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Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems —

Part 5: Two-dimensional data coding of components and data exchange format for PE piping systems

Tubes et raccords en matières plastiques — Appareillage pour l'assemblage par soudage des systèmes en polyéthylène —

Partie 5: Codage bidimensionnel des données des composants et format d'échange de données pour les systèmes de canalisations en PE

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4, *Plastics pipes and fittings for the supply of gaseous fuels*.

A list of all parts in the ISO 12176 series can be found on the ISO website.

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

Introduction

The use of two-dimensional code is becoming increasingly popular because of the quantity of information that it is possible to group in a small space, and this can provide increased opportunities for manufacturers and customers. There are many benefits for the market, but the scope of this document is not to show all of them. The most important technical advantage of using a two-dimensional code is the possibility to apply a built-in correction level to the coding, so that, even with some scratches or missing parts, the operator can still use all information coded safely. Another important fact, for those that want to use the power of the whole traceability, is that any important information regarding the piping component can be stored in an electronic device, by reading only one code instead of two (ISO 12176-4 and ISO 13950) and thus avoiding overlapping information. This document provides a means for coding all aspects not covered by ISO 12176-4 or ISO 13950, e.g. large diameters, big saddles or other imperial sizes. This document also aims to standardize the transfer of data stored in the memories of electronic units to another electronic equipment (e.g. computer/data base) and to encourage, at any level, the use of the traceability for a further development of the polyethylene piping systems.

Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems —

Part 5:
Two-dimensional data coding of components and data exchange format for PE piping systems

1 Scope

This document specifies an encoding system for data of components, assembly methods and jointing operations for polyethylene (PE) piping systems for gas, water and other industrial applications. These data can be used in a traceability system and/or used to perform the fusion of components by using equipment as specified in ISO 12176-1 and in ISO 12176-2.

This encoding system is explained in ISO/IEC 16022, ISO/IEC 18004 and ISO/IEC 24778 which refer to established code types, e.g. QR code.

Data to be encoded are: fusion cycle(s), traceability of manufactured products, other manufacturer's information that can also be given on websites such as voluntary certificates of quality and approvals.

This document specifies the export of data (type, format and sequence) from a data retrieval system.

Provisions of this document are applicable to polyethylene components conforming to ISO 4427-2, ISO 4427-3, ISO 4437-2, ISO 4437-3, ISO 4437-4 and ISO 15494, and can also be applicable to any other components used in PE systems.

ISO 13950 and ISO 12176-4, which partly cover the fields of application of this document, can be used in parallel.

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/IEC 10646, *Information technology — Universal coded character set (UCS)*

ISO 12176-1, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*

ISO 12176-2, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*

ISO 12176-3, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 3: Operator's badge*

ISO/IEC 16022, *Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification*

ISO/IEC 18004, *Information technology — Automatic identification and data capture techniques — QR Code bar code symbology specification*

ISO/IEC 24778, *Information technology — Automatic identification and data capture techniques — Aztec Code bar code symbology specification*

ASTM F 2897-15a, *Standard Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components (Pipe, Tubing, Fittings, Valves, and Appurtenances)*

3 Terms, definitions and abbreviated terms

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Terms and definitions

3.1.1
delimiter
character used to define a specific set of data

3.1.2
"]"
hexadecimal character code 5d
delimiter (3.1.1) of fields used in region data

3.1.3
"~"
hexadecimal character code 7e
delimiter (3.1.1) of sub-fields

3.1.4
fusion equipment
equipment that conforms to either ISO 12176-1 (butt fusion machine) or to ISO 12176-2 (control unit)

3.1.5
jointing process
act of jointing separate parts of a plastic piping system

Note 1 to entry: For the purpose of this document a fusion process can be either electro-fusion or butt fusion.

Note 2 to entry: For the purpose of this document jointing can also be performed using a mechanical fitting as defined in ISO 17885.

3.1.6
JSON
Java Script Object Notification
lightweight data-interchange format

Note 1 to entry: JSON is based on a subset of the JavaScript Programming Language Standard, ECMA-262 3rd Edition – December 1999.

Note 2 to entry: JSON is defined by ISO/IEC 21778.

3.1.7
JSON schema
JSON-based format for describing JSON data

Note 1 to entry: Published on https://json-schema.org.

