SASO ISO 1938-2: 2019

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Reference disk gauges خطأ! لم يتم العثور على مصدر المرجع.

ICS 17.040.10

Saudi Standards, Metrology and Quality Org (SASO)

Foreword

The Saudi Standards ,Metrology and Quality Organization (SASO) has adopted the International standard No. ISO 1938-1:2015 " خطأ! لم يتم العثور على مصدر المرجع." issued by the international Electrotechnical Commission(IEC). The text of this international standard has been translated into Arabic so as to be approved as a Saudi standard without introducing any technical modification.

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Introduction

This document is a Geometrical Product Specification (GPS) standard and is to be regarded as a general GPS standard (see ISO 14638). It influences links F and G of the size chain of standards in the general GPS matrix. For more detailed information on the relation of this document to other standards and the GPS matrix model, see Annex B.

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

The terms and concepts used in this document (compared to ISO/R 1938:1971) have been changed according to needs and terminology in the other GPS standards.

This document deals with reference disk gauges. The use of reference disk gauges is explained in Annex A.

NOTE The content of Table 2 uses the modifiers given in ISO 14405-1 and ISO 1101.

Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 2: Reference disk gauges

1 Scope

This document specifies the most important metrological and design characteristics of reference disk gauges.

This document covers linear sizes of the gauge up to 500 mm.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*

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

ISO 1938-1:2015, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Plain limit gauges of linear size*

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

ISO 17450-2, *Geometrical product specifications (GPS) — General concepts — Part 2: Basic tenets, specifications, operators, uncertainties and ambiguities*

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 99, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 286-1, ISO 1938-1, ISO 14405-1, ISO 17450-2, ISO/IEC Guide 98-3 and ISO/IEC Guide 99 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
reference disk gauge
gauge designed and intended to determine the working size of a gap gauge

3.2
unloaded size
US
<of a gap gauge> perpendicular distance between the gauging faces of a gap gauge when the measuring force is zero

3.3
working size
WS
<of a gap gauge> diameter of a disk over which the gap gauge just passes in a vertical direction under the working load marked on it, or, if this is not indicated, under its own weight

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 1938-1 and Table 1 apply.

Table 1 — Symbols and abbreviated terms

Symbols and abbreviated terms	Description
H_p	tolerance on the size characteristic, S, of a reference disk gauge
ref. GO-M	reference disk gauge for a new state GO gap gauge
ref. GO-U	reference disk gauge for a wear limits state GO gap gauge
ref. NO GO	reference disk gauge for a NO GO gap gauge
US	unloaded size (of a gap gauge)
WS	working size (of a gap gauge)

5 Design characteristics

For the purposes of this document, the design characteristics for gauges given in ISO 1938-1 apply.

Reference disk gauges can be made as full form cylindrical plug gauges (gauge type A) or as segmental cylindrical bar gauges (gauge type B).

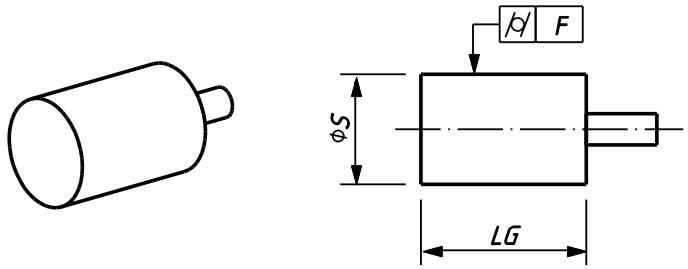
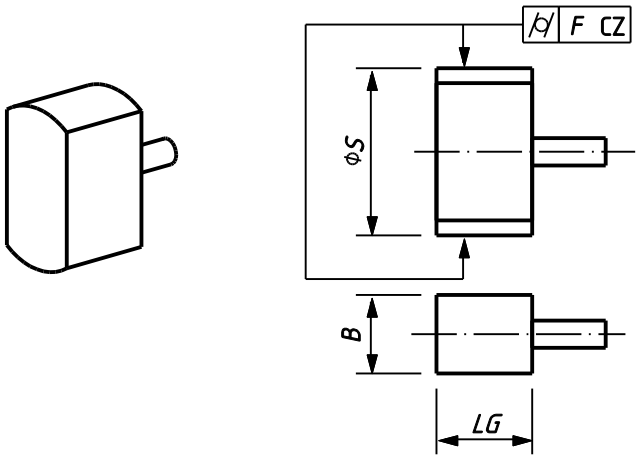
6 Metrological characteristics

The most important metrological characteristics are the size S and the form characteristics of the measuring feature of the reference disk gauge. To define the metrological characteristic on a reference disk gauge, the modifiers defined in ISO 14405-1 and the symbols defined in ISO 1101 shall be used.

