



CD/K/049:2009
ICS 23.040.10; 23.040.40

EAST AFRICAN STANDARD

Ductile iron pipes, fittings and accessories — External polyethylene coating for pipes — Requirements and test methods

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

© East African Community 2010 — All rights reserved*

East African Community

P O Box 1096

Arusha

Tanzania

Tel: 255 27 2504253/8

Fax: 255-27-2504481/2504255

E-Mail: eac@eachq.org

Web: www.each.int

Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

BS EN 14628:2005, *Ductile iron pipes, fittings and accessories — External polythene coating for pipes — Requirements and test methods*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

Draft for comments only — Not to be cited as East African Standard

BRITISH STANDARD

**BS EN
14628:2005**

Ductile iron pipes, fittings and accessories — External polyethylene coating for pipes — Requirements and test methods

The European Standard EN 14628:2005 has the status of a
British Standard

ICS 23.040.10; 23.040.40

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSi
British Standards

National foreword

This British Standard is the official English language version of EN 14628:2005.

The UK participation in its preparation was entrusted to Technical Committee PSE/10, Iron pipes and fittings, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 23 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 November 2005

© BSI 28 November 2005

ISBN 0 580 46917 4

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 14628

October 2005

ICS 23.040.10; 23.040.40

English Version

**Ductile iron pipes, fittings and accessories - External
polyethylene coating for pipes - Requirements and test methods**

Tuyaux, raccords et accessoires en fonte ductile -
Revêtement extérieur en polyéthylène de tuyaux -
Exigences et méthodes d'essai

Rohre, Formstücke und Zubehör aus duktilem Gusseisen -
Polyethylenumhüllung von Rohren - Anforderungen und
Prüfverfahren

This European Standard was approved by CEN on 29 August 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents	Page
Foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Ordering information	7
5 Technical Requirements	7
6 Performance requirements	9
7 Test Methods	11
Annex A (informative) Quality assurance	16
Annex B (informative) Application process	19
Annex C (informative) Coating material	21
Bibliography	23

Foreword

This European Standard (EN 14628:2005) has been prepared by Technical Committee CEN/TC 203 "Cast iron pipes, fittings and their joints", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EN 14628:2005 (E)

Introduction

This European Standard is in conformity with the general requirements already established by CEN/TC 164 in the field of water supply (e.g. potable water) and CEN/TC 165 in the field of waste water.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

- a) this European Standard provides no information as to whether the product may be used without restriction in any of the member states of the EU or EFTA;
- b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This European Standard defines the requirements and test methods applicable to factory applied extruded polyethylene coatings for the external corrosion protection of ductile iron pipes conforming to EN 545, EN 598 and EN 969 for use at operating temperatures up to 50 °C.

This European Standard does not cover ductile iron pipes protected with thin PE sleeve. Special works at site like drilling, tapping etc. may influence the corrosion protection properties. Those job steps shall be included in the instructions of pipe saddle and accessory manufacturers and all other essential installation instructions. These instructions are not part of this European Standard.

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.

EN 545, *Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods.*

EN 598, *Ductile iron pipes, fittings, accessories and their joints for sewerage application – Requirements and test methods.*

EN 969, *Ductile iron pipes, fittings, accessories and their joints for gas pipelines – Requirements and test methods.*

EN 1238, *Adhesives – Determination of the softening point of thermoplastic adhesives (ring and ball).*

EN ISO 527-1, *Plastics – Determination of tensile properties - Part 1: General principles (ISO 527-1:1993 including Corr 1:1994).*

EN ISO 527-2, *Plastics – Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994).*

EN ISO 1133, *Plastics – Determination of the melt mass - flow rate (MFR) and the melt volume - flow rate (MVR) of thermoplastics (ISO 1133:1997).*

EN ISO 3681, *Binders for paints and varnishes – Determination of saponification value – Titrimetric method (ISO 3681:1996).*

EN ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources (ISO 4892-2:1994).*

3 Terms and definitions

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

3.1

ductile iron

cast iron used for pipes, fittings and accessories in which graphite is present substantially in spheroidal form

3.2

elongation at break

relative change in length of the specimen of the polyethylene material when it breaks in a tensile test

EN 14628:2005 (E)

