CD/K/053:2009
ICS 23.040.01

EAST AFRICAN STANDARD

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

EAST AFRICAN COMMUNITY

First Edition 2010

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.

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Introduction

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

BS EN 15542:2008, *Ductile iron pipes, fittings and accessories — External cement mortar coating for pipes — Requirements and test methods*

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

BRITISH STANDARD

BS EN
15542:2008

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

ICS 23.040.01

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15542:2008.

The UK participation in its preparation was entrusted to Technical Committee PSE/10, Iron pipes and fittings.

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

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 cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2008

ISBN 978 0 580 57336 1

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15542

March 2008

ICS 23.040.01

English Version

Ductile iron pipes, fittings and accessories - External cement mortar coating for pipes - Requirements and test methods

Tuyaux, raccords et accessoires en fonte ductile - Revêtement extérieur en mortier de ciment pour tuyaux - Prescriptions et méthodes d'essai

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

This European Standard was approved by CEN on 7 February 2008.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 15542:2008: E

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Foreword

This document (EN 15542:2008) 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 September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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

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 European 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 cement mortar 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, and for soil conditions according to Annex D.2 of EN 545:2006.

Special activities on site such as joint protection, tapping, clamping, etc. could affect the corrosion protection properties of the cement mortar coating. These operations should be covered in the laying instructions supplied by the manufacturers of pipes, clamps, house connection saddles, etc. and any relevant users' procedures. Such 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 197-1, *Cement - Part 1: Composition, specifications and conformity criteria for common cements*

EN 197-2, *Cement - Part 2: Conformity evaluation*

EN 545:2006, *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 applications - Requirements and test methods*

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

EN 13055-1, *Lightweight aggregates - Part 1: Lightweight aggregates for concrete, mortar and grout*

EN 14020-1, *Reinforcements - Specification for textile glass rovings - Part 1: Designation*

EN 14020-2, *Reinforcements - Specification for textile glass rovings - Part 2: Methods of test and general requirements*

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 1183-1, *Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2004)*

EN ISO 4624:2003, *Paints and varnishes - Pull-off test for adhesion (ISO 4624:2002)*

ISO 695, *Glass - Resistance to attack by a boiling aqueous solution of mixed alkali - Method of test and classification*

ISO 719, *Glass - Hydrolytic resistance of glass grains at 98 °C - Method of test and classification*

ISO 2591-1, *Test sieving - Part 1: Methods using test sieves of woven wire cloth and perforated metal plate*

ISO 3310-1, *Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth*

3 Terms and definitions

For the purposes of this document, 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 spheroïdal form

3.2
cement mortar coating
multi-layer external coating system for ductile iron pipes, principally consisting of the two following layers:

— zinc coating;

— cement mortar layer.

Polymer additive, primer, pigments, surface tissue or top coatings may be used according to the method of application of the coating used by the different manufacturers

3.3
zinc coating
coating intended to protect the ductile iron and applied to the pipe by means of a thermal spraying process

3.4
primer
two-component resin which cures by exposure to moisture and serves as adhesive to the cement mortar layer

3.5
cement mortar layer
blast furnace slag cement mortar system reinforced with fibres. It may be polymer modified and/or pigmented, and may be covered with a layer of surface tissue

3.6
fibres
inert plastic fibres, e.g. polypropylene fibres, or alkali resistant glass fibres, e.g. AR-glass fibres, or special E-glass fibres which are used to reinforce the cement mortar layer

3.7
pigments
material added to the fresh cement mortar in order to identify the medium to be transported

3.8
polymer additive
organic material added to the fresh cement mortar in order to improve the workability and to reduce the water/cement ratio and to improve the performance of the cement mortar layer

3.9
surface tissue
polyolefin tissue in form of strip with a net-like structure, which may be applied to the cement mortar layer

3.10
top coating
coating applied to the cement mortar layer in order to identify the medium to be transported

3.11
minimum coating thickness
lower limit specified for the cement mortar coating thickness

3.12
impact strength
impact energy which a coating can withstand without damage under defined test conditions

3.13
bond strength
force per unit area, applied perpendicular to the surface, which is necessary to separate the coating from its substrate

3.14
performance test
test which is done once and is repeated according to a schedule or after relevant change of raw material supplier or relevant change in process application

3.15
routine test
test carried out to control the manufacturing process with a frequency defined by the manufacturer

4 Ordering information

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

Ductile iron pipes according to EN 545, EN 598 or EN 969, but coated with cement mortar coating by reference to this European Standard.

