

Precise conversion of inch and metric sizes on engineering drawings

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Foreword

In the conversion of inch and metric sizes on engineering drawings, it is necessary to employ a standard procedure which will give the essential accuracy required for precise dimensional interchangeability. This standard, which was first published in 1957, gives the conversion procedure recommended for this purpose; it is based on a paper prepared by Mr L. W. Nickols, of the Department of Trade and Industry: National Physical Laboratory, who had been associated with the late Mr J. E. Sears, CBE, in this work.

Due to the widespread use of this standard since its first publication it has been decided that the revision should be kept to a minimum. The changes which have been made are, first to correct certain inaccuracies which occurred in the text and secondly to align the document with the revision of BS 308, *“Engineering drawing practice”*, published in 1972. The conversion of sizes in work of a very high accuracy has been simplified by the adoption of 1 inch = 25.4 millimetres as an exact conversion factor by the USA and the UK.

This standard, which is in agreement with ISO Recommendation R 370, *“Conversion of toleranced dimensions from inches into millimetres and vice versa”*, has been prepared under the authority of the Mechanical Engineering Industry Standards Committee.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Scope

This British Standard provides a procedure for conversion which will give the essential accuracy required for precise dimensional interchangeability.

The standard lays down an optimum fineness of rounding the converted size so that the conversion is made with the required precision and, at the same time, an excessive number of decimal places in the converted size is avoided. The procedure adopted is designed to ensure correct acceptance or rejection of a component, with respect to sizes, whether manufactured in one system of units or the other, provided that the methods of measurement used in the two systems are of comparable accuracy.

The conversion factor used is: 1 inch = 25.4 millimetres.

This conversion factor is exact. It results from the legal definition of the yard in terms of the metre adopted by the USA in 1959 and by the UK in the Weights and Measures Act 1963. The values given in the tables in Appendix A are taken to a sufficient number of decimal places to cover the finest rounding required by the rules for conversion of inch and millimetre sizes.

Introduction

The inter-conversion of inch and metric sizes is of great importance to trade. Such conversions may be intended 1) to provide equivalent nominal designations or 2) to achieve functional interchangeability.

1) Equivalent nominal designations.

Approximate corresponding values are usually sufficient. The degree of approximation depends on the purpose of the conversion. Thus, bar stock for machining may be defined as "1 in (25 mm) round bar"; and a watering can may be specified as having a "2 gallon (9 litre) capacity". No rule can be given for this type of conversion.

2) **Functional interchangeability.** The requirement of functional interchangeability necessitates more accurate conversion than in 1), the degree of accuracy again depending on the type of function which the article is called upon to perform. There are two categories to be considered:

a) *Where sufficient latitude is given to enable existing near sizes or combinations of sizes in either system of measurement to be used without affecting functioning.* Thus, a shackle pin 10 mm in diameter may generally be used instead of a $\frac{3}{8}$ in diameter shackle pin without affecting functioning; and a sheet metal cover of nominal thickness 0.036 in, formerly known as 20 SWG, can be specified as 1 mm.

In an example taken from BS 1916-1, a hole and shaft combination selected from the inch tables to give a certain "fit" (e.g. H7 – g6) is functionally interchangeable, as far as "fit" is concerned, with the corresponding combination selected from the metric tables of BS 4500, even where the sizes are not exactly equivalent in both systems of measurement.

No definite rules can be laid down for this category.

b) *Where components manufactured to the two systems of units are required to be within certain precise limits of size in order to be dimensionally as well as functionally interchangeable.* Such components are mainly met with in general engineering drawings when firms which have established manufacturing or assembly plants in other countries find it necessary to re-dimension their engineering drawings in the system of units used in those countries.

The difficulty encountered for such conversions of sizes arises when it is necessary to ensure that component parts acceptable when inspected to a drawing dimensioned in one system of units are not rejected when inspected to the corresponding drawing dimensioned in the other system of units. Such dimensional interchangeability can, of course, be maintained by making the conversion to a very high degree of accuracy, i.e. by calculating the converted size to a large number of decimal places; but there is little justification in the use of a number of decimal places not warranted by the available data, and too many decimal places in the converted size become an embarrassment in practical use.