



**ANSI/(NFPA)  
T2.13.8-1997**  
First edition  
14 January 1997

---

**AMERICAN NATIONAL STANDARDS INSTITUTE • A NATIONAL STANDARD FOR FLUID POWER**

---

**Hydraulic fluid power —  
Fire resistant fluids —  
Definitions, classifications, and testing**

**SPONSOR**



National  
**FLUID POWER**  
Association

## AMERICAN NATIONAL STANDARD

This American National Standard is one of more than 10,000 standards approved as American National Standards by the American National Standards Institute. On 24 August 1966, the ASA was reconstituted as the USA Standard Institute; on October 1969, the USASI changed its name to the American National Standards Institute. Standards formerly designated as ASA or USASI are now designated as ANSI Standards. There is no change in their index identification or technical content.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether they have approved the standard or not, from manufacturing, marketing, purchasing or using products, processes or procedures not conforming to the standard. An approved ANSI Standard does 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. American National Standards are subject to periodic review and users are to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising, promotional material or on tags or labels that the goods are produced in conformity with particular American National Standards.

**NOTICE:** An approved ANSI standard does 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 ANSI standards. Approved ANSI standards 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 ANSI standards.

**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five (5) years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036-8002, (212) 642-4900. Information on this and other FLUID POWER standards may also be obtained by calling or writing the National Fluid Power Association, 3333 North Mayfair Road, Milwaukee, WI 53222-3219, (414) 778-3344.

Suggestions for improvement gained in the use of this standard will be welcome. They should be sent to the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036-8002.

Any part of this standard may be quoted. Credit lines should read: Extracted from American National Standard Hydraulic fluid power — Fire resistant fluids — Definitions, classifications, and testing, ANSI/(NFPA)T2.13.8-1997.

Published by  
NATIONAL FLUID POWER ASSOCIATION, INC.  
Copyright 1997 by the National Fluid Power Association, Inc.  
Printed in USA

## Foreword

This Foreword is not part of American National Standard Information Report *Hydraulic fluid power — Fire resistant fluids — Definitions, classifications, and testing*, ANSI/(NFPA)T2.13.8-1997.

T2.13.8 was started at the 21 August 1990 T2.13 meeting. The Committee reviewed ISO 7745-1989, Fire-resistant fluids guidelines, and decided to write their own document since the ISO document would need to be rewritten. At the 7 March 1991 T2.13 meeting George Totten (Union Carbide) gave a presentation on flammability testing of fire resistant fluids. At this meeting, George Totten (Union Carbide) agreed to serve as Project Chairman for a document reviewing and quantifying the results from the fire resistance tests for different fluids. The TSP was approved by the Technical Board at their 12 September 1991 meeting.

The Committee reviewed ASTM STP 406-1966, Fire Resistance of Hydraulic Fluids at their 14 November 1991 meeting. At the 12 November 1992 T2.13 meeting, Project Chairman George Totten supplied a listing of hydraulic fluid testing for fire resistance references. At the 25 March 1993 T2.13 meeting Chuck Faulkner (E. F. Houghton) arranged for a presentation on spray flammability methods from Armand Brando from Factory Mutual Research Corp.

At the 9 February 1994 meeting a copy of Draft No. 1 was distributed. Draft No. 1 was reviewed by the Committee and comments were discussed at the 26 May 1994 T2.13 meeting. The document was updated and Draft No. 2 was reviewed by the Committee at the 20 September 1994 T2.13 meeting.

At the 9 February 1995 T2.13 meeting it was voted to send this document out for General Review. The document was sent out for General Review on 28 March 1995. The General Review closed with comments from five companies.

At the 25 May 1995 T2.13 meeting, the document was reviewed along with the comments received. It was decided to incorporate all the comments from the General Review, as they were all editorial. It was also decided that once the comments were incorporated into the document, that it be put on the Technical Board agenda for approval to Ballot. On 12 July 1995 Headquarters received the marked up document.

All of the letters to the commentators were returned to NFPA by 15 August 1995. The document was approved for Ballot at the 17 August 1995 Technical Board meeting.

This document was sent out for Ballot on 24 August 1995. Balloting closed with two negative votes. These were discussed at the 21 September 1995 T2.13 meeting. It was decided not to incorporate the change suggested by one commentator and to incorporate all of the editorial changes suggested by the second commentator. These changes were made to the document and both of the commentators signed off by 14 November 1995.

This document was granted final approval at the 6 December 1995 Technical Board meeting.