This document describes potential metrological characteristics available on reference disk gauges. The final decision to select one or several metrological characteristics is left to the user.

Table 2 gives potential metrological characteristics for reference disk gauges, but also complementary design characteristics as defined in Clause 5. Depending on the need of the user, a set of these metrological characteristics shall be defined; by default, the two point size, S, of the gauge limit and the form deviation are required.

Table 2 — List of design and metrological characteristics for reference disk gauges

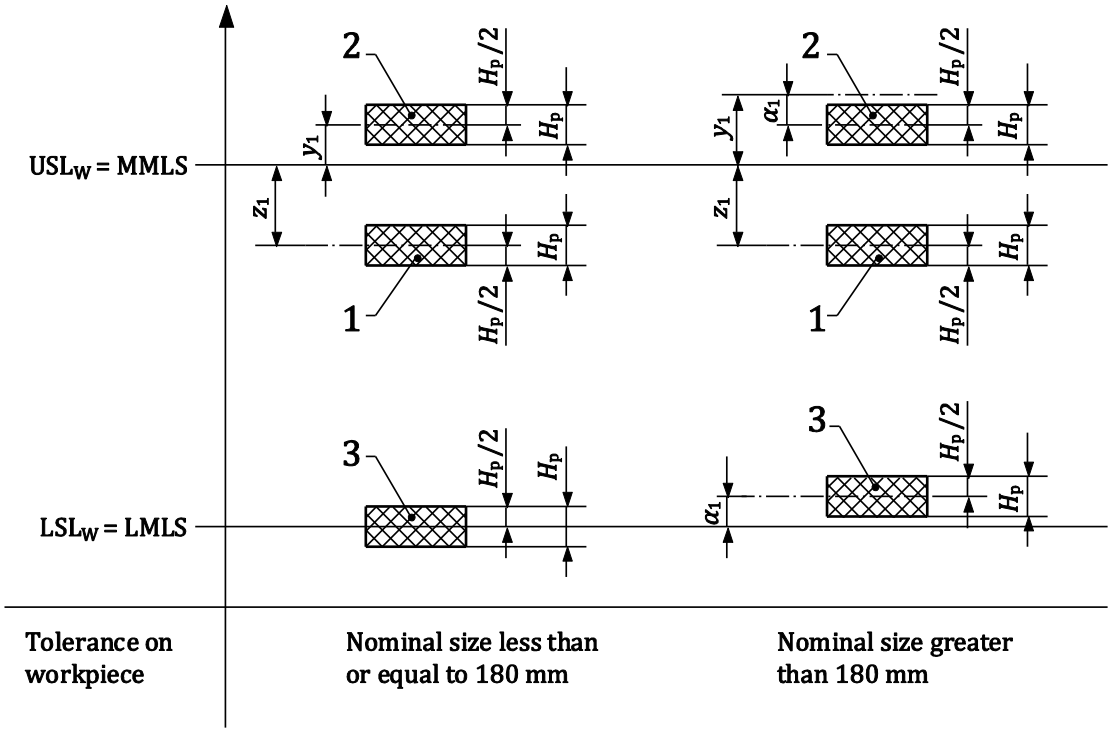
Description	Complementary design characteristics	Metrological characteristics
Full form cylindrical plug gauge — Gauge type A 	*LG*	ϕS (GX) ϕS (GN) ϕS (LP) a ⌭ F a ◯ F
Segmental cylindrical bar gauge — Gauge type B 	*LG* *B*	ϕS (GX) CT ϕS (GN) CT ϕS (LP) CT a ⌭ F CZ a ◯ F CZ

[a] Default metrological characteristics to be considered.

F	Cylindricity (form) tolerance value (see ISO 1101).
GX	Maximum inscribed (see ISO 14405-1).
GN	Minimum circumscribed (see ISO 14405-1).
LP	Two point size (see ISO 14405-1).
CT	Common tolerance (see ISO 14405-1).
CZ	Combined zone (see ISO 1101).

