INTERNATIONAL STANDARD

ISO 19973-5

First edition
2015-09-01

Pneumatic fluid power — Assessment of component reliability by testing —

Part 5: Non-return valves, shuttle valves, dual pressure valves (AND function), one-way adjustable flow control valves, quick-exhaust valves

Transmissions pneumatiques — Évaluation par essais de la fiabilité des composants —

Partie 5: Clapets anti-retour, vannes sélecteur de circuit, distributeurs à deux pressions (fonction AND), limiteurs de débit réglable monodirectionnel, purge rapide

Reference number
ISO 19973-5:2015(E)

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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **2**
4 Symbols and units ... **2**
5 Test equipment ... **2**
5.1 Basic test equipment ... 2
5.2 Connecting piping and volumes ... 5
6 Test conditions ... **5**
6.1 General test conditions ... 5
6.2 Initial condition ... 5
6.3 Cycling frequencies ... 5
6.3.1 Non-return valves and one-way adjustable flow control valves ... 5
6.3.2 Pilot-operated non-return valves ... 6
6.3.3 Quick-exhaust valves ... 7
6.3.4 Shuttle valves and dual pressure valves (AND function) ... 8
7 Test procedure ... **10**
7.1 Timing of checks and measurements ... 10
7.2 Type and scope of checks and measurements ... 10
7.2.1 Functional check ... 10
7.2.2 Measurement of leakage ... 10
7.2.3 Measurement of shifting pressures ... 11
7.3 Recording of test data ... 11
8 Failure criteria and threshold levels ... **12**
8.1 General ... 12
8.2 Functional failure ... 12
8.3 Failure due to leakage ... 12
8.4 Failure due to shifting pressures ... 12
8.5 Customised agreements ... 12
9 Data analysis ... **12**
10 Test report ... **13**
11 Identification statement (reference to this part of ISO 19973) ... **13**
Annex A (informative) **Test data sheet** ... **14**
Bibliography ... **18**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 131, *Fluid power systems*.

ISO 19973 consists of the following parts, under the general title *Pneumatic fluid power — Assessment of component reliability by testing*:

— *Part 1: General procedures*

— *Part 2: Directional control valves*

— *Part 3: Cylinders with piston rod*

— *Part 4: Pressure regulators*

— *Part 5: Non-return valves, shuttle valves, dual pressure valves (AND function), one-way adjustable flow control valves, quick-exhaust valves*

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Introduction

In pneumatic fluid power systems, power is transmitted and controlled through a gas under pressure within a circuit. Pneumatic fluid power systems are composed of components and are an integral part of various types of machines and equipment. Efficient and economical production requires highly reliable machines and equipment. This part of ISO 19973 is intended to provide requirements and test conditions that permit the assessment of the inherent reliability of pneumatic *non-return valves, shuttle valves, dual pressure valves (AND function), one-way flow control valves, quick-exhaust valves*.

It is necessary that machine producers know the reliability of the components that make up their machine's pneumatic fluid power system. Knowing the reliability characteristic of the component, the producers can model the system and make decisions on service intervals, spare parts inventory and areas for future improvements.

There are three primary levels in the determination of component reliability:

a) preliminary design analysis: finite element analysis (FEA), failure mode and effect analysis (FMEA);

b) laboratory testing and reliability modelling: physics of failure, reliability prediction, pre-production evaluation;

c) collection of field data: maintenance reports, warranty analysis.

Each level has its application during the life of a component. A preliminary design analysis is useful to identify possible failure modes and eliminate them or reduce their effect on reliability. When prototypes are available, in-house laboratory reliability tests are run and initial reliability can be determined. Reliability testing is often continued into the initial production run and throughout the production lifetime as a continuing evaluation of the component. Collection of field data are possible when products are operating and data on their failures are available.

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Pneumatic fluid power — Assessment of component reliability by testing —

Part 5: Non-return valves, shuttle valves, dual pressure valves (AND function), one-way adjustable flow control valves, quick-exhaust valves

1 Scope

This part of ISO 19973 provides test procedures for assessing the reliability of the following types of pneumatic valves:

— non-return (check) valves;

— pilot-operated non-return valves;

— shuttle valves;

— dual pressure valves (AND function);

— one-way adjustable flow control valves;

— quick-exhaust valves

by testing and the methods of reporting the results of testing. General test conditions and the calculation method are provided in ISO 19973-1. The methods specified in ISO 19973-1 apply to the first failure, as obtained with the three-points moving average (*3PMA*) method, without repairs, but excluding outliers.

The lifetime of these pneumatic valves is usually given as a number of cycles. Therefore, whenever the term "time" is used in this part of ISO 19973, this variable is understood as a number of cycles.

This part of ISO 19973 also specifies test equipment and threshold levels for tests to assess the reliability of these pneumatic valves.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphical symbols for conventional use and data-processing applications*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 8778, *Pneumatic fluid power — Standard reference atmosphere*

ISO 11727, *Pneumatic fluid power — Identification of ports and control mechanisms of control valves and other components*

ISO 19973-1, *Pneumatic fluid power — Assessment of component reliability by testing — Part 1: General procedures*

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ISO 80000-1, *Quantities and units — Part 1: General*

IEC 60050-191, *International Electrotechnical Vocabulary, chapter 191: Dependability and quality of service*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598, ISO 19973-1, IEC 60050-191, and the following apply.

NOTE Where a conflict of definitions exists for a term in any of these three documents, the following priority order applies: first, ISO 19973-5; second, ISO 19973-1; third, ISO 5598; and fourth, IEC 60050–191.

3.1
dual pressure valve (AND function)
valve in which an output signal is only obtained when both inlets are under pressure

Note 1 to entry: The weaker signal is fed to the output.

4 Symbols and units

Units of measurement shall be in accordance with ISO 80000-1.

NOTE 1 Graphical symbols used in this part of ISO 19973 conform to the requirements of ISO 1219-1.

NOTE 2 Ports are identified in accordance with ISO 11727.

5 Test equipment

5.1 Basic test equipment

Basic test equipment shall conform to the requirements given in Table 1 and Figure 1 through Figure 5, depending on the type of valve under test (test unit). Any silencers fitted to exhaust ports shall not restrict the valve's flow rate. The rated flow rate of the directional control valves shall be equal to or greater than the rated flow rate of the test unit.

The basic circuits in Figures 1 through 5 do not incorporate all the safety devices necessary to protect against damage in the event of component failure. It is important that those responsible for carrying out the test give due consideration to safeguarding both personnel and equipment.

Table 1 — Key to the test circuit components shown in Figures 1 through 5

Key item number	Description
1, 2, 3	ports of the test unit
4	supply pressure
5	silencer
6	volume
7	pressure transducer, necessary for test set-up and intermediate functional tests only
8	test unit
12	pilot port
V1, V2	directional control valve

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