ANSI/(NFPA)T3.6.7 R2-1996 (R2004)
Third edition
8 March 1996

Fluid power systems and products – Square head industrial cylinders – Mounting dimensions

(Revision and redesignation of ANSI/B93.15-1981)

A NATIONAL INDUSTRY STANDARD FOR FLUID POWER

Approved by Committee ASC B93,
accredited by the American National Standards Institute (ANSI)

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Developed and published by

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Foreword

This Foreword is not part of American National Standard — *Fluid power systems and products — Square head industrial cylinders — Mounting dimensions* (revision and redesignation of ANSI/B93.15-1971), (NFPA/T3.6.7, NFPA/T3.6.7 S1 & NFPA/T3.6.7 S2), ANSI/(NFPA)T3.6.7 R2-1996.

Recognizing a need for a standard of this type, the NFPA established Project Group T3.6.7 in 1966. The Project Group divided the work into two segments parts - T3.6.7.1 pneumatic and light duty hydraulic cylinders and T3.6.7.2 heavy duty hydraulic cylinders.

Through a series of three surveys and tabulations, manufacturers of cylinders were able to bring their dimensions into almost complete agreements. The Cylinder Section, in meeting on 28 January 1969, reviewed the results and determined that almost complete uniformity had been accomplished and recommend the material be placed in Final Draft form for Ballot.

Unsuccessful Balloting closed on 4 May 1969 with six negative ballots. After review, two negative ballots remained unresolved. These ballots related to five mounting styles. The NFPA Technical Board recommended these five mounting types be removed and the remaining document be approved as an NFPA Recommended Standard. The five mounting styles (MF1, MF5 and MT1 for heavy duty; and MT1 and MR2 for light duty) were to be resubmitted separately for possible subsequent approval.

This action was endorsed by the NFPA Board of Directors when they approved NFPA/T3.6.7-1969 on 9 November 1969.

On 13 January 1971, NFPA/T3.6.7 was submitted to ANSI Standard Committee B93 for promulgation as an ANSI Standard. Favorable ballot was concluded on 25 February 1971. Approval by the ANSI Board of Standards Review was granted on 14 July 1971.

The original projects, begun in April 1966, resulted in approval as an NFPA Recommended Standard on 9 November 1969. To obtain approval, it was necessary to delete five mountings where unanimous vote was not obtained.

Those mounting were resubmitted for ballot in December 1969, but were defeated in the March 1970 balloting. The NFPA Cylinder Section reviewed the Ballot results and revised the mountings to reach consensus at their 6 April 1971 meetings. At this time preferred dimensions were specified for trunnion mountings.

The NFPA Technical Board voted to resubmit the document to the Board of Directors for approval on 4 May 1971. The NFPA Board of Directors approved NFPA/T3.6.7 S1 on 30 April 1972.

Head and cap rectangular designs (ME5 and ME6) are another important part of the standard industrial fluid power cylinder product line. It was recognized these mounting dimensions eventually be included in ANSI/B93.15-1971 (NFPA/T3.6.7-1969) when it undergoes revision.

Mounting styles ME5 and ME6 had been developed to satisfy the continuous needs for additional standardized mounting styles.

The Cylinder Section recognized that it would be ideal if it could standardize an exact mounting thickness which would satisfy all possible requirements but found this to be an untenable solution because of the different port sizes, glands, cartridges, packing designs, and piston rod diameters which vary the section modulus of the flange.

Further, specifying a pressure was unproductive since all factors (size of hole, size of port, material used, etc.) can cause flange thickness to vary erratically from manufacturer to manufacturer and bore size to bore size.

It was ascertained, that a guideline was necessary for machine designers who would be using this type of mounting. Since the thickness of the mounting normally affected only the bolt length required to pass through it into the machine housing, it was felt minor variations in thickness and bolt length were not critical enough to deter standardizing the design.

Under this criterion, the Cylinder Section determined it could offer guidance in three areas:

– The mounting hole location;

– On head mounting, the distance from the front face of the head, which can be the mounting surface, to the reference point (ME5);

– The distance from the rear face of the cap to the reference point (ME6).

