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

Part 4: Traceability coding

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

Partie 4: Codage de la traçabilité

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 12176-4 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*.

ISO 12176 consists of the following parts, under the general title *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems*:

— *Part 1: Butt fusion*

— *Part 2: Electrofusion*

— *Part 3: Operator's badge*

— *Part 4: Traceability coding*

Introduction

Traceability in the construction and maintenance of a pipeline system is determined by the traceability of all relevant information on the system.

A complete traceability system can be built up from the following elements: fusion-jointing equipment data, fusion-jointing equipment operator data, site data (geographical location), data on fittings and pipes and fusion-jointing parameters, installation dates and assembly procedures.

The aim of this document is solely to define a system for encoding the characteristics of the pipes, fittings, fusion-jointing equipment, fusion-jointing equipment operators and fusion-jointing protocols. It is widely acknowledged that similar encoding systems can be used to monitor other aspects and applications of pipelines, relating to compatibility, for instance. Such systems may be subject to patent rights.

It is up to the user to create the link between the various elements in order to provide a complete traceability system. Care is necessary when determining which data are to be downloaded into the traceability system database and the minimum information to be stored in the database for later retrieval: the choice of data and the amount of data will strongly influence the performance of the database when it is used later.

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

Part 4: Traceability coding

1 Scope

This part of ISO 12176 specifies an encoding system for data on components, assembly methods and jointing operations for polyethylene (PE) piping systems for gas supply, for use in a traceability system.

Reading of the codes can be carried out using alphanumeric or numeric data-recognition systems such as bar-code, magnetic-stripe card or microchip card readers.

Other data-recognition systems conforming to ISO/TR 13950 may be used in association with one of the specified recognition systems to obtain the required traceability.

This part of ISO 12176 is applicable to PE pipes, fittings and valves conforming to ISO standards for gas supply piping systems and also to the assembly operation utilizing methods such as fusion using a heating tool (butt, socket and saddle fusion), electrofusion (socket and saddle fusion), induction fusion and mechanical jointing.

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.

ISO 1133, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics*

ISO/IEC 7810:2003, *Identification cards — Physical characteristics*

ISO/IEC 7811-2:2001, *Identification cards — Recording technique — Part 2: Magnetic stripe — Low coercivity*

ISO/IEC 7811-4:1995, *Identification cards — Recording technique — Part 4: Location of read-only magnetic tracks — Tracks 1 and 2*

ISO 8601:2000, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO 12176-3:2001 , *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 3: Operator's badge*

ISO/TR 13950:1997, *Plastics pipes and fittings — Automatic recognition systems for electrofusion*

ISO/IEC 15417:2000, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — Code 128*

ISO/IEC 16390:1999, *Information technology — Automatic identification and data capture techniques — Bar code symbology specifications — Interleaved 2 of 5*

3 Terms and definitions

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

3.1
component
item built into a gas network as a part of the piping system, such as a pipe, elbow, T-piece, reducer, saddle, socket fitting, valve or other element used for connecting pipes and/or accessories (e.g. electrofusion socket fitting, mechanical fitting)

3.2
PE assembly
combination of polyethylene (PE) pipes, a PE pipe and a fitting, a pipe or a fitting and a saddle, a valve, or another component, assembled by electrofusion, fusion using a heating tool, induction fusion or mechanical compression

3.3
traceability
ability to create a trace of the history, the purpose or the location of information, by means of records

NOTE 1 The term “traceability” may have one of three main meanings.

a) In a product sense, it may relate to:

   — the origin of materials and parts;

   — the product processing history;

   — the distribution and location of the product after delivery.

b) In a calibration sense, it relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials.

c) In a data-collection sense, it relates calculations and data generated through the quality loop to a user's quality requirements.

NOTE 2 Annex A gives an overview of the traceability system content with reference to relevant standards.

3.4
fusion joint made using a heating tool
joint made by heating the ends of two components, the surfaces of which match, by holding them against a heating tool until the PE material reaches fusion temperature, removing the heating tool quickly and pushing the two softened ends against one another, e.g. butt fusion joint, socket fusion joint or saddle fusion joint

3.5
electrofusion joint
joint made between a PE electrofusion socket or saddle fitting and a pipe or spigot end fitting, the jointing surfaces being heated by a current flowing through a heating element incorporated in each jointing surface (the Joule effect), causing the material adjacent to the heating elements to melt and the pipe and/or fitting surfaces to fuse together

3.6
mechanical joint
joint made by assembling a PE pipe with a fitting that generally includes a compression seal to ensure pressure integrity, leaktightness and resistance to end loads

NOTE A support sleeve inserted into the pipe bore may be used to provide a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces. The metallic part of the fitting can be jointed to a metal pipe by screw threads, compression joints, welded or brazed flanges or other means.

