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BSI Standards Publication

Industrial-process measurement and control — Data structures and elements in process equipment catalogues

Part 21: List of Properties (LOP) of automated valves for electronic data exchange — Generic structures

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National foreword

This British Standard is the UK implementation of EN 61987-21:2016. It is identical to IEC 61987-21:2015.

The UK participation in its preparation was entrusted by Technical Committee GEL/65, Measurement and control, to Subcommittee GEL/65/2, Elements of systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Industrial-process measurement and control - Data structures and elements in process equipment catalogues - Part 21: List of Properties (LOP) of automated valves for electronic data exchange - Generic structures (IEC 61987-21:2015)

Mesure et commande dans les processus industriels - Structures de données et éléments dans les catalogues d'équipements de processus - Partie 21: Liste de propriétés (LOP) des vannes automatisées pour l'échange électronique de données - Structures génériques (IEC 61987-21:2015)

Industrielle Leittechnik - Datenstrukturen und -elemente in Katalogen der Prozessleittechnik - Teil 21: Merkmalleisten (ML) für Stellventile für den elektronischen Datenaustausch - Allgemeine Strukturen (IEC 61987-21:2015)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 65B/996/FDIS, future edition 1 of IEC 61987-21, prepared by SC 65B "Measurement and control devices", of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61987-21:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-07-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-10-20

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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60534-7	NOTE	Harmonized as EN 60534-7.
IEC 60770-1	NOTE	Harmonized as EN 60770-1.
IEC 61360-1	NOTE	Harmonized as EN 61360-1.
IEC 61360-2	NOTE	Harmonized as EN 61360-2.
IEC 62424	NOTE	Harmonized as EN 62424.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60534-1	-	Industrial-process control valves - Part 1: Control valve terminology and general considerations	EN 60534-1	-
IEC 61069-5	-	Industrial-process measurement and control - Evaluation of system properties for the purpose of system assessment - Part 5: Assessment of system dependability	EN 61069-5	-
IEC 61508-6	-	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3	EN 61508-6	-
IEC 61987-1	2006	Industrial-process measurement and control - Data structures and elements in process equipment catalogues - Part 1: Measuring equipment with analogue and digital output	EN 61987-1	2007
IEC 61987-10	-	Industrial-process measurement and control - Data structures and elements in process equipment catalogues - Part 10: Lists of Properties (LOPs) for Industrial-Process Measurement and Control for Electronic Data Exchange - Fundamentals	EN 61987-10	-
IEC 61987-11	-	Industrial-process measurement and control - Data structures and elements in process equipment catalogues - Part 11: List of Properties (LOP) of measuring equipment for electronic data exchange - Generic structures	EN 61987-11	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INDUSTRIAL-PROCESS MEASUREMENT AND CONTROL – DATA STRUCTURES AND ELEMENTS IN PROCESS EQUIPMENT CATALOGUES –

Part 21: List of Properties (LOP) of automated valves for electronic data exchange – Generic structures

FOREWORD

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International Standard IEC 61987-21 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this standard is based on the following documents:

FDIS	Report on voting
65B/996/FDIS	65B/1024/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61987 series, published under the general title *Industrial-process measurement and control – Data structures and elements in process equipment catalogues*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

General

The exchange of product data between companies, business systems, engineering tools, data systems within companies and, in the future, control systems (electrical, measuring and control technology) can run smoothly only when both the information to be exchanged and the use of this information have been clearly defined.

Prior to this standard, requirements on process control devices and systems were specified by customers in various ways when suppliers or manufacturers were asked to quote for suitable equipment. The suppliers in their turn described the devices according to their own documentation schemes, often using different terms, structures and media (paper, databases, CDs, e-catalogues, etc.). The situation was similar in the planning and development process, with device information frequently being duplicated in a number of different information technology (IT) systems.

Any method that is capable of recording all existing information only once during the planning and ordering process and making it available for further processing, gives all parties involved an opportunity to concentrate on the essentials. A precondition for this is the standardization of both the descriptions of the objects and the exchange of information.

The IEC 61987 series proposes a method for standardization which will help both suppliers and users of process control equipment to optimize workflows both within their own companies and in their exchanges with other companies. Depending on their role in the process, engineering firms may be considered here to be either users or suppliers.

The method specifies process control equipment by means of blocks of properties. These blocks are compiled into Lists of Properties (LOPs), each of which describes a specific equipment (device) type. The IEC 61987 series covers both properties that may be used in an inquiry or a proposal and detailed properties required for integration of the equipment in computer systems for other tasks.

IEC 61987-10 defines structure elements for constructing lists of properties for electrical and process control equipment in order to facilitate automatic data exchange between any two computer systems in any possible workflow, for example engineering, maintenance or purchasing workflow and to allow both the customers and the suppliers of the equipment to optimize their processes and workflows. IEC 61987-10 also provides the data model for assembling the LOPs.

IEC 61987-11, while specifying a generic structure for measuring equipment, provides several important detail descriptions, such as the handling of composite devices that are also required for LOPs describing automated industrial valves. This part of IEC 61987 specifies the generic structure for Operating and Device Lists of Properties (OLOPs and DLOPs) for automated industrial valves. Automated industrial valves are so-called final control elements and include control valves, automated on/off-valves, and process regulators. It lays down the framework for further parts of IEC 61987 in which complete LOPs for final control elements of different construction and functional principle will be specified. The generic structure may also serve as a basis for the specification of LOPs for other industrial-process control instrument types.

Device type dictionary

Annex A contains a characterisation of final control elements. This is a tree of relationships between different device types. Starting at the root “equipment for industrial-process automation”, it introduces the final control elements. In addition to control valves, actuators as well as accessories such as positioners belong to this group. This characterisation is used in the Process Automation domain of the IEC Common Data Dictionary (CDD).

INDUSTRIAL-PROCESS MEASUREMENT AND CONTROL – DATA STRUCTURES AND ELEMENTS IN PROCESS EQUIPMENT CATALOGUES –

Part 21: List of Properties (LOP) of automated valves for electronic data exchange – Generic structures

1 Scope

This part of IEC 61987 provides

- a characterization for the integration of automated valves, including control valves, automated on/off-valves and process regulators, in the Common Data Dictionary (CDD);
- generic structures in conformance with IEC 61987-10 for Operating Lists of Properties (OLOPs) and Device Lists of Properties (DLOPs) of final control elements.

The generic structures for the OLOP and DLOP contain the most important blocks for final control elements. Blocks pertaining to a specific equipment type will be described in the corresponding part of the IEC 61987 standard series. Similarly, equipment properties are not part of this part of IEC 61987. For instance, the OLOP and DLOP for globe valves and rotary valves are found in IEC 61987-22.

