International Standard

ISO 22109

# Industrial valves — Gearboxes for valves

*Robinetterie industrielle — Réducteurs pour appareil de robinetterie*



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# Foreword

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This document was prepared by Technical Committee ISO/TC 153, *Valves*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 69, *Industrial valves*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 22109:2020), which has been technically revised.

The main changes are as follows:

— the rated torques 32 001 to 250 000 were added to Table 2;

— the mechanical advantage for gearboxes other than worm gearboxes was added to 5.4.2 and 5.4.3;

— the mechanical advantage along the stroke has been changed to above 80 % of the initial values in Clause A.5;

— editorial changes were made.

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.

# Industrial valves — Gearboxes for valves

## 1 Scope

This document specifies basic requirements for gearboxes to operate industrial valves for manual and automated on/off and modulating duties, including manual override gearboxes. It includes guidelines for classification, design and methods for conformity assessment.

This document does not cover gear systems which are an integral part in the design of valves and subsea gearboxes.

Other requirements or conditions of use different from those indicated in this document are agreed between the purchaser and the manufacturer or supplier (first party) prior to order.

## 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 5210, *Industrial valves — Multi-turn valve actuator attachments*

ISO 5211, *Industrial valves — Part-turn actuator attachments*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*



## 3 Terms and definitions

For the purposes of this document, the following terms and definitions 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**
**gearbox**
self-contained gear unit for torque/thrust/speed/orientation change that can be manually operated and/or automated with an actuator

**3.2**
**ambient temperature**
temperature of the environment surrounding the *gearbox* (3.1)

**3.3**
**end of travel**
predefined position related to a fully open or a fully closed condition

**3.4**
**end stop**
mechanical device designed to stop the *gearbox* (3.1) drive train movement

**3.5**
**endurance**
lifetime without failure at specified conditions and proved during the type test

**3.6**
**indicating arrangement**
device, externally visible, showing the position of the valve obturator

**3.7**
**rated torque**
classification defined by the *gearbox* (3.1) manufacturer used to define the maximum gearbox operating torque capability

**3.8**
**rated thrust**
maximum thrust for linear output actuators, available for valve operation, as stated by the manufacturer or maximum thrust for multi-turn output actuators, the actuator can withstand as stated by the manufacturer

[SOURCE: ISO 22153:2020, 3.7]

## 4 Classification

### 4.1 General

Gearboxes are classified per kind of operation and rotation and/or linear movement as detailed in 4.2 and 4.3.



### 4.2 Kind of operation

There are three kinds of operation:

— manual: gearbox designed for manual operation only, typically this has only one input;

— automated: gearbox designed for automated operation, typically this has only one input, normally by an actuator for example according to ISO 22153;

— manual override: gearbox designed for overriding automated operation, typically this has two inputs. The primary input is normally an actuator. The secondary input is normally by a handwheel. The secondary input is normally disengaged when the gearbox is being used in automated mode and is engaged when manual operation is required, e.g. on loss of power.

### 4.3 Kind of rotation

There are two kinds of rotation:

— part-turn: gearbox which transmits torque to the valve for a rotation of less than one revolution;

— multi-turn: gearbox which transmits torque for a rotation of at least one revolution and may be capable of withstanding thrust to the valve.

## 5 Design requirements

### 5.1 Endurance

The basic design requirements for automated gearboxes duty classification are given in Table 1.

**Table 1 — Automated duty classification**

| Class | Duty | Definition |
|---|---|---|
| A | On-off | The gearbox is required to drive the valve through its entire travel from the fully open position to the fully closed position or vice-versa. |
| B | Inching/positioning | The gearbox is required to occasionally drive the valve to any position (fully open, intermediate and fully closed). |
| C | Modulating | The gearbox is required to frequently drive the valve to any position between fully open and fully closed. |
| D | Continuous modulating | The gearbox is required to continuously drive the valve to any position between fully open and fully closed. |

The gearbox shall be designed to meet the endurance criteria defined in Table 2 or Table 3.

If the gearbox is provided in an automated version or required for a future automated version, it shall be designed to have a minimum endurance in accordance with Table 2 or Table 3.

Gearboxes shall be type-tested in accordance with Clause A.2 to Clause A.5.

**Table 2 — Part-turn gearboxes**

| **Rated torque**[a] (Nm) | **Manual** | **Automated** | | |
|---|---|---|---|---|
| | **On-off** (number of cycles)[b] | **Class A and B on-off and inching/positioning** (number of cycles)[b] | **Class C modulating** (number of starts)[c] | **Class D continuous modulating** (number of starts)[c] |
| Up to 125 | 500 | 10 000 | 1 800 000 | 10 000 000 |
| 126 to 1 000 | 500 | 10 000 | 1 200 000 | 10 000 000 |
| 1 001 to 4 000 | 500 | 5 000 | 500 000 | 5 000 000 |
| 4 001 to 32 000 | 300 | 2 500 | 250 000 | T.B.A.[d] |
| 32 001 to 63 000 | 250 | 1 000 | T.B.A.[d] | T.B.A.[d] |
| 63 001 to 250 000 | 250 | 500 | T.B.A.[d] | T.B.A.[d] |
| Above 250 000 | 250 | T.B.A.[d] | T.B.A.[d] | T.B.A.[d] |

[a] Based on ISO 5211.

[b] One cycle consists of nominal 90 ° angular travel at the driving component in both directions (i.e. 90 ° to open and 90 ° to close). The gearbox is able to transmit 100 % of the rated torque for at least 4,5 ° at each end of travel or for at least 9 ° at either opened or closed position in both directions. The average load cannot be below 30 % of the rated torque for the remaining travel (see Annex B). For angular travel other than 90 °, the endurance is agreed between the purchaser and the manufacturer or supplier. During testing a deviation of +20 % and −5 % in load is accepted.

[c] One start consists of a movement at least 1 % in either direction, with a load of at least 30 % of the rated torque.

[d] "T.B.A." means to be agreed between manufacturer/supplier and purchaser. There is no requirement to meet the values quoted at lower rated torque ranges.