EXAMPLE 5 000 m of ductile iron pipe DN 300 according to EN 545; external cement mortar coating according to EN 15542.

5 Technical requirements

5.1 Zinc coating

The zinc coating shall comply with the requirements specified in EN 545, EN 598 or EN 969 whereby the mean mass of zinc per unit area of not less than 200 g/ m^2 shall apply and the purity of the zinc used shall be at least 99,99 %. The zinc coating shall be dry and free from dirt, oil and grease.

5.2 Primer film thickness

When measured by one or both methods indicated in 7.1.2, the primer, if applicable, shall be applied to a mean thickness between 80 µm and 150 µm.

5.3 Fresh cement mortar composition

The requirements specified for fresh cement mortar refer to the condition of the mortar upon application. For testing purposes, samples shall be taken immediately before the material is to be applied. Fresh cement mortar is characterized by the sand/cement mixing ratio, v, the water/cement ratio, w, and the fibre content, f (fibres/fresh mortar) expressed as percentage. When tested in accordance with the method in 7.1.3, the requirements in respect to the composition as listed in Table 1 shall be met.

Table 1 — Requirements of the fresh mortar composition

Polymer modification	Sand/cement v	Water/cement w	Fibre content f
without	≤ 1	≤ 0,35	$0,8 \leq f \leq 3,5$
with	≤ 2	≤ 0,35	≤ 2

5.4 Fresh cement mortar layer thickness

The nominal thickness of the fresh cement mortar layer shall be 5 mm with individual minimum values of 3 mm when measured according to 7.1.4.

5.5 Pipe ends

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

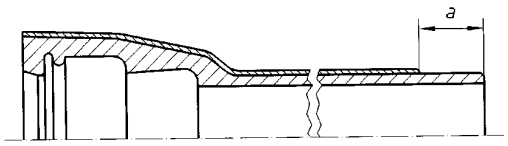

Figure 1 — Pipe end

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 pipe ends surfaces not covered by the cement mortar 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.

Pipe ends shall be inspected according to 7.1.5.

NOTE The pipe parts not covered by cement mortar will be protected after laying using appropriate measures, e.g. rubber sleeves, which are covered by the manufacturers laying instructions and are not within the scope of this standard.

5.6 Appearance of cured cement mortar coating

The cement mortar coating shall adhere to the pipe surface and shall be free of hollow areas. The cured coating shall not exhibit any chipping nor any loose sand particles. Protruding grains of sand and fibres, as well as hairline cracks, are permitted. Appearance shall be inspected according to 7.1.6.

5.7 Thickness of cured cement mortar coating

The thickness of the cured cement mortar coating is the sum of the thickness of the zinc coating, the primer if applied, the cement mortar layer and the surface tissue if applied. When measured by the method indicated in 7.1.7, the nominal thickness of the cement mortar coating shall be 5 mm with individual minimum values of 3 mm.

5.8 Repairs

In case of damage, repairs shall be carried out in accordance with the manufacturer's written instructions and tested according to 7.1.8.

5.9 Marking

All pipes shall be marked legibly and durably according to the pipe standard EN 545, EN 598 or EN 969 with the addition of EN 15542. The transported medium can be denoted by appropriate markings, e.g. by coloured pigments added to the fresh mortar or by an appropriate top coating. Marking shall be inspected according to 7.1.9.

6 Performance requirements

6.1 Cement mortar Constituents

The cement mortar mixture consists mainly of Cement, Sand, water and fibres.

Due to the potential contact with water intended to human consumption, e.g. captures zones or tapping, all constituents shall comply with national regulations or with the future requirements of the EAS.

6.1.1 Cement

Blast furnace slag cement shall comply with EN 197-1, type CEM III/B or type CEM III/A but with a minimal content of granulated blast furnace slag of 50 % by mass. The cement manufacturer shall provide the attestation of conformity according to EN 197-1. See 7.2.1.1.

6.1.2 Sand

The used sand shall consist of clean, natural, coarse or split quartz grains and shall comply with the requirements specified in EN 13055-1. It shall be clean and composed of hard, stable and resistant inert granular particles.

When tested in accordance with 7.2.1.2, the content of fine sand shall not exceed 10 %.