3.3

heat ageing

artificial ageing of the polyethylene under the effects of hot air at a given temperature and over a given period

3.4

impact strength

impact energy which a coating can withstand without damage under defined test conditions

3.5

indentation resistance

resistance of the coating to the penetration of a punch under defined test conditions

3.6

light ageing

artificial ageing of the polyethylene under the effects of xenon arc radiation at an elevated temperature and at a given level of atmospheric humidity using a xenon test apparatus

3.7

minimum coating thickness

lower limit specified for the polyethylene coating thickness

3.8

non-porosity

absence of holidays in a high voltage test under defined test conditions

3.9

peel resistance

force required to peel off a strip of polyethylene coating over a defined peeling path under defined test conditions

3.10

polyethylene coating

coating which generally consists of two factory applied layers:

- an adhesive layer applied by extrusion or by hot spraying; and
- an extruded polyethylene compound outer layer applied either by the tubular extrusion method (cross head extrusion) or by the flat die wrapping extrusion method.

3.11

specific coating resistance

surface related electric resistance of the coating perpendicular to the pipe wall

3.12

performance test

test which is done once and is repeated only after change of polymer supplier, polymer material or relevant change in process application

3.13

routine test

test carried out to control the manufacturing process with a frequency defined by the manufacturer

4 Ordering information

4.1 General The following information shall be supplied to the manufacturer by the purchaser:

4.2 Mandatory

Ductile iron pipes according to EN 545, EN 598 or EN 969, but coated in accordance with this European Standard shall be specified in the purchasers enquiry and order by reference to this standard:

EXAMPLE 5 000 m of ductile iron pipe DN 300 according to EN 545;
 external polyethylene coating according to EN 14628.

4.3 Options to be indicated by the purchaser

One of the following options shall be specified by the purchaser:

- a) standard thickness, pipe not zinc-coated: PE-A;
- b) increased thickness, pipe not zinc-coated: PE-B;
- c) standard thickness, pipe zinc-coated: PE-C;
- d) increased thickness, pipe zinc-coated: PE-D.

In the event that no option is stipulated option a) shall apply.

5 Technical Requirements

5.1 Surface preparation

The polyethylene coating shall be applied to the works' standard oxide skin surface, blast cleaned surface or zinc coated surface of ductile iron pipes. Immediately prior to application the surface of the pipes shall be substantially free of rust (individual incipient rust spots are permissible), loose constituent materials, dirt, oil, grease and moisture.

5.2 Material properties

5.2.1 Polyethylene

Only the use of virgin material is permitted.

5.2.2 Adhesive

The adhesive consists generally of a blend of rubber and high molecular weight resins and its physical properties shall conform to the values specified in Table 1.

Table 1 — Adhesive physical properties

Property	Standard	Requirements
Softening point	EN 1238	70 °C to 112 °C
Saponification value	EN ISO 3681	< 3 mg KOH/g

EN 14628:2005 (E)

5.3 Finished polyethylene coating

5.3.1 Appearance and continuity

The polyethylene coating shall be of:

- uniform colour, except for permitted marking;
- uniform appearance and smoothness, except admissible repairs.

5.3.2 Minimum coating thickness

The minimum coating thickness shall comply with the values given in Table 2 for the standard thickness or for the increased thickness (see 4.2.).

Table 2 — Polyethylene thickness

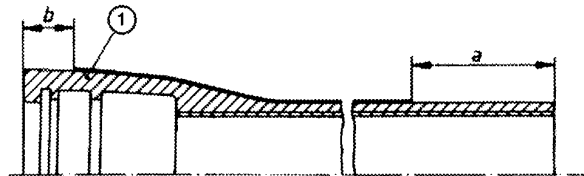
Nominal size DN	Minimum coating thickness mm	
	Standard thickness	Increased thickness
80 to 100	1,8	2,5
125 to 250	2,0	2,5
300 to 450	2,2	3,0
500 to 700	2,5	3,5
800 to 1 400	3,0	3,5
1 500 to 2 000	3,5	4,0

The polyethylene coating thickness shall be measured in accordance with the method defined in 7.2.

Localised areas where the minimum coating thickness is not attained are permissible if these do not exceed a total area of 5 cm² over one metre length of pipe and the thickness of the coating is not less than 90 % of the specified minimum coating thickness.

