TECHNICAL SPECIFICATION

ISO/TS 17902

First edition
2016-11-15

Wrapped electrofoaming joints for polyethylene (PE) piping systems with smooth outer wall for gravity drains and sewers

Enveloppes d'assemblage électro-expansibles pour les systèmes de canalisations en polyéthylène (PE) à paroi extérieure lisse pour les collecteurs et branchements d'assainissement gravitaire

Reference number
ISO/TS 17902:2016(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **2**
3.1 General terms and definitions ... 2
3.2 Geometrical terms and definitions ... 2
3.3 Material terms and definitions ... 3

4 Symbols and abbreviated terms ... **4**
4.1 Symbols ... 4
4.2 Abbreviated terms ... 4

5 Material ... **4**
5.1 Material for the main layer ... 4
5.2 Material for the foaming layer ... 4

6 General requirements ... **4**
6.1 General description of the wrapped electrofoaming joints ... 4
6.2 Appearance ... 5
6.3 Colour ... 6
6.4 Electrical properties ... 6

7 Geometrical characteristics ... **6**
7.1 General ... 6
7.2 Dimensions of the wrapped electrofoaming joint ... 6
7.3 Dimensions of the clamping band ... 8

8 Mechanical characteristics ... **8**
8.1 Joint material integrity ... 8
8.2 Other mechanical characteristics ... 8
8.2.1 Preparations and pretreatment of test pieces ... 8
8.2.2 Test conditions and requirements ... 8

9 Performance requirements ... **9**

10 Marking ... **9**
10.1 General ... 9
10.2 Minimum required marking ... 9

Annex A (informative) **Wrapped electrofoaming joint joining procedure guide** ... **11**

Bibliography ... **13**

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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids,* Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage).*

Introduction

This document is the specification for electrofoaming plastic pipe joints used in non-pressure underground drainage and sewerage for polyethylene (PE) piping systems with smooth outer wall.

The wrapped electrofoaming joints may also be applied to pipes with diametrically deviated pipe ends.

The installation procedures specified in this document are intended to describe the proper joining method of electrofoaming joints.

An informative guidance for the joining procedure of products complying with this document is provided in Annex A.

Wrapped electrofoaming joints for polyethylene (PE) piping systems with smooth outer wall for gravity drains and sewers

1 Scope

This document specifies the definitions and requirements for wrapped electrofoaming joints for polyethylene (PE) piping systems with smooth outer wall for underground drains and sewer without pressure.

This document specifies product range, material characteristics, test methods and test parameters, dimension and characteristics of wrap.

This document is applicable to jointing pipes which have external wall thickness greater than 1,4 mm and a diameter up to DN/OD 2000, or DN/ID 2200.

NOTE 1 For dimensions larger than DN/OD 2000, or DN/ID 2200, this document can serve as a general guide regarding appearance, colour, physical and mechanical characteristics as well as performance requirements.

NOTE 2 Such products are intended to be used with pipes made from virgin and reworked materials.

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 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 8772, *Plastics piping systems for non-pressure underground drainage and sewerage — Polyethylene (PE)*

ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification, designation and design coefficient*

ISO 13254, *Thermoplastics piping systems for non-pressure applications — Test method for watertightness*

ISO 13953, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 21138-1, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 1: Material specifications and performance criteria for pipes, fittings and system*

ISO 21138-2, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 2: Pipes and fittings with smooth external surface, Type A*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4435, ISO 8772, ISO 21138-1, ISO 21138-2, ISO 13272, and ISO 1043-1 and the following apply.

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

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

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

3.1 General terms and definitions

3.1.1
structured-wall pipes and fittings
products that have an optimized design with regard to material usage to achieve the physical, mechanical and performance requirements of ISO 21138-1

3.1.2
solid-wall pipe and fitting
polyethylene pipe and fitting intended for use for non-pressure underground draining and sewerage

Note 1 to entry: Products defined by this term shall comply with ISO 8772.