6.1.3 Fibres

The fibres used for fibre reinforcement shall be:

a) glass fibres made from E-type glass as specified in EN 14020-1 and in EN 14020-2, belonging to hydrolytic resistance class HGB1 (< value) as specified in ISO 719 and alkali resistance class A2 (< value) as specified in ISO 695;

b) alkali resistant glass fibres;

c) inert plastic fibres.

See 7.2.1.3.

6.1.4 Surface tissue

The surface tissue shall consist of flat HD-PE filaments with a density of 0,950 g/cm^3. The rupture load of one filament shall be at least 12 N, the elongation at break shall be more than 20 %. See 7.2.1.4.

6.1.5 Organic components

All organic components, like primer, polymer additive, plastic fibres, shall have a resistance to saponification > 45 ml when tested in accordance with 7.2.1.5.

6.2 Bond strength

When the coating is tested in accordance with clause 7.2.2, the minimum force required to lift it off shall be 0,5 N/mm^2.

6.3 Impact resistance

When the cement mortar is tested in accordance with clause 7.2.3, no chipping shall be observed.

7 Test methods

7.1 Routine tests

The following routine tests shall be carried out to control the coating production process to obtain a coating of high and stable quality.

7.1.1 Zinc coating

The zinc coating shall be tested as described in EN 545, EN 598 or EN 969.

Prior to application of the cement mortar the cleanliness of the zinc coating shall be checked visually.

7.1.2 Primer

The film thickness of the applied layer of primer shall be determined by either of the following methods:

a) directly on the pipe barrel with a 'wet film' thickness gauge where a correlation between wet film thickness and dry film thickness can be demonstrated; or

b) indirectly on a token which is attached to the pipe barrel before coating and is used after coating to measure the dry film thickness by mechanical means, e.g. micrometer, or by a weight method.

7.1.3 Fresh cement mortar composition

Fresh cement mortar mainly consists of sand, cement, water and fibres. Any additional elements (e.g. admixtures, additions, polymer) are considered to be integral with the cement. The weight of the different components shall be monitored continuously and the ratios v, w and f (see Table 1) shall be calculated according to Annex D.

7.1.4 Thickness of the cement mortar layer

The thickness of the freshly applied coating shall be tested by means of 'spear measurement'. That is by piercing the coating with a hardened steel point provided with graduations.

7.1.5 Pipe ends

The pipe ends are tested visually and with appropriate metering gauge.

7.1.6 Appearance and continuity of cured cement mortar coating

The appearance of the finished coating shall be checked visually.

7.1.7 Thickness of the cured cement mortar coating

The thickness of the cured cement mortar coating shall be measured with non-destructive instruments (e.g. based on magnetic or electro-magnetic principles) with a measuring accuracy of ± 5 %.

7.1.8 Repairs

Repairs have to be inspected according to the manufacturer's written instructions.

7.1.9 Marking

The marking of the finished coating shall be checked visually.

7.2 Performance tests

Performance tests are carried out once and are repeated according to a schedule or after relevant change of raw material supplier or relevant change in process application.

7.2.1 Constituents

7.2.1.1 Cement

The cement must be supplied with manufacturer's certificate according to EN 197-2 and having proof of quality according to EN 197-1.

7.2.1.2 Sand

Determine the content of fine sand by sieve analysis using sieves of 0,125 mm metal wire cloth complying with ISO 3310-1. Sampling is carried out in accordance with the requirements of ISO 2591-1.

7.2.1.3 Fibres

The E-glass fibres must be supplied with manufacturer's certificate according to EN 14020 Parts 1 and 2, in relation to hydrolytic resistance class HGB1as specified in ISO 719 and alkali resistance class A2 as specified in ISO 695.

AR-glass fibres and plastic fibres must be supplied with a manufacturer's certificate of conformity.

7.2.1.4 Surface tissue

The filaments of the surface tissue must be supplied with a manufacturer's certificate of conformity with respect to density, determined according to EN ISO 1183-1, to rupture load determined according to EN ISO 527-1 and to elongation at break determined according to EN ISO 527-2.

7.2.1.5 Saponification resistance of organic additives

Take a sample of organic additive with a mass of 5 g and mix it in 10 g of water. The sample is adjusted to a pH of 7,0 and 50 ml sodium hydroxide solution c(NaOH) = 0,1 mol/L is added. The mixture is maintained at 60 °C for 48 h.

The sample is back titrated potentiometrically with hydrochloric acid c(HCl) = 0,1 mol/L to pH = 7,0. The amount of hydrochloric acid used c(HCl) = 0,1 mol/L given in ml is a measure of resistance to saponification.