3.7
induction fusion joint
joint made between PE pipes and/or socket or saddle fittings using induction fusion techniques, the jointing surfaces being heated by a current flowing through a heating element incorporated in each jointing surface (the Joule effect), causing the material adjacent to the heating elements to melt and the pipe and/or fitting surfaces to fuse together

NOTE The heat energy supply source is an induction coil fitted in a manner designed to generate and transmit the heat flux necessary for melting to take place at the PE/PE interface.

3.8
fusion-jointing equipment operator
person trained and authorized to carry out fusion jointing between PE pipes and/or fittings based on a written procedure agreed by the pipeline operator

NOTE The operator may be trained and authorized to carry out one or more fusion-jointing procedures, involving the operation of manual and/or automatic fusion-jointing equipment.

3.9
fusion-jointing record
record including information and data related to the fusion-jointing equipment, the fusion-jointing operation and traceability

3.10
digit
integer from zero to nine

3.11
character
integer from zero to nine or letter or other symbol

NOTE Letters and other symbols are represented by a two-digit number as given in Table B.1.

3.12
virgin material
thermoplastics material in a form such as granules or powder which has not been previously processed other than for compounding and to which no reprocessable or recycled materials have been added

3.13
reprocessable material
thermoplastics material prepared from clean unused rejected pipes, fittings or valves, produced in a manufacturer's plant by a process such as injection-moulding or extrusion, which will be reprocessed in the same plant

NOTE Such material may include trimmings from the production of such pipes, fittings and valves.

3.14
standard dimension ratio
SDR
numerical designation of a pipe series, which is a convenient round number approximately equal to the ratio of the nominal outside diameter d_n to the nominal wall thickness e_n

3.15
melt mass-flow rate
MFR
value relating to the viscosity of a molten thermoplastic material when extruded at a specified temperature and load, expressed in grams per 10 min (g/10 min)

4 Coding-system design

4.1 General format

The encoding system is based on data to be provided by the component manufacturer(s)/supplier(s), the fusion-jointing equipment manufacturer and the fusion-jointing equipment operator. If the data are encoded in e.g. a bar code, a magnetic stripe or a microchip, they shall consist of a specified number of characters, i.e. the encoding system shall not be shortened.

The data are divided into different classes:

a) fusion-jointing equipment data;

b) traceability data:

- component data,
- component assembly operation data,
- joint identification data;

c) fusion-jointing operation data.

The data file shall contain at least the fusion-jointing equipment data and the traceability data.

4.2 Data description

4.2.1 Fusion-jointing equipment data

The length of the code used for the identification of the fusion-jointing equipment shall conform to the requirements of Table 1. These data shall be suitable for downloading into the traceability system database.

Table 1 — Fusion-jointing equipment data

Data	Number of alphanumeric characters
Fusion-jointing equipment manufacturer [a]	2
Fusion-jointing unit number	7
[a] In the first position.	

NOTE Information related to maintenance of the fusion-jointing equipment may be included as fusion-jointing operation status data or in the form of optional data.

The system for encoding fusion-jointing equipment data shall conform to 5.1.

4.2.2 Traceability data

4.2.2.1 General

Traceability data for a PE assembly are given by the traceability data for the different components in the assembly and the traceability data for the assembly operation.

The system for encoding traceability data shall conform to 5.2 and 5.3.

To allow assessment of the effectiveness of the traceability system in operation, provision shall be made for the following information to be downloaded and stored:

a) the size and type of component(s) identified by the system as having been installed;

b) the manufacturer/supplier of the component(s).

4.2.2.2 Component data

Encoded information for components shall conform to the requirements of Table 2. These data shall be suitable for downloading into the database of the traceability system.

Table 2 — Component data

Data	Number of digits
Component manufacturer/supplier	4
Component type	2
Component diameter(s)	3/10 [a]
Component production batch	8 [b]
Applicable pipe series (SDR)	1
Identification of PE compound	7 [c]

[a] Three digits for a bar code, 10 digits for a magnetic stripe.

[b] Including two digits for the production site.

[c] Including:

— one digit for the type of material;

— one digit for the designation of the PE;

— one digit for the MFR.

4.2.2.3 Assembly operation and joint identification data

Encoded information on the assembly operation and joint identification shall conform to the requirements of Table 3. These data shall be suitable for downloading into the traceability system database.

