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Geometrical product specifications (GPS) — Surface texture: Areal —

Part 73: Terms and definitions for surface defects on material measures

Spécification géométrique des produits (GPS) — État de surface: surfacique —

Partie 73: Termes et définitions pour les défauts de surface sur les mesures matérialisées

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 213, *Dimensional and geometrical product specifications and verification*.

A list of all parts in the ISO 25178 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

This document is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences chain link F of the chain of standards on profile surface texture, areal surface texture and surface imperfections.

The ISO GPS masterplan given in ISO 14638 gives an overview of the ISO GPS system of which this document is a part. The fundamental rules of ISO GPS given in ISO 8015 apply to this document. The default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise stated.

For more detailed information on the relation of this document to the GPS matrix model, see Annex B.

This document is based on the premise that a material measure has a real geometrical surface which is a realization of an ideal or nominal surface, which in turn can in most cases be regarded as a simple mathematical concept: for example a plane, a sphere, a step function or a sinusoidal shape. In each case there will be an associated precisely known quantity, which is used when the material measure is measured by a surface texture-measuring instrument in one or more operations during the calibration and set-up of that instrument.

Any portion of the measuring surface of the material measure at which the real surface deviates from the ideal nominal surface is therefore more or less undesirable, and is here denoted by the term *defect*.

0.2 Relationship to ISO 8785

ISO 8785 was intended to apply to all types of surface, whether functional or otherwise. Examples of functional surfaces are: brake disks, cylinder linings, optical lens and mirror surfaces, fluid pipe couplings, marine propeller blades and artificial hip joints. In each case, the surface has to perform one or more definite jobs and, consequently, the choice of method of manufacture and the type of surface geometry, together with a certain range of parameter values which are specified for it, are usually a compromise between conflicting requirements which might not all be perfectly fulfilled. The functional surface can then be measured in order to find out how closely it matches the parameter values which have been specified.

However, this is not the same as determining how well the surface functions. In many cases it is not obvious exactly what the ideal profile shape from the point of view of best function would be. Therefore, it is possible that a surface which deviates from the specified profile in some places actually performs better than one which has no deviations. For this reason, ISO 8785 used the general term *imperfections*, which does not suggest undesirability, in preference to the term *defects*, which does suggest this.

Unlike ISO 8785, this document does not deal with any classes of defect, other than geometrical, that might appear upon the surfaces of material measures. Examples of other classes of defect are: unwanted variations in such physical properties as:

— surface hardness;

— surface colour;

— electrical properties.

For the purposes of this document, no instance of such an unwanted variation in a physical property is considered to be a defect unless it coincides spatially with the area of a geometrical defect. For information on variations in surface colour, see Annex A.

0.3 Relationship to ISO 5436-1 and ISO 25178-70

The material measures and calibration specimens which are described in ISO 5436-1 and ISO 25178-70 are not functional surfaces as described in 0.2. Material measures exist only in order to be measured;

there are no physical jobs which they have to do. They are physical representations of a mathematically simple shape, which is therefore the ideal shape and which can be specified precisely.

Any deviation from this ideal shape is therefore undesirable, and so the term *defect* is preferable to the term *imperfection.* It is possible for a single calibration specimen to be used in two or more different applications, but for each application there exists a theoretically ideal shape, although certain features of the ideal might be more important in one application than in the other.

For example, a sinusoidal roughness specimen can be used to check Ra or RSm parameter values. In the first application it is more important that the sinusoidal specimen exhibits uniformity of amplitude (peak height) than uniformity of wavelength (peak spacing), but in the second application it is the other way around. The fact that the calibration specimen can be used in two different applications does not make it a functional surface; it is still a measurement standard which exists only in order to be measured.

0.4 Defining defects by reference to *geometrical shape* rather than *cause*

ISO 8785:1998, Clause 4, contains several descriptions of surface imperfections in terms which make reference to the *cause* of the imperfection, instead of just their geometrical shape. This can create the following difficulties when applying these descriptions in practice:

a) the possibility of confusion, in cases where a feature has the shape of one type of imperfection, but has the cause of a different one;

b) in many cases, particularly with very small features at the limits of visibility, the cause might be unknown and hard to discover;

c) it becomes more difficult to translate the terms into other languages.

In this document the emphasis is on geometrical shape, and three terms will be defined corresponding to the cases in which the deviation is upwards from the surface (outward defect, 3.2.6), downwards into the surface (inward defect, 3.2.7) or neither upward nor downward (neutral defect, 3.2.8). However, there is one exception: it is necessary to define one special type of defect (negative defect, 3.2.9) which sometimes appears on material measures that have been manufactured by one of the widely-used methods of replication and which appears on such a replicated material measure as the result of a corresponding defect on the surface of the mother mould (often called a *negative*), which produced the replica.

0.5 Terms for ways of responding to defects

Consistent with the general idea that defects are undesirable, this document contains a section which defines terms for all possible responses to the presence of defects. It does not specify which of these responses should be applied in any particular situation, it simply defines terms and names for them, and thus enables users, manufacturers, calibration metrologists and writers of other standards documents to state their own policies and procedures clearly and unambiguously.

0.6 Defect as a portion of the surface rather than a property of the whole surface

A defect is a *geometrical feature* limited by natural boundaries (in the language of ISO 8015:2011, 5.4 and ISO 22432:2011, 3.2), that is *non-ideal* and *real* (ISO 22432:2011, 3.2.2). In this document a defect is considered to be a *portion* of the physical surface of a geometrical measurement standard, rather than a *property* of the whole surface. This is necessary in order to distinguish between three common responses to the presence of defects on a measurement standard, responses which are easily confused with each other if they are not precisely defined. They are:

— first, to *remove* the defect (by either physically cutting it off the measuring area or else discarding data points in the software);

— second, to *avoid* the defect (by redefining the limits of the measuring area);

— third, to *repair* the defect (by either reworking or cleaning the specimen, or else retouching data in the software).

