



NFPA Recommended Standard
NFPA/T3.5.1 R2-2002 (R2010)
Third edition
14 February 2002

AN INDUSTRY STANDARD FOR FLUID POWER

Hydraulic fluid power – Valves – Mounting surfaces

(Revision of ANSI/B93.7M-1986)

Descriptors: hydraulic fluid power directional control valves compensated flow check pilot operated pressure sequence throttle unloading pressure relief valve interchangeability dimensional surfaces criteria mounting interfaces

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 2002 by the

NATIONAL FLUID POWER ASSOCIATION, INC.

Printed in the USA

All technical reports, citations, references and related data including standards and practices approved and/or recommended 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, Inc., its officers, directors or authors of such work. There is no agreement by or between anyone to adhere to any NFPA Recommended Standard, policy or practice, and related matters. In formulating and approving technical reports, the Technical Board, its councils and committees and/or the National Fluid Power Association, Inc. will not investigate or consider citations, references or patents which may or may not apply to such subject matter since prospective users of such reports and data alone are responsible for establishing necessary safeguards in connection with utilization of such matters, including technical data, proprietary rights or patentable materials.

Recommended standards and/or policies and procedures are subject to periodic review and may be changed without notice. Recommended standards, after publication, may be revised or withdrawn at any time and current information on all approved recommended standards may be received by calling or writing the National Fluid Power Association, Inc.

An approved NFPA Recommended Standard implies a consensus of those substantially concerned with its scope and provisions and is intended as a guide to aid the manufacturer, the consumer and the general public. The publication of the NFPA Recommended Standard does not in any respect preclude anyone, whether they have participated in the development of or approved the recommended standard or not, from manufacturing, marketing, purchasing, or using of products, processes or procedures not conforming to the recommended standard. An approved NFPA Recommended 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.

Participation by federal agency representative(s) or person(s) affiliated with the industry is not to be interpreted as government or industry endorsement of this standard and/or policy and procedure.

NOTICE

An approved NFPA recommended 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 of safety of any product or component, even those which may incorporate one or more NFPA recommended standards. Approved NFPA recommended 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 NFPA recommended standards

This publication may not be reproduced in whole or in part without the written permission of the National Fluid Power Association, Inc.

Foreword

This Foreword is not part of National Fluid Power Association Recommended Standard *Hydraulic fluid power – Valves – Mounting surfaces*, NFPA/T3.5.1 R2-2002 (Proposed revision of ANSI/B93.7-1986).

At the 6 March 1991 meeting, the NFPA Hydraulic Valve Section acknowledged the need to revise ANSI/B93.7-1986. Larry Coleman (Continental Hydraulics) agreed to serve as Project Chair. At the NFPA/T3.5 meeting on 19 August 1992, Jack Walrad (Vickers, Inc.) volunteered to be the Co-Chair.

At the 11 November 1992 project group meeting, it was recommended that NFPA/T3.5.36 and NFPA/T3.5.46 should be added to the document. Also, four ISO DO2 size interfaces would be added to the document. On 18 February 1993, Headquarters received a marked up document from Co-Chair Coleman with the changes to be made. These changes were incorporated into the document. Co-Chair Walrad discussed eventually putting the document into CETOP format and sent a copy of a CETOP document to Headquarters for the file.

At the 18 August 1993 meeting, Co-Chair Coleman made one change to the document and it was agreed upon by NFPA/T3.5 that the document was to be sent out for general review.

On 29 September 1993, the document was sent out for general review. The general review closed with comments from three companies. On 2 February 1994, Project Co-Chair Coleman wrote to the commentators and by 11 February 1994, all three commentators had signed off on their comments.

At the 9 February 1994 NFPA/T3.5 meeting, members agreed to send NFPA/T3.5.1 R2 out for a second general review after all the comments have been incorporated into the document. Comments from the second general review included a comment to change the word "interfaces" to "surfaces" in the title. The document was updated for the second general review and reviewed by the project group at their 25 May 1994 meeting. The TSP was updated and approved at the 18 August 1994 Technical Board meeting.

