



**NFPA Recommended Practice**  
**NFPA/T2.12.11-1 R1-2009 (R2014)**  
Second edition  
2 April 2009

---

AN INDUSTRY STANDARD FOR FLUID POWER

**Fluid power systems and components –  
Reliability analysis, field data reporting format  
and database compilation**

Descriptors: fluid power systems components reliability analysis reporting format database compilation recommended practice maintainability availability controlled studies

---

published by

**NATIONAL FLUID POWER ASSOCIATION, INC.**

6737 W. Washington St., Suite 2350 / Milwaukee, WI 53214 USA  
PHONE: +1 414 778 3344 / FAX: +1 414 778 3361 / E-mail: [nfpa@nfpa.com](mailto:nfpa@nfpa.com)

Copyright 2009 by the  
**NATIONAL FLUID POWER ASSOCIATION, INC.**  
Printed in the USA

All standards, recommended practices, information reports, and bibliographies (collectively, "NFPA Documents") are advisory only. Use thereof by anyone for any purpose is entirely voluntary and in any event without risk of any nature to the National Fluid Power Association (NFPA), its officers, directors or authors of such work. There is no agreement by or between anyone to adhere to any NFPA Document. In formulating and approving NFPA Documents, NFPA and/or its councils and committees will not investigate or consider citations, references or patents which may or may not apply to such subject matter since prospective users of such NFPA Documents alone are responsible for establishing necessary safeguards in connection with utilization of such matters, including technical data, proprietary rights or patentable materials.

The information and data contained in NFPA Documents has been obtained from sources believed to be reliable. However, it should not be assumed that all acceptable or applicable sources of information, procedures, methods or techniques are contained in NFPA Documents, or that additional measures may not be required under certain circumstances or conditions.

NFPA Documents and/or policies and procedures are subject to periodic review and may be changed without notice. NFPA Documents are only current as of their publication date. NFPA Documents, after publication, may be revised or withdrawn at any time and current information on all NFPA Documents may be received by calling or writing NFPA. Additionally, the various codes and regulations referenced in NFPA Documents may be amended from time to time and it should not be assumed that the versions referenced therein are the most current versions of such codes and regulations. Please consult the appropriate regulatory authorities for the most up-to-date versions.

NFPA Documents imply a consensus of those substantially concerned with their scope and provisions and are intended as a guide to aid the manufacturer, the consumer and the general public. The publication of NFPA Documents does not in any respect preclude anyone, whether they have participated in the development of or approved such NFPA Documents or not, from manufacturing, marketing, purchasing, or using of products, processes or procedures not conforming to the NFPA Documents. NFPA Documents do not constitute or indicate a warranty of any sort, express or implied, including but not limited to a warranty or representation as to quality, merchantability or fitness for a particular use or purpose.

Participation by federal agency representative(s) or person(s) affiliated with the industry is not to be interpreted as government or industry endorsement of an NFPA Document(s).

#### **NOTICE**

NFPA Documents do not express or imply any judgment, certification or endorsement of or with respect to, the safety, design or performance of any product, component, or its use.

NFPA does not examine, investigate, test, recommend, or certify the design, use or safety of any product or component, even those which may incorporate one or more NFPA Documents. NFPA Documents therefore have no application to and do not express or imply any recommendation, representation or warranty, with respect to the safety, design, use, performance, or functional interchangeability of components or products which incorporate NFPA Documents.

This publication may not, in whole or in part, be reproduced, copied or disseminated, entered into or stored in a computer database or retrieval system, or otherwise utilized without the prior written permission of NFPA.

## Foreword

This foreword is not part of National Fluid Power Association Recommended Practice *Fluid power systems and components – Reliability analysis, field data reporting format and database compilation*, NFPA/T2.12.11-1 R1-2009.

Five years after the publication of NFPA/T2.12.11-1-2001, NFPA/T2.12 agreed to revise the document. Tom Wanke and John Montague agreed to serve again as project co-chairs. The Title, Scope and Purpose (TSP) was approved at the 11 January 2007 NFPA Technical Board meeting. Drafts no. 1 and 2 of the document were discussed at joint meetings of NFPA/T2.12 and U.S. TAG SC 8 on 14 February 2007 and 16 May 2007, respectively. At the 20 September 2007 meeting, draft no. 3, which incorporated a number changes, was discussed, and a motion was approved to circulate the document for general review.