The project was initiated at the 28 September 1971 meeting of the Cylinder Section, It was further discussed by T3.6 on 8 February 1972, 23 May 1972, 3 October 1972 and 6 February 1973. During this time the project was designated T3.6.20. The TSP was approved by the Technical Board on 21 February 1973. At that time, the project was renumbered NFPA/T3.6.7 S2.

A first draft was prepared on 12 June 1973 and discussed at the Cylinder Section meeting on 11 July 1973. The draft was further discussed on 5 February 1974, 21 May 1974, and 9 – 10 July 1974. The Final Working Draft was forwarded to Headquarters following the 15 January 1975 Cylinder Section meeting. Headquarters Technical Staff prepared the General Review Draft on 14 April 1975.

General Review comments were answered at the 28 October 1975 T3.6 Section meeting with the exception of two companies who restated their objections. Section members present voted to request approval to ballot from the Technical Board despite these objections. On 4 February 1976, approval to ballot was granted. The document was balloted on 28 April 1976.

The only negative ballot was received from Miller Fluid Power Corp. The Cylinder Section considered Miller's negative ballot on 28 September 1976 and decided it could not be resolved. The Technical Auditor agreed and so advised the Technical Board. After careful consideration, the Technical Board voted to recommend to the Board of Directors that T3.6.7 S2 be approved as an NFPA Standard. The NFPA Board of Directors granted final approval to NFPA/T3.6.7 S2 on 14 December 1976.

In the intervening time, on 28 October 1975, T3.6 reviewed ANSI/B93.15-1971 and appointed Donald Selke (Sheffer Corp.) as Chairman of the Project Group to undertake the revision of this document.

In revising the existing standard, the Project Group planned to incorporate Supplement Nos. 1 and 2 (NFPA/T3.6.7 S1-1971 and NFPA/T3.6.7 S2-1976). The Project was designated NFPA/T3.6.7 R1.

The Final Working Draft of T3.6.7 R1 was completed at the 12 October 1977 Section meeting. Headquarters Technical Staff circulated the General Review Draft on 23 February 1978. Four negative comments were received and were resolved through editorial modifications to the document. The NFPA Technical Board granted approval to ballot 4 May 1978. Headquarters Technical Staff prepared the document for ballot on 24 May 1978. It was circulated 26 October 1979.

Five negative comments were received and technical changes were made to the document to resolve these comments. Consequently, a Second Ballot Draft was recommended to and granted by the NFPA Technical Board on 20 June 1979. Headquarters Technical Staff prepared the Second Ballot Draft on 26 October 1979. Ballot closed 23 November 1979.

Because of the new availability of material, thus making NFPA/T3.6.7 S1 and NFPA/T3.6.7 S2 applicable documents, the T3.6 Cylinder Section on 17 April 1980 recommended T3.6.7 R1 project be deactivated. Furthermore, it unanimously recommended to revise ANSI/B93.15.

Project Group members who developed this standard (NFPA/T3.6.7, NFPA/T3.6.7 S1 and NFPA/T3.6.7 S2):

Donald Selke
Project & Section Chairman
Sheffer Corp.

George Ovanin
Section Secretary
S-P Manufacturing Corp.

Peter Wolf
Technical Auditor
Eaton Corp.

James C. White *
Director of Technical Services
National Fluid Power Association

Henry Schultz **
Past Project & Section Chairman
(NFPA/T3.6.7 S1)
Ortman Fluid Power

Ray Knable
Past Project Chairman
(NFPA/T3.6.7 & NFPA/T3.6.7 S2)
Parker Hannifin Corp.

Henry Flock **
Past Project Chairman
(NFPA/T3.6.7 S2)
Garlock/OM

Paul Crothers
Past Section Chairman
Sheffer Corp.