Table 3 — Assembly operation and joint identification data

Data	Number of alphanumeric characters
Type of jointing method	1
Assembly procedure	1
Status of fusion-jointing operation	2
Date of assembly	6
Time of assembly	4
Clamping	1
Scraping	1
Ambient temperature	
+ or –	1
value	3
unit (°C, °F)	1
Jointing-equipment operator	6
Country which issued operator's badge	3
Organization which issued operator's badge	2
Job number/location	16

4.2.3 Fusion-jointing operation data

Information related to the fusion-jointing operation (e.g. complete butt fusion graph, details of voltage and current during the electrofusion-jointing operation) shall be defined in accordance with the user's requirements. These data shall be suitable for downloading into the traceability system database.

The level of detail of information related to the fusion-jointing operation directly influences the total amount of data contained in a fusion-jointing cycle record and therefore the number of cycles that can be stored in the memory of a fusion-jointing unit.

5 Encoding of data

5.1 Encoding of fusion-jointing equipment data

The fusion-jointing equipment shall be identified by a unique code, composed of nine alphanumeric characters. This code shall be given by the manufacturer of the fusion-jointing equipment in accordance with the relevant ISO standards. The first two characters shall identify the manufacturer of the fusion-jointing equipment.

5.2 Encoding of component data

5.2.1 Identification of component manufacturer/supplier

Each component manufacturer/supplier shall be identified by one or more codes which can be used only by this component manufacturer/supplier. These codes shall be as given by the relevant list available on the web site <http://www.traccoding.com>.

5.2.2 Identification of component type

Each type of component shall be identified by two numeric characters as given by the relevant list available on the web site <http://www.traccoding.com>. Table B.4 gives an overview of the most important components. The list is limited to 49 components. Code-numbers are reserved for additional information and these will be activated by the webmaster of the web site <http://www.traccoding.com> as and when necessary.

5.2.3 Identification of component diameter(s)

If required, the component diameter(s) shall be identified by a code expressed as specified in B.1.2.4.

With magnetic-stripe cards, the diameter(s) are not encoded (see Clause B.2).

5.2.4 Identification of production batch

The production batch shall be identified by a production batch number, composed of six numeric characters, plus an additional two numeric characters to identify the production site.

The production batch/site code shall be as given by the component manufacturer and shall define the production batch in a unique way. This code can be freely defined by the manufacturer. It gives access to all production batch data, e.g. production date, date of batch release testing.

The code shall be unique in relation to the other data given in Table 2 [component type, component diameter(s), applicable pipe series (SDR), identification of PE compound] for a period of at least 10 years.

5.2.5 Identification of SDR

The SDR of pipes and the applicable pipe series for fittings, as marked on the components, shall be identified by a code as specified in Table 4.

Table 4 — SDR codes

SDR	Code
> 33	0
33	1
26	2
21	3
17,6	4
17	5
13,6	6
11	7
9	8
< 9	9

5.2.6 Identification of PE compound

The PE compound shall be identified by a unique code. This code will be managed through the web site <http://www.traccoding.com> where the current list will be available.

Any request for inclusion of a new code will be dealt with directly through the web site by allocating a unique code generated automatically using the next number available.

The use of reprocessable material shall be indicated by a single-digit code as specified in Table B.8.

The designation of the PE compound shall be identified by a single-digit code as specified in Table B.9.

The MFR of the PE compound shall be identified by a single-digit code as specified in Table B.10.

5.3 Encoding of assembly operation and joint identification data

5.3.1 General

Encoded information is stored in the memory of the fusion-jointing unit for each cycle. This information shall be suitable for downloading into the traceability system database.

5.3.2 Identification of type of jointing method

The type of jointing method used shall be identified by a code, composed of one numeric character, as specified in Table 5.

Table 5 — Codes for types of jointing method

Type of jointing method	Code
Fusion joint made using heating tool:	
Butt fusion jointing	1
Socket fusion jointing	2
Saddle fusion jointing	3
Electrofusion jointing	4
Mechanical jointing	5
Induction fusion jointing	6

5.3.3 Identification of assembly procedure

The assembly procedure used shall be identified by a code composed of one alphanumeric character. This code shall be as given by the manufacturer of the fusion-jointing equipment and shall be explained in the operating instructions.

5.3.4 Indication of result of fusion operation

The result of the fusion operation (e.g. OK/not OK) shall be indicated by a code composed of two alphanumeric characters. This code shall be as given by the manufacturer of the fusion-jointing equipment and shall be explained in the operating instructions.

5.3.5 Indication of date and time of assembly

The date and time of assembly of the joint shall be indicated by a code composed of 10 numeric characters, six for the date and four for the time in accordance with ISO 8601.

5.3.6 Indication of use of clamping

The use of clamping shall be indicated by a code composed of one alphanumeric character. This code shall be as given by the manufacturer of the fusion-jointing equipment and shall be explained in the operating instructions.

5.3.7 Indication of use of scraping

The use of scraping shall be indicated by a code composed of one alphanumeric character. This code shall be as given by the manufacturer of the fusion-jointing equipment and shall be explained in the operating instructions.

