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AN INDUSTRY STANDARD FOR FLUID POWER

Information report – Hydraulic fluid power — Determination of particulate contaminant level using automatic optical particle counters

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Foreword

This Foreword is not part of NFPA Information Report *Hydraulic fluid power — Determination of particulate contaminant level using automatic optical particle counters*, NFPA/T2.9.16-1995 (R2002).

This project was started at the T2.9 Contamination meeting on 22 August 1990. A Particle Counter Calibration Seminar was held at the Milwaukee School of Engineering on the 25th and 26th of September 1990. The seminars purpose was to review the particle counter calibration procedure as described in ANSI/(NFPA)T2.9.6 R1, and to demonstrate or develop the proper handling procedures for processing a field oil sample as in ANSI/(NFPA)T2.9.11.

The committee reviewed the first draft of the document, dated 13 November 1991, and CETOP RP94H. A letter, indicating that a round robin test for T2.9.16 was in order, was circulated 27 April 1992. The Project Group met on 19 August 1992 to review and prepare responses to the comments received on the document. Also, the TSP was revised at this meeting.

The NFPA Technical Board approved the TSP on 17 September 1992. A letter dated 7 October 1992 informed the Project Group that the preliminary information received on the round robin indicated that the sample made up from a field oil was not a homogeneous sample and therefore most of the round robin testing needed to be repeated.

The document was revised and Draft No 2, dated 13 October 1992, was sent out for the Project Group to review on 20 October 1992.

NFPA Technical Staff prepared the General Review Draft on 18 March 1993. The General Review closed with comments from seven companies. Project Co-Chairman Gram wrote letters responding to the commentators and updated the document. All off the commentators had signed off by September 1993.

The Project Group met on 19 August 1993 during the T2.9 meeting and updated the document again. On 17 November 1993 the Project Group again met to discuss and update the document. The Project Group met on 9 February 1994 to review the updated draft and make additional changes to the document. It was agreed upon at this meeting to send the document out for a Second General Review after the changes discussed at the meeting were incorporated into the document.

Project Co-Chairman Gram sent a revised document to Headquarters on 19 March 1994. The document was updated and sent out for a Second General Review on 30 March 1994. Comments were received from six companies. Responses to the commentators were reviewed at the 21 September 1994 Project Group meeting. Letters to the commentators were sent out on 8 November 1994.

The document was updated and approved for Ballot at the 17 August 1995 Technical Board meeting. The document was sent out for Ballot on 21 August 1995. Balloting closed with three approval comments and no negative votes. The approval comments were discussed at the 20 September T2.9 meeting. Letters were written to the commentators and the document updated at Headquarters on 27 October 1995.

The Technical Board granted the document final approval at their 6 December 1995 meeting.

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Introduction

The establishment of national and international standards for the purpose of calibrating automatic optical particle counters (ANSI/(NFPA)T2.9.6 R1 and ISO 4402) and a standard indicating the process to evaluate a field oil sample (ANSI/(NFPA)T2.9.11) several years ago gave hope that the analysis of a common sample by any two technologists at any two locations would be able to provide particle counts within 30 % of each other (20 % calibration differential and 10 % location).

Unfortunately, it did not take long to find out that this was not happening. The reasons are many, the primary ones being equipment differences, calibration dust variation, and failure of technologists to follow procedure.

The primary factor that standards development can help to control is the calibration material. For this reason, an intensive effort was made to establish a new calibration procedure which could be traceable, and ANSI/(NFPA)T2.9.6 R1 was initiated. This standard utilized mono-sized latex spheres in oil as the calibration suspension. Subsequent to the adoption of ANSI/(NFPA)T2.9.6 R1, it was found that particle counters utilizing different technologies produced a wide range of results, and it was determined that the standard should be revised again to use a controlled test dust as the calibration material. ANSI/(NFPA)T2.9.6 R2 was therefore initiated to specify a NIST (National Institute for Standards Testing) material. This work is presently in process.

It is the intent of the NFPA T2.9 Contamination Technology Committee, that the former ACFTD calibration procedure (ISO 4402) be dropped after NFPA/T2.9.6 R2 has been finalized and a reasonable implementation period for NFPA/T2.9.6 R2 has passed. The implementation of NFPA/T2.9.6 R2 has three major impacts on data accumulated using the former calibration procedure, NFPA/T2.9.6 R1 or ISO 4402.

A. The particle size that formerly was defined as a 10 μm particle (measured by longest chord) is now defined by NIST traceable materials.

B. The stated number of particles per mL in 1 mg/L of ACFTD changes.

C. The third most important factor the document will impact is the equipment used to conduct the analysis. NFPA/T2.9.6 R2 establishes particle counter performance specifications.

This information report expands on ANSI/(NFPA)T2.9.11 by providing additional information intended to help the particle technologist from falling into traps that others have fallen into.

Information report — Hydraulic fluid power — Determination of particulate contaminant level using automatic optical particle counters

1 Scope

To include guidelines for proper sample handling, preparation, and counting of petroleum based fluids with liquid-borne automatic optical particle counters calibrated with either ACFTD (Air Cleaner Fine Test Dust) or NIST traceable standards.

To provide information summarizing experience and guidelines concerning sample handling and counting of hydraulic fluid bottle samples using a liquid automatic optical particle counter calibrated with either ACFTD or NIST traceable standards.

2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this NFPA document. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this NFPA document are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. NFPA maintains registers of currently valid documents.

ANSI/(NFPA)T2.9.6 R1-1990, *Hydraulic Fluid Power — Liquid automatic particle counters — Method for calibration*.

ANSI/(NFPA)T2.9.11-1989, *Hydraulic Fluid Power — Method for determining the particle count of an oil sample from a system (using liquid automatic counters).*

ANSI/(NFPA)T2.9.14-1993, *Hydraulic Fluid Power — Fluid Contamination — Determination of Solid Contaminant level by the gravimetric method.*

ANSI/B93.2-1986, *Fluid power systems and products — Glossary*.

ANSI/B93.20M-1972 (R1980), *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods.*

ANSI/B93.30M-1980, *Hydraulic Fluid Power — Contamination analysis data — Reporting Method*.

ANSI/ASQC Z1.4-1981, *Sampling Procedures and Tables for Inspection by Attributes*.

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 4402:1991, *Hydraulic Fluid Power — Calibration of liquid automatic particle count instruments — Method using Air Cleaner Fine Test Dust Contaminant*.

ISO 4407:1991, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using a microscope*.

MIL-H-5606-1984, *Hydraulic fluids — Petroleum Base Aircraft Missile and Ordinance*.