7 Maximum permissible limits on metrological characteristics

The positions of tolerance limits for reference disk gauges in relation to workpiece tolerance limits are shown in Figure 1.



Key

1 ref. GO-M
2 ref. GO-U
3 ref. NO GO

Figure 1 — MPL size position for reference disk gauges

The value for H_p (see Figure 1) is specific for reference disk gauges. It is based on workpiece tolerance grade and workpiece feature size and shall be taken from Table 3.

The value of z_1, α_1 and y_1 (see Figure 1) is specific for each workpiece tolerance grade and size and shall be taken from ISO 1938-1:2015, Tables 7 to 11.

The requirement on the size, S, of the gauge element shall be in accordance with the following gauge tolerances for new and wear limits state (see Figure 1).

a) For a reference disk gauge for a new state GO gap gauge:

1) for the upper specification limit: $USL_{M,\ ref.\ GO\text{-}M} = USL_{U,\ ref.\ GO\text{-}M} = USL_W - z_1 + H_p/2$;

2) for the lower specification limit: $LSL_{M,\ ref.\ GO\text{-}M} = LSL_{U,\ ref.\ GO\text{-}M} = USL_W - z_1 - H_p/2$.

b) For a reference disk gauge for a wear limits state GO gap gauge:

1) for the upper specification limit: $USL_{M,\ ref.\ GO\text{-}U} = USL_{U,\ ref.\ GO\text{-}U} = USL_W + y_1 - \alpha_1 + H_p/2$;

2) for the lower specification limit: $LSL_{M,\ ref.\ GO\text{-}U} = LSL_{U,\ ref.\ GO\text{-}U} = USL_W + y_1 - \alpha_1 - H_p/2$.

c) For a reference disk gauge for a NO GO gap gauge:

1) for the upper specification limit: $USL_{M,\ ref.\ NO\ GO} = USL_{U,\ ref.\ NO\ GO} = LSL_W + \alpha_1 + H_p/2$;

2) for the lower specification limit: $LSL_{M,\ ref.\ NO\ GO} = LSL_{U,\ ref.\ NO\ GO} = LSL_W + \alpha_1 - H_p/2$.

Table 3 — Values of H_p and F for calculation of MPL of reference disk gauges in standard tolerance grades according to ISO 286-1

Workpiece standard tolerance grades					
IT6 and IT7		IT8 to IT12		IT13 to IT18	
Size H_p	Form $2 \times F$	Size H_p	Form $2 \times F$	Size H_p	Form $2 \times F$
IT1		IT2	IT1	IT3	IT2
The form limit values are half the values given in column $2 \times F$.					

When the tolerance of the dimension of a feature of size of a workpiece is given as a code according to ISO 286-1:2010, Table 3 and ISO 1938-1:2015, Tables 7 to 11 can be used directly. When the size tolerance is not given as an ISO code, the standard tolerance grade shall be defined as the standard tolerance grade corresponding to the first tolerance interval, T, given in ISO 1938-1:2015, Tables 7 to 11, lower than or equal to the tolerance interval of the workpiece in the same range of nominal sizes.

When grades 6 to 8 are associated with the letter N (6N, 7N or 8N), then for the GO gap gauge and their reference disk gauges, the values y_1 and α_1 are equal to zero.

8 Marking

Each reference disk gauge shall be legibly and permanently marked with the following:

— size tolerance of the workpiece given by

  — the workpiece tolerance limits,

  — by ISO code (nominal size value of the workpiece with the symbol designating the tolerance class according to ISO 286-1), or

  — by the nominal size value of the workpiece, with the lower and upper deviation of the workpiece, or with only the suitable deviation (lower or upper) depending on the gauge type (ref. GO-M, ref. GO-U or ref. NO GO);

— the type of reference disk gauge:

ref. GO-M	for a reference disk gauge for a new state GO gap gauge;
ref. GO-U	for a reference disk gauge for a wear limits state GO gap gauge;
ref. NO GO	for a reference disk gauge for a NO GO gap gauge;

EXAMPLE 1 20 g6 ref. GO-M

EXAMPLE 2 12,1 ±0,15 ref. GO-U

EXAMPLE 3 11,95/12,5 ref. NO GO

— the serial number (alphanumerical);

— the manufacturer's name or trademark.

The marking shall not be on gauging surfaces and shall not affect the metrological characteristics of the gauges.