3.1.3
main layer
PE layer to maintain the foaming layer in contact with the pipe surfaces

3.1.4
foaming layer
PE layer to which substances are added in order to ensure expansion under specified heating conditions, to obtain the final properties of the jointing

3.1.5
wrapped electrofoaming joint
joint consisting of a *main layer* (3.1.3) and a *foaming layer* (3.1.4) and which can be wrapped around the pipes

3.1.6
clamping band
metallic ancillary maintaining the wrapped *electrofoaming joint* (3.1.5) in position during the assembly procedure and which can be removed after cooling

3.1.7
electrofusion welding machine
electric power source that supplies constant current and/or voltage to connect the pipe with the *wrapped electrofoaming joint* (3.1.5)

3.2 Geometrical terms and definitions

3.2.1
nominal size DN
numerical designation of the size of a component, other than a component designated by thread size, which is approximately equal to the manufacturing dimension in millimetres

3.2.2
nominal size DN/OD
nominal size related to the outside diameter

3.2.3
nominal size DN/ID
nominal size related to the inside diameter

3.2.4
nominal diameter
d_n
specified diameter, in millimetres, assigned to a nominal size (DN/OD or DN/ID)

3.2.5
outside diameter
d_e
value of the measurement of the outside diameter through its cross-section at any point of a pipe or fitting, rounded to the next greater 0,1 mm

3.2.6
mean inside diameter
d_{im}
average value of a number of equally spaced measurements of inside diameter in the same cross-section of a pipe or fitting

3.2.7
minimum fitting wall thickness
e_{min}
measured fitting wall thickness at any point of the body of a component

3.3 Material terms and definitions

3.3.1
virgin material
material in form such as granules or powder that have not been subjected to use or processing other than that required for their manufacture and to which no reprocessable or recyclable materials have been added

3.3.2
own reprocessable material
material prepared from rejected unused pipes or fittings, including trimmings from the production of pipes and fittings, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known

3.3.3
external reprocessable material
material comprising either one of the following:

a) material from rejected unused pipes or fittings, or trimmings there from, that will be reprocessed and that were originally processed by another manufacturer;

b) material from the production of unused thermoplastics products other than pipes and fittings, regardless of where they are manufactured

3.3.4
recyclable material
material comprising either one of the following:

a) material from used pipes or fittings which have been cleaned and crushed or ground;

b) material from used thermoplastics products other than pipes or fittings which have been cleaned and crushed or ground

4 Symbols and abbreviated terms

4.1 Symbols

d_e outside diameter

d_{em} mean outside diameter

d_{im} mean inside diameter

d_n nominal diameter

t fitting wall thickness (at any point)

t_{min} minimum fitting wall thickness (at any point)

4.2 Abbreviated terms

DN/ID nominal size related to inside diameter

DN/OD nominal size related to outside diameter

ID inside diameter

OD outside diameter

PE polyethylene

S pipes series S

SDR standard dimension ratio

5 Material

5.1 Material for the main layer

The main layer shall be made from PE 80 or PE 100 material complying with ISO 12162.

The qualification of the material is granted as long as it fulfils the requirements of 7.1.

5.2 Material for the foaming layer

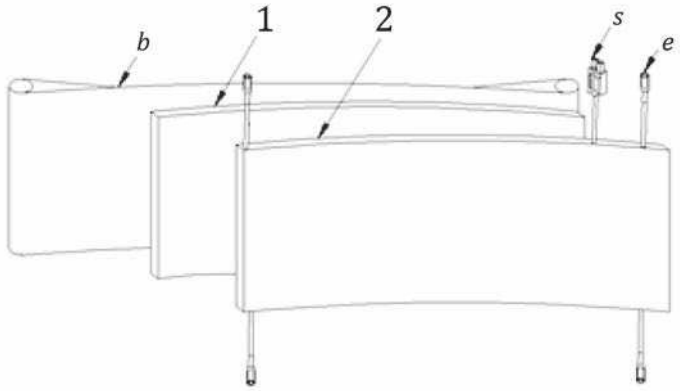
The base material for the foaming layer shall have a density from 911 kg/m^3 to 940 kg/m^3, when measured according to ISO 1183-1, to which may be added those additives that are needed to facilitate the manufacture of fitting conforming to the requirements of this document (e.g., foaming agent, adhesive agent).