NOTE Within the classification (see also Figure 1), “final control element” has only the specializations automated valves and process regulators. In practice there are other specializations that are not considered in this standard.

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.

IEC 60534-1, *Industrial-process control valves – Part 1: Control valve terminology and general considerations*

IEC 61069-5, *Industrial-process measurement and control – Evaluation of system properties for the purpose of system assessment – Part 5: Assessment of system dependability*

IEC 61508-6, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

IEC 61987-1:2006, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 1: Measuring equipment with analogue and digital output*

IEC 61987-10, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 10: List of Properties (LOPs) for Industrial-Process Measurement and Control for Electronic Data Exchange – Fundamentals*

IEC 61987-11, *Industrial-process measurement and control – Data structures and elements in process equipment catalogues – Part 11: List of Properties (LOP) of measuring equipment for electronic data exchange – Generic structures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61987-10, IEC 61987-11 and IEC 60534-1 apply.

4 General

4.1 Characterization scheme

IEC 61987-1 describes a general classification scheme for industrial process measuring equipment based on measured variables. The introduction of the LOPs of any area of technology into the IEC Common Data Dictionary (CDD) requires the creation of a characterization scheme for the device types of this technology area.

The area of technology considered in this standard concerns final control elements. The characterisation of the area for the CDD is provided in Table A.1.

The area of final control elements belongs to the domain of “Process Automation” in the CDD. This area consists of two sub-areas for:

– control valves and automated on/off-valves, and
– process regulators.

While the sub-area for process regulators contains only a list of device types, the sub-area for control valves and automated on/off-valves comprises the substructure shown in Figure 1. Since the term “valve” is normally used to describe a complete assembly, i.e. valve body, actuator, and accessories such as positioners and feedback units, at the next sub-level the various types of valve are classified according to their valve body assembly. The branch “actuator” in Figure 1 also has the substructure shown in Figure 2.

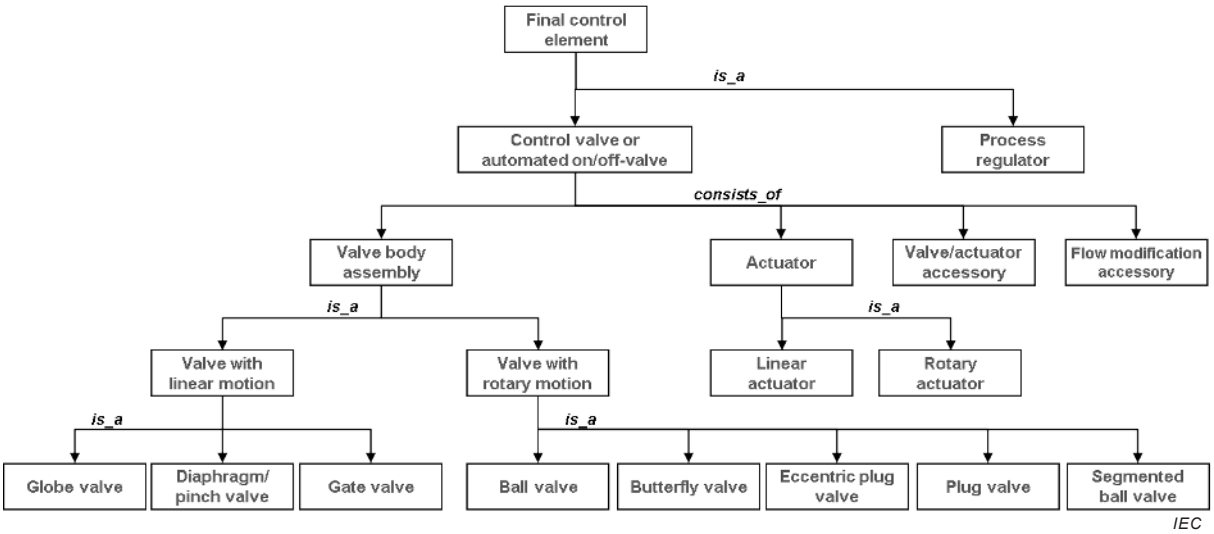

Figure 1 – Characterization of final control elements on the basis of IEC 60534-1

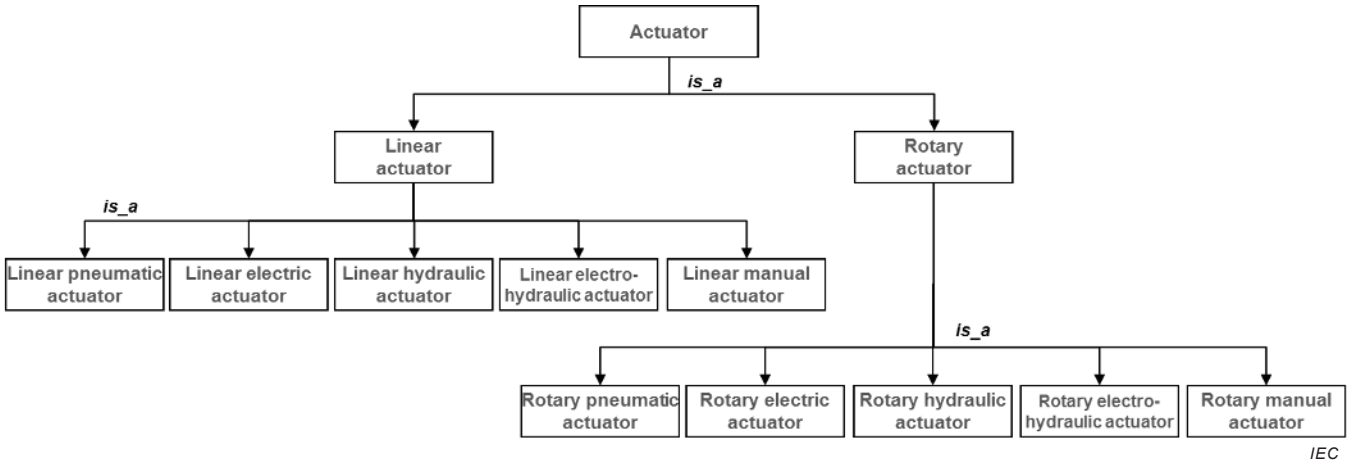

Figure 2 – Characterization of actuators

4.2 OLOP and DLOP

An Operating List of Properties (OLOP) describes an aspect relating to a device type, for example, the operational environment of the device, the device design requirements as well as all the boundary conditions applicable to the point of operation. The structure element “aspect” is described in IEC 61987-11. Among a range of possible aspects, the operating aspect represented by the OLOP is the most important.

