



NFPA Recommended Standard  
**NFPA/T3.6.68-2010 (R2015)**  
First edition  
28 September 2010

---

AN INDUSTRY STANDARD FOR FLUID POWER

**Fluid power – Square head cylinders –  
Determination of the static failure pressure rating of pressure-  
containing components**

**(Revision and redesignation of ANSI/B93.10-1969)**

Descriptors: fluid power cylinders

---

published by

**NATIONAL FLUID POWER ASSOCIATION, INC.**

6737 w. Washington St., Ste. 2350 / Milwaukee, WI 53214 USA  
PHONE: +1 414 778 3344 / FAX: +1 414 778 3361 / E-mail: [nfpa@nfpa.com](mailto:nfpa@nfpa.com)

Copyright 2010 by the  
**NATIONAL FLUID POWER ASSOCIATION**  
Printed in the USA

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 NFPA Documents, after publication, may be revised or withdrawn at any time and current information on all NFPA Documents may be received by calling or writing NFPA.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

On 24 July 2007, a Title, Scope and Purpose (TSP) for ANSI/(NFPA)T3.6.68.1-200x, *Fluid power systems – Static pressure rating methods of square head fluid power cylinders – Part 1: Pressure containing components* (revision and redesignation of ANSI/B93.10-1969) was approved via the online committee forums, and then approved by the NFPA Technical Board on 9 August 2007. At a project group meeting on 11 March 2008, members of NFPA/T3.6 discussed a draft of the document and agreed to a number of changes. The document was further discussed and changed by members of NFPA/T3.6 at a meeting on 10 June 2008.

At the 17 September 2008 meeting of NFPA/T3.6, a motion was approved to circulate ANSI/(NFPA)T3.6.68.1-200x for general review. The document was circulated for general review on 3 December 2008. The voting resulted in four approval votes, zero disapprovals and four abstentions, as well as submission of a number of comments. As a result of the comment resolutions, the document number and title were changed to ANSI/(NFPA)T3.6.68-200x, *Fluid power – Square head cylinders – Determination of the static failure pressure rating of pressure-containing components*. A revised TSP was approved by the NFPA Technical Board at its meeting on 2 April 2009.

At its teleconference meeting on 12 May 2009, NFPA/T3.6 reviewed the latest draft, which had been updated from the general review comments, and agreed to a number of changes. A motion was approved to ask the NFPA Technical Board for permission to circulate the document for simultaneous NFPA final and ANSI approval ballots. However, as a result of a decision made by the NFPA Board of Directors at its meeting on 27 June 2009, NFPA discontinued its activities as an ANSI Accredited Standards Developer. Therefore, the document designation was changed to NFPA/T3.6.68-20xx.

At its meeting on 6 August 2009, the NFPA Technical Board approved a motion to circulate the document for final ballot. They also approved a revised Title, Scope and Purpose (TSP) with a change to the document's scope.

The document was circulated for final ballot on 20 April 2010. The voting resulted in nine approval votes, zero disapprovals and two abstentions, with one comment which was satisfactorily resolved. On 10 September 2010, a motion was approved by NFPA/T3.6 via the online forums to ask the NFPA Technical Board for permission to publish the document. The Technical Board gave its permission to publish via the online forums on 28 September 2010.

Project Group Members who developed this standard:

**Pete Molloy**  
Project group chair  
SMC Corporation

**Lido Boni**  
Parker Hannifin Corp.

**Bryan Nelson**  
Caterpillar, Inc.

**Dan Rosinski**  
Bosch Rexroth Corp.

**Charles Woodin**  
Milwaukee Cylinder

**Carrie Tatman Schwartz**  
Program Manager  
National Fluid Power Association

## **Introduction**

Fluid power systems are those that transmit power through the use of a pressurized fluid (liquid or gas) within an enclosed circuit.

One component of such systems is the fluid power cylinder. This is a device that 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 tie rod 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.

# Fluid power – Square head cylinders – Determination of the static failure pressure rating of pressure-containing components

## 1 Scope

**1.1** This recommended standard covers tie rod constructed square head industrial fluid power cylinders which apply to NFPA/T3.6.7 and provides requirements and design parameters for the determination of the theoretical static failure pressure rating of pressure containing components. It also provides guidance on material selection.

**1.2** It is recognized that cylinder mountings, rod buckling, etc. are pertinent to proper cylinder application; but they are considered beyond the scope of this document.

**1.3** The information contained in this document is intended to

- a) establish a basic method for calculating the static failure pressure rating of a cylinder which will be consistent and understandable to both the manufacturer and the user, but is in no way intended to imply the maximum operating pressure of the cylinder;
- b) allow the user or manufacturer to apply or recommend whatever safety factor deemed necessary and consistent with the intended use of the cylinder;
- c) allow manufacturers freedom of design in cylinders without restricting the advancement of the art while still providing basic guidelines that will assure users that adequate safeguards are present.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of this 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 standards.

ASME B1.1 (latest edition), *Unified Inch Screw Threads (UN and UNR Thread Form)*.

NFPA/T3.6.7 (latest edition), *Fluid power systems and products- Square head industrial cylinders – mounting dimensions*.

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