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**Pneumatic fluid power — Assessment of  
component reliability by testing —**

**Part 1:  
General procedures**

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

*Partie 1: Procédures générales*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 19973-1 was prepared by Technical Committee 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*

## 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.

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, which can be determined from laboratory testing, 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 is possible when products are operating and data on their failures are available.

Specific component test procedures and exclusions are provided in ISO 19973-2, ISO 19973-3 and ISO 19973-4.

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# Pneumatic fluid power — Assessment of component reliability by testing —

## Part 1: General procedures

### 1 Scope

This part of ISO 19973 provides general procedures, the calculation method for assessing the reliability of pneumatic fluid power components and the methods of reporting. These procedures are independent of the kinds of components and of their design.

This part of ISO 19973 also provides general test conditions and a method for data evaluation.

**NOTE** Because the service life of any component is subject to variations, a statistical evaluation assists the interpretation of the test results.

The methods specified in this part of ISO 19973 apply to the first failure without repairs (see IEC 60300-3-5) [4], but exclude outliers; however, because outliers can be highly significant, information about how to deal with them is given in Annex D.

### 2 Normative references

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

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

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

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

IEC 61649, *Goodness-of-fit tests, confidence intervals and lower confidence limits for Weibull distributed data*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-1, ISO 5598 and IEC 60050-191 and the following apply.

#### 3.1

##### **catastrophic failure**

sudden failure of an item that results in its complete inability to perform all required functions

[IEC 60050-191]