The Device List of Properties (DLOP) is used to describe a given device type, for example a globe control valve, a pneumatic linear actuator or a positioner. The DLOP describes, for example, the mechanical construction, the electrical construction and performance of a device. Each DLOP describes a particular device type.

For automated valves two OLOPs are available, one for valve body assemblies and process regulators and one for actuators. This is necessary because of the different requirements that shall be specified for each.

Figure 3 shows the relationship between the OLOP and DLOPs for valve body assemblies. The OLOP is valid for the generic DLOP as well as for the DLOPs for the various device types, for example globe valves, gate valves etc., which differ in their valve body assembly.

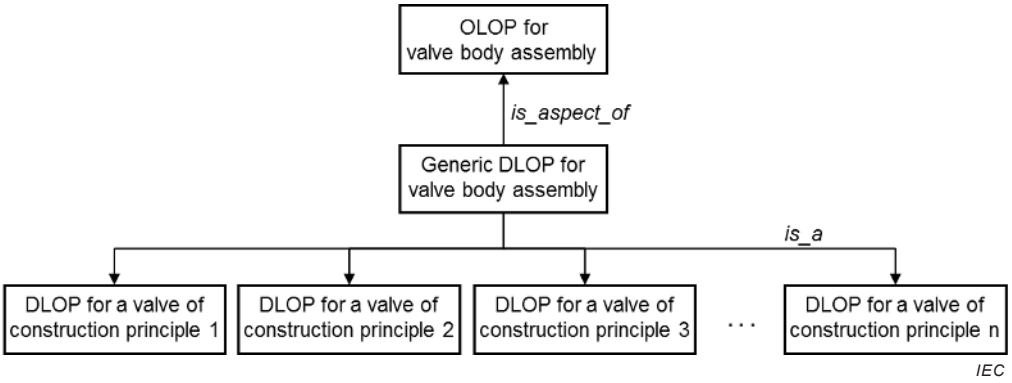

Figure 3 – Assignment of OLOP and DLOPs for valve body assembly

Figure 4 shows the relationship between the OLOP for actuators and the actuator DLOPs. The OLOP is valid for the generic DLOP as well as for the DLOPs for the various device types, for example linear electrical actuators, rotary pneumatic actuators etc., which differ in their construction and power source.

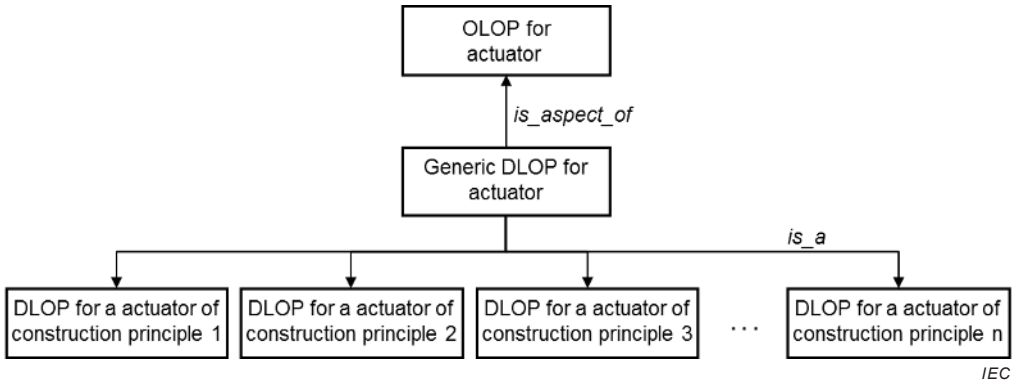

Figure 4 – Assignment of OLOP and DLOPs for actuators

At higher levels of their construction, OLOPs and DLOPs contain blocks of properties that are common to all process variables or device types respectively. This part of IEC 61987 specifies these generic block structures.

Further parts of this standard series specify the block structures and properties of OLOPs and DLOPs for particular construction principles.

4.3 Cardinality and polymorphism

The principles and the description of the cardinality and polymorphic areas applied in this standard are described in IEC 61987-10 and IEC 61987-11. These structural elements introduce a high degree of flexibility in the description of a device and its surroundings, provided the block structure in the LOP is used. They can be briefly described as follows:

- Cardinality allows a LOP element, for example a property block describing a particular feature of a device, to be repeated as many times as necessary.
- Polymorphism allows the introduction of a complete property block from a selection of property blocks at a particular structure level of a LOP.

In the case of final control elements, the cardinality can be used for replication of the “End connection” block. For example a final control element can have four end connections: two for the controlled medium and two for steam heating, requiring four end-connection property blocks. Two of the end connections can be flanges, one a thread and one a welded joint.

5 Operating List of Properties (OLOP)

5.1 Generic block structure

An operating list of properties is a list of properties describing the aspect concerning the operational conditions of the device and additional information regarding the design conditions under which it will be applied. An OLOP contains no information about the device itself: this is to be found in the DLOP.

The role of an OLOP is similar to that of an engineering datasheet, in which data describing the plant environment where the device is to operate are collected. This includes information on the process medium, the ambient conditions, the design safety conditions and plant infrastructure. All of these data are described with an OLOP.

The generic block structure of an OLOP for valve body assemblies and process regulators shall correspond to that shown in Table 1. It corresponds to the generic block structure of an OLOP for measuring equipment (see IEC 61987-11). Details of the individual blocks are to be found in 5.2 to 5.7. The generic block structure for the OLOP of actuators and the accessories of valves follows the general structure.

Table 1 – Generic block structure of an OLOP

Operating list of properties
Base conditions
Process case [c]
Process conditions for final control elements
Process conditions at the inlet [c]
Liquid phase
Vapor phase
Gas phase
Other material properties
Process conditions at the outlet [c]
Liquid phase
Vapor phase
Gas phase
Other material properties
Calculation results
Other process case variable [c]
Operating conditions for device design
Installation design conditions
Environmental design conditions
Normal environmental design conditions
Limiting environmental design conditions
Design conditions for external cleaning in place
Process design conditions
Normal process design conditions
Design conditions for internal cleaning in place
Design conditions for valve body assembly
Pressure-temperature design conditions
Design deratings [c]
Process equipment
Line or nozzle [c]
End connection
Physical location [c]
Available power supply
Process criticality classification
Area classification [c]
[c] The block can be repeated as many times as needed using cardinality, which means that a cardinality property with the name “number of <name of the block>” directly precedes the block (see IEC 61987-10).

5.2 Base conditions

The block base conditions shall contain the properties of the reference variables that are to be used throughout the document. Such variables give the reference state or reference conditions to which calculated variables such as normalized flow rate are calculated.

For example the conditions of pressure and temperature to be used to calculate density would be entered in the properties “absolute base pressure” and “base temperature”.