Alternatively the organic additives may be supplied with the manufacturer's certificate acc. to the a. m. test method.

7.2.2 Bond strength

The bond strength of three zones of one coated test piece shall be tested according to EN ISO 4624:2003 (9.4.2). The area to be tested shall be equal to that of a test cylinder having a diameter of 50 mm. Prior to the attachment of the cylinder, the surface of the cured coating shall be suitably prepared (e.g. by roughening with a file).The force required to lift off the coating vertically shall be measured.

The bond strength of the coating shall be expressed as the force related to the cylinder surface area ($2 \cdot 10^3$ mm^2), as the mean value from three measurements, in N/mm^2. It shall be noted whether the failure is cohesive or adhesive.

7.2.3 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 hardened steel ball with a diameter of 25 mm.

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 15 J per mm of nominal coating thickness.

Three different zones of the pipe shall be subjected to impact. The minimum distance between two impact points shall be 150 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.

The test piece shall be visually checked for any chipping.

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 A.1) ;

Table A.1 — Performance requirements and performance tests

Nr	Parameter	Requirement	Clause	Test	Clause
1	Cement	> 50 % blast furnace slag content	6.1.1	Cement supplier' s certificate	7.2.1.1
2	Sand	< 10 % of particles smaller than 0,125 mm	6.1.2	Sand supplier' s certificate	7.2.1.2
3	Fibres	a) E-glass fibre b) alkali resistant glass fibre	6.1.3	Fibre supplier's certificate	7.2.1.3
4	Surface tissue	rupture load > 12 N, elongation at break > 20 % density =0,950 g/cm³	6.1.4	Suppliers certificates according to EN ISO 527-1 and -2 according to EN ISO 1183-1	7.2.1.4
5	Saponification resistance of organic components	> 45 ml	6.1.5	Saponification with NaOH according to ISO 3681	7.2.1.5
6	Bond strength	> 0,5 N/mm²	6.2	Punch separation method according to EN ISO 4624	7.2.2
7	Impact strength	> 15 J/mm	6.3	Dropping weight, no chipping	7.2.3

— and to control the manufacturing process by routine tests (Table A.2):

Table A.2 — Technical requirements and routine tests

Nr	Parameters	Requirements	Clause	Tests	Frequency	Clause
1	Zinc coating	Free of dirt, oil, grease	5.1	Visual	100 %	7.1.1
2	Primer film thickness	80 µm to 150 µm	5.2	Non destructive instruments	10 %	7.1.2
3	Fresh cement mortar composition		5.3	Chemical analysis or continuous monitoring of formulation and weekly check of data	1/week	7.1.3
	3a: Without polymer modification	$v \leq 1$ $w \leq 0{,}35$ $0{,}8 \leq f \leq 3{,}5$				
	3b: With polymer modification	$v \leq 2$ $w \leq 0{,}35$ $f \leq 2$				
4	Fresh mortar layer thickness	> 5 mm mean value > 3 mm min. value	5.4	Needle penetration	10 %	7.1.4
5	Pipe ends	Uncoated length a of Figure 1	5.5	Appropriate measures	100 %	7.1.5
6	Appearance of cured cement mortar coating	Continuity, no hollow areas, no chipping, no loose particles	5.6.	visual	100 %	7.1.6
7	Cured coating thickness	5 mm > 3 mm min value	5.7	Non destructive instruments accuracy ± 1 %	2 %	7.1.7
8	Repairs	Acc. to written instructions	5.8	visual	100 %	7.1.8
9	Marking	Legible and durable	5.9	visual	100 %	7.1.9

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 and the performance requirements of Clause 6.

Testing shall be carried out by the manufacturer or by an accredited test institute.

For each cement mortar coating application method, compliance with the performance requirements specified in clause 6 shall be verified by means of type testing.

The process control during cement mortar coating production should be as specified in Table A.2.

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 European 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 ISO/IEC 17021.

Annex B
(informative)

Application process

B.1 Coating process

B.1.1 Temperature during work

Cement mortar coatings shall be applied to pipes with an outside surface temperature of more than 5 °C.

B.1.2 Application of zinc coating

The zinc coating shall be applied as specified in EN 545.

B.1.3 Application of primer

A suitable primer shall be brushed or sprayed onto the zinc coating. Subject to agreement, the primer may be omitted where the cement mortar is polymer modified.