Note 2 to entry: The version of JSON-Schema used in this document is the "Draft 2019-09".

3.1.8
multilevel fusion
sequence of more than one fusion phase on the same electro-fusion fitting, i.e. pre-heating, heat soak and fusion

3.1.9
multiplicity
defines how often an element can be present in the respective context

Note 1 to entry: Multiplicity's symbols have the following meanings: 1 = exactly once; 1...* = at least once; 0...1 = optionally none or once; 0...* = optionally none or several times.

3.1.10
nominal target heating energy
heating energy to be reached at 20 °C before correction in conjunction with the ambient temperature

3.1.11
nominal target heating time
heating time to be reached at 20 °C before correction in conjunction with the ambient temperature

3.1.12
protocol
JSON object that contains one or more fusion records of a fusion device

Note 1 to entry: A fusion record is made by an electronic device, which is coupled with fusion equipment as described in ISO 12176-1 or ISO 12176-2.

3.1.13
UTF-8
8-bit Unicode Transformation Format
variable-width character encoding

Note 1 to entry: This is capable of encoding all 1, 112, 064 valid character code points in Unicode using one to four one-byte (8-bit) code units.

3.2 Abbreviated terms

Classification of pipes not in the International System of Units (SI):

CTS	copper tube size (dimensions in inches)
DIPS	ductile iron pipe size (dimensions in inches)
IPS	iron pipe size (dimensions in inches)

4 Barcode type, structure and contents

4.1 General

This data encoding system shall use alternatively a code type according to ISO/IEC 16022 (Data Matrix code), ISO/IEC 18004 (QR code), and ISO/IEC 24778 (Aztec code). A maximum of 1 024 bytes can be included in the two-dimensional code.

When the two-dimensional code conforms to ISO/IEC 18004 (QR code), the two-dimensional code shall be of the following characteristics:

a) minimum module width: 0,253 mm (valid for all versions);

b) minimum resolution: 300 dpi (valid for all versions);

c) correction level M (for codes smaller or equal to type 14, level L correction level may be used).

Examples of two-dimensional codes are given in Annex E.

In the case that the resulting code size is too large (e.g. to be stuck on small fittings or components), the code symbols may be appended in a structured format.

For multi-byte encoding characters, examples of checksum calculation are given in Annex F.

Attention is drawn to control units that can have limited character sets and can not be able to represent multi-byte characters correctly on their display or in their pdf file output. Nevertheless, control units shall guarantee that the characters are correct in data retrieval for exchange formats, like csv or JSON.

4.2 Contents

Data are coded in fields as defined hereafter. Fields are identified and delimited by the use of the symbol "]" at the end of any field. All data are grouped in homogeneous regions. There are five regions:

Region 0:	revision of data coding definition	(subclause 4.2.1)
Region 1:	identification components type	(subclause 4.2.2)
Region 2:	jointing process information	(subclause 4.2.3)
Region 3:	Traceability	(subclause 4.2.4)
Region 4:	additional factory information	(subclause 4.2.5)

Each field consists of a defined number of characters (see 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.5) and only characters defined in the following are acceptable. The characters: "]" and "~" shall be used exclusively as delimiters. Each character is an alphanumerical digit or one special character. Each character is represented as 1 to 4 bytes and shall be encoded in UTF-8.

After the five regions there is the checksum (subclause 4.2.6).

4.2.1 Revision of data coding definition (region 0)

The region 0 is without field(s) and it starts and ends with character '~' (see 3.1.2.2). The revision number is shown as a double-digit counter, starting with "00" with the first publication of this document and increases by +1 for every revision of the data format.

Region 0, for the first publication of this document, is identified by the characters ~00~. For clarity, at the next revision of the data format the region 0 will be: ~01~ (this document can be revised in the future without changes of the data format).

In region 0, a minimum and a maximum of four characters are used comprising two delimiters "~".

The following is an example of data in region 0, total characters used 4 out of 4 available in this region:

Region 0				
Data	~	0	0	~

4.2.2 Identification components type (characters of region 1)

Field n°1: type component, identified as per Table 1.

Table 1 — Characters for Field n°1 and meaning

Character	Meaning
0	Other component
1	Pipe

Table 1 *(continued)*

Character	Meaning
2	Electrofusion fitting
3	Spigot fitting
4	Mechanical fitting[7]

A total of two characters is used comprising the delimiter "]".