The qualification of the material is granted as long as it fulfils the requirements of 7.1.

6 General requirements

6.1 General description of the wrapped electrofoaming joints

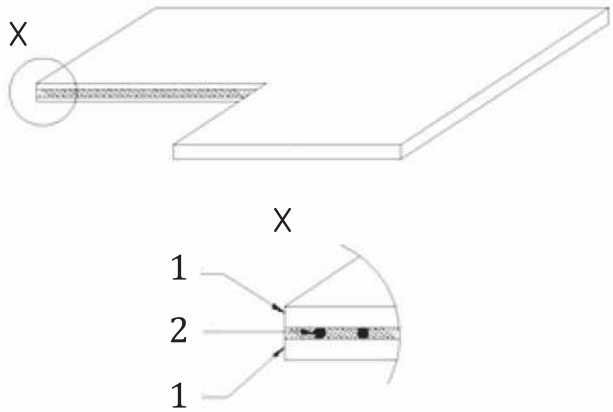
Wrapped electrofoaming joints consist of several layers (see Figure 1 and Figure 2): foaming layer including electrical device and main layer.



Key

1 main layer of electrofoaming joint
2 foaming layer of electrofoaming joint
b clamping band of joint
s temperature sensor connection terminal
e electric connection terminal

Figure 1 — Schematics of electrofoaming joints



Key

1 foaming layer of electrofoaming joint
2 electric thermal wire embedded in foaming layer

Figure 2 — Schematics of foaming layer

6.2 Appearance

When viewed without magnification, wrapped electrofoaming joints shall meet the following requirements:

— the internal and external surfaces shall be smooth, clean and free from grooving, blistering, impurities, pores and any other surface irregularity likely to prevent conformity with this document;

— the ends of wrapped electrofoaming joints shall be square to their axis.

The wrapped electrofoaming joints shall be homogeneous throughout, except where heating coils or electrical connectors are incorporated. They will also be free of cracks, holes, foreign inclusions, or injurious defects such as gouges, dents, cuts, etc. The wrapped electrofoaming joints shall be as uniform as commercially practicable in opacity, density, and other physical properties. Any heating coils, connecting cables, connectors, and related electrical power source shall be designed to prevent electrical shock to the user.

6.3 Colour

The colour of each layer should preferably be black. Other colours may be used.

6.4 Electrical properties

The electrical protection to be provided by the system depends on the voltage and the current strength used and on the characteristics of the electricity power.

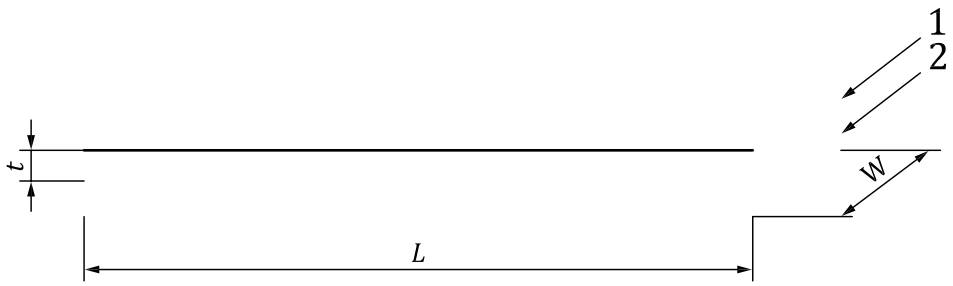
For voltages greater than 25 V, direct human contact with the energized parts shall not be possible when the joint is in the fusion cycle during assembly in accordance with the instructions of the manufacturer of the joints and assembly equipment, as applicable.

7 Geometrical characteristics

7.1 General

Dimensions in Figure 3 shall be measured in accordance with ISO 3126.

