
Hydraulic fluid power — Measurement techniques —

Part 1:
General measurement principles

Transmissions hydrauliques — Techniques de mesure —
Partie 1: Principes généraux de mesure



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 131, *Fluid power systems*, Subcommittee SC 8, *Product testing*.

This second edition cancels and replaces the first edition (ISO 9110-1:1990), which has been technically revised.

The main changes compared to the previous edition are:

- new normative and informative references have been added;
- new definitions have been added;
- classes of accuracy to measurement have been renamed;
- assessment of uncertainties has been revised and expanded and general measurement considerations and requirements have been renamed;
- guidance on gravity correction has been added;
- readability uncertainty evaluation has been added;
- determination of uncertainty limits and classification of uncertainties has been combined and uncertainty limit specifications have been renamed;
- frequency of calibration has been revised and assurance control techniques have been renamed;
- total measurement uncertainty clause has been added;
- original [Annex A](#) has been deleted;
- new [Annex A](#) - Measurement System Acceptance Designated Information Sheet, has been added;
- new [Annex B](#) - Uncertainty Propagation, has been added;

— new [Annex C](#) - Best Practices Tutorial, has been added.

A list of all parts in the ISO 9110 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

Universal measurement standards are required if meaningful comparisons are to be made and valid conclusions deduced. A fundamental aspect of fluid power technology is the need to quantify the performance characteristics of hydraulic components and systems to provide a basis for action or decision-making. The method of measurement used is capable of reliably determining such performance characteristics.

This document provides guidance for identifying uncertainty sources and magnitudes in the calibration of instruments and their use in measurement situations encountered in hydraulic fluid power testing. Methods are described for assessing the uncertainty in measurements and derived results.

It is widely recognized that no measurement, irrespective of the amount of care exercised, can ever be absolutely accurate and free of error. Different circumstances each have unique uncertainty requirements. The value of a measurement is dictated by the use that will be made of it, as well as the particular circumstance. Therefore, the maximum value of a reported measure can only be realized if it can be applied under many different circumstances, requiring that the uncertainty associated with a measure be assessed and reported.

This document is intended to be used in conjunction with others that address the measurement of specific physical parameters: flow, pressure, torque, speed and temperature.

This document (ISO 9110-1) relates to general principles for the measurement of static or steady-state conditions. ISO 9110-2 deals with the measurement of average steady-state static pressure in a closed conduit.

Hydraulic fluid power — Measurement techniques —

Part 1: General measurement principles

1 Scope

This document establishes general principles for the measurement of performance parameters under static or steady-state conditions.

This document provides guidance on the sources and magnitudes of uncertainty to be expected in the calibration of and measurements using hydraulic fluid power components. It describes practical requirements for assessing the capability of the measuring system, and hence the level of uncertainty of the measurement system, or for assisting in developing a system which will meet a prescribed level of uncertainty.

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 5598, *Fluid power systems and components — Vocabulary*

ISO 7870-1, *Control charts — Part 1: General guidelines*

ISO 7870-2, *Control charts — Part 2: Shewhart control charts*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

data reduction errors

errors that stem from any processing of test data to the final result, as from digital computer resolution, numerical rounding of results, and uncertainty in model curve fitting and interpolation

3.2

indicated value

magnitude of the measure and the parameter subject to measurement

3.3

parallax

phenomenon responsible for reading errors when the observer's eye is not perpendicular to the meter face, and is not directly in line with a pointer whose tip is not in the same plane as the instrument scale