NOTE Base conditions are often standardized for particular industries or applications.

5.3 Process case

5.3.1 General

The block process case shall contain the properties required to characterize the process media at the point of control. It comprises at least the sub-blocks:

- Process conditions for final control elements

- Other process case variable

NOTE A process case contains the data corresponding to an operating point of the plant at the location where the final control element is installed. It defines process medium-related data such as pressure, temperature, viscosity, conductivity, etc.

5.3.2 Process conditions for final control elements

5.3.2.1 General

The block process conditions for final control elements shall contain properties that characterize the operating state conditions and the physical properties of process media for different phases. It comprises the following blocks:

- Process conditions at the inlet
- Process conditions at the outlet
- Calculation results of control devices

5.3.2.2 Process conditions at the inlet

The block process conditions at the inlet shall contain the properties of the set of common process variables for a stream consisting of one or more phases at the inlet of the final control element.

- Liquid phase
- Vapor phase
- Gas phase
- Other material properties

5.3.2.3 Process conditions at the outlet

The block process conditions at the outlet shall contain the properties of the set of common process variables for a stream consisting of one or more phases at the outlet of the final control element.

- Liquid phase
- Vapor phase
- Gas phase
- Other material properties

5.3.2.4 Calculation results of control devices

The block calculation results of control devices shall comprise the results of calculations based on the current process case such as flow coefficients or sound pressure levels.

5.3.3 Other process case variable

The block other process case variable contains text properties which allow the user to characterize variables that are not foreseen in the block process case variables.

The cardinality property “number of other process case variables” allows the block to be replicated the required number of times to describe all other process case variables.

5.4 Operating conditions for device design

5.4.1 General

The block operating conditions for device design shall contain properties describing the nominal conditions to be found at the control point. It comprises five sub-blocks:

- Installation design conditions
- Environmental design conditions
- Process design conditions
- Design conditions for valve body assembly
- Pressure temperature design conditions

NOTE The corresponding blocks in the DLOP are described in 6.11.

5.4.2 Installation design conditions

5.4.2.1 General

The block installation design conditions shall contain properties that describe the installation conditions at the control point. It comprises one block:

- Deployment design conditions

5.4.2.2 Installation design conditions

The block deployment design conditions shall contain properties that describe installation conditions at the control point.

Examples are the proposed mounting orientation of the device or the special process conditions given.

5.4.3 Environmental design conditions

5.4.3.1 General

The block environmental design conditions shall contain properties that describe the environmental conditions outside the process, under which the final control element will be operated. It comprises three blocks:

- Normal environmental design conditions
- Limiting environmental design conditions
- Design conditions for external cleaning in place

5.4.3.2 Normal environmental design conditions

The block normal environmental design conditions shall contain properties describing the range of operating conditions for which a device is to be designed. These include the ambient temperature or the climate class.

5.4.3.3 Limiting environmental design conditions

The block limiting environmental design conditions shall contain properties describing the extreme values which influence the final control element. These include for example, mechanical shock, maximum and minimum rate of ambient temperature change, maximum and minimum value of storage temperature or vibration.

The final control element shall be able to withstand these extreme values without permanent impairment of its operating characteristics.

5.4.3.4 Design conditions for external cleaning in place

The block design conditions for cleaning in place shall contain properties that describe the conditions beyond the normal ambient conditions as well as the duration of these conditions when the device is cleaned in place.

5.4.4 Process design conditions

5.4.4.1 General

The block process design conditions shall contain properties that describe the process variables for which the device shall be designed to control or withstand. It comprises two blocks:

- Normal process design conditions
- Design conditions for internal cleaning in place

NOTE 1 The process design and operating design conditions are generally associated with the lines or equipment, and are not related to the process case.

NOTE 2 Users can either use the process case or the normal process design conditions to specify the process conditions, but typically not both.

5.4.4.2 Normal process design conditions

The block normal process design conditions shall contain properties describing the range of process conditions at the point of control for which the final control element shall operate within its specified performance limits. The limits are expressed, as maximum and minimum values of, for example, process pressure and temperature.

Process design condition variables are independent of process operation variables. They reflect the minimum and maximum process values that are allowable in the operation of the plant. The final control element shall operate safely and reliably in these conditions.

5.4.4.3 Design conditions for internal cleaning in place

The block design conditions for cleaning in place shall contain properties that describe the conditions beyond normal process design conditions as well as the duration of these conditions when the pipe is cleaned with the device in place.

5.4.5 Design conditions for valve body assembly

In this block, criteria specific to the design of valves shall be found. Examples are the maximum differential pressure at closed valve, leakage rates, allowed sound pressure, and travelling times.

5.4.6 Pressure-temperature design conditions

The block pressure/temperature design conditions shall contain properties that describe the extreme combinations of process temperature and pressure which may occur during the operation of the plant. The block shall contain the sub-block:

- Design deratings

The cardinality property “number of design deratings” determines the number of times the design deratings block is replicated, in order to map a temperature-pressure derating curve.

NOTE For pipe specifications the deratings are implicit in the pipe rating; for vessels they can be specified by the use of this block.

5.5 Process equipment

5.5.1 General

The block process equipment shall contain properties that describe the process equipment at which the point of control is located. The block contains the sub-block:

- Line or nozzle

5.5.2 Line or nozzle

The block line or nozzle shall contain properties that describe the connection end of a piece of a line.

The properties of the line or nozzle end connections are collected in separate sub-blocks. The end connection block is identical for OLOP and DLOP.

The cardinality property “number of end connections” allows multiple connections to be described.

NOTE Line connection properties do not represent valve connection properties. The lines are generally sized and designed based on piping specifications and design criteria, which are independent of the design criteria for valves. The valve connection size is generally not known until the instrument has been selected and sized. Valve sizes are frequently smaller than line sizes and are often not manufactured in all of the end connection styles and material of construction that are available for lines.

5.6 Physical location

5.6.1 General

The block physical location shall contain properties that describe conditions other than those of the environment and process that are in force at the instrument location. The block contains the following sub-blocks:

- Available power supply
- Process criticality classification
- Area classification

The cardinality property “number of physical locations” allows all the locations to be described, where parts of the final control element are to be deployed.

5.6.2 Available power supply

The block available power supply shall contain properties that describe the available power supply. It may contain the following sub-blocks:

- Electrical line power supply
- Electrical loop power supply
- Pneumatic/hydraulic supply

The cardinality property “electrical line power supply” allows more than one source of power to be described for cases in which there is more than one type available in the plant.

5.6.3 Process criticality classification

The block process criticality classification shall contain properties that describe the criticality classification for the means of assuring plant safety, not including hazardous area classifications, for example, the safety integrity level.

