machines

Méthode d'essai de dureté Brinell et de vérification des machines d'essai de dureté Brinell

Brinellhärteprüfung und Prüfung von Brinellhärteprüfmaschinen

BSi British Standards

Foreword

This British Standard has been prepared under the direction of the Iron and Steel and the Non-ferrous Metals Standards Committees. In order to draw attention to the need for regular verification of testing machines and to the availability of traceability to the national standard hardness scales, publication has been arranged as a single standard. It supersedes BS 240 : Part 1 : 1962 and BS 240 : Part 2 : 1964 which are withdrawn.

The Technical Committee has reconsidered the scope of this standard, with the intention of including new developments wherever justifiable. For instance, major changes have occurred in the design of testing machines, particularly in respect of the different techniques for the direct measurement of the area of an indentation upon which the calculation of the hardness number is based and these are now recognized. Also, tungsten carbide balls are specified in view of experience in their use which has established that they will give the same hardness value as that obtained with steel balls for hardness up to 350 HB and additionally will show greater consistency with a longer life.

On the other hand, certain tests similar to the Brinell in concept, e.g. those applying a load at high rate in order to expedite rates of testing and those made with machines that deduce the surface area of indentations from measurements of their depths, cannot be deemed to satisfy the requirements of this British Standard. Nevertheless, such tests are known to be frequently used on a comparative basis and with certain types of uniform material they may give equally consistent results as those obtainable by a conventional procedure. Their use and the interpretation of the significance of the results obtained are a matter for negotiation between all parties concerned.

Continuity from the previous standard has been retained and cognizance has been taken of discussions in the International Organization for Standardization (ISO) and the International Organization for Legal Metrology (OIML). Thus, a Brinell hardness value is an explicit relationship between test force, ball diameter and area of indentation and although, in this standard, the test forces are now expressed in newtons, each value of force is given exactly to four figures in order to maintain the same hardness numbers as before in the established Brinell scales. In the interests of standardization and to minimize proliferation of the number of hardness scales, i.e. combinations of test force and ball diameter, particular attention has been given to ensure that those chosen are generally in common use in major industries both in the UK and abroad. For convenience of reference, tabulations of calculated hardness values for the chosen scales are included in appendix D.

The standard also incorporates extensive detail changes that reflect the considerably improved knowledge of the effect of various parameters upon the possible accuracy of a Brinell hardness test. The committee has recognized the need to specify reasonable tolerances upon the various parameters and these collectively impose a limit of ± 4 % of hardness number upon the maximum overall inaccuracy of a testing machine. In addition, it is now more clearly established that the finite limit of accuracy that is likely to be obtainable from a Brinell hardness test is ± 2 % HB. The introduction of a separate indirect verification for the measuring microscope should enable specialist users to correlate the performance of observer and microscope and so to obtain this order of accuracy when it is required.

Detailed requirements for the thickness of a test piece and for the spacing of indentations ensure that hardness values so obtained will be traceable to the accepted national hardness scales. The interpretation of comparative results given by tests not meeting these requirements is a matter for negotiation between the parties concerned.

As previously, the full direct verification procedure is normally carried out on a new machine or after major overhaul of an existing machine; it incorporates further checking that the accuracy of the machine is valid by application of the indirect verification, following machine assembly and installation. Regular checks of accuracy of an installed machine, e.g. as part of quality assurance procedures or immediately after servicing, would normally be carried out by means of the indirect procedure. As the extent of usage of machines varies considerably it is not possible to give rules for frequency of such verifications. Guidance may be obtained on the basis of informed technical judgement from recognized calibrating authorities.

Considerable importance is attached by the committee to routine monitoring and maintenance of a testing machine's performance during the period between verifications. Although these procedures are not part of the standard as such, recommended forms of procedure that do not impose onerous obligations upon users are included in appendices A and B.

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