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Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Classification system and qualification procedures for type testing of stem seals for valves

National foreword

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Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Classification system and qualification procedures for type testing of stem seals for valves

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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 document 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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This document was prepared by Technical Committee ISO/TC 153, *Valves*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The objective of this document is to establish test methods to evaluate the performance of different designs and constructions of stem sealing for valves in order to reduce fugitive emissions.

The results from the testing provide a means of classification and qualification under various test conditions.

This classification will help valve manufacturers to choose a suitable stem seal system to allow valve testing in accordance with ISO 15848-1.

The procedures of this document can only be used with the application of necessary precautions for testing with flammable or inert gas at temperature and under pressure.

Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Classification system and qualification procedures for type testing of stem seals for valves

1 Scope

This document covers the type testing of valve stem seals using a test fixture that is designed and fully defined to be representative of the performance of a valve using similar geometry.

This document is applicable to stem seals for multi-turn, linear and quarter turn valves. It is intended to provide comparative type test results confirming the performance of seal manufacturers' stem seal designs.

This document is not intended to replace type testing of complete valve assemblies or valve production testing.

Compliance with this document is not intended to be a mandatory qualification test to be completed for a stem seal design prior to testing a valve to the requirements of ISO 15848-1.

Compressible seals with and without live loading, elastomers and pressure energized seals are in the scope of this document.

Corrosion tests are not included in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 15848-1:2015, *Industrial valves — Measurement, test and qualification procedures for fugitive emissions — Part 1: Classification system and qualification procedures for type testing of valves*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15848-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

live loading

application of a load to the gland follower of adjustable compression stem seals using a stored energy device such as a spring

3.2

quarter-turn stem

QT

test fixture designed to simulate movement of a valve to the fully open or close position with approximately 90° rotation of the stem

3.3

non-rotating rising stem

NRRS

test fixture designed to simulate valve stem movement in an axial direction, with no rotation

3.4

rotating non-rising stem

RNRS

test fixture designed to simulate a valve in which the stem movement consists of one or multiple rotations but with no movement of the stem in an axial direction

3.5

rotating rising stem

RRS

test fixture designed to simulate a valve in which the movement of the stem is in an axial direction, with rotation

3.6

seal housing

metallic component(s) containing non-adjustable elastomer, spring and pressure energized *seal stack* ([3.7](#))

3.7

seal stack

several individual sealing elements, at least one of which is energized by a spring or elastomer, which can have different profiles arranged in a defined sequence to form a non-adjustable spring and pressure energized stem seal assembly

3.8

stem movement

stroke/angle for stroking the stem

3.9

test fixture

test stand packing gland and/or seal housing constructed as a fixture designed to simulate a typical valve

3.10

temperature range

minimum and maximum temperatures at which a stem seal is tested to assess its performance, behaviour, suitability and tightness

3.11

full rated travel of stem

maximum stroke/angle movement of the stem to open and close the fixture in which the seal has been tested

Note 1 to entry: Full rated travel is defined as two times the stroke.

4 Type test

4.1 Test facility

The tests shall be carried out at the manufacturing facilities or at an external facility. However, a single set of minimum requirements shall be established for both facilities. These requirements can include, but are not limited to:

- demonstration of the capability to perform required tests, inspections, analysis and examinations, in terms of both personnel qualification and equipment availability;
- a quality management system;
- a health, safety and environment management system;

- familiarity with pressure and leakage testing standards, as well as the reporting of the test results (in appropriate formats).

4.2 Stem seal type

4.2.1 General

Compression packing is a widely used stem seal type in industrial valves. But a significant number of industrial valves uses stem seal designs other than compression packing, e.g. part turn rotary valves, high pressure globe valves.

Many industrial valve applications where fugitive emissions are critical use pressure energised seal systems (e.g. elastomers, pressure energised lip seals), due to the high sealing performance and low maintenance requirements of these designs.

A standardized or specially manufactured test fixture shall be used to test stem seals by performing tests at the experimental conditions specified by this document. If the capability of the test fixture does not meet the specified test conditions, only temperature and pressure conditions covered by the test fixture performance shall be tested.

4.2.2 Adjustable sealing (compression)

4.2.2.1 Description

Made from relatively soft, pliant materials, compression or mechanical packings consist of a number of rings, which are inserted into the annular space (stuffing box) between the rotating or reciprocating stem and the body or bonnet of a valve.

By tightening a follower or packing gland against the top or end ring, pressure is transmitted to the packing set. This expands the rings radially against the side of the stuffing box and the reciprocating or rotating stem creating an effective seal.

Adjustable compression packing sealing designs can include live loaded types where the follower will continue to load the packing in order to compensate for packing compression loss by thermal cycling, friction, extrusion, creep, relaxation, consolidation etc. as the valve operates. These live loaded compression seal designs apply the load to the packing by using a stored energy device such as a spring.

Compression packing seals or gland seals are used to seal a variety of fluids under a range of conditions. They are used to help contain water, acids, solvents, gases, oil and other chemicals that are subjected to various temperatures and pressures.

4.2.2.2 Specification and materials

The most common type of compression packing is braided compression packing.

This type of packing is typically installed by cutting rings of the required size from rope packing, or using pre-formed rings, inserting them into a stuffing box and tightening them to achieve the right density. However, alternative installation processes may also be used.

Depending on the service, construction materials can be as diverse as plants or animal derivatives, mineral fibres or synthetic plastics, and even metal.

Typical materials for compressible packing include, but are not limited to

- PTFE (polytetrafluoroethylene)/graphite
- PTFE
- aramide/PTFE
- aramide