5.6.4 Area classification

The block area classification shall contain properties that describe the equipment’s internal, local and remote area, including the wiring concept.

The cardinality property “number of area classifications” allows more locations to be described. The property “type of area classification” describes the location.

6 Device List of Properties (DLOP)

6.1 Basic structure

6.1.1 General

As there are large similarities between measuring equipment and final control elements, the first level structure of the generic Device List of Properties (DLOP) for final control elements closely adheres to the structure defined in IEC 61987-1.The differences are explained in 6.1.3.

6.1.2 Generic block structure

Table 2 shows the generic block structure of the Device List of Properties (DLOP).

Should a device not offer a particular function, for example digital communication, the corresponding block is not filled out or used in the DLOP structure.

Each block comprises a generic set of properties and where appropriate additional sub-blocks. Sub-blocks may be generic for a family of similar devices or particular to a device type. The sub-blocks may also contain other blocks.

Subclauses 6.2 to 6.15 describe the blocks in the generic structure as shown in Table 2. In general, the individual properties have not been described unless they are of special interest, as all carry a definition which can be viewed in the Common Data Dictionary.

A description of the blocks to be found below the generic level is to be found in subsequent parts of the IEC 61987 series.

Table 2 – Generic block structure of a DLOP

Device list of properties
Identification
Application
Parameters of <device group>
Function and system design
Dependability [c]
Input
Control input [c]
Type of control input [p]
<Signal> input
Auxiliary input [c]
Type of auxiliary input [p]
<Signal> input
Output [c]
Type of output [p]
<Signal> output
Digital communication
Digital communication interface [c]
Performance
Reference conditions for the device
Performance variable [c]
Rated operating conditions
Installation conditions
Deployment conditions
Start-up conditions
Environmental design ratings
Normal environmental conditions
Limiting environmental conditions
External cleaning in place conditions
Process design ratings
Normal process conditions
Limiting process conditions
Limiting <process variable> conditions
Internal cleaning in place conditions
Pressure-temperature design ratings
Design deratings [c]
Mechanical and electrical construction
Overall dimensions and weight
Structural design
Explosion protection design approval [c]
Codes and standards approval
Operability
Basic Configuration
Parametrization
Adjustment
Operation
Diagnosis
Power supply
Certificates and approvals
Component part identifications
[c] The block can be repeated as many times as needed using cardinality, which means that a cardinality property with the name “number of <name of the block>” directly precedes the block (see IEC 61987-10).
[p] The block contains a polymorphic area, which consists of a control property for polymorphism with a value list and of as many polymorphic (alternative) sub-blocks as there are values in the value list (see IEC 61987-10). The alternative sub-blocks are the ones directly below the marked block and belonging only to the next structure level. For clarity the table contains only block levels of technical relevance. Additional structural elements for creating polymorphic areas are not shown in the structure (see for example IEC 61987-22).

6.1.3 Relationship to IEC 61987-1

For the generation of the DLOPs, the structure of a DLOP for measuring equipment in IEC 61987-1 shall be taken into account with the following amendments:

a) For final control elements a block Parameters of <device type> has been introduced.

b) In order to characterize the properties of a digital communication interface, which acts as both an input and output, a separate block “Digital communication” has been created.

c) IEC 61987-1:2006, 5.7, “Operating conditions” has been renamed “Rated operating conditions” to distinguish it from its counterpart in the OLOP of “Operating conditions for device design”.

d) IEC 61987-1:2006, 5.8, “Mechanical construction” has been renamed “Mechanical and electrical construction” and has been expanded accordingly.

e) IEC 61987-1:2006, 5.13, “Documentation” has been placed as a separate aspect.

The DLOP or aspects of it contain(s) other elements not included in IEC 61987-1 which are used to describe any calibrations or tests carried out by the manufacturer, the device components, accessories and documentation delivered with the device.

6.2 Identification

The block identification shall contain the properties necessary for unambiguous identification of the equipment, for example manufacturer or supplier, product type and designation. Additional information about the actual equipment supplied, for example serial number and version, may be added as required.

6.3 Application

The block application shall contain properties describing the designated use of the equipment.

6.4 Parameters of <device group>

The block parameters of <device group> shall contain values referring to parameters specific to the device group. Examples are the flow coefficient, the maximum allowable force for a globe valve, or the limit stops for an actuator.

6.5 Function and system design

6.5.1 General

The block function and system design shall contain properties describing system aspects relevant to the characterization and operation of the equipment.

6.5.2 Dependability

The block dependability shall contain properties describing the dependability of the device in accordance with IEC 61069-5 and IEC 61508-6, where applicable.

6.6 Input

6.6.1 General

The block input shall contain information about the means by which an instrument receives its control signal.

NOTE This block is normally only needed for positioners and feedback units.

6.6.2 Control input

6.6.2.1 General

The block control input shall contain all possible input signal types that may be used by an instrument to acquire its control signal.

6.6.2.2 Type of control input

6.6.2.2.1 General

The block type of control input provides properties identifying the function and connected process variable, the appropriate signal input block being selected by the polymorphism control property “Control input type” in the sub-block “Type of control input” containing the polymorphic area. The block name “<Signal> input” in Table 2 stands for a range of the following input type blocks:

- Analog current input
- Analog voltage input
- Pneumatic/hydraulic input
- Manufacturer-specific input

Should the input to be described not be contained within the list of input types, the block “Manufacturer-specific input” shall be used.

NOTE Digital inputs are specified in the Digital communication block.

6.6.2.2.2 <Signal> input

Each block <Signal> input, for example “analog current input”, shall contain properties describing the electrical specifications of the signal interface.

- <signal> parameters
- <signal> on alarm
- Passive and active operation
- Galvanic isolation
- Explosion protection parameters
- Electrical connection
- Cable specifications

6.6.3 Type of auxiliary input

6.6.3.1 General

The block provides properties identifying the function and connected process variable, the appropriate signal input block being selected by the polymorphism control property “Auxiliary input type” in the sub-block “Type of auxiliary input” containing the polymorphic area. The block name “<Signal> input” stands for a range of the following input type blocks:

- Analog current input
- Analog voltage input
- Frequency input
- Manufacturer-specific input

Should the input to be described not be contained within the list of output types, the block “Manufacturer-specific input” shall be used.

NOTE Digital inputs are specified in the Digital communication block.

6.6.3.2 <Signal> input

Each block <Signal> input, for example “analog current input”, shall contain the properties describing the electrical specifications of the signal interface and the assignment of the signal to a process variable.

The content of the “<Signal> input” blocks are different. Generally, the blocks for analog signals contain other parameters than the blocks for binary, frequency and pulse signals. The following sub-blocks can occur in this block.

