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Hydraulic fluid power — Background, impact and use of ISO 11171:2020 on particle count and filter test data

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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).

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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 6, *Contamination control*.

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

The 2020 revision of ISO 11171 was initiated due to depletion of supplies of the National Institute of Standards and Technology (NIST) Standard Reference Material® (SRM) 2806b, which is required for primary calibration of liquid automatic particle counters (APC) using ISO 11171:2016. The 2016 edition of ISO 11171 also provides an option for reporting particle size in units of either µm(c) or µm(b), which has resulted in confusion among users of particle count data. µm(b) sizes are about 10 % larger than the corresponding µm(c) sizes. Thus, µm(b) concentrations can be as much as 8 times (3 ISO Codes) lower, and µm(b) filter Beta Ratios can be an order of magnitude lower than the same numerical value reported in µm(c). This is problematic when attempting to conform with fluid cleanliness and filter performance specifications.

ISO 11171:2020 addresses these issues by specifying the historically consistent, traceable µm(c) as the sole acceptable means of reporting particle size. Unlike the 2016 edition, ISO 11171:2020 is not dependent upon a specific batch of SRM 2806, as NIST henceforth certifies the material as a consensus standard to minimize the potential for shifts in particle size with future batches. Additional refinements to ISO 11171 facilitate calibration at smaller and larger particle sizes.

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1 Scope

This document provides the background for ISO 11171:2020 and the use of µm(c) as the sole means of reporting particle size for APC particle count data. It also summarizes results of the international inter-laboratory study (ILS) of its reproducibility using SRM 2806d candidate material and suspensions of Reference Material (RM) 8632a. The ILS results provided the basis for certification of SRM 2806d used for primary calibration of APC. Their implications with respect to particle counting and filter testing are discussed in this document.

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 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 3534-2, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

ISO 3534-3, *Statistics — Vocabulary and symbols — Part 3: Design of experiments*

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 11171, *Hydraulic fluid power — Calibration of automatic particle counters for liquids*

ISO 16889, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-1, ISO 3534-2, ISO 3534-3, ISO 4406, ISO 5725-1, ISO 11171 and ISO 16889 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/

4 Undesirable consequences of ISO 11171:2016

ISO 11171:2016 specified the use of NIST SRM 2806b for primary APC sizing calibration. Prior to this, SRM 2806 and SRM 2806a, which have the same certified particle size distribution, were used for primary calibration. Supplies of SRM 2806 and SRM 2806a were exhausted by 2010. The replacement batch, SRM 2806b, was released to the market in 2014. SRM 2806 and SRM 2806b were certified by scanning electron microscopy (SEM), but SRM 2806b was produced by a different supplier and advanced methods of metrology were used. An important difference between the batches is that the