5.3.8 Indication of ambient temperature

The ambient temperature during assembly shall be indicated by a code including a symbol (+ or −) indicating whether the temperature is above or below freezing, three numeric characters indicating the temperature and a single alphanumeric character indicating the temperature scale (°C or °F) (see Table 3). This code shall be as given by the manufacturer of the fusion-jointing equipment and shall be explained in the operating instructions.

5.3.9 Identification of the fusion-equipment operator

The fusion-equipment operator responsible for assembly shall be identified by a code composed of six numeric characters as specified in ISO 12176-3.

5.3.10 Identification of country

The country where the fusion-equipment operator's badge was issued shall be identified by a code composed of three numeric characters as specified in ISO 12176-3.

5.3.11 Identification of competent organization

The organization that issued the badge shall be identified by a code composed of two alphanumeric characters as specified in ISO 12176-3.

5.3.12 Identification of job number and location

The job number and location shall be identified by a code defined by the gas distributor. The length shall be limited to 16 alphanumeric characters.

6 Data carriers

6.1 General

A traceability system can be built up by manual input of the traceability information or by automatic input of that information or by a combination of the two.

In the case of automatic input, the component traceability information shall be made available on a standardized data carrier, such as a bar-code card, magnetic-stripe card or microchip card, delivered with the components. The traceability information stored in the fusion-jointing equipment (e.g. identification number of the equipment, fusion-jointing cycle data) shall be made available by downloading from the fusion-jointing equipment.

Two encoding systems, type 1 and type 2, are defined in this part of ISO 12176 and are detailed in Annex B. The two encoding systems are managed by the webmaster of the web site <http://www.traccoding.com>.

The type 1 encoding system will run until such time that 75 % of the system capacity has been used for manufacturers/suppliers of components and/or compounds (monitored through the web site). At this time, the type 2 encoding system will be activated without the loss of the type 1 encoding-system data.

6.2 Bar-code card

If the traceability information is encoded as a bar code, the bar code shall be of the Code 128, code character set C, type as defined in ISO/IEC 15417, allowing the use of double-density numeric characters with a total length of 40 digits for pipes and 26 digits for other components. For printing the bar code, a standard resolution shall be chosen with a bar thickness of 0,19 mm (narrowest bar).

If the fusion-jointing parameters for an electrofusion fitting are provided on a bar-code card, the encoding system shall be of the “2 of 5 interleaved” type as specified in ISO/TR 13950 and defined in ISO/IEC 16390.

NOTE This means that the electrofusion fitting will carry two bar codes, one for the fusion parameters (2/5 interleaved) and a second one for the traceability data (Code 128).

6.3 Magnetic-stripe card

The traceability information can be stored on a card with a magnetic-stripe data carrier.

The magnetic-stripe card shall conform to the requirements for ID-1 given in ISO/IEC 7810. The characteristics of the magnetic stripe shall conform to ISO/IEC 7811-2 and ISO/IEC 7811-4. The data shall be stored on track 1.

The card shall not contain physically embossed characters.

6.4 Microchip card

The microchip coding shall contain the same data and in the same order as the bar code.

Annex A
(informative)

Content of traceability system

The basic content of a traceability system is given in Table A.1.

Table A.1 — Content of traceability system

Traceability coding			Relevant standards
Manufacturer	Components	Pipes	ISO 4437
		Fusion-jointing fittings	ISO 8085-1, ISO 8085-2, ISO 8085-3
		Mechanical fittings	ISO 10838-1, ISO 10838-2, ISO 10838-3
		Valves	ISO 10933
User	Fusion-jointing equipment		ISO 12176-1, ISO 12176-2
	Fusion-jointing equipment operator		ISO 12176-3
	Code of practice		ISO/TS 10839

Gas distributor		Relevant specifications
User	Geographical location	User specifications

Annex B
(normative)

Data carrier

B.1 Bar-code card

B.1.1 Format description

The format shall be a bar code with 26 or 40 digits taken from Code 128, character set C. This is a four-level full-ASCII code. The width of a module is fixed at 0,19 mm for the narrowest bar.

The following general format shall be used:

Start character Code C Value 105	Body of message 40 or 26 digits	Physical checksum	Stop character Value 106

B.1.2 Body of message

B.1.2.1 General

The traceability information shall be made available in accordance with the following two encoding structures:

— a structure for encoding data on pipes, with a total length of 40 digits;

— a structure for encoding data on other components listed in Table B.4, with a total length of 26 digits.

Information shall be stored in the order given in B.1.3 or B.1.4, as applicable, without any spaces between data elements.

The character codes shall be as specified in Table B.1.