- Assigned variable
- <signal> parameters
- Signal behaviour
- Passive and active operation
- Galvanic isolation
- Explosion protection parameters
- Electrical connection
- Cable specifications

6.7 Output

6.7.1 General

The block output shall contain properties describing the signals’ output by the instrument.

The number of outputs offered by the instrument is to be entered in the cardinality property “number of outputs” which replicates the output block the corresponding number of times.

If an instrument offers more than one output of the same type, the properties for each shall be entered separately.

NOTE This block is normally only needed for positioners and feedback units.

6.7.2 Type of output

6.7.2.1 General

The polymorphism control property “output type” in the sub-block “Type of output” determines the type of signal output to be described. It replicates the desired block with all associated properties. The block name “<Signal> output” in Table 2 stands for a range of the following output type blocks:

- Analog current output
- Analog voltage output
- Binary output IEC 60947-5-6 (NAMUR)
- Binary current output
- Binary isolated output (relay)
- Binary electronic output (transistor, thyristor etc.)
- Manufacturer-specific output
- Pneumatic/hydraulic output
- Pneumatic/hydraulic output for positioner
- Binary pneumatic/hydraulic output

Should the output to be described not be contained within the list of output types, the block “Manufacturer-specific output” shall be used.

NOTE Digital outputs are specified in the Digital communication block.

6.7.2.2 <Signal> output

The content of the “<Signal> output” blocks are different. Generally, the blocks for analog signals contain other parameters than the blocks for binary signals. The following sub-blocks can occur in this block.

- <signal> parameters
- <signal> on alarm
- Passive and active operation
- Galvanic isolation
- Explosion protection parameters
- Electrical connection
- Cable specifications

6.8 Digital communication

6.8.1 General

The block digital communication shall contain information about the digital communication interfaces provided by the device.

The number of interfaces offered by the equipment is to be entered in the cardinality property “number of communication interfaces” which replicates the “Digital communication interface” block the corresponding number of times. Each individual interface may be assigned a PCE identifier/tag name with category and function as required.

NOTE This block is normally only needed for positioners and feedback units.

6.8.2 Digital communication interface

The block digital communication interface shall contain properties that describe the functional, metrological and electrical aspects of the digital communication interface. The property “type of communication” determines the communication interface to be described, for example HART, PROFIBUS PA, FOUNDATION fieldbus H1[1] etc. Should the communication interface type to be described not be contained within the value list of output types, “Manufacturer-specific output” shall be used.

- Communication protocol
- Communication variable
- Physical layer
- Wired communication interface
- Optical communication interface
- Wireless communication interface
- Device integration
- Fieldbus parameters

[1] HART, PROFIBUS PA, FOUNDATION Fieldbus H1 are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.

6.9 Performance

6.9.1 General

The block performance shall contain properties that describe the performance of final control elements. The properties shall be compiled into the sub-blocks:

- Reference conditions for the device
- Performance variable

The number of variables for which a performance statement is made is determined by the cardinality property “number of performance variables” which replicates the block the corresponding number of times. Each individual output may be assigned a PCE identifier/tag name with category and function as required.

6.9.2 Reference conditions for the device

The block reference conditions for the device shall contain properties describing the conditions under which the measuring equipment was tested and for which the performance specifications apply.

6.9.3 Performance variable

6.9.3.1 General

The block performance variable shall contain properties describing the accuracy and dynamic response of the measuring equipment under reference conditions. The properties shall be compiled into the following sub-blocks:

- Reference conditions for the performance variable
- Percentage performance
- Absolute performance for <performance variable>

6.9.3.2 Reference conditions for the performance variable

The block reference conditions shall contain properties describing the conditions under which the measuring equipment was tested and for which the performance specifications apply.

NOTE The reference conditions block is replicated with the process variable block. Normally the conditions will remain the same, however, there are some cases, where they will be different.

6.9.3.3 Percentage performance

6.9.3.3.1 General

The block percentage performance shall contain properties that describe the accuracy of an output in terms of percent of scale, value or scan. The performance may be expressed over a single range or two or more measurement intervals. In addition to the standard accuracy statements, the percentage performance block shall contain properties pertaining to the influence of external quantities and the dynamic behaviour of the measuring equipment. Information on dynamic and long-term behaviour is entered in the sub-blocks:

- Dynamic behaviour
- Long-term behaviour

6.9.3.3.2 Dynamic behaviour

The block dynamic behaviour shall contain properties that describe the response of a device to a preset change in input.

6.9.3.3.3 Long-term behaviour

The block long-term behaviour shall contain properties that change in the output of a device over a fixed period of time.

6.9.3.4 Absolute performance for <process variable>

6.9.3.4.1 General

The block absolute performance for <process variable> shall contain properties that describe the accuracy of an output in terms of an absolute value. The performance may be expressed over a single range or two or more measurement intervals. In addition to the standard accuracy statements, the absolute performance block shall contain properties pertaining to the influence of external quantities and the dynamic behaviour of the measuring equipment. Information on dynamic and long-term behaviour is entered in the sub-blocks:

- Dynamic behaviour
- Long-term behaviour

6.9.3.4.2 Dynamic behaviour

The block dynamic behaviour shall contain properties that describe the response of a device to a preset change in input.

6.9.3.4.3 Long-term behaviour

The block long-term behaviour shall contain properties that change in the output of a device over a fixed period of time.

6.10 Rated operating conditions

6.10.1 General

The block rated operating conditions shall contain properties describing the conditions under which the equipment can be operated within its specified limits and without permanent impairment of its operating characteristics as well as the safe operating limits. It shall comprise the following four sub-blocks:

- Installation conditions
- Environmental design ratings
- Process design ratings
- Pressure-temperature design ratings

NOTE The rated operations block in the DLOP provides confirmation that the requirements of the design operating conditions block of the OLOP can be met by the equipment, see 5.4.

6.10.2 Installation conditions

6.10.2.1 General

The block installation conditions shall contain properties describing the installation conditions necessary to obtain the specified performance of the equipment. It shall comprise the following sub-blocks:

- Deployment conditions
- Start-up conditions

6.10.2.2 Deployment conditions

The block deployment conditions shall contain properties that describe the deployment of the equipment in the pipe required to obtain the specified performance of the equipment.

6.10.2.3 Start-up conditions

The block start-up conditions shall contain properties that describe the start-up conditions which shall be upheld to ensure that the device performs within its specified limits.

6.10.3 Environmental design ratings

6.10.3.1 General

The block environmental design ratings shall contain properties describing the environmental conditions under which the equipment can be stored and operated within its specified limits and without permanent impairment of its operating characteristics. The block shall comprise three blocks:

- Normal operating conditions
- Limiting operating conditions
- External cleaning in place conditions

6.10.3.2 Normal environmental conditions

The block normal environmental conditions shall contain properties describing the range of conditions of the environment within which the equipment is designed to operate within specified performance limits.

