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INTERNATIONAL STANDARD

Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

REPRESENTATION OF PROCESS CONTROL ENGINEERING – REQUESTS IN P&I DIAGRAMS AND DATA EXCHANGE BETWEEN P&ID TOOLS AND PCE-CAE TOOLS

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International Standard IEC 62424 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

This standard cancels and replaces IEC/PAS 62424 published in 2005. This first edition constitutes a technical revision.

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

FDIS	Report on voting
65/420/FDIS	65/428/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.

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

- reconfirmed,
- withdrawn,
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A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

Efficient process engineering requires highly sophisticated tools for the different needs of the involved work processes and departments. These engineering tools are normally specialized in Process Design (PD), in Process Control Engineering (PCE), etc. Therefore a working interoperability is essential to optimize the engineering process in total. Thus, the definition of a harmonized interface and data management is a core task to ensure a smooth workflow during the whole project and to guarantee data consistency in the different tools.

This standard defines procedures and specifications for the exchange of PCE relevant data provided by the Piping and Instrumentation Diagram (P&ID) tool. The basic requirements for a change management procedure are described. A generally accepted technology for machine information exchange, the Extensible Markup Language (XML) is used. Hereby, a common basis is given for information integration.

However, a definition for uniform semantics is still necessary. CAEX (Computer Aided Engineering eXchange) as it is defined in this document is an appropriate data format for this purpose. This concept of data exchange is open for different applications.

The main task of a data exchange is transporting/synchronizing information from the P&ID database to the PCE databases and vice versa. The owner's reference designation system and a unique description of the processing requirement is the key for a unique identification. For detailed information about representation of PCE loops in P&ID's see Clause 6.

The data exchange system may be a stand-alone, vendor independent application or a module in an engineering environment. The data between a P&ID tool and a PCE tool and vice versa is exchanged via CAEX.

After the data exchange, there are three places where information about the plant is stored. Both the proprietary databases of the considered tools include private and common information. Both are stored at different places and different divisions that are working on them. Hereby, the intermediate database CAEX only stores common information. In a wider approach, the intermediate database should store both common and private information. This becomes important if a third application is connected to the neutral database. If the intermediate database is used as a temporary data stream only (without storing the information in a file), the information will be lost after processing the data conciliation.

Figure 1 illustrates the information flow for the P&ID and the PCE database reconciliation. The data exchange is done via a neutral intermediate CAEX database, not directly from database to database. The intermediate CAEX database should be a file (for file based data exchange) or a stream (for network based data exchange). The term “CAEX database” within this standard has to be understood in this way, it does not denominate a database product as e. g. SQL.

Annex C of this standard contains the full XML schema of the CAEX Model. It is attached to this publication in XSD format.

NOTE Buyers of this publication may copy it for their own purposes only in the required amount.

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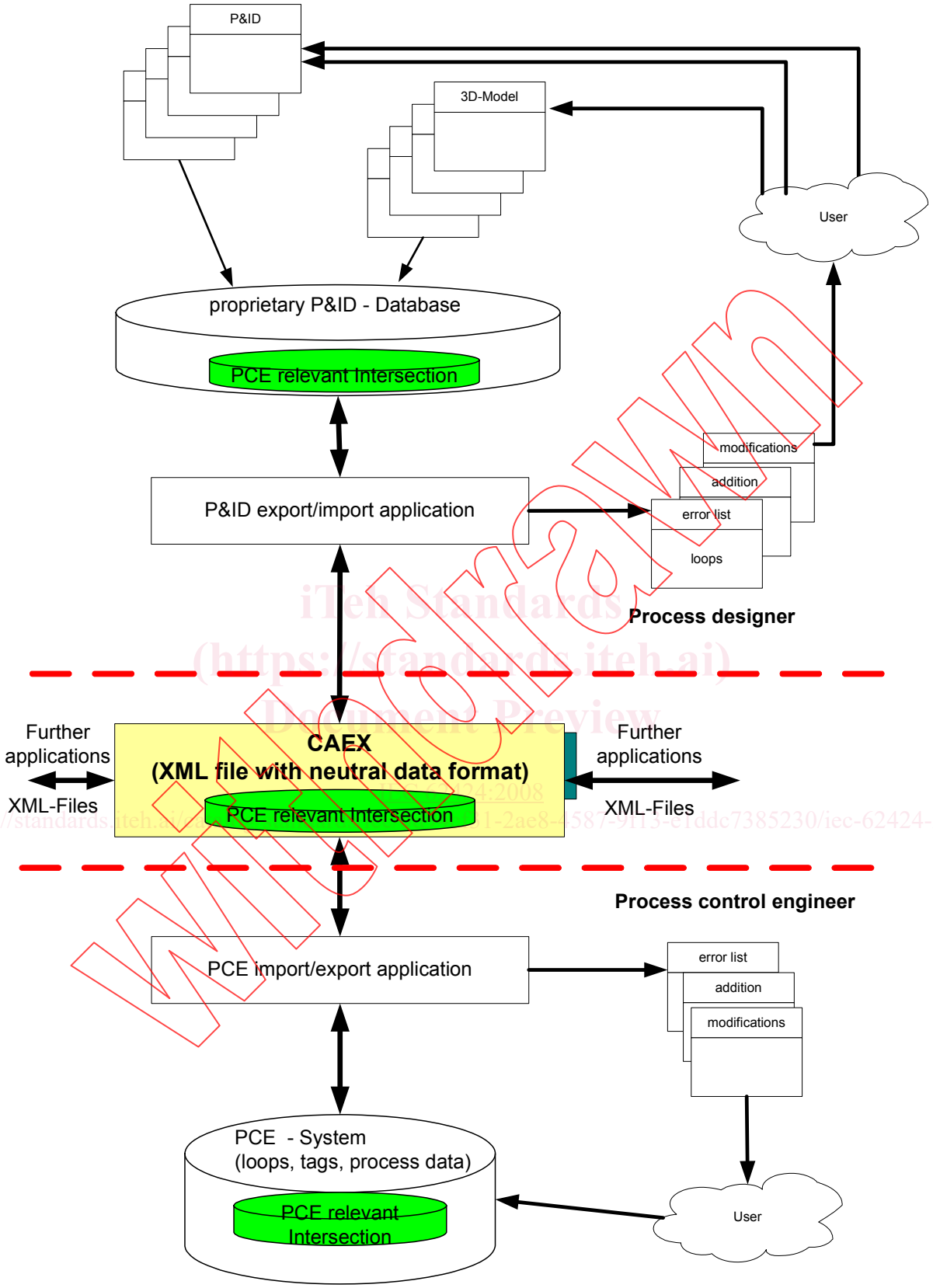

