The Vision of
ISO/TC 213 Dimensional and Geometrical Product Specification

To develop standards that will enable:

- Reduction of costs
- Improved product quality and time to market
- Optimized economical allocation of resources amongst specification, manufacturing and verification
- Proper implementation of GPS, which is important for companies in surviving in a global competition
Design requirement

Design tools:
- Kinematic Analysis
- Interface analysis
- Risk Analysis
- Geometry check
- Tolerance Analysis
- etc.

Specification tools:
- Interface Analysis
- Functional Analysis
- Specification procedure
ISO 8015 – GPS Fundamental assumptions

4.2 Functional limits

It is assumed for interpretation that the functional limits are based on an exhaustive investigation done by experiment or theory, or a combination of both, so the functional limits are known with no uncertainty.

4.3 Tolerance limits

It is assumed for interpretation that the tolerance limits are identical to the functional limits.

4.4 Workpiece functional level

It is assumed for interpretation that the workpiece functions 100% within the tolerance limits and 0% outside the tolerance limits.
How will the specification be received by your stakeholders?
GPS Drawing

Stakeholder acceptance?

Functional Specification

Design

Verification

Manufacturing
ISO 8015 & ISO 17450 Operator concept

A complete specification operator defines the measurand for the specification in all significant details. This eliminates ambiguity of the specification.

The verification operator is the physical implementation of the specification operator. It may have exactly the same operations in the same order, in which case the method uncertainty is zero, or it may have different operations or perform the operations in a different order, in which case the method uncertainty is not zero.

The verification operator is not specified in the drawing. Rather, it is decided during verification to be sufficiently close to the specification operator to keep the method uncertainty at an acceptable level.

The specification do not dictate how to manufacture or verify the part.

Duality Principle

\[ U_{\text{Spec}} \lor U_{\text{Meas}} \]

The Drawing

The Manufacturing

The Verification

Variation
ISO 21619
“TYPES OF DOCUMENTS WITH GPS SPECIFICATION”
ISO TS 21619 about to be published

Design

Manufacturing

Verification

GPS Fun-Spec

GPS Veri-spec (F)

GPS Veri-spec (M)

GPS Man-Spec

(Workshop drawings)
# Types of drawings

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<tr>
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<td>ASM</td>
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![Diagram](image-url)
# Types of drawings

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<tr>
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<tr>
<td><strong>Assembly ASM</strong></td>
<td>✓</td>
<td>✓ (✓)</td>
<td>✓</td>
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<tr>
<td><strong>Sub-Assembly SUB</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Component COM</strong></td>
<td>✓</td>
<td>✓</td>
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![Diagram of a mechanical component with annotations and measurements](image-url)
Example on a FUN- and MAN-SPEC for a linear guided carriage
Nominal Dimensioning
FUN-SPEC

How does a Functional Specification (FUN-SPEC) look like?
Nominal Dimensioning
Functional Coordinate System
Functional Datum System and Specification

Tolerancing ISO 8015

title block
Functional Datum System and Specification

Tolerancing ISO 8015

Title block
How does a Manufacturing Specification (MAN-SPEC) look like?
Nominal Dimensioning

![Diagram showing nominal dimensions with x, y, z axes labeled.]
Functional Coordinate system
Manufacturing Datum System and Specification

Tolerancing ISO 8015

Title block
Manufacturing Specification

2x Ø20H7 ©
Ø CZ
Ø A B C
Ø CZ A

Tolerancing ISO 8015

title block
FUN-SPEC versus MAN-SPEC
FUN-SPEC versus MAN-SPEC

FUN-SPEC

MAN-SPEC

Ø 2 A

Ø 1 CZ

2x
FUN-SPEC versus MAN-SPEC
FUN-SPEC versus MAN-SPEC

FUN-SPEC

MAN-SPEC
FUN-SPEC versus MAN-SPEC

FUN-SPEC

MAN-SPEC
FUN-SPEC versus MAN-SPEC

**FUN-SPEC**

- Dimensions: 50, 49, 51

**MAN-SPEC**

- Dimensions: 50, 49, 51
FUN-SPEC versus MAN-SPEC

FUN-SPEC

MAN-SPEC
MAN-SPEC versus VERI-SPEC

MAN-SPEC

\[ \varnothing 10 \pm 0.2 \text{ (GG)} \]

VERI-SPEC

\[ \varnothing 10 \pm 0.2 \text{ (LP SA)} \]

ISO 14405-1
The development of **rule based** GPS standards


1996

Example based → Rule based
Interesting new and upcoming standards

- **ISO 1101**: 2017 Geometrical tolerancing — Tolerances of form, orientation, location and run-out
- **ISO 1660**: 2017 Geometrical tolerancing — Profile tolerancing
- **ISO 5458**: 2018? Geometrical tolerancing — Positional and pattern tolerancing
- **ISO 21619**: 2018? Types of documents with GPS Specification
- **ISO 21204**: 2018? Specification of defined transitions between features
- **ISO 22081**: 20?? Geometrical specifications — General specifications
Thank you for listening!