Table B.1 — Basic alphabet code

Basic alphabet code					
A = 01	F = 06	K = 11	P = 16	U = 21	Z = 26
B = 02	G = 07	L = 12	Q = 17	V = 22	+ = 27
C = 03	H = 08	M = 13	R = 18	W = 23	□ = 28
D = 04	I = 09	N = 14	S = 19	X = 24	■ = 29
E = 05	J = 10	O = 15	T = 20	Y = 25	

The content of each digit shall be as specified in B.1.2.2 to B.1.2.13.

B.1.2.2 Digits 1 to 4 — Component manufacturer (name/trade mark)

B.1.2.2.1 Type 1 encoding system

With the type 1 encoding system, the code, composed of two alphabetical characters, shall be as given in the relevant list available on the web site <http://www.traccoding.com>.

Component diameter information is added to digit 1. The offset value shall be as specified in Table B.2.

Table B.2 — Offset for component diameter information

Component diameter information	Offset
Two diameters in accordance with Table B.7	+ 0
One diameter expressed in millimetres	+ 3
One diameter expressed in centimetres	+ 6

Checksum information is added to digit 3. The offset value shall be as specified in Table B.3.

Table B.3 — Offset for checksum information

Checksum information	Offset
Without checksum	+ 0
With checksum calculated by Modulo 10 (digit 26)	+ 3

B.1.2.2.2 Type 2 encoding system

With the type 2 encoding system, the code shall be composed of four numeric characters as given by the relevant list available on the web site <http://www.traccoding.com>.

Any request for registering a new code will be dealt with directly through the web site by allocating a unique code generated automatically using the next number available.

B.1.2.3 Digits 5 and 6 — Type of component

The component code shall be as specified in Table B.4.

Table B.4 — Component codes

Component	Code
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
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	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	27
PE/brass transition fitting	28
Excess-flow valve	29

In digit 5, an offset allows differentiation between the type 1 and type 2 encoding systems. The offset value shall be as specified in Table B.5.

Table B.5 — Offset for differentiation between type 1 and type 2

Type of encoding system	Offset
Type 1	+ 0
Type 2	+ 5

B.1.2.4 Digits 7 to 9 — Component diameter(s)

B.1.2.4.1 General

Diameters shall be represented by three digits.

Diameters shall be expressed in one of the following ways:

— two diameters, encoded in accordance with B.1.2.4.2;

— one diameter given directly in millimetres (i.e. not encoded);

— one diameter given directly in inches (i.e. not encoded).

B.1.2.4.2 Encoding system for diameters

IMPORTANT — When a diameter is encoded, two diameters are always used. The same diameter is used for both sockets and pipes in the calculation.

To calculate the value D of the code, use the following factors:

— factor C_1 for the first diameter D_1,

— factor C_2 for the second diameter D_2,

where C_1 and C_2 are as specified in Table B.6.

For dimensions given in millimetres, take D_1 as the larger of the two diameters, i.e. $D_1 \geqslant D_2$ (where $D_1 = D_2$ corresponds to the case when there is only one diameter). D then is given by Equation (1).

$$D = (C_1 \times 31) + C_2 \quad (1)$$

For dimensions given in inches, take D_2 as the larger of the two diameters, i.e. $D_2 \geqslant D_1$ (where $D_2 = D_1$ corresponds to the case when there is only one diameter). D is then given by Equation (2).

$$D = (C_1 \times 31) + C_2 + 1 \quad (2)$$

In the case of pipe or socket diameters (same diameter) expressed in inches, the diameter can also be encoded directly as 001 in to 031 in.

The calculated values of D for all pipe and fitting diameters are given in Table B.7.

Table B.6 — Factors used in encoding diameters

D_1 **or** D_2 mm	D_1 **or** D_2 inch CTS [a]	D_1 **or** D_2 inch IPS [b]	**Factor** C_1 **or** C_2
16	1/2		01
20	1		02
25	1 1/4		03
32			04
40			05
50			06
63			07
75			08
90			09
110			10
125		1/2	11
140		3/4	12
160		1	13
180		1 1/4	14
200		1 1/2	15
225		2	16
250		3	17
280		4	18
315		6	19
355		8	20
400		10	21
450		11	22
500		12	23
560		13	24
630		14	25
710			26
800			27
900			28
1 000			29
1 200			30
$\geqslant$ 1 400			31

[a] CTS = Copper tubing system

[b] IPS = Iron pipe system

EXAMPLES

For 1/2 in CTS, D = (31 $\times$ 1) + 1 + 1 = 033

For 200 mm $\times$ 200 mm, D = (31 $\times$ 15) + 15 = 480

For 2 in $\times$ 1/2 in IPS, D = (31 $\times$ 11) + 16 + 1 = 358

For 90 mm $\times$ 63 mm, D = (31 $\times$ 9) + 7 = 286

For 21 in IPS, D = 021

Table B.7 — Calculated values of codes for diameters

Calculation: $(C1 \times 31) + C_2 + 1$ with $D_2 \geqslant D_1$; C_1 = 1, 2 and 3 = CTS; C_1 = 11, 12, ... 25 = IPS **Inch sizes**