Figure 1 – Information flow between P&ID and PCE tool

REPRESENTATION OF PROCESS CONTROL ENGINEERING – REQUESTS IN P&I DIAGRAMS AND DATA EXCHANGE BETWEEN P&ID TOOLS AND PCE-CAE TOOLS

1 Scope

This International Standard specifies how process control engineering requests are represented in a P&ID for automatic transferring data between P&ID and PCE tool and to avoid misinterpretation of graphical P&ID symbols for PCE.

It also defines the exchange of process control engineering request relevant data between a process control engineering tool and a P&ID tool by means of a data transfer language (called CAEX). These provisions apply to the export/import applications of such tools.

The representation of the PCE functionality in P&ID'S will be defined by a minimum number of rules to clearly indicate their category and processing function, independent from the technique of realization (see Clause 6). The definition of graphical symbols for process equipment (e. g. vessels, valves, columns, etc.), their implementation and rules for the reference designation system are not in the scope of this standard. These rules are independent from this standard.

Clause 7 specifies the data flow between the different tools and the data model CAEX.

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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.

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IEC 61346-1, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 61511-1, *Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and software requirements*

ISO 10628, *Flow diagrams for process plants – General rules*

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

Extensible Markup Language (XML) 1.0 (Third Edition), W3C Recommendation 04 February 2004, available at <http://www.w3.org/TR/2004/REC-xml-20040204/>

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
actuator
functional unit that generates from the controller output variable the manipulated variable required to drive the final controlling element

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NOTE If the final controlling element is mechanically actuated, it is controlled via an actuating drive. The actuator drives the actuating drive in this case.

[IEV 351-28-07]

EXAMPLE A practical example of an actuator acting directly on the final controlling element is a pneumatic control valve.

3.2
adjusted nominal pipe size
size of the related pipe for the process connection of the PCE request in case of pipe diameters size reduction based on process requirements

3.3
bubble
oval symbol used to denote the PCE category and processing function of a PCE request and to uniquely identify a PCE request

NOTE On the basis of ISA S5.1, Clause 3.

3.4
control narrative
verbal description of a functional control scheme

3.5
design pressure
maximum pressure for which the system or component was designed for continuous usage

[ISO 13628-6, 3.4]

3.6
design temperature
maximum temperature for which the system or component was designed for continuous usage

3.7
equipment ID
unique identifier of equipment

3.8
equipment/pipe flag
unique identifier of equipment/pipe type

3.9
function chart
graphic description tool with symbolic representation of sequential control systems

NOTE 1 The symbolic representation of steps, commands, transitions and directed links is based on input and output Boolean variables and also on internal state variables and binary delay elements.

NOTE 2 The elements, rules and basic structures for function charts are given in IEC 60848.

[IEV 351-29-22]

3.10
heat tracing
heating system for pipe to prevent freezing of process requirements

3.11
heat tracing type
type of heating system for pipe

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EXAMPLE Steam or electrical heating system.

3.12
heat tracing temperature set point
set point for the controller of a heat tracing

3.13
insulation type
description of the used insulation type

EXAMPLE Sound insulation.

3.14
insulation thickness
thickness of insulation added to the outer diameter of the pipe size

3.15
intermediate database
intermediate data storage system between source and target tool

3.16
material balance point
balance point of the process calculation

3.17
medium code
abbreviation and identifier for the fluid running through a process pipe

3.18
medium code description
description of the fluid running through a process pipe

3.19
neutral database
vendor independent data storage system

3.20
PCE category
letter that designates the kind of process control engineering request

NOTE Unlike other standards, this standard uses the term "PCE category" instead of "measured variable" (e.g. temperature measurement) for the first digit of the PCE request. The PCE category as defined in this standard allows to unambiguously identify the kind of PCE request, without the need to specify a second letter as modifier for actuators. Based on this, only one letter for sensor and actuator identification of PCE request is necessary.

3.21
PCE control function
function in a PCE control

NOTE According to IEC 61512-1.

3.22
PCE loop
collection of PCE requests and PCE control functions depicting their functional coherence

3.23
PCE request
requirement for process control equipment. Each PCE request is graphically represented by a bubble which collects all information on the functional requirements

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