Annex A

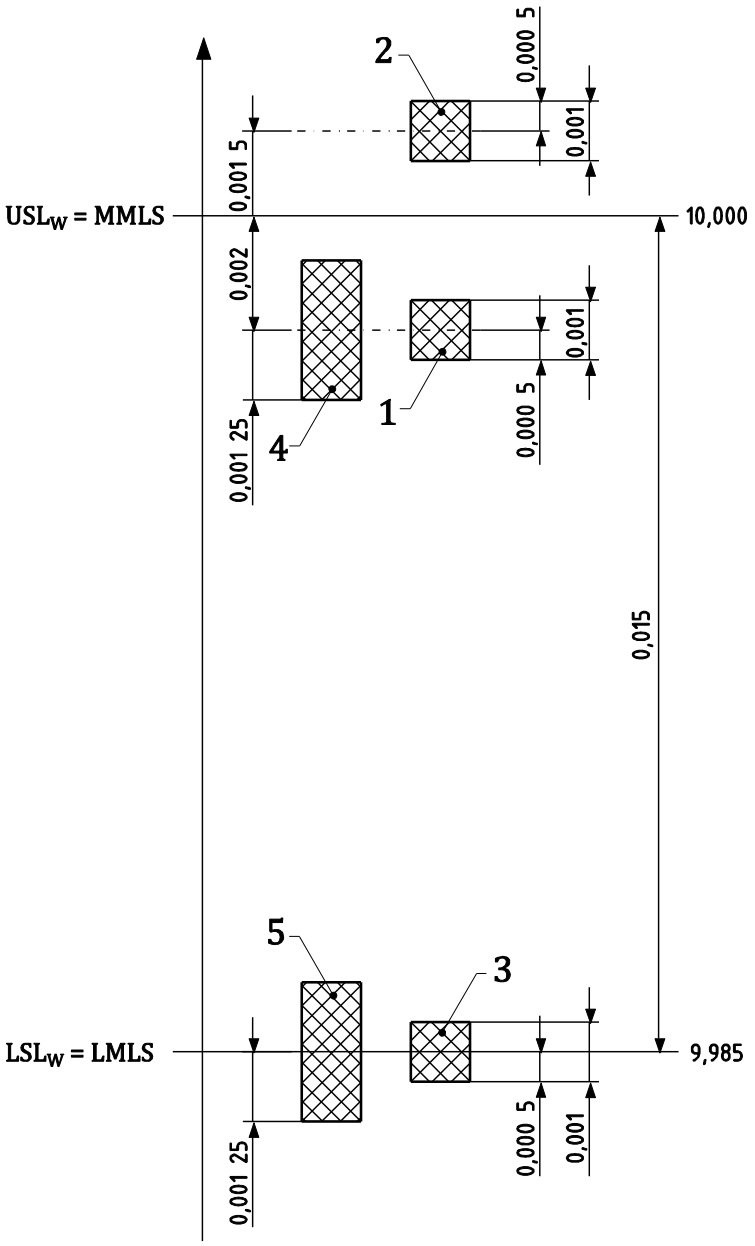
(informative)

Material measure (reference) of the working size, WS, of a gap gauge

A.1Interpretation of size

For gap gauges, *H* determines the limits of the value of the working size, WS, but not of the unloaded size US. The working size of a gap gauge, however, is not defined with a zero measuring force, as for other gauges, because in use, a gap gauge may be regarded as a comparator which effects a transfer measurement between a known dimension, e.g. a reference disk gauge and a workpiece.

If gap gauges are verified without applying the standardized measuring force, e.g. by using a coordinate measuring machine, then it is necessary to know the elastic deflection of the gauge body in order that the working size can be calculated by the measured unloaded size. The measured size is the smallest distance of at least five measured lengths (four positions close to the corners and one at the centre of the gauging faces).



Key

1 ref. GO-M
2 ref. GO-U
3 ref. NO GO
4 new state GO gap gauge
5 NO GO gap gauge

Figure A.1 — MPL size position for gap gauges and reference disk gauges (example for the workpiece dimension 10 h7)

The relationship between the workpiece specification and the MPL size position for gap gauges and reference disk gauges is shown in Figure A.1 as example for the workpiece dimension 10 h7.

NOTE The relation between the tolerance H of the gap gauge and the tolerance H_p of its reference disk gauge is as follows.