			C_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	C_2	
C_1	D_1		D_2	1/2″	1″	1 1/4″	CTS						IPS	1/2″	3/4″	1″	1 1/4″	1 1/2″	2″	3″	4″	6″	8″	10″	11″	12″	13″	14″						D_1	C_1
1	16	032		033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049	050	051	052	053	054	055	056	057	058	059	060	061	062	1/2″	1
2	20	063	064		065	066	067	068	069	070	071	072	073	074	075	076	077	078	079	080	081	082	083	084	085	086	087	088	089	090	091	092	093	1″	2
3	25	094	095	096		097	098	099	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	1 1/4″	3
4	32	125	126	127	128		129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	CTS	4
5	40	156	157	158	159	160		161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186		5
6	50	187	188	189	190	191	192		193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217		6
7	63	218	219	220	221	222	223	224		225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248		7
8	75	249	250	251	252	253	254	255	256		257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279		8
9	90	280	281	282	283	284	285	286	287	288		289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310		9
10	110	311	312	313	314	315	316	317	318	319	320		321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	IPS	10
11	125	342	343	344	345	346	347	348	349	350	351	352		353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	1/2″	11
12	140	373	374	375	376	377	378	379	380	381	382	383	384		385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	3/4″	12
13	160	404	405	406	407	408	409	410	411	412	413	414	415	416		417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	1″	13
14	180	435	436	437	438	439	440	441	442	443	444	445	446	447	448		449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	1 1/4″	14
15	200	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480		481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	1 1/2″	15
16	225	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512		513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	2″	16
17	250	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544		545	546	547	548	549	550	551	552	553	554	555	556	557	558	3″	17
18	280	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576		577	578	579	580	581	582	583	584	585	586	587	588	589	4″	18
19	315	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608		609	610	611	612	613	614	615	616	617	618	619	620	6″	19
20	355	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640		641	642	643	644	645	646	647	648	649	650	651	8″	20
21	400	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672		673	674	675	676	677	678	679	680	681	682	10″	21
22	450	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704		705	706	707	708	709	710	711	712	713	11″	22
23	500	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736		737	738	739	740	741	742	743	744	12″	23
24	560	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768		769	770	771	772	773	774	775	13″	24
25	630	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800		801	802	803	804	805	806	14″	25
26	710	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832		833	834	835	836	837		26
27	800	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864		865	866	867	868		27
28	900	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896		897	898	899		28
29	1000	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928		929	930		29
30	1200	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960		961		30
C_1	⩾1400	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992		D_1	C_1
	D_2	16	20	25	32	40	50	63	75	90	110	125	140	160	180	200	225	250	280	315	355	400	450	500	560	630	710	800	900	1000	1200	⩾1400	D_2		
	C_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	C_2		

Calculation: $(C_1 \times 31) + C_2$ with $D_1 \geqslant D_2$ **Metric sizes**

B.1.2.5 Digits 10 to 15 — Production batch number

The production batch number shall be as given by the component manufacturer/supplier (see 5.2.4).

B.1.2.6 Digits 16 and 17 — Production site

The production site code shall be as defined by the component manufacturer (see 5.2.4).

B.1.2.7 Digit 18 — SDR

The code for the applicable pipe series SDR shall be as specified in Table 4.

B.1.2.8 Digits 19 to 22 — PE compound

With the type 1 encoding system, the code shall be composed of one alphabetical character and two numeric characters as given by the relevant list available on the web site <http://www.traccoding.com>.

With the type 2 encoding system, the code shall be composed of four numeric characters as given by the relevant list available on the web site <http://www.traccoding.com>.

B.1.2.9 Digit 23 — Type of material

The use of reprocessable material shall be identified by a code as specified in Table B.8.

Table B.8 — Codes for type of material

Type of material	Code
Virgin material	0
100 % reprocessable material	1
Virgin + reprocessable material	2

With the type 2 encoding system, information on the diameter(s) is added to digit 23. The offset value shall be as specified in Table B.2.

B.1.2.10 Digit 24 — PE designation

The code for the PE designation (MRS classification) shall be as specified in Table B.9.