6.10.3.3 Limiting environmental conditions

The block limiting environmental conditions shall contain properties describing the extreme values which an influence quantity can assume without causing permanent impairment of the operating characteristics of the equipment.

6.10.3.4 External cleaning in place conditions

The block external cleaning in place conditions shall contain properties describing the allowable conditions for the external cleaning of the device.

6.10.4 Process design ratings

6.10.4.1 General

The block process design ratings shall contain properties describing the process conditions under which the equipment can be operated within its specified accuracy limits and without permanent impairment of its operating characteristics. The block may comprise up to three blocks:

- Normal process conditions
- Limiting process conditions
- Internal cleaning in place conditions

6.10.4.2 Normal process conditions

The block normal process conditions shall contain properties describing the range of process conditions within which a device is designed to operate within specified performance limits.

6.10.4.3 Limiting process conditions

The block limiting process conditions shall contain properties describing the extreme values which a process quantity can assume without causing permanent impairment of the operating characteristics of the equipment.

6.10.4.4 Internal cleaning in place conditions

The block cleaning in place conditions shall contain properties describing the allowable conditions for the in-line cleaning of the device.

6.10.5 Pressure-temperature design ratings

6.10.5.1 General

The block pressure-temperature design ratings shall contain properties describing the safe operating range of the equipment as a function of pressure and temperature and the extreme values of temperature and pressure that the equipment can withstand without losing its integrity, but which may cause permanent damage. The block shall contain the sub-block:

- Design deratings

The cardinality property “number of design deratings” determines the number of times the design deratings block is replicated, in order to map a temperature-pressure derating curve.

6.10.5.2 Design deratings

The block design deratings shall contain properties describing the extreme conditions which the device or pipe can withstand without being a risk to persons and environment.

6.11 Mechanical and electrical construction

6.11.1 General

The block mechanical and electrical construction shall contain properties describing the constructional details of the equipment and its subcomponents. It may comprise the following sub-blocks:

- Overall dimensions and weight
- Structural design
- Explosion protection design approval
- Codes and standards approval

6.11.2 Overall dimensions and weight

The block overall dimensions and weight shall contain properties describing the general mechanical details of the equipment.

6.11.3 Structural design

The block structural design shall contain properties describing the constructional details of the device. It shall contain the sub-blocks necessary to describe the various mechanical parts of the equipment, for example valve style, body, end connections and trim style.

6.11.4 Explosion protection design approval

The block explosion protection design approval shall contain properties describing the type of protection offered by the equipment as well as the hazardous areas in which it may operate.

6.11.5 Codes and standards approval

The block codes and standards approval shall contain properties of codes and standards for which the equipment is approved, for instance pressure equipment directive.

6.12 Operability

6.12.1 General

The block operability shall contain properties describing the design, operating concept, structure and functionality of the human interface of the equipment. The block shall contain the sub-blocks:

- Basic configuration
- Parametrization
- Adjustment
- Operation
- Diagnosis

6.12.2 Basic configuration

The block basic configuration shall contain properties describing the means provided to influence the basic settings of the equipment.

6.12.3 Parametrization

The block parametrization shall contain properties describing the means provided to configure the equipment.

6.12.4 Adjustment

The block adjustment shall contain properties describing the means provided for the adjustment of the equipment.

6.12.5 Operation

The block operation shall contain properties describing the means provided for the operation of the equipment.

6.12.6 Diagnosis

The block diagnosis shall contain properties describing the diagnostic facilities provided by the equipment.

6.13 Power supply

The block power supply shall contain properties describing the permanent or temporary power to be supplied to the equipment in order to maintain its function. The following sub-blocks can be used:

- Electrical power input circuit
- Electrical power output circuit
- Pneumatic/hydraulic supply

6.14 Certificates and approvals

The block certificates and approvals shall contain properties describing the certificates and approvals that can be supplied with the equipment. The following sub-blocks can be used:

- Approval for general usage
- Hazardous area approval
- Functional safety approval

- Approval for use in special applications
- Special procedure
- Telecommunication compliance
- Pressure test approval
- Quality certificate
- Fieldbus certificate
- Calibration certificate
- Calculation certificate
- Other certificate

6.15 Component part identifications

The block component part identifications can contain properties identifying and describing the component parts of the final control element (see Clause 7), or a list of recommended spare parts.

7 Composite devices

The same approach as described in IEC 61987-11 is valid also for LOPs for the final control elements.

8 Additional aspects

The same approach as described in IEC 61987-11 is valid also for LOPs for the final control elements.

Annex A
(informative)

Device type dictionary – Classification of final control elements

NOTE The working version of the classification can be found in the IEC Common Data Dictionary at http://std.iec.ch/cdd/iec61987/cdddev.nsf/. As each part of IEC 61987 becomes an international standard the normative version will be found in the IEC Common Data Dictionary at http://std.iec.ch/iec61360.

Table A.1 shows the classification scheme equipment for industrial-process automation which forms the basis of this standard. Each device type has been assigned an identifier, which is the code of an object in the IEC Common Data Dictionary (CDD). Additionally, The column "LOP" in Table A.1 indicates the device types and LOPs which will be available in further parts of the IEC 61987 series.

Table A.1 – Classification scheme for final control elements

Classification	Definition	Identifier	LOP
equipment for industrial-process automation	equipment that supports partial or fully automated operation of industrial processes	IEC-ABA000	
— final control element	artifact that responds quantitatively to a control signal and performs the actual control action	IEC-ABD340	
— — control valve or automated on/off-valve	final control element that changes a fluid flow rate either proportional to the magnitude (control valve) or cuts off/allows flow according to the state (automated cut-off valve) of a signal from a control or safety instrumented system NOTE A control valve/automated on/off valve comprises a valve body assembly, an actuator and if required other valve accessories.	IEC-ABD341	
— — — valve body assembly	that part of a control valve/automated on/off cut-off valve that forms a pressure retaining envelope which contains a closure member for changing the flow rate	IEC-ABD342	x
— — — — valve with linear motion	valve with a closure member that is moved linearly into or away from a seat to modulate the flow	IEC-ABD343	
— — — — — globe valve	valve with linear motion in which the closure member moves in a direction perpendicular to the plane of the seat(s)	IEC-ABD344	x
— — — — — diaphragm/pinch valve	valve with linear motion in which the fluid flow passage through the valve is changed by deformation of a flexible closure member	IEC-ABD346	x
— — — — — gate valve	valve with linear motion whose closure member is a flat gate that moves in a direction parallel to the plane of the seat	IEC-ABD345	x
— — — — valve with rotary motion	valve with a closure member that is rotated into or away from a seat to modulate flow	IEC-ABD347	
— — — — — ball valve	valve with rotary motion with a closure member that is a sphere with an internal passage NOTE The centre of the spherical surface is coincident with the axis of the shaft.	IEC-ABD349	x
— — — — — butterfly valve	valve with rotary motion with a circular body and a rotary motion disk closure member, pivotally supported by its shaft NOTE The shaft and/or closure member can be centered or offset.	IEC-ABD352	x

