

NFPA/T3.6.31 R2-2000



NFPA

Solutions through motion technology

15 March 2000

AN INDUSTRY STANDARD FOR FLUID POWER

**Telescopic cylinders and cylinders of nonbolted end construction –
Pressure rating supplement to NFPA/T2.6.1 R2-2000, Fluid power
components – Method for verifying the fatigue and establishing the
burst pressure ratings of the metal pressure containing envelope of a
telescopic and nonbolted end fluid power cylinder**

Descriptors: cylinder, element; fluid power; pressure, cyclic test; pressure, rated fatigue; pressure, rated burst; pressure burst test; pressure rating, by analytical methods; pressure rating, by similarity; pressure rating, by test; pressure rating, telescopic and nonbolted end fluid power cylinder.

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 2000 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 Recommended standards, after publication, may be revised or withdrawn at any time and current information on all approved recommended standards may be received by calling or writing the National Fluid Power Association, Inc.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 *Telescopic cylinders and cylinders of nonbolted end construction – Pressure rating supplement to NFPA/T2.6.1 R2-2000, Fluid power components – Method for verifying the fatigue and establishing the burst pressure ratings of the metal pressure containing envelope of a telescopic and nonbolted end fluid power cylinder*, NFPA/T3.6.31 R2-2000.

This project was initiated on 11 February 1997. The Technical Board approved the TSP on 10 April 1997. The first draft was an update to coordinate the document with the update of NFPA/T2.6.1 R2. Both were issued for general review on 30 December 1998. Comments were reviewed at the T2.6 committee meeting of 9 February 1999, and proposed changes were reviewed by the T3.21 committee at its meeting of 18 May 1999. NFPA Headquarters prepared the ballot draft on 2 August 1999. One negative ballot was reviewed by the T2.6 committee at its meeting on 22 September 1999 but not resolved. It was overridden by the Technical Board, and the document given final approval, at their meeting of 18 November 1999.

Project Group members who developed this standard:

John Berninger

Project Chairman and T2.6 Chairman
Parker Hannifin

Donald Blackman

Section Chairman
Miller Fluid Power Corp.

Donald Selke*

Section Chairman
The Sheffer Corp.

Thomas Hurley

Section Secretary
Mannesmann Rexroth Corporation

Paul Schacht

Technical Auditor
Bosch Automation Technology

June M. VanPinsker

Technical Coordinator
National Fluid Power Association

Lido Boni

Parker Hannifin Corp.

Matt Boswell

Bosch Automation Technology

Jerry Carlin

Eaton Corp.

Richard Schink

Eaton Corp.

* Retired

/jmv

Introduction

In fluid power systems, power is transmitted and controlled through a fluid (liquid or gas) under pressure within an enclosed circuit. During operation, telescopic and nonbolted end fluid power cylinders in a system may be loaded from internal pressure, gravity, inertia, thermal variations and external forces. The nature of these loads can vary from a single static application, to continuously varying amplitudes, repetitive loadings and even shock.

It is important to know how well a telescopic and nonbolted end fluid power cylinder can withstand these loads but this standard addresses only the loading due to internal pressure.

There are many ways in which internal pressure loads are imposed upon a telescopic and nonbolted end fluid power cylinder. This standard considers a broad range of waveforms but within prescribed time limits, temperatures, environmental conditions and only upon certain metals. It is anticipated that these limitations could still provide sufficient common ground for comparing products. This rating method, therefore, provides the system designer with certain information to assist in a selection of telescopic and nonbolted end fluid power cylinders for an application. The designer still has the responsibility to consider the other loading characteristics described above and to determine how they might affect the cylinder's ultimate pressure retaining capability.

This standard serves as a universal "verification test" to give credibility to the many in-house and other methods of determining telescopic and nonbolted end fluid power cylinders pressure ratings. The credibility is based upon the fundamental nature of fatigue of metals with its statistical treatment and use of the pressure rating verification theory developed in NFPA standard NFPA/T2.6.1 R2. Nevertheless, design knowledge of the component population and its representative samples, including consistency in materials, shapes, fabrication techniques, etc. is necessary to maximize accuracy in the verification method.

The basic pressure rating document, NFPA/T2.6.1 R2, established a group of common requirements intended to provide an industry-wide philosophy and basic standard, providing a rational for judging a component's ability as a pressure containing envelope. Although the specific applicability of NFPA/T2.6.1 R2 is limited, it immediately established a uniform base for subsequent, more specific proposed NFPA recommended standards for individual fluid power components. This standard implements NFPA/T2.6.1 R2 and specifically applies to telescopic and nonbolted end fluid power cylinders.

The method for verifying the fatigue and establishing the burst pressure ratings of the metal pressure containing envelope of a tie rod or bolted cylinders is covered in a separate document, NFPA/T3.6.29 R2.

This version of NFPA/T3.6.31 R2 replaces earlier editions and utilizes the same basic theory. Products rated under the first (1977) edition may not be rated to the same values under this edition. See 13.1 for the differences in rating identification.

This is a preview of "ANSI/(NFPA)T3.6.31 R...". [Click here to purchase the full version from the ANSI store.](#)

Telescopic cylinders and cylinders of nonbolted end construction – Pressure rating supplement to NFPA/T2.6.1 R2-2000, Fluid power components – Method for verifying the fatigue and establishing the burst pressure ratings of the metal pressure containing envelope of a telescopic and nonbolted end fluid power cylinder

1 Scope

1.1 This standard provides:

- test and statistical methods for generating fatigue distribution data;
- test and statistical methods for conducting a verification of the pressure ratings on telescopic and nonbolted end fluid power cylinders;
- common requirements and an industry-wide philosophy in judging one type of pressure capability for telescopic and nonbolted end fluid power cylinders;
- uniform methods of product comparison.

1.2 Follow NFPA/T2.6.1 R2.

1.3 This standard encourages manufacturers to use this common method to enhance the credibility of their pressure ratings.

2 Normative references

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

NFPA/T2.6.1 R2-2000, *Fluid power components – Method for verifying the fatigue and establishing the burst pressure ratings of the pressure containing envelope of a metal fluid power component.*

NFPA/T3.6.29 R2-19xx, *Tie rod or bolted cylinder pressure rating supplement to NFPA/T2.6.1 R2-19xx, Fluid power systems and products – Method for verifying the fatigue and establishing the burst pressure ratings of the metal pressure containing envelope of a tie rod or bolted cylinder.*

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

ASTM E466-1996, *Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials.*