The document was sent out for second general review on 19 August 1994. The second general review closed with comments from four companies. The project group met on 8 February 1995 to review the comments received and decided that the document should be sent out for a third general review. Letters to the commentators were sent out on 20 February 1995.

Headquarters received a revised draft document on 18 January 1996. The document was revised and distributed at the 14 February 1996 NFPA/T3.5 meeting. No action on the document was taken at this meeting.

At the 22 May 1996 NFPA/T3.5 meeting, it was voted on to send the document out for third general review after Project Co-Chair Coleman reviewed the document.

On 27 August 1996, approval to send the document out for third general review was received from Project Co-Chair Coleman.

The document was sent out for third general review on 28 August 1996. At the 12 February 1997 Hydraulic Valve meeting, it was recommended to send the document out for a fourth general review after the four commentators signed off. The commentators signed off and the document was sent out for fourth general review on 16 May 1997.

The project group met on 11 February 1998 and discussed comments that were received on the fourth general review and were resolved. At the 11 February NFPA/T3.5 meeting a recommendation was made to send the document out for a fifth general review. A marked up document was received from Project Co-Chair Mr. Coleman on 30 March 1998. The fifth general review was circulated on 1 April 1999.

On 19 May 1999, the project group reviewed comments received from the fifth general review and recommended disposition. All comments were editorial, accompanied by votes of approval and addressing style, format or clarity, rather than the intended meaning. The group expects acceptance of the recommended dispositions and plans to propose a ballot draft at the September 1999 project group meeting.

On 29 March 2000, members reviewed the conference call draft, dated 23 March 2000, and the comments received from Mr. McAllister. Headquarters updated all mounting artwork sent from Mr. Coleman and centered all figures within the document. Members discussed the definition of surface roughness and surface flatness and agreed on the following for both definitions: they are not listed in ISO 5598 because they are too general; ISO 4287 only defines surface profile and roughness profile; and ISO 4288 describes how to measure surface roughness.

At the 17 May 2000 project group meeting, members reviewed the final ballot draft no. 2 and made changes to the document.

At the 31 October 2000 conference call, Mr. Coleman reviewed the conference call draft, dated 26 October 2000, and made changes to the document.

The final ballot was circulated on 6 January 2001 and closed 6 February 2001. At the 7 February 2001 project group meeting, members reviewed comments received from the fifth general review and recommended disposition.

At the 5 April 2001 Technical Board meeting, the Technical Auditor agreed that all comments from the final ballot had been resolved and the document had been updated. The Technical Board approved NFPA/T3.5's recommendation to publish.

Project group members who developed this document:

Larry Coleman
Project Co-Chair
Continental Hydraulics

Wayland Tenkku*
Past Section Chair
Sun Hydraulics

Jack Walrad*
Project Co-Chair
Eaton Corp.

Thomas Weinkauff
Section Vice Chair
Daman Products Company Inc..

Richard McAfee
Section Chair
Eaton Corp.

Barry Verdegan
Technical Auditor
Nelson Industries, Inc.

June M. VanPinsker
Technical Coordinator
National Fluid Power Association

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

Harold Jacoby**
Robert Bosch Fluid Power

Ron Schilling
Bosch Rexroth Corp.

Jeffrey Cooper
Sun Hydraulics Corp.

* Retired

** Company affiliation has changed.

/jmv

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. These devices control flow direction, pressure or flow rate of liquids in the enclosed circuit.

