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AN INDUSTRY STANDARD FOR FLUID POWER

## Hydraulic fluid power components – Assessment of reliability by testing

Descriptors: hydraulic fluid power components reliability testing

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## Foreword

This foreword is not part of National Fluid Power Association Recommended Practice *Hydraulic fluid power components – Assessment of reliability by testing*, NFPA/T2.12.11-2-2007.

During development of the NFPA standard T2.11.12-1 on field data recording, it was agreed to develop a separate standard to determine reliability by laboratory testing. At the 11 February 1997 NFPA/T2.12.11 Reliability project group meeting, the Title, Scope and Purpose (TSP) was revised to include two documents: (part 1) Reliability reporting and (part 2) Reliability testing. The Technical Board approved the TSP at its 10 April 1997 meeting. The Reliability project group revised the TSP at subsequent committee meetings of 8 February 2000, 6 February 2001, and 17 May 2006, and the final TSP was approved by the Technical Board on 10 August 2006.

The project group developed drafts in preparation for an industry open meeting that occurred on 19 September 2000. Attendees agreed with the direction of the work and recommended continuation. Subsequent drafts were developed and reviewed, culminating in agreement to issue a first general review draft at the NFPA/T2.12.11 meeting of 6 February 2003; and this draft was circulated for comment on 15 April 2003.

During 2003, the annexes relating to pneumatic components were deleted because they had become parts of a developing ISO standard. The scope of NFPA/T2.12.11-2 was then revised to apply to hydraulic components only.

Revisions continued, and agreement was reached to issue a second general review at the NFPA/T2.12.11 meeting of 9 June 2005. Resulting comments were reviewed at project group meetings of 21 September 2005, and 22 February 2006. At the NFPA/T2.12 committee meeting of 17 May 2006, it was agreed to request Technical Board approval for a final ballot, and permission was granted by the Technical Board on 10 August 2006.

The document was circulated for final ballot, which closed on 11 September 2006. The voting resulted in 20 approval votes and two abstentions. A comment that was submitted on Annex E was resolved and incorporated into the document. At its 21 September 2006 meeting, members of NFPA/T2.12, Testing, approved a motion to ask the NFPA Technical Board for final approval. The NFPA Technical Board approved the document for publication at its 11 January 2007 meeting.

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This is a preview of "NFPA/T2.12.11-2-2007...". [Click here to purchase the full version from the ANSI store.](#)

## Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Fluid power systems are composed of components and are an integral part of various types of machinery and equipment. Efficient and economic production requires highly reliable machines and equipment.

Machine producers need to know the reliability of the components that make up their machine's fluid power system. Knowing the reliability characteristic of the component, the producers can model the system and make decisions on service intervals, spare parts inventory and areas for future improvements.

Four phases determine the reliability of a component during its lifetime:

- preliminary design analysis – finite element analysis (FEA), failure mode and effect analysis (FMEA);
- basic laboratory testing – physics of failure, reliability prediction, accelerated tests, pre-production evaluation, design of experiments;
- collection of field data – maintenance reports, warranty analysis;
- Weibayes/substantiation tests – reduced laboratory testing using field data.

Each phase has its application during the life of a component. A preliminary design analysis is useful to identify possible failure modes and eliminate them or reduce their effect on reliability. When prototypes are available, in-house laboratory reliability tests are run and initial reliability can be determined. Reliability testing is often continued into the initial production run and throughout the production lifetime as a continuing evaluation of the component. Collection of field data is possible when products are operating and data on their failures are available. These data, in turn, can be used for reduced lab testing (Weibayes) on improvements to the products, or similar new products.

This recommended practice describes both testing phases of the overall compendium described above – the basic laboratory testing and the Weibayes/substantiation testing. The procedure for collecting and reporting reliability of components in the field can be found in NFPA/T2.12.11-1-2001.

# Hydraulic fluid power components – Assessment of reliability by testing

## 1 Scope

**1.1** This recommended practice provides guidelines for assessing the reliability of hydraulic components by testing and reporting for components used in fluid power systems. Specific requirements for assessing the reliability of the components listed in 1.2 are contained in annexes to this practice.

**1.2** This practice applies to the following components:

- a) accumulators;
- b) hydraulic cylinders;
- c) hydraulic filters;
- d) hydraulic pumps and motors;
- e) hydraulic valves;

**1.3** This practice provides:

- a) general requirements for reliability testing;
- b) statistical methods for determining reliability;
- c) an example of reliability calculations;
- d) annexes with specific test guidelines and threshold level criteria for each component listed in 1.2.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this NFPA document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this NFPA document are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referenced applies. NFPA maintains registers of currently valid NFPA and ANSI/(NFPA) Standards. Standards development organization contact information and links can be found on the NFPA website ([www.nfpa.com](http://www.nfpa.com)).

ANSI/B93.62 (*latest edition*), *Hydraulic fluid power – Reciprocating dynamic sealing devices in linear actuators – Method of testing, measuring and reporting leakage*.