Project Group Members who developed this standard:

**George Totten**  
Project Chairman  
Union Carbide Corporation

**Paul Schacht**  
Technology Committee Chairman  
Robert Bosch Fluid Power

**Thelma Marougy**  
Technology Committee Vice Chairman  
Vickers, Inc.

**Paul Michael**  
Technology Committee Secretary  
Benz Oil

**Lido Boni**  
Technical Auditor  
Parker Hannifin

**Linda E. Gasso**  
Technical Coordinator  
National Fluid Power Association

**Shirley C. Seal**  
Manager of Standards Development —  
Industry/National  
National Fluid Power Association

**Glenn M. Webster**  
Union Carbide Corporation

On 4 September 1996, ANSI/(NFPA)T2.13.8 was submitted to ANSI Committee B93 for Ballot. Balloting closed with no negative comments. ANSI granted approval to this document on 14 January 1997.

The membership roster of Standards Committee B93 at the time of Ballot:

**Jack C. McPherson**  
Chairman

**Daniel B. Shore**  
Vice Chairman

**Shirley C. Seal**  
Secretary

**American Society of Agricultural Engineers**  
W. L. Snyder

**Compressed Air & Gas Institute**  
John Wiskamp  
John Addington (alternate)

**Fluid Controls Institute, Inc.**  
Jude Pauli  
John Addington (alternate)

**Fluid Power Society**  
Probir K. Chatterjea  
Art DesMarais III  
Greg Gordon  
Ray Hanley  
Bernard Larson  
Paul Prass (alternate)  
N. Pliny Smith  
James J. Staczek

**Fluid Sealing Association**  
Stephen B. Chapman  
Robert Ecker (alternate)

**Material Handling Institute**  
Jack C. McPherson

**National Fluid Power Association**  
John Berninger  
David Prevallet  
Paul Schacht  
William Wilkerson

**National Machine Tool Builders' Association**  
Anthony Bratkovich

**US Department of Defense**  
Wayne K. Wilcox

**Company Members**  
Dennis Bonacorsi  
John Welker (alternate)  
Logan Mathis

**Individual Members**  
John Eleftherakis  
Russ Henke  
Richard Pettibone  
A. O. Roberts  
Daniel B. Shore  
Vince Torrusio  
Jack Walrad  
Tom Wanke  
James C. White  
Frank Yeaple

/leg

# Hydraulic fluid power — Fire resistant fluids — Definitions, classifications, and testing

## Abstract

*Although considerable research has been performed to quantitatively compare the relative fire-resistance afforded by different hydraulic fluids in various industrial applications, issuance of new standards reflecting these developments is still incomplete. The objective of this paper is to provide an overview of the classical tests that have, and are currently, used to quantify relative fire safety of fluids. This will be followed by a discussion of new tests that could be incorporated into future standards. This discussion will not only focus on single tests but also on potentially more effective test protocol which may include multiple tests.*

## 0 Introduction

Many industrial processes require the use of hydraulic fluids that afford a greater margin of fire safety than achievable with mineral oils. For example, machinery in steel mills, die casting, mining, and lumber industries may encounter temperatures sufficient to cause mineral oils and other hydraulic fluids to exhibit an unacceptable fire hazard relevant to worker safety, plant and equipment. However, the selection of the appropriate test to model the relative degree of fire resistance that a particular fluid may afford is often not obvious and in many occasions has been controversial.

This problem led to the formation of a special group, section N.06 of the ASTM D.02 subcommittee. The chairman of this study group made the following statement during a 1966 conference which was held to assess fire-safety testing methods available at that time. "A major problem confronting the industry today is the lack of test standardization and interpretation of test results to adequately measure fire resistance of fluids. Cooperative effort is recommended." Although considerable test development work has subsequently been performed, completed standards reflecting many of these developments still have not been published.

The objective of this paper is to review the various tests that are currently used to evaluate the fire resistance properties of hydraulic fluids. This discussion will begin with a basic classification of hydraulic fluids and will be followed by a brief description of the strategies involved in test selection. An overview of more classical tests that are often utilized will be provided. A discussion of more recently developed tests will then follow. Finally, an assessment of the current state of hydraulic fluid flammability standards development with recommendations for future test development will be given.

## 1 Normative references

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

**1.1** C.L. Early and R.E. Hatton, "Industrial and ASTM Fluid Fire-Test Programs" in Fire Resistance of Hydraulic Fluids; American Society for Testing and Materials, No. STP 406, Philadelphia, PA, 1966; pp 105-134.

**1.2** Commission of the European Communities, Safety and Health Commission for the Mining and Extractive Industries, Working Party Rescue arrangements, Fires and Underground Combustion, Committee of Experts on Fire-resistant Fluids; Sixth Report on Specifications and Testing Conditions Relating to Fire-Resistant Hydraulic Fluids used for Power Transmission (Hydrostatic and Hydrokinetic) in Mines, Doc. 2786/8/81 E, Luxembourg, 1983.

**1.3** D.F. Smith, Hydraulics & Pneumatics, June, 77, (1970).