Field n°2: dimensional unit systems used to manufacture the component, identified as per Table 2.

Table 2 — Characters for Field n°2 and meaning

Character	Meaning
0	Metric system (mm)
1	IPS
2	DIPS
3	CTS

A combination between characters in Table 2 is allowed with a maximum of two characters. The order of the characters shall represent the actual joint figure and is important for a good interpretation of diameters as indicated in Field n°6.

EXAMPLE 1 Metric by IPS→ 01, IPS by metric→ 10.

In case of components with equal dimensions, the coding is reduced to only one character.

EXAMPLE 2 Metric by metric→ 0.

In Field n°2, a minimum of two and a maximum of three characters are used comprising the delimiter "]".

Field n°3: manufacturer shall be coded in the form of a name or trade mark. A minimum of three and a maximum of 21 characters are used comprising the delimiter "]". Only spaces are not allowed.

NOTE 1 For a better comprehension of the coding of the manufacturer, see Reference [9].

Field n° 4: component type, identified as per Table 3.

Table 3 — Components and character identification for Field n° 4

Component	Character
Other components	00
Pipe, straight	01
Pipe, coiled	02
Socket	03
Tapping saddle	04
Branching saddle	05
Elbow, 90°	06
Elbow, 45°	07
Elbow, undefined	08
Tee	09
End cap	10
Reducer	11
Swept bend	12
Flange adapter	13

Table 3 *(continued)*

Component	Character
Mechanical fitting	14
PE-body valve, quarter-turn (QT)	15
PE-body valve, multi-turn (MT)	16
Non-PE-body valve, QT	17
Non-PE-body valve, MT	18
Repair fitting	19
Transition fitting (e.g.: with welding end, etc.)	20
Wall channel, rigid	21
Wall channel, flexible	22
Pressure tapping valve	23
Ventilation end cap	24
Stop-off saddle	25
Cap for tapping saddle	26
PE/steel transition fitting threaded	27
PE/brass transition fitting threaded	28
Excess-flow valve	29
Cross	30
Manhole	31
Filter	32
Wall plate	33
Gas excess flow valve integrated in a socket	34
Anchoring bracket	35

NOTE 2 Components and characters are coded with reference to Reference [9].

A total of three characters is used, comprising the delimiter "]".

Field n° 5: component's particularity. If the component is a pipe, then Table 4 applies.

Table 4 — Characters for Field n° 5 and meaning

Character	Meaning
0 (zero)	Other
1	co-extruded layers
2	Solid wall
3	PE pipes with a peelable layer
4	Barrier pipe

If the component is other than a pipe, then Table 5 applies.

Table 5 — Characters for Field n° 5 and meaning

Character	Meaning
0 (zero)	Other
A	Monofilar
B	Bifilar
C	Single socket
D	Multi socket

A combination of two characters is acceptable.

A minimum of two and a maximum of three characters, as capital letters or numbers, are used comprising the delimiter “]”.

Field n° 6: component diameter.

Number characters "0,1...9", the character "x", as separator for two diameters are allowed only.

In addition, and for a correct identification of imperial sizes (inches), the character "/" and a space can be used.

For examples of component diameter and units and characters to be used, see Table 6.

Table 6 — Examples of component diameter and units and characters to be used

Component diameter and units (mm) or (inches)	Characters	
	Field n° 2	Field n° 6
1 200 mm	0	1200
250 mm × 110 mm	0	250 × 110
12” IPS × 10”IPS	1	12 × 10
12” IPS × 110 mm	10	12 × 110
400 mm × 10”IPS	01	400 × 10
1”1/4 CTS × 4”IPS	31	1[a] 1/4 × 4

[a] A space is left when imperial sizes are used; this space is used to identify fractions of inches.

Content of this field is expressed in a syntax diagram (given for programming purposes), see Figure 1 and Figure 2.

