Hydraulic fluid power –
Solenoid operated directional control valves –
Measurement of response time

Descriptors: hydraulic fluid power measurement response time solenoid directional control valves

published by
NATIONAL FLUID POWER ASSOCIATION, INC.
3333 N. Mayfair Road / Milwaukee, WI 53222-3219 USA
PHONE: +1 414 778 3344 / FAX: +1 414 778 3361 / E-mail: nfpa@nfpa.com
Copyright 2008 by the

NATIONAL FLUID POWER ASSOCIATION

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 NFPA Documents, after publication, may be revised or withdrawn at any time and current information on all NFPA Documents may be received by calling or writing NFPA.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 Standard Hydraulic fluid power – Solenoid operated directional control valves – Measurement of response time, NFPA/T3.5.30-2008.

At the 28 September 1976 Hydraulic valve section meeting (NFPA/T3.5), a project group was appointed to prepare a hydraulic valve response test Title, Scope and Purpose (TSP) for submission to the NFPA Technical Board.

The NFPA Technical Board approved the project TSP at the 10 November 1976 meeting. This activity was assigned project number NFPA/T3.5.30.

After several discussions by the members of the project group, the scope was revised on 9 May 1979 to limit the type of valve to hydraulic directional valves and to expand the scope to include electrically, hydraulically or pneumatically operated hydraulic directional valves. The Technical Board approved the revised TSP on 16 November 1979.

A working draft of NFPA/T3.5.30 was written 26 October 1981, based on NFPA/T3.21.8, Pneumatic valve response test document.

At the 5 October 1983 project group meeting, members agreed to limit the scope to electrically operated valves to reduce the complexity of the document. Draft no. 1, dated 19 September 1984, included this limitation along with other changes.

Draft no. 2, dated 5 March 1986, refined the previous draft with several editorial changes.

On 30 September 1986, project group members agreed to submit the document for general review with minor editorial changes. On 1 October 1986, NFPA/T3.5 members approved general review circulation.


The first general review netted negative comments from 11 members. Several changes were made to the document to accommodate the negative responses.

At the 8 April 1992 Hydraulic valve section meeting, the document was approved for a second general review. The second general review document was submitted to NFPA Headquarters on 29 July 1992. Headquarters prepared the document for second general review on 25 August 1992.

At the 21 May 1997 project group meeting, the document was circulated and reviewed. Comments were discussed.

On 23 January 1998, Draft no. 4 was distributed for comments to be discussed at the 11 February 1998 project group meeting.
At the 11 February 1998 group project meeting, members agreed that the document was to be revised and draft no. 5 was reviewed at the 20 May 1998 project group meeting.

On 31 August 1998, Project Chair Cooper developed draft no. 6.

Corrections were made and draft no. 7 was distributed at the 10 February 1999 project group meeting, for review and recommendation for a fourth general review.

On 10 February 1999, project group members met and discussed whether response testing should be under a dynamic condition (full flow across spool) or under static flow condition (load valve closed; single flow path). The document was revised to show pressure transducer on the inlet or service port, as appropriate for the spool type being tested. Mr. Cooper made corrections to the document for distribution of draft no. 8 at the next meeting.

At the 19 May 1999 project group meeting, members reviewed draft no. 8 and made additional changes. A motion was made to circulate the fourth general review. Comments were discussed at the September 1999 meeting.

On 22 September 1999, project group members met, discussed comments received from the 4 August 1999 fourth general review and made changes to the document. Members continued to discuss the 4 August 1999 fourth general review comments at the February 2000 meeting.

On 9 February 2000, project group members continued discussion of the fourth general review comments. NFPA/T3.5 members agreed to circulate the document for fifth general review.

The document was circulated for fifth general review on 26 April 2000, and comments were incorporated into the document. At the 19 September 2001 project group meeting, a motion was approved to circulate the document for sixth general review.

The document was circulated for sixth general review on 10 December 2001 and closed on 10 January 2002. Comments were successfully resolved and the resulting changes were incorporated into the final ballot draft. At the 8 June 2005 joint meeting of NFPA/T3.5 and U.S. TAG to ISO/TC 131/SC 5/WG 2, a motion was approved to circulate the document for final ballot. The NFPA Technical Board gave its permission to circulate the document for final ballot on 12 April 2007.

The document was circulated for final ballot on 6 July 2007 and closed on 6 August 2007. The voting resulted in nine approval votes and no disapprovals or abstentions. The comments were satisfactorily resolved and permission to publish NFPA/T3.5.30-200x was granted by the NFPA Technical Board on 14 August 2008.

Project group members who developed this standard:

- **Jeffrey Cooper**  
  Project Chair  
  Sun Hydraulics Corp.

- **Nathan Oaks**  
  Past Project Chair  
  G. W. Lisk Co.

- **Harold Jacoby**  
  Past Section Chair (1985-1990)  
  Racine Bosch Group

- **Wayland Tenkku**  
  Past Section Chair  
  Sun Hydraulics Corp.
Richard McAffee*
Past Section Chair
Eaton Corporation

Thomas M. Weinkauf
Section Chair
Daman Products Company Inc.

John Berninger
Technical Auditor
Parker Hannifin Corp.

Douglas Miller*
Past Technical Auditor
Applied Power Inc.

Jenna Wetzel*
Standards Development Coordinator
National Fluid Power Association

June M. VanPinsker*
Technical Coordinator
National Fluid Power Association

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

Clifford W. Allen**
Lexair, Inc.

Felix Aranovich*
Sterling Hydraulics, Inc.

Jerry Carlin
Eaton Corporation

Stanislav Chudakov**
Hydac Corp.

Lawrence Coleman**
Continental Hydraulics Division

Jack Curnow*
Vickers, Inc.

K.C. Fung
Hydraforce, Inc.

Bill Hotchkiss
SunSource

Jack Johnson
IDAS Engineering Inc.

John Kaufman
Caterpillar Inc.

Henry Kiernan**
Oilgear/Hydro-Stack

Martin F. McAllister†
Lexair, Inc.

Chuck Meinke
Bosch Rexroth Corp.

Donald Reinicker**
HUSCO International, Inc.

Ronald Rueter**
Hydraforce, Inc.

John Tackes
Delta Power Company

Jack Walrad
Consultant

Wayne K. Wilcox
Consultant

*Company affiliation has changed.

** Retired

† Deceased

/cts
Introduction

In hydraulic power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Hydraulic valves can be used to control the direction of the working fluid through the circuit. For some applications, the time required to change the direction of the fluid by energizing or de-energizing the solenoid valve is important to the fluid power system designer.
Hydraulic fluid power – Solenoid operated directional control valves – Measurement of response time

1 Scope

1.1 This standard includes a standardized procedure for defining, measuring and reporting the response time of hydraulic solenoid operated directional control valves with minimum influence from the system. Valves included are electrically controlled, either directly or with a direct-mounted pilot valve, excluding servo and proportional valves.

1.2 This standard is intended to:

a) establish a standard definition of response time;

b) provide a uniform basis to manufacturers and users of hydraulic fluid power systems for measuring and comparing the response time of hydraulic fluid power solenoid operated directional valves;

c) establish a standard means for presenting the results of response time measurements.

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).


ANSI/(NFPA)T2.12.10 (latest edition), Recommended practice – Hydraulic fluid power – Systems and products – Testing general measurement principles and tolerances (to be used in conjunction with ANSI/(NFPA)T2.12.1).


ISO 1000 (latest edition), SI units and recommendations for the use of their multiples and of certain other units.


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