5.3.3 Ends of pipes

The spigot shall be not covered by the polyethylene coating over a free length "a" (see Figure 1).



Key

- 1 Push in socket

Figure 1 — Ends of pipe

The uncoated spigot length "a" depends on the type of joint. It is the responsibility of the manufacturer to define the appropriate uncoated length for each type of joint.

The front end of sockets may be uncoated on a length "b" depending on the application method (see Annex B):

- tubular extrusion: < 5 mm, (15 mm after storage outside);
- flat die wrapping extrusion: < 50 mm.

The pipe ends surfaces not covered by the polyethylene coating (spigot, front end of socket and internal section of socket) shall be coated with filled bituminous paint or other suitable coating(s). Where such coatings are in contact with water intended for human consumption, these shall comply with the relevant requirements stated in the introduction of this European Standard.

NOTE The pipe parts not covered by PE will be protected after laying using appropriate measures, e.g. heat shrinkable sleeves, which are in compliance with EN 545, EN 598 or EN 969.

5.4 Repairs

In case of holidays or damage, repairs shall be carried out in accordance with the manufacturer's written instructions. All repairs shall subsequently meet the non-porosity test requirements.

5.5 Marking

All pipes shall be marked legibly and durably according to the pipe standard EN 545, EN 598 or EN 969 with the addition: PE-A, PE-B, PE-C or PE-D (see 4.3). The transported medium can be denoted by appropriate markings, e.g. by coextruded coloured stripes.

5.6 Peeling strength

Experience with the transport, laying and operation of polyethylene-coated pipes and pipelines has shown that good bonding is necessary in order to avoid mechanical damage. It is, however, not necessary to ensure the corrosion protection properties of polyethylene coating if the thickness and the quality of the coating comply with the requirements of this European Standard.

When tested in accordance with method 1 as defined in 7.1.2, the adhesive shall be selected in order to provide a mean peel resistance of at least 10 N per cm strip width (zinc coating) or 20 N per cm strip width (oxide skin) of polyethylene coating.

When tested in accordance with method 2 defined in 7.1.3, the peeling time shall be at least 0,04. *DN* in minutes. The mean peeling rate is thus 10 mm/min.

5.7 Non-porosity

The polyethylene coating shall be free from pores extending through the coating, so, no electrical puncture shall occur according to the test method defined in 7.3.

6 Performance requirements

6.1 Impact strength

The minimum impact strength shall be determined in accordance with the test method defined in 7.4.

The number of electrical punctures in the test shall be confined to range A as defined in Figure 2.

6.3 Elongation at break

The elongation at break shall be assessed by testing in accordance with the test method defined in 7.6.

The elongation at break for polyethylene coating shall be at least 200 %.

Ten specimens taken from at least five different pipes shall be subjected to this test.

The maximum allowable failure rate shall be one specimen out of ten. If the result does not comply with the requirements, a second test with ten specimens shall be carried out without any failure allowed.

6.4 Specific coating resistance

The specific coating resistance of the polyethylene coating shall be assessed by testing in accordance with the test method defined in 7.7.

The specific coating resistance of the polyethylene coating after immersion in a 0,1 M NaCl solution for 100 days shall be at least $10^8 \Omega \text{ m}^2$.

The ratio (resistance after 100 days)/(resistance after 70 days) shall not be less than 0,8 if the surface resistance of the coating is only one decimal power above the minimum permissible value for 100 days.

6.5 Heat ageing

The heat ageing shall be assessed in accordance with the test method defined in 7.8.

The change in the melt-flow rate of the specimens after being subjected to the effects of heat shall not exceed $\pm 35 \%$ of the initial value.

6.6 Light ageing

The light ageing shall be assessed in accordance with the test method defined in 7.9.

The change in the melt-flow rate of the specimens after exposure to xenon arc radiation shall not exceed $\pm 35 \%$ of the initial value.

7 Test Methods

7.1 Peel resistance of the adhesive

7.1.1 General

Test methods 1 and 2 are comparative tests to assess the resistance to peeling of the polyethylene coating on ductile iron pipes. They do not provide absolute bonding strength values. Therefore, a direct comparison of the values produced by test methods 1 and 2 is not possible. The test temperature shall be between 15 °C and 25 °C.

