

# SVENSK STANDARD

## SS-EN ISO 2692:2014



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**Geometriska produktspecifikationer (GPS) – Form- och lägetoleranser – Max materialkrav (MMR), min materialkrav (LMR) och reciprocitetskrav (RPR) (ISO 2692:2014)**

**Geometrical product specifications (GPS) – Geometrical tolerancing – Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR) (ISO 2692:2014)**

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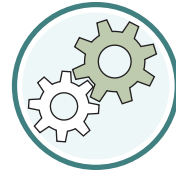
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Denna standard ersätter SS-EN ISO 2692:2007, utgåva 1.

The European Standard EN ISO 2692:2014 has the status of a Swedish Standard. This document contains the official version of EN ISO 2692:2014.

This standard supersedes the Swedish Standard SS-EN ISO 2692:2007, edition 1.

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EUROPEAN STANDARD

**EN ISO 2692**

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2014

ICS 01.100.20

Supersedes EN ISO 2692:2006

English Version

**Geometrical product specifications (GPS) - Geometrical tolerancing - Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR) (ISO 2692:2014)**

Spécification géométrique des produits (GPS) - Tolérancement géométrique - Exigence du maximum de matière (MMR), exigence du minimum de matière (LMR) et exigence de réciprocité (RPR) (ISO 2692:2014)

Geometrische Produktspezifikation (GPS) - Geometrische Tolerierung - Maximum-Material-Bedingung (MMR), Minimum-Material-Bedingung (LMR) und Reziprozitätsbedingung (RPR) (ISO 2692:2014)

This European Standard was approved by CEN on 16 August 2014.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION  
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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Maximum material requirement, MMR and least material requirement, LMR</b> .....	<b>5</b>
4.1 General.....	5
4.2 Maximum material requirement, MMR.....	6
4.2.1 Maximum material requirement for toleranced features.....	6
4.2.2 Maximum material requirement for related datum features.....	7
4.3 Least material requirement, LMR.....	8
4.3.1 Least material requirement for toleranced features.....	8
4.3.2 Least material requirement for related datum features.....	9
<b>5 Reciprocity requirement, RPR</b> .....	<b>10</b>
5.1 General.....	10
5.2 Reciprocity requirement and maximum material requirement.....	10
5.3 Reciprocity requirement and least material requirement.....	10
<b>Annex A (informative) Examples of tolerancing with <math>\text{\textcircled{M}}</math>, <math>\text{\textcircled{L}}</math> and <math>\text{\textcircled{R}}</math></b> .....	<b>11</b>
<b>Annex B (informative) Concept diagram</b> .....	<b>43</b>
<b>Annex C (informative) Relation to the GPS matrix model</b> .....	<b>44</b>
<b>Bibliography</b> .....	<b>46</b>

## **Foreword**

This document (EN ISO 2692:2014) has been prepared by Technical Committee ISO/TC 213 "Dimensional and geometrical product specifications and verification" in collaboration with Technical Committee CEN/TC 290 "Dimensional and geometrical product specification and verification" the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2015, and conflicting national standards shall be withdrawn at the latest by June 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 2692:2006.

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### **Endorsement notice**

The text of ISO 2692:2014 has been approved by CEN as EN ISO 2692:2014 without any modification.

## Introduction

### 0.1. General

This International Standard is a geometrical product specification (GPS) standard and is to be regarded as a general GPS standard (see ISO/TR 14638). It influences the chain links 1, 2 and 3 of the chain of standards on size of linear “features of size” and form of a line (independent/dependent of a datum), form of a surface (independent/dependent of a datum), orientation and location of derived features based on “features of size” and datums also based on “features of size”.

The ISO GPS Masterplan given in ISO/TR 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 and the default decision rules given in ISO 14253-1 apply to specifications made in accordance with this document, unless otherwise indicated.

For more detailed information on the relation of this International Standard to the GPS matrix model, see [Annex C](#).

This International Standard covers some frequently occurring workpiece functional cases in design and tolerancing. The “maximum material requirement”, MMR, covers “assembleability” and the “least material requirement”, LMR, covers, for example, “minimum wall thickness” of a part. Each requirement (MMR and LMR) combines two independent requirements into one collective requirement, which more accurately simulates the intended function of the workpiece. In some cases of both MMR and LMR, the “reciprocity requirement”, RPR, can be added.

