



Expert commentary

BS EN ISO 6892-1:2019 — *Metallic materials – Tensile testing. Method of test at room temperature*

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1 Overview

BS EN ISO 6892-1 describes the tensile testing of metallic materials at room temperature using various test piece geometries taken from product forms including bar, plate, tube and other sections. The determination of tensile properties including yield strength, proof stress, tensile strength, Young's modulus and the determination of ductility through the measurement of elongation and reduction in area after fracture are all defined in this standard.

A number of informative and normative annexes are included in this standard including those for the use of computer-controlled testing machines, predominantly used in most testing laboratories: types of test pieces to be used, method for the determination of Young's modulus and the determination of uncertainty of measurement for the primary properties defined by this standard.

The conditions of testing including the method of gripping and testing rates provide many options to the user. The alignment of the test piece in the gripping mechanism should be such to ensure the force is applied axially through the longitudinal axis. Testing rates need to be chosen carefully considering the application of the test results and how they relate to the requirement for this testing.

The most recent changes to the standard are predominantly editorial and are of a minor nature. More significant changes, described below, were seen in July 2016 with the publication of the 2016 version.

2 Commentary

All the equipment used to perform the tensile test is calibrated by a method traceable to the national measurement system. For the calibration of the force measuring system and extensometers (extension measuring system) the methods defined in BS EN ISO 7500-1 and BS EN ISO 9513 apply respectively. The allowable classes for determining the various properties are specified in the relevant clauses of BS EN ISO 6892-1. It is important to ensure the range of calibration is compatible with the ranges used for testing, e.g. extensometers calibrated over the range used for determining proof stress and/or extension measurements.

The accuracy of measuring instruments for the determination of test piece dimensions is not comprehensively defined in the standard. $\pm 5\%$ is referenced in annex D: D.4. and G: G.3.1.4. It is mandated that the measuring equipment is calibrated in accordance with appropriate reference standards traceable to the national measurement system. The geometrical product specification BS EN ISO 14978 defines the general requirements for the calibration of measuring equipment and can be used to define the metrological characteristics for measuring equipment employed. The shape and dimensions of test pieces used, including full size product such as bars and wires, are defined in the standard. It is essential that the geometries defined in the body of the standard and Annexes B, C, D and E are complied with for the accurate determination of tensile properties, though it should be noted that some product standards require the use of different test piece geometries. In order to achieve the measurement capability required in these annexes the user should ensure the maximum error of the measuring equipment used is adequate for the property being determined.

Calibrations should be performed by a competent authority such as a calibration laboratory accredited to BS EN ISO/IEC 17025.

The 'room temperature' for this standard is defined as between 10°C to 35°C with an additional requirement for a controlled environment of 18°C to 28°C. Testing and Calibration of equipment outside the stated temperature can lead to inaccurate results. It should be noted that testing at temperatures greater than 35°C is defined in BS EN ISO 6892-2 and the additional requirements for testing between +10°C and -196°C are defined in BS EN ISO 6892-3. BS EN ISO 6892-4 also defines the method for tensile testing in liquid helium.

Test pieces can be machined, cast or full-size product, possibly straightened. The extraction and preparation of test pieces from product involves numerous techniques and operations. Conventional methods such as cutting, milling, turning and grinding and more contemporary methods such as water jet and laser cutting can be used. It is not possible for this standard to comprehensively address all the variations that can be encountered through the preparation of test pieces and therefore the user should in all cases ensure the properties of the material under test are not compromised by the preparation techniques used. Careful attention to the surface finish of machined samples is necessary to prevent premature failure, especially in the case of brittle materials.

In addition to the preparation of the final test pieces the location and position of the test piece is critical in relation to the product. In several product standards, the sampling of the test piece is clearly defined, if not the location of test pieces in relation to the product and the texture of the product is defined in national standards, e.g. BS EN ISO 377 and BS EN ISO 3785.