



**NFPA Recommended Standard**  
**NFPA/T3.5.16-1988 (R2018)**  
First edition  
15 September 1988

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AN INDUSTRY STANDARD FOR FLUID POWER

**Hydraulic fluid power – Flow control valves –  
Method for measuring and  
reporting regulating characteristics**

Descriptors: flow characteristic measuring, flow characteristic reporting, fluid power, pressure compensation measuring, pressure compensation reporting, testing flow characteristic, testing valve, valve, hydraulic fluid power valve, port size

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## Foreword

This Foreword is not part of National Fluid Power Association Recommended Standard Hydraulic fluid power — Flow control valves — Method for measuring and reporting regulating characteristics, NFPA/T3.5.16-1988.

On 24 March 1982, the Hydraulic Valves Section approved the preparation of this standard as a Hydraulic Valve Section project. A project group was appointed, met and prepared a TSP.

Headquarters assigned the project the number NFPA/T3.5.16. The TSP was forwarded to and approved by the Technical Board on 26 May 1982. On 20 August 1982, the TSP was circulated for ballot among the NFPA Member Company Representatives having a Participant on the Hydraulic Valve Section.

After the successful conclusion of balloting the TSP, Draft No. 1 was prepared and forwarded to the NFPA Headquarters. The NFPA Headquarters Technical Staff prepared the draft (17 September 1982) for review by project group members prior to the 29 September 1982 Section meeting.

It was reported at the 29 September Hydraulic Valve Section meeting that the project group had two new members.

The project group met 16 March 1983 to review comments received as a result of Draft No. 1. Several minor changes and the inclusion of a provision to test priority type flow control valves were approved.

Upon completion of the addition, the document was forwarded to the NFPA headquarters. The NFPA Technical Staff prepared Draft No. 2 on 10 June 1983 for review by the project group members prior to the project group meeting scheduled in the fall of 1983.

The project group met 5 October 1983 to resolve the two comments received resulting from Draft No. 2.

The Hydraulic Valve Section (T3.5) granted approval to circulate NFPA/T3.5.16 for general review. At this time, Project Chairman Clark announced his retirement as chairman and from the Industry. Ken Kramer accepted project group chairmanship.

Upon receiving comment resolutions, Headquarters Technical Staff prepared the document for first general review on 22 December 1983. The general review period ended 23 January 1984.

Comments were received and addressed at the 28 March 1984 project group meeting.

Resolutions were assimilated into the document and forwarded to the NFPA headquarters, whereupon the document was prepared for circulation among the project group (28 August 1984) for discussion at the 3 October 1984 project group meeting.

At the 6 March 1985 project group meeting the remaining comments were reviewed and resolved. The Hydraulic Valve Section (6 March 1985) recommended that the document be submitted for ballot.

The Technical Board granted approval to ballot at their 16 May 1985 meeting. Headquarters Technical Staff prepared the document for ballot on 27 September 1985.

The ballot closed with four negatives. The project group met on 19 March 1986 and 1 October 1986 to discuss the negatives. They concurred with some of the comments and it was decided to make technical changes to the document, where required, to resolve the negatives. A second ballot draft was prepared on 25 March 1988.

The ballot closed with one negative comment. This negative was withdrawn when the wording in clause 9.4.1 was changed from "load valve" to "test valve". At the 15 June 1988 meeting of the Hydraulic Valve Section it was recommended that the document be submitted to the NFPA Technical Board for final approval. The Technical Board concurred with this recommendation and granted final approval on 15 September 1988.

Project group members who developed this standard:

**Kenneth Kramer**

Project Group Chairman  
John Deere

**Thomas Clark\***

Project Group Chairman (1982-1984)  
Dana Corp./Racine Hydraulics Div.

**Harold Jacoby**

Section Chairman  
Racine Fluid Power, Inc.

**Dave Prevallet**

Section Chairman (1979-1985)  
Dana Corp./Fluid Mobile Products Div.

**Wayland Tenkku**

Section Secretary  
Sun Hydraulics Corp.

**Pete Mardosa**

Technical Auditor  
Dayton T. Brown Inc.

**Rick Earles\*\***

Technical Director  
National Fluid Power Association

**Lanson Becker\*\***

General Signal/Hydreco

**Lawrence Coleman**

Continental Hydraulics Div.

**Charles Guthrie**

United Technologies/Fluid Power Systems

**Jack Johnson**

Milwaukee School of Engineering

**Donald Reinicker**

HUSCO International

**Edward Saloum**

Snap-Tite Inc.

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\* Retired

\*\*Company affiliation has changed

# Hydraulic fluid power — Flow control valves — Method for measuring and reporting regulating characteristics

## 0 Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Typical components found in such systems are hydraulic valves. This standard addresses the valve component that controls the flow rate of liquid in the enclosed circuit.

## 1 Scope and field of application

### 1.1 This standard includes:

- standard methods for testing the regulating characteristics of hydraulic flow control valves;
- a uniform method for presenting the test data;
- standardized information to enable the conducting of comparative tests.

**1.2** This standard is intended to provide a uniform laboratory procedure for measuring and reporting the regulating characteristics for a hydraulic flow control valve.

**1.3** This standard is intended to include steady state performance characteristics only. Transient performance tests are not included.

## 2 References

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

ANSI/B93.9-1969, *Symbols for Marking Electrical Leads and Ports on fluid Power Valves.*

ANSI/B93.30M-1980, *Hydraulic fluid power - Contamination analysis data - Reporting method.*

ANSI/B93.49-1980, *Hydraulic fluid power - Valves - Pressure differential flow-characteristics - Method of measuring and reporting.*

ASTM/D 445-1988, *Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids.*

ISO 1219-1976, *Fluid power systems and components - Graphic symbols.*

NFPA/T2.10.1M-1978, *Metric Units for Fluid Power Applications.*

ISO 1000-1981, *SI units and recommendations for the use of their multiples and of certain other units.*

## 3 Terms and definitions

For terms and definitions used, see ANSI/B93.2.

## 4 Units of measurement

**4.1** Units of measurement are used in accordance with NFPA.T2.10.1M. This document agrees with ISO 1000.

**4.2** Approximate conversions to Customary US units are shown in parentheses after their metric counterparts and are made in accordance with NFPA/T2.20.1M.

## 5 Letter symbols

The following symbols apply to this document.

- Q Test flow rate
- Q<sub>b</sub> Bypass flow
- Q<sub>c</sub> Specified maximum controlled flow
- Q<sub>i</sub> Inlet flow