NOTE In ISO GPS standards, threaded features are often considered as features of size of type cylinder. However, no rules are defined in this International Standard for how to apply MMR, LMR and RPR to threaded features. Consequently, the tools defined in this International Standard cannot be used for threaded features.

### 0.2 Information about maximum material requirement, MMR

The assembly of parts depends on the combined effect of

- a) the size (of one or more extracted features of size), and
- b) the geometrical deviation of the (extracted) features and their derived features, such as the pattern of bolt holes in two flanges and the bolts securing them.

The minimum assembly clearance occurs when each of the mating features of size is at its maximum material size (e.g. the largest bolt size and the smallest hole size) and when the geometrical deviations (e.g. the form, orientation and location deviations) of the features of size and their derived features (median line or median surface) are also at their maximum. Assembly clearance increases to a maximum when the sizes of the assembled features of size are furthest from their maximum material sizes (e.g. the smallest shaft size and the largest hole size) and when the geometrical deviations (e.g. the form, orientation and location deviations) of the features of size and their derived features are zero. It therefore follows that if the sizes of one mating part do not reach their maximum material size, the indicated geometrical tolerance of the features of size and their derived features may be increased without endangering the assembly to the other part.

This assembly function is controlled by the maximum material requirement. This collective requirement is indicated on drawings by the symbol  $\text{M}$ .

### 0.3 Information about least material requirement, LMR

The least material requirement is designed to control, for example, the minimum wall thickness, thereby preventing breakout (due to pressure in a tube), the maximum width of a series of slots, etc. It is indicated on drawings by the symbol  $\text{L}$ . The least material requirement is also characterized by a collective requirement for the size of a feature of size, the geometrical deviation of the feature of size (form deviations) and the location of its derived feature.



#### **0.4 Information about reciprocity requirement, RPR**

The reciprocity requirement is an additional requirement, which may be used together with the maximum material requirement and the least material requirement in cases where it is permitted — taking into account the function of the toleranced feature(s) — to enlarge the size tolerance when the geometrical deviation on the actual workpiece does not take full advantage of, respectively, the maximum material virtual condition or the least material virtual condition.

The reciprocity requirement is indicated on the drawing by the symbol  $\textcircled{R}$ .

#### **0.5 General information about terminology and figures**

The terminology and tolerancing concepts in this International Standard have been updated to conform to GPS terminology, notably that in ISO 286-1, ISO 14405-1, ISO 14660-2:1999 and ISO 17450-1:2011.



# Geometrical product specifications (GPS) — Geometrical tolerancing — Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR)

## 1 Scope

This International Standard defines the maximum material requirement, the least material requirement and the reciprocity requirement. These requirements can only be applied to features of size.

These requirements are used to control specific functions of workpieces where size and geometry are interdependent, e.g. to fulfil the functions “assembly of parts” (for maximum material requirement) or “minimum wall thickness” (for least material requirement). However, the maximum material requirement and least material requirement are also used to fulfil other functional design requirements.

Considering this interdependence between size and geometry, the *principle of independency* defined in ISO 8015 does not apply when the maximum material requirement, least material requirement, or reciprocity requirement, are used.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1101:2012, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

ISO 5459:2011, *Geometrical product specifications (GPS) — Geometrical tolerancing — Datums and datum systems*

ISO 14405-1:2010, *Geometrical product specifications (GPS) — Dimensional tolerancing — Part 1: Linear sizes*

ISO 14660-2:1999, *Geometrical Product Specifications (GPS) — Geometrical features — Part 2: Extracted median line of a cylinder and a cone, extracted median surface, local size of an extracted feature*

ISO 17450-1:2011, *Geometrical product specifications (GPS) — General concepts — Part 1: Model for geometrical specification and verification*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5459:2011, ISO 14405-1:2010, ISO 14660-2:1999, ISO 17450-1:2011 and the following apply.

### 3.1

#### **integral feature**

geometrical feature belonging to the real surface of the workpiece or to a surface model

Note 1 to entry: An integral feature is intrinsically defined, e.g. skin of the workpiece.

Note 2 to entry: Adapted from ISO 17450-1:2011, definition 3.3.5.