Classification	Definition	Identifier	LOP
eccentric plug valve	valve with rotary motion with an eccentric closure member that may be in the shape of a spherical or conical segment	IEC-ABD348	x
plug valve	valve with rotary motion with a closure member that is cylindrical or conical, with an internal passage	IEC-ABD351	x
segmented ball valve	valve with rotary motion with a closure member that is a segment of a sphere NOTE The centre of the spherical surface is coincident with the axis of the shaft.	IEC-ABD350	
actuator	that part of a control valve/automated on/off valve which transforms a signal into a corresponding movement controlling the position of the internal regulating mechanism (closure member) NOTE The signal or energizing force can be pneumatic, electric, hydraulic, or any combination thereof.	IEC-ABD353	
linear actuator	actuator that moves in a line perpendicular to the seating plane	IEC-ABD354	
pneumatic linear actuator	linear actuator that uses a pneumatic signal to control its motion	IEC-ABD356	x
electrical linear actuator	linear actuator that uses an electrical signal to control its motion	IEC-ABD355	
hydraulic linear actuator	linear actuator that uses an hydraulic signal to control its motion	IEC-ABD357	
electro-hydraulic linear actuator	linear actuator that uses an electro-hydraulic signal to control its motion	IEC-ABD358	
manual linear actuator	linear actuator that uses a handwheel or similar mechanical means to control its motion	IEC-ABD359	
rotary actuator	actuator that is rotated into or away from a seat to modulate flow	IEC-ABD360	
pneumatic rotary actuator	rotary actuator that uses a pneumatic signal to control its motion	IEC-ABD365	x
electrical rotary actuator	rotary actuator that uses an electrical signal to control its motion	IEC-ABD361	
hydraulic rotary actuator	rotary actuator that uses a hydraulic signal to control its motion	IEC-ABD363	
electro-hydraulic rotary actuator	rotary actuator that uses an electro-hydraulic signal to control its motion	IEC-ABD362	
manual rotary actuator	rotary actuator that uses a handwheel or similar mechanical means to control its motion	IEC-ABD364	
valve/actuator accessory	that part of a control valve/automated on/off valve, usually attached to the actuator, which provides additional control functions NOTE Examples are positioners, relays, solenoid valves, airsets, handwheels, and limit switches.	IEC-ABD366	
positioner	actuator/valve accessory that is mechanically connected to a moving part of a final control element or its actuator and automatically adjusts its output to the actuator in order to maintain a desired position of the closure member in proportion to the input signal	IEC-ABD367	x

Classification	Definition	Identifier	LOP
I/P converter	actuator/valve accessory that is actuated by a current signal from one system and transmits power as a pneumatic signal to a second system NOTE In ANSI/ISA 75.05.01-2000 an I/P converter is called transducer.	IEC-ABD370	x
solenoid valve	actuator/valve accessory comprising a valve with linear action which is fitted with a solenoid for quick operation	IEC-ABD371	x
limit switch	actuator/valve accessory comprising a pneumatic, hydraulic or electrical device that relates to the valve stem to detect a single, preset valve stem position NOTE A position switch is also called a limit switch.	IEC-ABD368	x
air operated valve	actuator/valve accessory comprising a valve with a 2/2, 3/2 or 5/2 relay triggered by a pneumatic signal	IEC-ABD376	
filter regulator	actuator/valve accessory comprising a regulator that is used to control the supply pressure to the valve actuator and its auxiliaries NOTE In ANSI/ISA 75.05.01-2000 a filter regulator is called an air set.	IEC-ABD377	x
lock-up relay	actuator/valve accessory that is a relay that locks in its energized position	IEC-ABD378	
position transmitter	actuator/valve accessory that is mechanically connected to the valve stem or shaft and generates and transmits a pneumatic or electrical signal representing the valve position NOTE Position feedback is the term used in IEC 60534-7.	IEC-ABD369	x
quick exhaust	actuator/valve accessory that is a fast-acting valve used in a single-acting pneumatic actuator to quickly release pressure	IEC-ABD380	
actuator relief valve	actuator/valve accessory that is a safety valve which automatically relieves a pressure system when the pressure exceeds a set limit and which closes when pressure falls below the set limit NOTE It is a full lift pressure relief valve intended for gas or steam service.	IEC-ABD373	
reversing amplifier	actuator/valve accessory that operates a double-acting pneumatic actuator using a single-acting pneumatic or electro-pneumatic positioner or position switch	IEC-ABD379	
volume booster	actuator/valve accessory used together with a positioner to increase the positioning speed of a pneumatic actuator.	IEC-ABD372	
volume tank	actuator/valve accessory comprising a gas tank that provides a back-up in the event of loss of instrument fluid supply	IEC-ABE322	
flow modification accessory	accessory of a control valve/automated on/off valve that is used to modify the characteristics of fluid flow NOTE It usually comprises a device mounted in the pipeline upstream and/or downstream of the valve body assembly.	IEC-ABD381	

Classification	Definition	Identifier	LOP
diffuser	flow modification accessory that comprises a perforated plate, tube insert or similar construction of a fixed area that is mounted downstream of the valve body assembly NOTE It is used, for example, to reduce the noise level produced by a valve or to reduce the pressure drop of a valve.	IEC-ABD383	
restriction orifice	flow modification accessory that comprises a plate with one or more holes	IEC-ABD382	x
process regulator	final control element that comprises a self-actuating control valve intended to modulate a fluid flow rate to maintain a predefined upstream or downstream process pressure	IEC-ABD385	
pressure reducing regulator	process regulator that acts against a spring pressure to maintain a constant downstream pressure	IEC-ABD386	x
back pressure/excess pressure regulator	process regulator that acts against a spring pressure to maintain a constant upstream pressure	IEC-ABD387	x
differential pressure regulator	process regulator that acts against a spring pressure to maintain a constant differential pressure	IEC-ABD374	
flow regulator	process regulator that acts against a spring to maintain a constant flow value	IEC-ABD375	
temperature regulator	process regulator intended to modulate a fluid flow rate to maintain a predefined downstream process temperature	IEC-ABD388	

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