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Pneumatic valve – 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 pressure containing envelope of a metal fluid power pneumatic valve

(Revision of NFPA/T3.21.4 R1-1994)

A NATIONAL INDUSTRY STANDARD FOR FLUID POWER

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NATIONAL FLUID POWER ASSOCIATION
3333 N. Mayfair Road, Suite 211• Milwaukee, WI 53222-3219 USA
Phone: +1 414 778-3344 • Fax: +1 414 778 3361 • e-mail: nfpa@nfpa.com

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Foreword

This Foreword is not part of NFPA Recommended Standard *Pneumatic valve – 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 pressure containing envelope of a metal fluid power pneumatic valve*, NFPA/T3.21.4 R2-2000.

This project was initiated on 11 February 1997 and the TSP was approved on 10 April 1997. The first draft was an update to coordinate the document with the updated NFPA/T2.6.1 Rx. 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. The ballot draft was prepared by NFPA headquarters on 2 August 1999. There were no negative ballots and the Technical Board granted final approval on 18 November 1999.

Project Group Members who developed this standard:

John Berninger
Project Chairman and T2.6 Chairman
Parker Hannifin Corp.

Jim Rosenbury
Section Chairman
Ingersoll-Rand Company

Clifford Allen
Section Vice Chairman
Lexair, Inc.

Logan Mathis*
Past Section Chairman
Ross Operating Valve Co.

Paul Schacht
Technical Auditor
Bosch Automation Technology

June VanPinsker
Technical Coordinator
National Fluid Power Association

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

Michael Lyons
Mannesmann Rexroth Corporation

*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, pneumatic valve(s) 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 pneumatic valve 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 pneumatic valve. 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 pneumatic valves 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 pneumatic valve's ultimate pressure retaining capability.

There are many standards already in existence for pressure rating individual pneumatic valves (e.g. maximum allowable operating pressure), and this standard is not intended to displace them. Instead, a method of fatigue verification is provided.

This standard serves as a universal “verification test” to give credibility to the many in-house and other methods of determining pneumatic valve 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/T2.6.1 R2. Nevertheless, design knowledge of the pneumatic valve population and its representative samples, including consistency in materials, shapes, fabrication techniques, etc., is necessary to maximize accuracy in the verification method.

This standard describes specific methods for testing pneumatic valves, verifying their fatigue pressure ratings, and establishing burst pressure ratings. It also provides specific means to determine some of the optional parameters.

This standard is a supplement to the basic pressure rating standard, NFPA/T2.6.1 R2. It follows the provisions of that document but is more specific to pneumatic valves. Application of this pressure rating method will require use of both documents.

This version of NFPA/T3.21.4 R2 replaces earlier editions and utilizes the same basic theory. Products rated under the first (1977) editions may not be rated to the same values under this edition. See clause 11 for the differences in rating identification.

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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 pneumatic valves;

– common requirements and an industry-wide philosophy in judging one type of pressure capability for pneumatic valves;

– uniform methods of product comparison.

1.2 This standard limits conditions as follows:

– constant amplitude, pressure induced loading of the elements that constitute or maintain the pressure containing envelope;

– product life of at least 100,000 cycles;

– defined conditions for pressure levels and pulse durations;

– temperatures from the charpy impact transition temperature to the threshold of creep sensitivity;

– environments which are chemically compatible with the materials of the pressure containing envelope;

– materials that are aluminum, magnesium, steel, iron, copper based alloys, cobalt, titanium, stainless steels, nickel steels, and monel. Specifically excluded are creep sensitive materials such as: zinc, plastic, rubber, and sealing devices.

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