NOTE The figure is a schematic sketch only, to indicate the relevant dimensions.



Key

1 main layer of electrofoaming joint
2 foaming layer of electrofoaming joint
W layer width of electrofoaming joint
L layer length of electrofoaming joint
t thickness of main layer

Figure 3 — Dimensions of electrofoaming layer

7.2 Dimensions of the wrapped electrofoaming joint

The dimension of wrapped electrofoaming joint shall satisfy DN/OD and DN/ID series of pipe allowance described in ISO 8772 and ISO 21138-2 and follow Table 1 and Table 2.

Table 1 — Wrapped electrofoaming joints layer dimension for DN/OD series

Dimensions in millimetres

Pipe nominal size DN/OD	Nominal outside diameter d_n	Minimum layer length L_{min}	Minimum width W_{min}	Minimum thickness of the main layer t_{min}
200	200	630	160	5
250	250	790	160	5
315	315	990	220	5
355	355	1 115	220	5
400	400	1 260	220	5
450	450	1 415	300	6
500	500	1 537	300	6
630	630	1 980	300	6
800	800	2 520	400	6
1 000	1 000	3 145	460	7
1 200	1 200	3 770	460	7
1 400	1 400	4 400	460	7
1 600	1 600	5 026	520	7
1 800	1 800	5 654	520	7
2 000	2 000	6 280	520	7

Table 2 — Wrapped electrofoaming joints layer dimension for DN/ID series

Dimensions in millimetres

Pipe nominal size DN/ID	Mean inside diameter d_{im}	Minimum layer length L_{min}	Minimum width W_{min}	Minimum thickness of the main layer t_{min}
300	300	1 236	220	5
360	360	1 450	220	5
400	400	1 585	220	5
450	450	1 816	300	6
500	500	1 984	300	6
600	600	2 348	300	6
700	700	2 684	400	6
800	800	3 032	400	6
900	900	3 431	400	6
1 000	1 000	3 780	460	7
1 200	1 200	4 583	460	7
1 400	1 400	5 245	460	7
1 500	1 500	5 641	520	7
1 600	1 600	5 856	520	7
1 800	1 800	6 630	520	7
2 000	2 000	7 383	520	7
2 200	2 200	8 096	520	7

7.3 Dimensions of the clamping band

The clamping band shall cover the whole outer circumferences of the pipes and ensure that no gap remain between the clamping elements after tightening.

8 Mechanical characteristics

8.1 Joint material integrity

The joint material integrity is assessed with the test method as specified in Table 3, using the indicated parameters. The foaming layer integrated with main layer, the material shall have characteristics confirming to the requirements given in Table 3.

Table 3 — Joint material integrity requirements

Characteristic	Requirement	Test parameter		Test methods
Tensile strength[a]	> 20 MPa	Cross-head speed	5 mm/min	ISO 13953
Resistance to internal pressure[b]	No failure during the test period	Test temperature	80 °C	ISO 1167-1
		Pressure	0,25 bar[c]	ISO 1167-2
		Type of test	In accordance with ISO 1167-1	
		Test period	Water-in-water 1 000 h	

[a] Test piece shall be cut from a solid-wall pipe integrated with wrapped electrofoaming joints in longitudinal machine direction without the clamping band.

[b] This test shall be carried out in the form of a solid-wall pipe integrated with wrapped electrofoaming joints without the clamping band.

[c] The specified test pressure shall a minimum at any point of the sample (specially the highest point of large diameter pipes), and added to the potential external pressure resulting from the outer water, due to water-in-water test.

8.2 Other mechanical characteristics

8.2.1 Preparations and pretreatment of test pieces

For the testing according to 8.2.2, test pieces shall be prepared in accordance with Table 4, from PE pipes and wrapped electrofusion joint, which have been assembled according to the manufacturer recommendations. Unless otherwise specified, test samples shall be conditioned in temperature (23 ± 2)°C and relative humidity of (50 ± 20) % for 24 h, before being submitted to test.