MOUNTING SURFACE CODE AND FIGURE INDEX

Mounting surface code	Figure number	Figure title	Page number
D02	1	D02 mounting surface for four-port hydraulic directional control valves with 4.5/.177 maximum port diameter	6
D03	2	D03 mounting surface for four-port hydraulic directional control valves with 7.0/.276 maximum port diameter	7
D05	3	D05 mounting surface for four-port hydraulic directional control valves with 11.2/.44 maximum port diameter and without pilot port	8
D05	4	D05 mounting surface for four-port hydraulic directional control valves with 11.2/.44 maximum port diameter and with pilot ports – Alternative A	9
D05	5	D05 mounting surface for four-port hydraulic directional control valves with 11.2/.44 maximum port diameter and with pilot ports – Alternative B	10
D06	6	D06 mounting surface for four-port hydraulic directional control valves with 14.7/.58 maximum port diameter	11
D07	7	D07 mounting surface for four-port hydraulic directional control valves with 17.5/.69 maximum port diameter	12
D08	8	D08 mounting surface for four-port hydraulic directional control valves with 25/.98 maximum port diameter	13
D10	9	D10 mounting surface for four-port hydraulic directional control valves with 32/1.25 maximum port diameter and with or without drain port	14
F02	10	F02 mounting surface for compensated flow control valves with main ports of 4.5/.177 maximum port diameter	16
F03	11	F03 mounting surface for compensated flow control valves with main ports of 7.0/.276 maximum port diameter	18
2F06	12	2F06 mounting surface for compensated flow control valves with two main ports of 14.7/.58 maximum port diameter	20
3F06	13	3F06 mounting surface for compensated flow control valves with three main ports of 14.7/.58 maximum port diameter	22
2F07	14	2F07 mounting surface for compensated flow control valves with main ports of 23.4/.91 maximum port diameter	24
3F07	15	3F07 mounting surface for compensated flow control valves with three main ports of 17.5/.69 maximum port diameter	26
2FB07	16	2FB07 mounting surface for compensated two-stage cam actuated flow control valves with two main ports of 19.1/.75 maximum port diameter	28
2F08	17	2F08 mounting surface for compensated flow control valves with two main ports of 23.4/.92 maximum port diameter	30
2F09	18	2F09 mounting surface for compensated flow control valves with two main ports of 28.5/1.12 maximum port diameter	32
C06	19	C06 mounting surface for non-return (check) valves with main ports of 14.7/.58 maximum port diameter	34
C08	20	C08 mounting surface for non-return (check) valves with main ports of 23.4/.92 maximum port diameter	36
C09	21	C09 mounting surface for non-return (check) valves with main ports of 28.7/1.13 maximum port diameter	38

MOUNTING SURFACE CODE AND FIGURE INDEX

Mounting surface code	Figure number	Figure title	Page number
POC06	22	POC06 mounting surface for pilot operated non-return (check) valves with main ports of 14.7/.58 maximum port diameter	40
POC08	23	POC08 mounting surface for pilot operated non-return (check) valves with main ports of 23.4/.92 maximum port diameter	42
PCO09	24	POC09 mounting surface for pilot operated non-return (check) valves with main ports of 28.7/1.13 maximum port diameter	44
P02	25	P02 mounting surface for pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and non-return (check) valves with main ports of 4.5/.177 maximum port diameter	46
P03	26	P03 mounting surface for pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and non-return (check) valves with main ports of 7.0/.276 maximum port diameter	48
P06	27	P06 mounting surface for pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and non-return (check) valves with main ports of 14.7/.580 maximum port diameter	51
P08	28	P08 mounting surface for pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and non-return (check) valves with main ports of 23.4/.92 maximum port diameter	52
P10	29	P10 mounting surface for pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and non-return (check) valves with main ports of 32/1.25 maximum port diameter	53
R02	30	R02 mounting surface for pressure relief valves with main ports of 4.5/.177 maximum port diameter	56
R03	31	R03 mounting surface for pressure relief valves with main ports of 7.0/.276 maximum port diameter	58
R06	32	R06 mounting surface for pilot operated pressure relief valves with main ports of 14.7/.580 maximum port diameter	60
R08	33	R08 mounting surface for pilot operated pressure relief valves with main ports of 23.4/.92 maximum port diameter	62
R10	34	R10 mounting surface for pilot operated pressure relief valves with main ports of 32/1.260 maximum port diameter	64
RP06	35	RP06 mounting surface for pilot operated pressure relief valves with main ports of 14.7/.58 maximum port diameter	66
RP08	36	RP08 mounting surface for pilot operated pressure relief valves with main ports of 23.4/.92 maximum port diameter	68
RP10	37	RP10 mounting surface for pilot operated pressure relief valves with main ports of 32/1.26 maximum port diameter	70
RV08	38	RV08 mounting surface for pilot operated pressure relief valves with 23.4/.92 maximum port diameter	72
RV10	39	RV10 mounting surface for pilot operated pressure relief valves with 32.0/1.26 maximum port diameter	73