The difference between the limits of size given by H and by H_p represents a safety zone on both sides of H_p to compensate for errors of measurement. H and H_p are therefore symmetrical (see Figure A.1). Therefore if, according to the definition of working size, gap gauges lie outside the zone H_p but within the zone H, they are still to be regarded as correct.

A.2Use of reference disk gauges

There are two main methods which may be used as a reference of the working size of gap gauges.

The two methods are as follows:

a) Reference disk gauge method

For a GO gap gauge, two reference disk gauges are used.

The GO gap gauge should pass over the reference disk gauge for a new state GO gap gauge (ref. GO-M) in a vertical direction, under the working load, after having been brought carefully to rest in contact with the reference disk gauge and then released. Inertia forces are thus avoided.

The GO gap gauge should not pass over the reference disk gauge for a wear limits state GO gap gauge (ref. GO-U) when this is applied in the same manner described above.

The NO GO gap gauge should pass over the reference disk gauge for a NO GO gap gauge (ref. NO GO) when this is applied in the same manner described above.

b) Reference disk gauge and gauge block method

This method uses a reference disk gauge with a diameter smaller than the working size of the gap gauge, used in conjunction with gauge blocks according to ISO 3650 grade 1 and is appropriate to both GO and NO GO gap gauges. The sum of the sizes of the gauge block(s) and the reference disk gauge shall meet the size requirement of the gauge element of the corresponding reference disk gauge according to Clause 7.

The GO gap gauge should pass over the combined width of the gauge block(s) and the reference disk gauge corresponding to the reference disk gauge for a new state GO gap gauge (ref. GO-M) in a vertical direction, under the working load, after having been brought carefully to rest in contact with the gauge block(s) and the reference disk gauge and then released. Inertia forces are thus avoided.

The GO gap gauge should not pass over the combined width of the gauge block(s) and the reference disk gauge corresponding to the reference disk gauge for a wear limits state GO gap gauge (ref. GO-U) when this is applied in the same manner described above.

The NO GO gap gauge should pass over the combined width of the gauge block(s) and the reference disk gauge corresponding to the reference disk gauge for a NO GO gap gauge (ref. NO GO) when this is applied in the same manner described above.

It is important that the gauging faces of the gap gauge, the gauge block(s) and reference disk gauge (depending on the method used) be carefully wiped clean before any measurements are performed. For reference disk gauges, it is also recommended that they should be greased with a thin film of paraffin jelly and then carefully wiped, without completely removing the paraffin jelly.

Annex B
(informative)

Relation to the GPS matrix model

B.1 General

For full details about the GPS matrix model, see ISO 14638.

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

B.2 Information about this document and its use

This document provides the most important design and metrological characteristics of reference disk gauges.

Only those design characteristics which are critical to interchangeability have been assigned requirement values. The metrological characteristics are not subject to requirement values as it is the philosophy that the values of these characteristics are matters of the manufacturer and/or user. However, this document provides definition of the metrological characteristics and states those metrological characteristics for which the manufacturer states an MPL value.

B.3 Position in the GPS matrix model

This document is a global GPS standard, which influences the chain links F and G of all chains of standards in the general GPS matrix model, as graphically illustrated on Table B.1.

Table B.1 — Position in the GPS matrix model

	Chain links						
	A	**B**	**C**	**D**	**E**	**F**	**G**
	Symbols and indications	Feature requirements	Feature properties	Conformance and non-conformance	Measurement	Measurement equipment	Calibrations
Size						•	•
Distance							
Form							
Orientation							
Location							
Run-out							
Profile surface texture							
Areal surface texture							
Surface imperfections							

B.4 Related standards

The related standards are those of the chains of standards indicated in Table B.1.

Bibliography

[1] ISO 1, *Geometrical product specifications (GPS) — Standard reference temperature for the specification of geometrical and dimensional properties*

[2] ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

[3] ISO 3650, *Geometrical Product Specifications (GPS) — Length standards — Gauge blocks*

[4] ISO 8015, *Geometrical product specifications (GPS) — Fundamentals — Concepts, principles and rules*

[5] ISO 14253-1:2013, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for proving conformity or nonconformity with specifications*

[6] ISO 14638, *Geometrical product specifications (GPS) — Matrix model*

[7] ISO 14978:2006, *Geometrical product specifications (GPS) — General concepts and requirements for GPS measuring equipment*