The tests shall be carried out on a ductile pipe, either with the oxide layer, or zinc coated.

Test methods 1 and 2 may be used for all diameters of pipe. In all cases the test method used is to be specified together with the determined peel resistance.

7.1.2 Test method 1

Conditions for use:

Maintenance of a constant peeling rate and a peeling angle of 90° to the surface of the pipe.

EN 14628:2005 (E)

The following are required for the test:

A double-bladed saw or a corresponding cutting device and a peeling device with recording dynamometer (example shown in Figure 3).

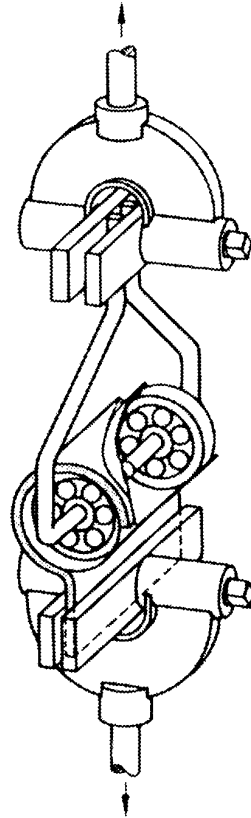


Figure 3 — Peel resistance test method 1

Incisions shall be made in the polyethylene coating (e.g. by means of a double-bladed saw) down to the wall of the ductile iron pipe to produce a strip of minimum 20 mm and maximum 50 mm in width around the circumference. The strip thus produced shall be cut at right angle to the incisions and a length of approximately 20 mm lifted from the pipe by means of a knife. The strip shall be peeled off in the peeling device at a rate of 10 mm/min. The force applied shall be recorded. The mean value shall be calculated from this recording and expressed in N, the first and last 20 mm being excluded from the evaluation. In the test, the test path used may not contain any averaged path section in which the mean peeling force is less than 75 % of the mean value required. A path section is deemed to be any part of the path over the extent of the test path with a length of 20 mm.

7.1.3 Test method 2

The following are required for the test:

A double-bladed saw or a corresponding cutting device, a clamp, and a stop watch. The test arrangement can be seen from Figure 4.

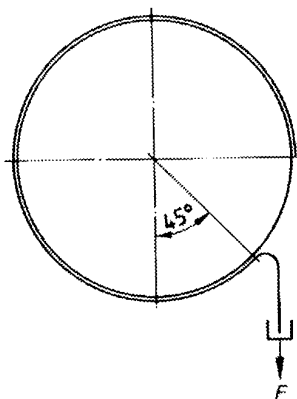


Figure 4 — Peel resistance test method 2

Incisions shall be made in the polyethylene coating (e.g. by means of a double-bladed saw) down to the wall of the ductile iron pipe to produce a strip of minimum 20 mm and maximum 50 mm in width. The strip shall be cut off laterally at the lowest point of the circumference of the pipe and at the level of the pipe axis. Starting at the latter cut, the strip shall be lifted from the ductile iron pipe by means of a knife over a 45° section of the circumference of the pipe (see Figure 4). A weight equal to 2,0 kg (pipe with oxide skin) or 1,0 kg (zinc coated pipe) per cm width of strip shall be attached to the free end.

The peeling time required for the 45° section terminating at the lowest point shall then be measured.

7.2 Coating thickness

The thickness of the coating shall be measured with non-destructive instruments (e.g. based on magnetic or electro-magnetic principles) with a measuring accuracy of $\pm 1\%$.

A sufficient number of measurements distributed over the production shift or batch, length and circumference of the pipes, shall be carried out to demonstrate conformance with the specified requirements.

7.3 Non-porosity

AC or DC devices with a voltage of 25 kV and test electrodes are required as test instruments.

During the measurement the test electrode (e.g. the metal brush) shall be in contact with the surface of the coating, since any significant air gap would falsify the result. The presence of faults can be detected by the noise of the arcing spark or by signals emitted by the instrument.