Hydraulic fluid power – Valves – Mounting surfaces

1 Scope

1.1 This standard includes mounting surfaces for the following:

- non-return (check) valves;
- compensated flow control valves;
- directional control valves;
- pilot operated non-return (check) valves;
- pressure control valves;
- pressure relief valves;
- sequence valves;
- throttle valves; and
- unloading valves.

1.2 This standard includes the following dimensional criteria:

- minimum surface width and length dimensions;
- sizes and locations of ports;
- sizes and locations of tapped holes for mounting fasteners; and
- sizes and locations of dowel or rest pins where required.

1.3 This standard provides the following general criteria:

- surface roughness and flatness;
- indication of appropriate radii; and
- indication of tolerances where pertinent.

1.4 This standard only applies to the dimensional criteria of products manufactured in conformance with this standard. It does not apply to their functional characteristics. The maximum working pressure for subplates and manifold blocks with this mounting surface shall be supplied by the manufacturer.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this 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 to applies. NFPA maintains registers of currently valid NFPA standards.

ANSI/B93.9-1969, *American National Standard Symbols for Marking Electrical Leads and Ports on Fluid Power Valves*.

ANSI/Y14.5M-1994, *Dimensioning and Tolerancing*.

ANSI/IEEE 268-1992, *Metric Practice*.

ISO 273:1979, *Fasteners – Clearance holes for bolts and screws*.

NFPA/T3.5.1 R2-2002

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 1219-1:1991, *Fluid power systems and components – Graphic symbols and circuit diagrams – Part 1: Graphic symbols.*

ISO 1302:1992, *Technical drawings – Method of indicating surface texture.*

ISO 4287:1997, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters.*

ISO 4288:1997, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Rules and procedures for the assessment of surface texture.*

ISO 4412-1:1991, *Hydraulic fluid power – Test code for determination of airborne noise levels – Part 1: Pumps (second edition).*

ISO 5598:1985, *Fluid power systems and components – Vocabulary.*

ISO 9461:1992, *Hydraulic fluid power – Identification of valve ports, subplates, control devices and solenoids.*

3 Definitions

For the purposes of this standard, the terms and definitions given in ISO 5598 apply.

4 Units

4.1 Dimensions are given in millimeters.

4.2 Inch dimensions shown below the millimeter conform to ISO 4412-1.

5 Symbols

5.1 Letter symbols

For the purposes of this standard, the following symbols apply:

- a) A, B, P, T, L, V, X and Y identify ports in accordance with ISO 9461;
- b) F_1 , F_2 , F_3 , F_4 , F_5 and F_6 identify threaded holes for mounting fasteners; and
- c) G_1 and G_2 identify location pin holes.

5.2 Graphic symbols

Graphic symbols in accordance with ISO 1219-1, shown in figures 10A through 39A, represent examples of valves used with the mounting surfaces in figures 10 through 39 and show the normal port usage and flow direction for each.

6 Mounting surface identification coding

The following prefixes relate to the mounting surface valve type:

- C is the non-return (check) valve;
- D is the directional control valve;
- FB is the cam-actuated two-stage compensated flow control valve;