NFPA/T2.12.11-1 R1-200x was circulated for general review on 28 November 2007 and closed on 28 December 2007. At the 12 June 2008 meeting, the committee reviewed the comments from the general review, which were satisfactorily resolved and the resulting changes were incorporated into the document. At the same meeting, NFPA/T2.12 approved a motion to circulate the document for final ballot. On 14 August 2008, the NFPA Technical Board gave its approval for final ballot.

The document was circulated for final ballot on 25 November 2008 and closed on 26 December 2008. The voting resulted in 20 approval votes, zero disapproval votes and one abstention, and all comments were satisfactorily resolved. At the 12 February 2009 joint meeting of NFPA/T2.12 and U.S. TAG SC 8, a motion was approved to ask the NFPA Technical Board for permission to publish the document. At its 2 April 2009 meeting, the NFPA Technical Board gave its permission to publish the document.

Project Group Members who developed this recommended practice:

**John Montague**

Project Co-Chair  
Consultant

**Thomas Wanke**

Project Co-Chair  
Testing Technology Committee Chair  
Milwaukee School of Engineering

**John Berninger**

Parker Hannifin Corp.

**Eugene Cottle\***

Bosch Rexroth Corp.

**John Kaufman**

Caterpillar, Inc.

**Chuck Meinke**

Bosch Rexroth Corp.

**James F. Simpson\***

SMC Corporation

**John F. Walrad**

Consultant

**Carrie Tatman Schwartz**

Industry/National Standards Development  
Manager  
National Fluid Power Association

\*No longer with company  
/cts

This is a preview of "NFPA/T2.12.11-1 R1-2...". [Click here to purchase the full version from the ANSI store.](#)

## **Introduction**

In fluid power systems, power is transmitted and controlled through a liquid or gas under pressure within an enclosed circuit. Fluid power systems comprise a number of components and are an integral subsystem of various machines and equipment. Efficient and economic production requires highly reliable machines and equipment.

Collection of field reliability data is an essential element of an effective product reliability program. It is one of the most valuable sources of data since it represents actual customer/user product experience under real world conditions.

In a broad perspective, reliability is associated with dependability and availability, successful operation and performance, and the absence of breakdowns or failures. Failure occurs because of manufacturing defects, misapplication of product, inadequate maintenance, cumulative wear and degradation, design deficiencies and random chance.

The collection of field reliability data provides a measure of product quality over time and end user experience.

# Fluid power systems and components – Reliability analysis, field data reporting format and database compilation

## 1 Scope

1.1 This recommended practice includes guidelines for the collection of data relating to reliability, maintainability, availability and maintenance of fluid power components and systems operating in the field.

1.2 This recommended practice is intended to:

- provide guidance for collecting field reliability data in controlled studies of reliability; and
- provide guidance for analysis and presentation of field reliability data.

## 2 Normative references

The following standards contain provisions, which, through reference in this test, 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 listed below. NFPA maintains registers of currently valid NFPA/ANSI, IEC, and ISO standards.

IEC 60300-3-2 (latest edition), *Dependability management – Part 3: Application guide – Section 2: Collection of dependability data from the field.*

IEC 60050-581 (latest edition), *International electrotechnical vocabulary* (Chapter 191: Dependability and quality of service).

IEC 60605-6 (latest edition), *Equipment reliability testing – Part 6: Tests for the validity and estimation of the constant failure rate and constant failure intensity.*

ISO 5598 (latest edition), *Fluid power systems and components – Vocabulary.*

ISO 4406 (latest edition), *Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles.*

ISO 8258 (latest edition), *Shewhart control charts.*

## 3 Definitions

For the purposes of this recommended practice, the terms and definitions given in ISO 5598, IEC 60050-581 and the following apply:

**3.1 reliability:** probability that machinery/equipment can perform continuously, without failure, for a specified interval of time when operating under stated conditions.