7.4 Impact strength

The impact strength shall be tested by dropping a weight on the coating with a given energy and checking the level of damage. The specimen (pipe or pipe shell) shall be supported in such a way that the spring action of the specimen caused by the impact of the falling weight is absorbed. The impacting surface of the falling weight shall be a section of a sphere with a diameter of 25 mm. A high-voltage instrument with a test voltage of 25 kV shall also be used to determine the presence of punctures.

EN 14628:2005 (E)

The test shall be carried out at an ambient temperature of (23 ± 2) °C. The height of fall of the falling weight shall be approximately 1 m.

The impact energy to be applied shall be 5 J per millimetre of minimum coating thickness for $DN > 200$; This figure shall be reduced by 15 % for $DN \leq 200$ in order to account for their increased radius of curvature.

The minimum distance between two impact points shall be 30 mm.

Care shall be taken to ensure that the impact energy is maintained at a constant level by ensuring that little or no friction is encountered when the falling weight is dropped.

Any punctures shall be detected immediately after impact by applying a test voltage of 25 kV (in accordance with 7.3).

For reasons of statistical accuracy, a sufficient number of impacts shall be carried out until the number of electrical punctures falls into either range A or range C given in Figure 2. If the number of punctures falls into range B (see Figure 2), the test shall be continued accordingly until either range A (passed) or range C (failed) is reached.

7.5 Indentation resistance

The test is to be carried out on the peeled-off and adhesive-free PE-layer with max. 2 mm thickness, if necessary by grinding off the underside.

The test is to be carried out on five specimens taken from different pipes. If one of the specimens fails to satisfy the requirements, the test is to be repeated on ten additional specimens taken from ten different pipes, in which case none of the specimens may fail.

The test apparatus consists of a 250 g metal bar which can receive an additional weight. A metal pin with a smooth end face measuring 1,8 mm in diameter ($2,5 \text{ mm}^2$ of punch area) shall be attached centrally to the bottom end of the bar. The total weight shall be 2,5 kg which equates to a pressure of 10 N/mm^2 . A penetrometer comprising a dial gauge with an accuracy of 0,05 mm is required.

The test shall be carried out at a temperature of (23 ± 2) °C. After a temperature stabilisation period of one hour, the punch without additional weight shall be slowly and carefully placed on the specimen and the zero value determined within 5 s. The additional weight shall subsequently be applied slowly and carefully. The depth of penetration (indentation depth) shall be measured on the penetrometer scale to within 0,05 mm after a loading period of 24 h.

7.6 Elongation at break

Ten specimens taken from at least 5 different pipes shall be subjected to this test. The specimens shall be prepared in such a way that they shall be removed without damage either by applying the PE without adhesive or by subsequently heating the pipe to a maximum temperature of 80 °C. The specimens shall be taken in the circumferential direction.

The test of elongation at break shall be carried out at a temperature of (23 ± 2) °C in accordance with EN ISO 527-2 on shoulder test bars type 1B. Measurements shall be taken between measuring marks at a speed of 50 mm/min in accordance with EN ISO 527-1. For smaller diameters test bar type 1BA may be used. In this case a speed of 20 mm/min shall apply.

7.7 Specific coating resistance

Five specimens each with a test area of not less than $0,03 \text{ m}^2$ taken from five different pipes shall be tested. If one of the specimens does not satisfy the requirements, the test shall be repeated on 10 further specimens, in which case none of the specimens may fail. Prior to the test each specimen shall be tested for non-porosity (see 7.3). The test equipment shall comprise a counter electrode with a surface area of not less than 10 cm^2 , a DC source with an output voltage of not less than 50 V, an ammeter and a voltmeter are also required. A 0,1 M NaCl solution shall be used as the test medium.

The specimens shall be exposed to the test medium for a duration of 100 days.

Either one of the following test arrangements may be used:

- a) one end of the pipe specimen to be tested shall be sealed in such a way that the test medium cannot come into contact with the metal surface of the ductile iron pipe. For the purposes of measuring the resistance, the specimens may be removed from the test medium and wetted with any suitable electrolyte solution (towel method);
- b) a vessel containing the test medium shall be attached to the surface of the pipe by means of an appropriate adhesive.

The measurement shall be carried out by attaching the positive pole of the DC source to the ductile iron pipe and the negative pole to the counter electrode. The counter electrode shall be immersed in the test medium. It may be the container wall as under a) or the vessel wall as under b).