Table 4 — Test pieces preparation

Characteristic	Test piece	Preparation	Number of test piece
Mechanical strength or flexibility	Wrap coupled with pipe	Wrap length	1
Impact strength (drop test)	Wrap coupled with pipe	Fuse (500 ± 100) mm pipe to the wrap	1

8.2.2 Test conditions and requirements

When tested in accordance with the test methods as specified in Table 5 using the indicated parameters, the test pieces shall have mechanical characteristics conforming to the requirements given in Table 5.

Table 5 — Mechanical characteristics

Characteristic	Requirement	Test parameter		Test methods
Impact strength (drop test)	See applicable pipe standard			
Mechanical strength or flexibility	No signs of splitting cracking, separation	Test period	15 min	ISO 13264
		Minimum displacement	170 mm	
		Minimum moment[a] for:		
		[DN] ≤ 250	$0{,}15 \cdot [DN]^3 \times 10^{-6}$ kN·m	
		[DN] > 250	0,01·[DN] kN·m	
[a] Choose between minimum displacement and minimum moment, as applicable.				

9 Performance requirements

When determined in accordance with the test methods as specified in Table 6 using the indicated parameters, the fitness-for-purpose characteristics of the joints and assembly shall conform to the requirements given in Table 6.

Table 6 — Fitness for-purpose characteristics of assembly

Characteristic	Test parameters		Requirements	Test method
Tightness of electrofoaming joints	Test temperature	(23 ± 5) °C		ISO 13254
	EF deflection	10 %		
	Water or air pressure	50 kPa (0,5 bar)	No leakage	
	Air pressure	−30 kPa (−0,3 bar)	Pressure after 15 min ≤ −27 kPa (−0,27 bar)	

10 Marking

10.1 General

Marking elements shall be labelled, printed, or formed directly on the external layer, in such a way that after storage, weathering, handling and installation, legibility is maintained.

Marking shall not initiate cracks or other types of defect that adversely influence the performance of the wrapped electrofoaming joints.

10.2 Minimum required marking

The minimum required marking of the wrapped electrofoaming joints shall conform to Table 7.

Table 7 — Minimum required marking of the wrapped electrofoaming joints

Information	Marking or symbols
Number of this Technical Specification	ISO/TS 17902
Diameter series, nominal size	
DN/OD series	DN/OD 200
[a] Shall be given in clear figures or in a code providing traceability to the following details: — the production period year and month; — the production site if the manufacturer is producing in different sites, nationally and/or internationally.	

Table 7 *(continued)*

Information	Marking or symbols
And/or applicable	
DN/ID series	DN/ID 200/198
Manufacturer's name and/or trade mark	XXX
Material	PE
Manufacturer's information	[a]

[a] Shall be given in clear figures or in a code providing traceability to the following details:

— the production period year and month;

— the production site if the manufacturer is producing in different sites, nationally and/or internationally.

Annex A
(informative)

Wrapped electrofoaming joint joining procedure guide

A.1 Fusion joint procedure for DN/OD and DN/ID below 600 — 1 wrap

A.1.1 Make a mark line on each end of the pipes to be connected. Remove dirt, moisture and earth on the outer surface of the pipe and inner surface of the joint.

A.1.2 Place the wrap joint on the marked line of the pipe.

A.1.3 Tighten the wrap joint with the clamping band until the electrofoaming joint comes into contact with the pipe surface.

A.1.4 Connect the temperature sensor and the power cable terminal of the wrapped electrofoaming joints to the welding machine. Input the information for fusion process on the welding machine if necessary. Press the start button of the welding machine.

A.1.5 After the foaming fusion process stops, disconnect the temperature sensor and the power cable, then, remove the clamping band (see Figure A.1).