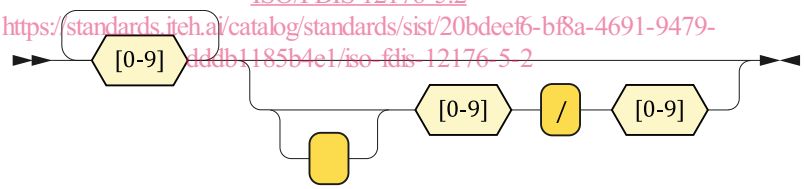

Figure 1 — DimPart

DimPart ::= [0-9]+ (' '? [0-9] '/' [0-9])?

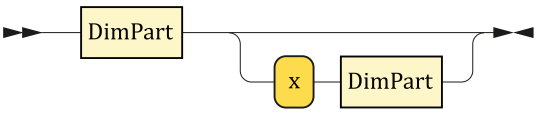

Figure 2 — Dimension

Dimension ::= DimPart ('x' DimPart)?

A minimum of two and a maximum of thirteen characters are used comprising the delimiter “]”.

Field n° 7: component design SDR.

Number characters ‘0,1...,9’ and the decimal dot ‘.’ are allowed only.

A minimum of two and a maximum of five characters are used comprising the delimiter "]".

EXAMPLE SDR13,6 → 13.6].

Field n° 8: materials used for manufacturing components are identified by using characters as per Table 7.

Table 7 — List of relevant materials and characters

Material	Characters
Other material	00
PE 80	11
PE 100	12
PE 100 RC	13
PE 100 RT Type 1	14
PE 100 RT Type 2	15
PE 3710	31
PE 4608	32
PE 4708	33
PE 4710	34
Copper	51
Copper alloys	52
Spheroidal graphite cast iron	61
Malleable cast iron	62
Steel	63
Stainless steel	64

A combination of four characters for two materials, is acceptable.

A minimum of three and a maximum of five characters are used comprising the delimiter "]".

The following provides and example of data in region 1, total characters used 42 out of 55 available in this region:

Field	1		2		3														
Data	2	]	0	]	a	n	y		t	r	a	d	e		m	a	r	k	]

Field	4			5		6										7					8		
Data	0	3	]	B	]	1	2	0	0	X	1	0	0	0	]	1	3	.	6	]	1	2	]

4.2.3 Jointing process information (characters of region 2)

In region 2 the jointing process information, e.g. for controlling an electro-fusion process, is encoded.

Region 2 consists of only one field with a flexible number of characters including the delimiter. Specification given in Annex A shall be used to code region 2.

Data field 1 of region 1 determines the contents of region 2 as given in Table 8.

Table 8 — Cross-reference between field 1 of region 1 and fusion data

Value of field 1 of region 1	Type of jointing process information	Number of characters	Reference
0	No information given	1	
1	No information given	1	
2	Electro-fusion process information	min. 22 to max. 121	Annex A
3	No information given	1	
4	No information given	1	

If no jointing process information is defined for a value of Field n° 1 of region 1, region 2 contains the delimiter only "]".

EXAMPLE If character in Field n° 1 of region 1 is "2", region 2 will be filled with fusion process information for electro-fusion process, e.g. 1~0.85C0~140.0012054~30].

4.2.4 Traceability (characters of region 3)

Field n° 1: batch n° (or production date) = xxxxxxxxxx. A minimum of one character up to a maximum of eleven characters are used comprising the delimiter "]".

EXAMPLE 1 If batch number is not given, the character is the delimiter "]" only.

Field n° 2: name of compound = xxxxxxxxxx. A minimum of one character up to a maximum of eleven characters are used comprising the delimiter "]".

EXAMPLE 2 If the name of compound is not given, the character is the delimiter "]" only.

Compound name can be in plain text or coded. For a better comprehension of the coding of the compound, more information can be found at Reference [9].

Field n° 3: identification of MFR value. The MFR value of the compound used is identified as per Table 9.

Table 9 — Characters for Field n° 3 to identify MFR value

MFR (g/10 min)	Character
MFR value not specified[a]	0
MFR ≤ 5	1
5 < MFR ≤ 7	2
7 < MFR ≤ 10	3
10 < MFR ≤ 15	4
15 < MFR ≤ 20	5
20 < MFR ≤ 25	6
25 < MFR ≤ 32	7
32 < MFR ≤ 40	8
MFR > 40	9

[a] e.g.: for electrofusion fusion.

Two characters are used comprising the delimiter "]".

Field n° 4: type of material (virgin or reprocessable). The quality of the material is identified as per Table 10.