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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Représentation de l'ingénierie de commande de processus – Demandes sous forme de diagrammes P&I et échange de données entre outils P&ID et outils PCE-CAE

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

FOREWORD

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

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

This second edition is a compatible extension of the first edition. The main changes and extensions are detailed in Annex E and are summarized below:

a) updated definitions and new definitions;
b) identification replaced with reference designation;
c) updated PCE categories and process functions;
d) CAEX version 3.0, introduction of:
    - native multiple role support;

- nested interfaces;
- life cycle meta information;
- a separate Attribute library;
- updated examples;

e) updated electronic data model of the PCE request:

- new normative attribute library for basic PCE request attributes;
- new informative extended attribute library for further PCE request attributes;
- new informative electronic data model for the PCE request.

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

CDV	Report on voting
65/544/CDV	65/560B/RVC

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.

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

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- withdrawn,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

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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&IDs 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 in 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 for example 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 can copy it for their own purposes only in the required amount.

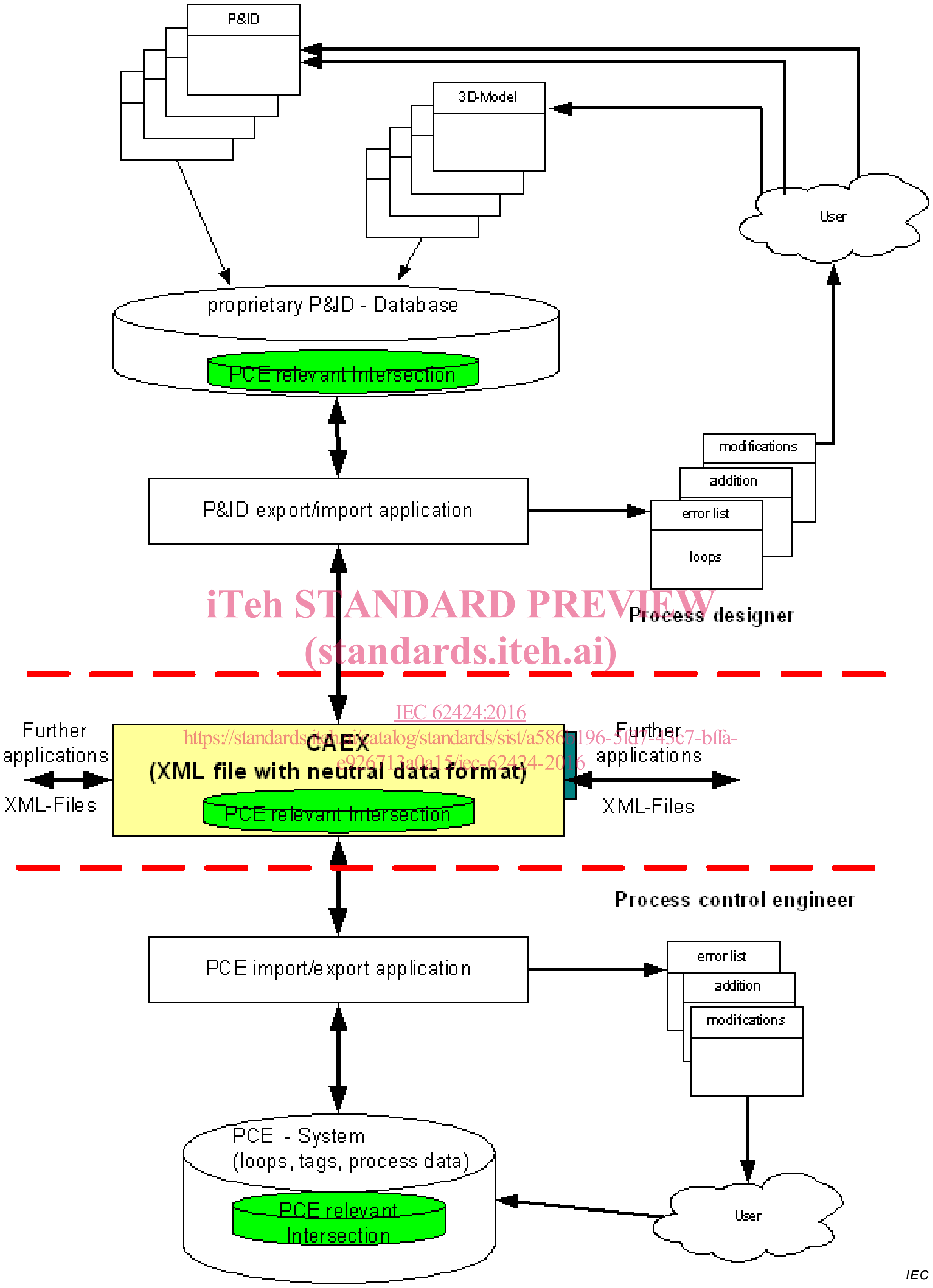

Figure 1 – Information flow between P&ID and PCE tool

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&IDs 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.

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

IEC 81346-1:2009, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic 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 the manipulated variable, required to drive the final controlling element, from the output variable of the controlling element

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

Note 1 to entry: If the final controlling element is mechanically actuated, it is controlled via an actuating drive. The actuator drives the actuating drive in this case.

[SOURCE: IEC 60050-351:2013, 351-49-07]

3.2
actuating drive
physical unit used for driving mechanically actuated final controlling elements

Note 1 to entry: Examples of actuating drives are electric, hydraulic or pneumatic actuating drives, diaphragm systems or piston actuators.

Note 2 to entry: No actuating drive is required for a final controlling element if the manipulated variable at the controller output is capable of directly influencing the mass flow or energy flow, i.e. without any mechanical intermediate variable (quantity).

[SOURCE: IEC 60050-351:2013, 351-56-16]

3.3
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

3.4
bubble
oval symbol used to denote the PCE category and processing function of a PCE request and to uniquely identify a PCE request

Note 1 to entry: On the basis of ISA 5.1:2009, Clause 3.

3.5
closed-loop control
process whereby one variable quantity, namely the controlled variable is continuously or sequentially measured, compared with another variable quantity, namely the reference variable, and influenced in such a manner as to adjust to the reference variable

Note 1 to entry: Characteristic for closed-loop control is the closed action in which the controlled variable continuously influences itself in the action path of the closed loop.

[SOURCE: IEC 60500-351:2013, 351-47-01]

3.6
control narrative
verbal description of a functional control scheme

3.7
design pressure
maximum pressure for which the system or component was designed for continuous usage

[SOURCE: ISO 13628-6:2006, 3.4]

3.8
design temperature
maximum temperature for which the system or component was designed for continuous usage

3.9
equipment ID
unique identifier of equipment