Table B.9 — PE designation codes

PE designation	Code
Not used	0
PE 63	1
PE 80	2
PE 100	3
Reserved for future use	4
Reserved for future use	5
Reserved for future use	6
Reserved for future use	7
Reserved for future use	8
Reserved for future use	9

B.1.2.11 Digit 25 — MFR

The value of the MFR declared by the compound manufacturer/supplier, determined in accordance with ISO 1133 at a load of 21,6 kg and a temperature of 190 °C, shall be encoded in accordance with Table B.10.

Table B.10 — MFR codes

MFR g/10 min	Code
MFR value not specified [a]	0
MFR $\leqslant$ 5	1
5 < MFR $\leqslant$ 7	2
7 < MFR $\leqslant$ 10	3
10 < MFR $\leqslant$ 15	4
15 < MFR $\leqslant$ 20	5
20 < MFR $\leqslant$ 25	6
25 < MFR $\leqslant$ 32	7
32 < MFR $\leqslant$ 40	8
MFR > 40	9

[a] E.g. for electrofusion jointing.

B.1.2.12 Digit 26 — Control character (checksum)

The control character (checksum) is optional for the type 1 encoding system.

The control character (checksum) is mandatory for the type 2 encoding system.

The value of the control character shall be calculated

— for pipes: from all digits from 1 to 40, except digit 26;

— for other components: from all digits from 1 to 25.

Calculate the value of the control character in accordance with Clause A.9 of ISO/TR 13950:1997, as follows:

1 Add the numerical values of the odd positions in the message read from left to right, and multiply the total by 3.

2 Add the numerical values of the even positions in the message read from left to right.

3 Add the odd and even totals obtained in stage 1 and stage 2.

4 Determine the smallest number which, when added to the sum obtained in stage 3, produces a multiple of 10.

5 This number is then the control character value, and shall be placed in the 26th position in the message read from left to right.

B.1.2.13 Digits 27 to 40 – Additional information on pipes

Digits 27 to 36 are available for additional information required by the gas distributor (e.g. raw material batch number).

Digits 37 to 40 are available for further information (e.g. length of piping), if required by the gas distributor.

B.1.3 Bar-code structure for pipes

The bar-code structure shall be as specified in Table B.11. When the information is not required, zeros shall be inserted in the empty spaces.

Table B.11 — 40-digit bar-code structure

Digit number	Source	Information	Type 1 encoding system			Type 2 encoding system		
			Offset		Example	Offset		Example
1	List on web site	Name of manufacturer/supplier	+ 0, + 3, + 6 [a]	0	AL Two diameters encoded	—	9	9052
2			—	1		—	0	
3			+ 0, + 3 [b]	1		—	5	
4			—	2		—	2	
5	Table B.4	Type of pipe	+ 0 [c]	0	Straight pipe	+ 5 [c]	5	Coiled pipe
6			—	1		—	2	
7	Table B.7, if applicable	Diameter of pipe	—	4	200 mm × 200 mm	—	1	160 mm
8			—	8		—	6	
9			—	0		—	0	
10	Component manufacturer/supplier	Production batch number	—	1	Batch No. 123456	—	1	Batch No. 123456
11			—	2		—	2	
12			—	3		—	3	
13			—	4		—	4	
14			—	5		—	5	
15			—	6		—	6	
16		Production site	—	1	Site 12	—	1	Site 12
17			—	2		—	2	
18	Table 4	SDR value	—	7	SDR 11	—	4	SDR 17,6
19	List on web site	PE compound	—	0	A01	—	0	0101
20			—	1		—	1	
21			—	0		—	0	
22			—	1		—	1	
23	Table B.8	Type of material	—	0	Virgin material	+ 0, + 3, + 6 [d]	4	[e]
24	Table B.9	PE designation	—	2	PE 80	—	3	PE 100
25	Table B.10	MFR	—	5	$15 < MFR \leqslant 20$	—	4	$10 < MFR \leqslant 15$
26	Digits 1 to 40, except 26	Control character	—	0	—	—	1	[f]
27	Gas distributor's specifications	Additional information	—	0	Batch No. 713532J	—	0	Batch No. 120
28			—	0		—	0	
29			—	7		—	0	
30			—	1		—	0	
31			—	3		—	0	
32			—	5		—	0	
33			—	3		—	0	
34			—	2		—	1	
35			—	1		—	2	
36			—	0		—	0	
37	Gas distributor's specifications	Additional information	—	0		—	0	Length of piping 240 m
38			—	0		—	1	
39			—	0		—	2	
40			—	0		—	0	

[a] For component diameter information with the type 1 encoding system, as specified in Table B.2.

[b] For checksum information, as specified in Table B.3.

[c] To differentiate between type 1 and type 2, as specified in Table B.5.

[d] For component diameter information in the type 2 encoding system, as specified in Table B.2.

[e] 1 (100 % reprocessable material) + 3 (one diameter, expressed in millimetres).