James I. Morgan
NFPA, ANSI, and ISO Liaison
National Fluid Power Association

John Luecke *
Director of National Technical Services
National Fluid Power Association

J. Fisher
Schrader Bellows

J. Harding
Hydro-Line Mfg. Co.

R. Henthorn
Sheffer Corp.

S. Karbowniczek
Garlock/OM

Ike McMillen
Garlock, Inc

R. Pabst
Miller Fluid Power

J. Pietrowski *
Rexnord Inc.

H. Pikoski
Milwaukee Cylinder

* Company affiliation has changed

** Retired

T. Watson
Tomkins-Johnson Co.

R. Winkler
Milwaukee Cylinder

On 27 June 1980, ANSI/B93.15 was submitted to the ANSC B93 for Ballot. Balloting closed 28 July 1980 with two negative comments. After the resolution of these comments ANSI/B93.15 was submitted to ANSI Board of Standards Review on 15 May 1981. Approval was granted 21 September 1981.

At the 14 June 1988, T3.6 meeting it was agreed to initiate project *Hydraulic fluid power — Heavy duty hydraulic cylinders — Supplementary mounting dimensions for MT4 mounting style* (Proposed supplement to ANSI/B93.15-1981), ANSI/(NFPA)T3.6.7 S3-19xx and incorporate it into the exiting ANSI/B93.15-1981.

Lido Boni (Parker Hannifin) agreed to serve as Project Chairman. The Technical Board requested two changes to the TSP. First, the TSP should read "For Information Only" and second, that it be limited to the study of ferrous materials. The TSP was changed and resubmitted to the Technical Board. Work continued on this project for several meetings. At the 15 November 1989 meeting it was reported that testing would begin in spring of 1990. At the 21 March 1990 meeting, Project Chairman Boni reported on the testing procedures and that the test material had been changed to P.V.Q. plate.

Testing continued for the next several meetings. At the 6 March 1991 T3.6 meeting, Project Chairman Boni reported that a new project would be proposed in November for center trunnion. By the 13 November 1991 T3.6 meeting, the Project Group was working on correlating test data obtained to date. At the 19 August 1991 meeting, Project Chairman Boni reported that the TSP was to be changed from formula development to development of MT4 mounting dimensions for heavy duty hydraulic cylinders. This was based on substantial finite element analysis work.

At the T3.6.57 meeting on 11 November 1992, the Project Group agreed that this document should be a supplement to B93.15. On 24 March 1992, the Project Group finished their review of the document and approved the document to be sent out for General Review. The project number, T3.6.57, was changed to T3.6.7 S3 because the document is a supplement to ANSI/B93.15. This change in the numbering was approved by the Technical Board at their 20 May 1993 meeting.

The document was sent out for General Review on 24 June 1993. The General Review closed with comments from three companies. These comments were discussed at the 18 August 1993 Project Group meeting and Project Chairman Boni wrote letters to the commentators. It was agreed upon by the Project Group, that after the document was updated from the General Review comments, the document should be sent out for Second General Review.

Introduction, Scope and Normative Reference clauses were all added to the document and it was sent out for Second General Review on 8 October 1993. There were no negative comments received from the Second General Review. At the 17 November 1993 T3.6 meeting it was agreed upon to send the document to the Technical Board for approval to Ballot.

The Technical Board met on 20 January 1994 and granted approval to Ballot. The document was sent out for Balloting on 7 February 1994. Only approval Ballots were returned. This document was granted final approval by the Technical Board on 14 April 1994.

Project Group Members who developed this standard:

Lido Boni
Project Chairman
Parker Hannifin

Donald Selke
Section Chairman
Sheffer Corp.

Wayne Hays
Section Vice Chairman
Bimba Mfg. Co.

Gregory Pesch
Section Secretary
Hanna Corp.

Jim Cheema *
Technical Auditor
Greer Hydraulics

Linda E. Gasso
Technical Coordinator
National Fluid Power Association

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

Paul Gies **
Vickers, Inc.

Richard Schink
Vickers, Inc.

* Company affiliation has changed

** Retired

On 19 April 1994, ANSI/(NFPA)T3.6.7 S3 was submitted to ANSI Committee B93 for Ballot. Balloting closed with no negative comments.