B.2 Application of cement mortar

B.2.1 Application with primer

Before the primer has cured, a mixture of cement mortar and fibre reinforcement shall be sprayed onto the (rotating) pipe. The mortar may then be covered with a layer of surface tissue.

B.2.2 Application without primer

Primer need not be used where the cement mortar is polymer modified, in which case the mortar shall be applied directly to the zinc coating. Following application, it may be covered with a layer of surface tissue.

Prior to delivery of the pipes, the coating shall have reached a state of cure that would not promote damage to the pipes during transport and storage.

Annex C
(informative)

Explanatory notes

Cement mortar coatings have been used for more than 25 years as corrosion protection for ductile iron pipes, especially those in contact with highly aggressive soils.

The corrosion protecting effect of these coatings has been verified on the basis of extended laboratory and field testing.

The high mechanical stability and robustness of cement mortar coatings permits ductile iron pipes to be transported and stored without risk of mechanical damage. Therefore these pipes are suitable to be laid with the original backfilling material. Additional sand bedding and transport of excavated material for deposition is not necessary.

Excellent experience with these cement mortar coated pipes has been gained using trenchless laying methods with the result that cement mortar coating of ductile cast iron pipes is requested in several standards concerning trenchless laying methods.

During assembling the joints can be protected by different means, as:

— rubber collars (most used appropriate standard solution);

— heat shrinkable sleeves;

— adhesive protection tapes;

— mortar protection tapes.

The manufacturer's instructions should be considered.

Annex D
(informative)

Calculation of fresh cement mortar composition

D.1 General

$$v = \frac{[(S_1 + F_1)/M_1] - F_3/M_3}{1 - [(S_1 + F_1)/M_1] - W_2/M_2}(1 + k) \quad \text{(D.1)}$$

$$w = \frac{W_2/M_2}{1 - [(S_1 + F_1)/M_1] - W_2/M_2}(1 + k) \quad \text{(D.2)}$$

$$f = \frac{F_3}{M_3} \times 100 \text{ (as a percentage)} \quad \text{(D.3)}$$

Check the validity of "(1+ k)" in the formula. Also, k and W_2 are never determined.

where

$(S_1 + F_1)$ is the mass of the sand and the fibres in sample mortar mass M_1;

F_3 is the mass of the fibres in sample mortar mass M_3;

W_2 is the mass of the water in the sample mortar mass M_2;

k is the resin/cement ratio (resin of polymer modifier).

D.2 Sampling

Prior to application of the CEMENT MORTAR coating, about 500 g of fresh cement mortar shall be taken. This sample shall be thoroughly mixed, so that three sub samples weighing about 200 g (M_1), 100 g (M_2) and 200 g (M_3) can be obtained for the purpose of determining the $(S + F)/M$, W/M and F/M ratios.

D.3 Determination of the content of sand and fibres

Using sample mass M_1 (weighing about 200 g), the ratio $(S_1 + F_1)/M_1$ is to be determined.

Immediately following sampling and weighing (M_1) using a 2 000 ml beaker, the sample shall be placed in a 0,09 mm sieve complying with ISO 3310-1. The oversize shall then be rinsed into a porcelain dish, followed by the addition of 20 ml to 30 ml of concentrated hydrochloric acid. The material shall be returned to the sieve and rinsed with water to remove all acid residue, then transferred to an oven having a temperature of 105 °C, and dried to constant mass. The mass $(S_1 + F_1)$ shall be obtained by weighing, and the result corrected by adding the mass of fines and cement.

D.4 Determination of the fibre content

Using sample mass M_3 (weighing about 200 g), the ratio F_3/M_3 is to be determined.

Immediately following sampling and weighing using a 2 000 ml beaker, the sample (of mass M_3) shall be placed in a sieve complying with ISO 3310-1 and having an aperture size selected such that the largest particles of sand pass the sieve (a size of 1,6 mm is usually sufficient for this purpose).

Since a small portion of fibres will pass the sieve in this process, the first batch of undersize material shall be passed through a 0,4 mm sieve complying with ISO 3310-1.

The fibres shall be removed from both sieves by aid of tweezers, dried at 105 °C and weighed, to obtain mass F_3.

Bibliography

[1] EN ISO 9001, *Quality management systems - Requirements (ISO 9001:2000)*

[2] EN ISO/IEC 17021, *Conformity assessment - Requirements for bodies providing audit and certification of management systems (ISO/IEC 17021:2006)*

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