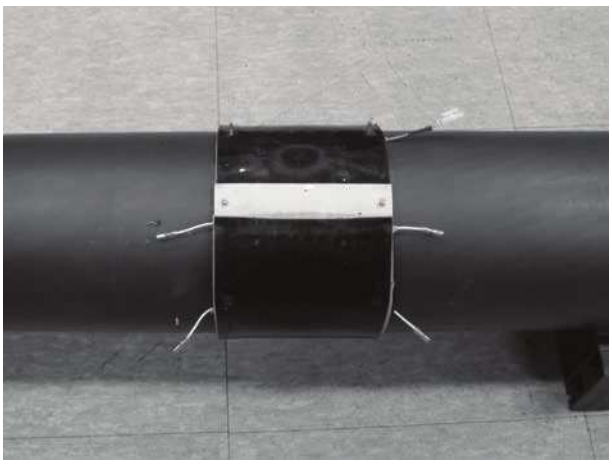


Figure A.1 — Example of a 1 wrap joint

A.1.6 Print the fusion data from the welding machine to check the fusion integrity and to keep the information, if it is available.

NOTE The use of fittings and joining procedures which are not covered by a recognized standard is subjected to the judgment and discretion of the purchaser. Further investigation and testing could be needed to establish its suitability and safety for the intended service.

A.2 Fusion joint procedure for 2 or more wrap joint (DN/OD and DN/ID over 700) — 2 wrap process

A.2.1 Make a mark line on each end of the pipes to be connected. Remove dirt, moisture and earth on the outer surface of the pipe and the inner surface of the joint.

A.2.2 The electrofoaming wrap for DN/OD and DN/ID over 700 consists of two or more wraps, designated as A and B. Place the EF-A and the EF-B on the marked line of the pipe.

A.2.3 Tighten the wrap joint with the clamping band until the electrofoaming joint comes into contact with the pipe surface.

A.2.4 Connect the temperature sensor and the power cable terminal of the EF-B joints to the welding machine. Input the information for fusion process on the welding machine if necessary. Press the start button of the welding machine.

A.2.5 After the foaming fusion process for EF-B is completed, disconnect the sensing terminal and the power cable of EF-B. Repeat joining procedure A.2.4 on the EF-A part.

A.2.6 After the EF-A and EF-B wrap welding process, remove the clamping band.

A.2.7 Print the fusion data from the welding machine if possible for checking the fusion integrity.

A.3 Fusion joint procedure for 2 or more wrap joint (DN/OD and DN/ID over 700) — 4 wrap process

A.3.1 The EF wrap for DN/OD and DN/ID above 1 400 consists of four wraps, designated as A-1, A-2, B-1, B-2.

A.3.2 Assemble A-1 and B-1(same with A-2 and B-2), see Figure A.2.

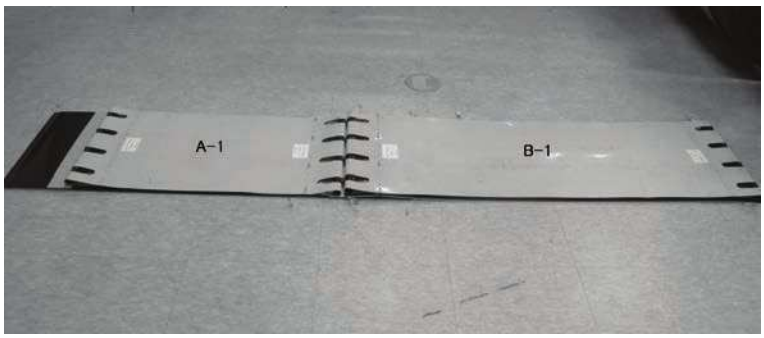


Figure A.2 — Example of a 2-wrap joints

A.3.3 Place the assembled wraps (EF A-1/B-1 and EF A-2/B-2) on the marked line of the pipe. Assembling and jointing methods are the same as the aforementioned steps A.2.3 to A.2.7.

A.3.4 The fusion joint sequences are as follows: B-1, B-2, A-1, A-2.

Bibliography

[1] ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

[2] ISO 13272, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP), polypropylene with mineral modifiers (PP-MD) and polyethylene (PE) — Specifications for manholes and inspection chambers in traffic areas and underground installations*

ICS 23.040.20; 23.040.45; 93.030

Price based on 13 pages