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

Compressed Air & Gas Institute
Douglas Morris
John Addington (alternate)

Fluid Controls Institute
Jude Pauli
E. C. Rutter (alternate)

Fluid Power Distributors Association, Inc.
Thomas Neff

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

Fluid Sealing Association
Stephen Chapman
Robert Ecker (alternate)

Material Handling Institute
Jack C. McPherson

National Fluid Power Association
Bruce McCord †
David Prevallet
Paul Schacht
William Wilkerson

National Machine Tool Builders' Association
Anthony Bratkovich

US Department of Defense
Wayne K. Wilcox

Company Members
Don McGeachy
John Welker (alternate)
Logan Mathis

Individual Members
John Eleftherakis
William Jones
Zdenek J. Lansky
A. O. Roberts
Daniel B. Shore
William L. Snyder
Vincent Torrusio
Jack Walrad
Tom Wanke
James C. White
Frank Yeaple

The ANSI/(NFPA)T3.6.7 S3-1994 was incorporated into ANSI/B93.15-1981 and redesignated ANSI/(NFPA)T3.6.7 R2-19xx. Although the supplement had been circulated and approved by the B93 Committee, the ANSI/B93.15-1981 document was in need of a five-year review.

On 9 November 1995 the new document, ANSI/(NFPA)T3.6.7 R2-19xx was submitted to ANSI Committee B93 for Ballot. Balloting closed with no negative comments. ANSI's Board of Standards Review grated final approval to this document on 8 March 1996.

The membership roster of 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
Douglas Morris
John Addington (alternate)

Fluid Controls Institute, Inc.
Jude Pauli
E. C. Rutter (alternate)

Fluid Power Distributors Association, Inc.
Thomas Neff

† Deceased

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
William Jones
A. O. Roberts
Daniel B. Shore
Vince Torrusio
John Walrad
Thomas Wanke
James C. White
Frank Yeaple

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On 27 May 2004, ANSI/(NFPA)T3.6.7 R2-1996 was submitted to ANSI Committee B93 for ballot to reaffirm the document. Balloting closed on 12 July 2004 with no negative votes.

ANSI/(NFPA)T3.6.7 R2-1996 (R2004) was approved by ANSI's Board of Standards Review on 15 December 2004.

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

Jack C. McPherson
Chair

Jenna Wetzel
Secretary

American Society of Agricultural Engineers
Scott Cedarquist

Compressed Air & Gas Institute
John Addington

Eaton Corporation
Jerry Carlin

Fluid Power Society
Clayton W. Fryer

Fluid Sealing Association
Robert Ecker

General Motors
R. Joe Nunley

Material Handling Institute
Jack C. McPherson

Milwaukee School of Engineering
Thomas S. Wanke

Motion Industries
Larry Kuziak

National Fluid Power Association
John F. Berninger

Individual Members
Dennis Bonacorsi

Individual Members
John Montague
Albert Roberts
Paul Schacht
Jack Walrad
James C. White
Wayne K. Wilcox

/jw

Fluid power systems and products — Square head industrial cylinders — Mounting dimensions

0 Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit.

One component of such systems is the fluid power cylinder. This is a device which converts fluid power into linear mechanical force and motion. It consists of a movable element, such as a piston and piston rod, plunger, or ram operating within a cylindrical bore.

The square head cylinder is a specific design initially developed for industrial (in plant) use. It is manufactured and sold as an interchangeable component by a majority of suppliers. Recognition of this interchangeability is one of the purposes of this document.

1 Scope

1.1 This standard includes:

– interchangeable mounting dimensions for pneumatic, light duty hydraulic, square head industrial fluid power cylinders;

– interchangeable mounting dimensions for heavy duty hydraulic square head industrial fluid power cylinders.

1.2 This standard is intended to:

– promote interchangeability by establishing uniform mounting dimensions for various types of cylinder mountings;

– allow manufacturers freedom of design in cylinders without restricting the advancement of the art while still providing basic guidelines necessary for product interchangeability.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this ANSI document. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this ANSI 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.

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

ANSI/B93.1-1964, *Dimension identification code for fluid power cylinders.*

ANSI/B93.3-1984, *Fluid power systems and products — Cylinder bores and piston rod diameters — Inch series.*

ANSI/B93.8-1968, *Bore and rod size combinations and rod end configurations for cataloged square head industrial fluid power cylinders.*

3 Definitions

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

4 Units

"Customary US" units are used in this document.

Note — The NFPA Cylinder section chose not to include metric units in this document because another document (ISO 6020-2:1991) for a similar product has been approved by ISO with metric mounting dimensions.