The specific coating resistance R_s of the coating shall be calculated using equation:

$$R_s = \frac{U \cdot A}{I} \text{ in } \Omega\text{m}^2 \quad (1)$$

where

R_s is the specific coating resistance, in $\text{Ohm}\cdot\text{m}^2$;

U is the voltage between counter electrode and ductile iron pipe, in Volt;

A is the test area in m^2 ;

I is the current flowing through the coating, in amperes.

The electrical voltage shall only be applied during the measurement. The first measurement shall be carried out at least 3 days after the specimen has been installed. Measurements shall subsequently be carried out at 10 day intervals.

7.8 Heat ageing

Heat ageing shall be tested in a forced-air oven on specimens removed from the pipes and with all adhesive removed. The maximum thickness of the specimens shall be 2 mm: the underside is to be removed by abrasion where necessary. The test shall be carried out at a temperature of 100 °C over a period of 100 days (2 400 h). In order to determine the melt-mass flow rate the specimens shall be removed at intervals of 400 h and the melt-mass flow rate measured in accordance with EN ISO 1133.

7.9 Light ageing

In order to carry out comparative tests on the polyethylene coating under the effects of ultraviolet radiation the specimens shall be subjected to a short-period test using a defined xenon light source at a constant temperature and humidity in a xenon test apparatus in accordance with EN ISO 4892-2, but without sprinkling. By measuring the melt-flow it is possible to identify any change in the material in the course of this ageing process due to the effects of light.

For the purposes of the test, specimens with a maximum thickness of 2 mm are produced, where necessary by reducing the thickness by abrading the underside, from polyethylene coating removed from the pipe and with all adhesive removed. The specimens shall be subjected to xenon arc radiation in the xenon test apparatus for a radiation dose of 5 GJ/m² (synchronised, without sprinkling) at a blackpanel temperature of (45 ± 2) °C and a relative humidity of 60 % to 70 %.

The melt-mass flow rate shall be determined in accordance with EN ISO 1133 before subjecting the specimens to radiation and at intervals of 400 h.

Annex A (informative)

Quality assurance

A.1 General

The manufacturer has the responsibility to demonstrate the conformity of his products with this standard by carrying out performance tests (Table A1) and by controlling the manufacturing process by routine tests (Table A.2).

Table A.1 — Performance tests

nr	Parameter	Requirement	Clause	Test	Clause
1	Peeling strength	20 N (Oxide skin) 10 N (Zn-coated surface)	5.6	Method 1	7.1.2
2	Impact strength	Fig.2, range A	6.1	Dropping weight High voltage test	7.4
3	Indentation resistance	< 0,3 mm	6.2	Penetrometer	7.5
4	Elongation at break	> 200 %	6.3	Tensile test	7.6
5	Specific coating resistance in 0,1m NaCl	>10 ⁸ Ωm ²	6.3	Resistivity test Towel method or vessel method	7.7
6	Ratio of resistance	> 0,8	6.4	Res.100 d/ res. 70 d	7.7
7	Heat ageing 100d 100°C	< ± 35 %	6.5	$(MFR_0 - MFR_{100}) / MFR_0 * 100$	7.8
8	Light ageing 100d xenon arc radiation	< ± 35 %	6.6	$(MFR_0 - MFR_{100}) / MFR_0 * 100$	7.9
9	Saponification properties of adhesive	Saponification value < 3 mg KOH/g	5.2.2	EN ISO 3681	5.2.2

Table A.2 — Routine tests

nr	Parameters	Requirements	Clause	Tests	Frequency	Clause
1	Surface preparation	Technical cleanliness	5.1	Visual	100 %	
2	Appearance of finished coating	Uniform and smooth	5.3.1	Visual	100 %	
3	Marking	Legible and durable	5.5	Visual	10 %	
4	Minimum coating thickness	Table 1	5.3.2	Non destructive instruments error. $\pm 10\%$	min. 1/shift	7.2
5	End of pipes painted parts	b < 5 mm tubular extrusion b < 50 mm flat die extrusion	5.3.3	Appropriate measures	10 %	
6	Non porosity	No spark at 25 kV	5.7	High voltage test instrument	100 % at tubular extrusion (B.1) Random sample at flat die wrapping extrusion (B.2)	7.3
7	Peeling strength	Peel time[min] = 0,04 DN with 10 N per cm strip width with Zn-coating 20 N per cm strip width with oxide skin	5.6	Method 2	min. 1/shift	7.1.3
8	Softening point of adhesive	70-112 °C	5.2.2	EN 1238	1/batch	5.2.2
9	Repairs	Manufacturer's written instructions	5.4	High voltage test	100 %	7.3

If the polyethylene coating is composed of several super-imposed layers fused together (see Figure B.2), the manufacturing process precludes any pores extending through the coating. In this case a random sample test shall be considered as sufficient.