[f] Calculated in accordance with Clause A.9 of ISO/TR 13950:1997:

$10 - [(9+5+5+1+0+2+4+6+2+0+0+4+4+0+0+0+0+2+0+2) \times 3 + (0+2+2+6+1+3+5+1+4+1+1+3+0+0+0+1+0+1+0)]_{10} = 1$

B.1.4 Bar-code structure for other components

The bar-code structure shall be as specified in Table B.12. When the information is not required, zeros shall be inserted in the empty spaces.

Table B.12 — 26-digit bar-code structure

Digit number	Source	Information	Type 1 encoding system			Type 2 encoding system		
			Offset	Example		Offset	Example	
1	List on web site	Name of manufacturer/supplier	+ 0, + 3, + 6 [a]	0	AL Two diameters encoded	—	9	9052
2			—	1		—	0	
3			+ 0, + 3 [b]	1		—	5	
4			—	2		—	2	
5	Table B.4	Type of component	+ 0 [c]	1	Reducer	+5 [c]	5	Socket
6			—	1		—	3	
7	Table B.7, if applicable	Component diameter(s)	—	4	160 mm × 125 mm	—	1	160 mm
8			—	1		—	6	
9			—	4		—	0	
10	Component manufacturer/ supplier	Production batch number	—	1	Batch No. 123456	—	1	Batch No. 123456
11			—	2		—	2	
12			—	3		—	3	
13			—	4		—	4	
14			—	5		—	5	
15			—	6		—	6	
16		Production site	—	1	Site 12	—	1	Site 12
17			—	2		—	2	
18	Table 4	SDR value	—	7	SDR 11	—	8	SDR 9
19	List on web site	PE compound	—	0	A01	—	0	0101
20			—	1		—	1	
21			—	0		—	0	
22			—	1		—	1	
23	Table B.8	Type of material	—	0	Virgin material	+ 0, + 3, + 6 [d]	4	[e]
24	Table B.9	PE designation	—	2	PE 80	—	3	PE 100
25	Table B.10	MFR	—	5	$15 < MFR \leqslant 20$	—	4	$10 < MFR \leqslant 15$
26	Digits 1 to 25	Control character	—	0	—	—	0	[f]

[a] For component diameter information with the type 1 encoding system, as specified in Table B.2.

[b] For checksum information, as specified in Table B.3.

[c] To differentiate between type 1 and type 2, as specified in Table B.5.

[d] For component diameter information in the type 2 encoding system, as specified in Table B.2.

[e] 1 (100 % reprocessable material) + 3 (one diameter, expressed in millimetres).

[f] Calculated in accordance with Clause A.9 of ISO/TR 13950:1997:

$10 - [(9+5+5+1+0+2+4+6+2+0+0+4+4) \times 3 + (0+2+3+6+1+3+5+1+8+1+1+3]_{10} = 0$

B.2 Magnetic-stripe card

The encoding of the process-specific fusion-jointing parameters shall be as specified in ISO/TR 13950:1997, including the product types (P0 ... P6) (see ISO/TR 13950:1997, Clause B.5), and the code shall include the information specified in Table B.13.

The production batch code shall include the SDR series and the PE material used, as defined in Table 4 and Table B.9.

Table B.13 — Details for encoding on magnetic card

Characteristic	Identifier/number of digits	Example
Manufacturer/supplier (logo)	F/2	FGF
Product/diameter	P/10	P4,160 × 110 (reducer)
Product batch code + SDR and PE material	S/6,2,1,3	S123456,11,7,N10

B.3 Microchip card

See Clause B.1 for encoding of data.

Bibliography

[1] ISO 4437:1997, *Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications*

[2] ISO 8085-1:2001, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 1: Fittings for socket fusion using heated tools*

[3] ISO 8085-2:2001, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 2: Spigot fittings for butt fusion, for socket fusion using heated tools and for use with electrofusion fittings*

[4] ISO 8085-3:2001, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 3: Electrofusion fittings*

[5] ISO 10838-1:2000, *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels — Part 1: Metal fittings for pipes of nominal outside diameter less than or equal to 63 mm*

[6] ISO 10838-2:2000, *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels — Part 2: Metal fittings for pipes of nominal outside diameter greater than 63 mm*

[7] ISO 10838-3:2001, *Mechanical fittings for polyethylene piping systems for the supply of gaseous fuels — Part 3: Thermoplastics fittings for pipes of nominal outside diameter less than or equal to 63 mm*

[8] ISO/TS 10839:2000, *Polyethylene pipes and fittings for the supply of gaseous fuels — Code of practice for design, handling and installation*

[9] ISO 10933:1997, *Polyethylene (PE) valves for gas distribution systems*

[10] ISO 12176-1:1998, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*

[11] ISO 12176-2:2000, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*

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