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AMENDMENT 1
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Pneumatic fluid power — Assessment of component reliability by testing —

Part 2: Directional control valves

AMENDMENT 1

Transmissions pneumatiques — Évaluation par essais de la fiabilité des composants —
Partie 2: Distributeurs

AMENDEMENT 1

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Foreword

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This document was prepared by Technical Committee ISO/TC 131, *Fluid power systems*.

A list of all parts in the ISO 19973 series can be found on the ISO website.

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Pneumatic fluid power — Assessment of component reliability by testing —

Part 2: Directional control valves

AMENDMENT 1

Clause 2 Normative references, Page 1

Add the following references to Clause 2.

ISO 12238, *Pneumatic fluid power — Directional control valves — Measurement of shifting time*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

Add the following new Annex B for the estimation of B_{10D} values for valves used in functional safety applications.

Annex B
(normative)

Estimating B_{10D} for valves used in functional safety applications

B.1 Introduction

When a machine is built, a risk assessment must be conducted for evaluation of potential hazards according to ISO 12100. This is also a requirement in the ISO 4413 and ISO 4414 standards for hydraulic and pneumatic systems. ISO 13849 is a standard that describes a method for risk reduction on safety related parts of control systems, in accordance with ISO 12100. Components in safety related parts of control systems shall have sufficient reliability to perform their function when a hazard occurs, otherwise the component is considered to have failed dangerously.

Reliability of a pneumatic component is typically characterized by its B_{10}, η and β values, obtained from a Weibull plot using all defined failures from Clause 8. B_{10D} values are obtained only from failures that are classified as dangerous. For pneumatic valves, shifting off-time failures are considered dangerous failures whereas shifting on-time failures are not considered dangerous because, according to the basic safety principle ("use of de-energization principle" of ISO 13849-2:2012, Table B.1), that is not the action typically required for implementing a safety function. Leakage is a performance failure and not considered a dangerous failure (unless it is so severe as to prevent a return shift). Minimum shifting pressure is not considered a dangerous failure because it is typically much lower than the operating pressure of a system. If these or additional failure types (based upon a specific application) lead to a dangerous failure, these failure mechanisms shall be considered as well. Additional failure mechanisms shall clearly be based on agreement between supplier and purchaser.

The method for estimating a B_{10D} life in this Annex is based on using the termination life at the first termination failure in a sample of seven test units. The cumulative failure for that first of seven test units is 9,4 % (from a Median Rank table). This is close to the 10 % level on which the B_{10D} life is defined, and the first failure life is considered to be an acceptable estimate for the B_{10D}. Thus, it is not necessary to continue the test after the first termination failure. If there is one suspension in the sample of seven test units, before a first termination failure occurs, the cumulative failure is 11,4 % at the first failure life. This is still considered to be an acceptable estimate of the B_{10D} life.

The ISO 13849 series of standards includes two other methods to estimate a B_{10D} life:

1) $B_{10D} = 2 \times B_{10}$ if only B_{10} data is available,

2) B_{10D} = 20 million cycles as a default value if data is not available.

These methods are applicable to a user of the ISO 13849 series of standards if no B_{10D} values are available; whereas this Annex is for a supplier for testing to estimate a B_{10D} value.

B.2 Test equipment and test conditions

Set up the test equipment in accordance with Clause 5.