EN 14628:2005 (E)

A.2 Performance test

In order to ensure their fitness for purpose in the field of corrosion protection all the pipes shall fulfil the technical requirements of Clause 5.

In order to demonstrate this, the performance tests shall be performed on pipes of each different application method. If the same pipe diameters are manufactured by different processes, pipes of both processes shall be tested.

Where tests have been performed in accordance with the requirements and test methods of this standard (prior to the adoption of the standard) these tests results may be taken into account for the purpose of initial performance testing.

A.3 Quality assessment system

The manufacturer controls the quality of his products during their manufacture by a system of process control in order to comply with the technical requirements of this standard. Wherever possible, statistical sampling techniques shall be used.

It is recommended that the manufacturer's quality system conforms to EN ISO 9001.

If third party certification is involved, it is recommended that the certification body is accredited to EN 45012.

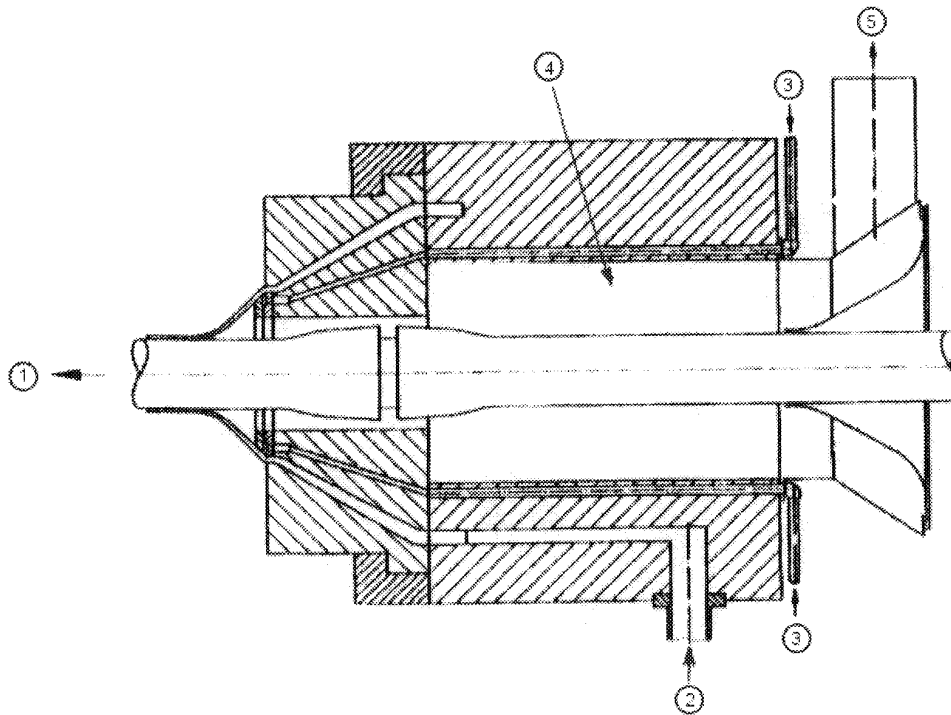
Annex B (informative)

Application process

B.1 General

The coating is generally applied using the methods given below:

B.2 Tubular extrusion method



Key

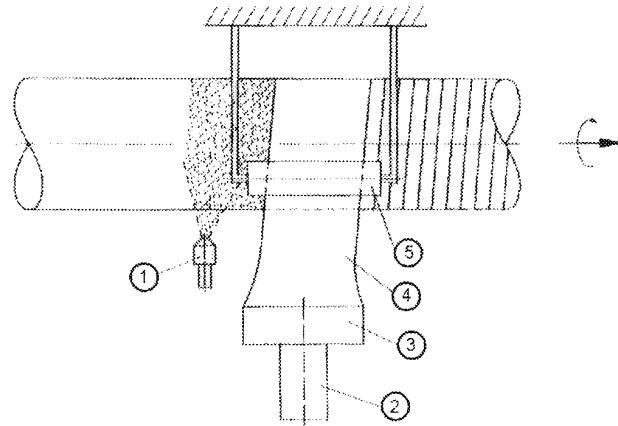
- 1 Pipe direction
- 2 PE-input
- 3 Adhesive input
- 4 Vacuum
- 5 Exhauster

Figure B.1 — Principle of tubular extrusion

The adhesive is to be applied to the clean pipe surface. Immediately following the application of the adhesive, the polyethylene layer is extruded over the adhesive layer. Immediately following the extrusion, the polyethylene layer is water quenched so that it will shrink tightly around the pipe and adhesive layer.

EN 14628:2005 (E)

B.3 Flat die wrapping extrusion method



Key

- 1 Adhesive
- 2 PE-extruder
- 3 Sheet die
- 4 PE-tape
- 5 Pressing roll

Figure B.2 — Principle of flat die extrusion

The adhesive is applied by flat die extrusion or by hot spraying.

Immediately following the application of the adhesive, the polyethylene layer is applied by flat die extrusion in single or multiple layers to produce a tightly bonded seamless coating. The different layers are welded together by means of a pressing roll.

Immediately following the extrusion, the polyethylene layer is water quenched so that it will shrink tightly around the pipe and adhesive layer.

Annex C (informative)

Coating material

C.1 General

All coating materials purchased or used under this specification should be packaged in suitable and approved containers to keep the contents clean and dry during handling, shipping and storage. These containers should be plainly marked with the name of the manufacturer, type of material and batch or lot number where applicable. Bulk shipment may be allowed provided the above information is included in the bill of lading.

Storage and handling conditions should be in accordance with the manufacturer's recommendations.

Precautions should be taken during handling, shipping and storage of all materials to prevent damage to the containers that would result in contamination of the coating materials. All contaminated or otherwise damaged materials should be discarded.

C.2 Polyethylene

It is the responsibility of the manufacturer to extrude either:

- a ready to use polyethylene compound; or
- a polyethylene compound prepared in his own factory with the appropriate additives.

In both cases, the polyethylene and the additives will be selected in order that the final product complies with the technical requirements given in Clause 5 of this European Standard.

The physical properties of the polyethylene compound should comply with requirements given in Table C.1.

Table C.1 — Polyethylene physical properties

Property	Standard	Requirements
Melt Flow Rate	EN ISO 1133	0.2 to 1,0 g/10 min
Density	EN ISO 1183-1	0.910 to 0,960 g/cm ³

EN 14628:2005 (E)

C.3 Adhesive

The adhesive consists generally of a blend of rubber and high molecular weight resins and its physical properties should conform to the values specified in Table C.2.

Table C.2 — Adhesive physical properties

Property	Standard	Requirements
Viscosity	EN ISO 3219	□ 4 000 mPa s at 180 °C Brookfield Thermosel Sp 21/5min ⁻¹

NOTE The following technical functions are provided by the adhesive layer:

- to prevent water infiltration between ductile iron and polyethylene (e.g. in case of connection);
- to give a peeling resistance so as to avoid disorders during transport, storage, pipe laying.

Bibliography

- [1] EN ISO 3219, *Plastics – Polymers/resins in the liquid state or as emulsions or dispersions – Determination of viscosity using a rotational viscometer with defined shear rate (ISO 3219:1993)*.
- [2] EN ISO 6708, *Pipework components – Definition and selection of DN (nominal size) (ISO 6708:1995)*.
- [3] EN ISO 9001, *Quality management systems – Requirements (ISO 9001:2000)*.
- [4] EN 45012, *General requirements for bodies operating assessment and certification/registration of quality systems (ISO/IEC Guide 62:1996)* .

BSI
389 Chiswick High Road
London
W4 4AL

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.
Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.
Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.
Email: copyright@bsi-global.com.

Draft for comments only — Not to be cited as East African Standard