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Guide to the use of EN 598

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National foreword

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Guide to the use of EN 598

Guide pour l'utilisation de l'EN 598

Hinweise zur Anwendung von EN 598

This Technical Report was approved by CEN on 20 March 2010. It has been drawn up by the Technical Committee CEN/TC 203.

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Foreword

This document (CEN/TR 16017:2010) has been prepared by Technical Committee CEN/TC 203 “Cast iron pipes, fittings and their joints”, the secretariat of which is held by AFNOR.

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.

EN 598 deals with components of piping systems for sewerage – pipes, fittings, accessories and joints – which together, form the part of a sewerage network. Each of these components can be manufactured by a different supplier, which is often the reality; the performances and the tests required by EN 598, although perfectly comprehensive, are not always formulated with enough accuracy to be easily used in every real situation occurring in the market.

In regard to quality assurance, the attestations and certifications of conformity to the standards available on the markets:

attestation of compliance to the performance tests;

certification of conformity of the products of a batch;

certification of conformity to EN ISO 9001 of the supplier;

national quality or conformity marks;

third party certification of conformity of products to a standard;

self-declaration of conformity to a standard by the supplier for products that he sells,

have different meanings for the customer, who generally needs all products to be fully in compliance with this standard.

In addition EN 598 is now a harmonized standard prepared under the Mandate M/131 “Pipes, tanks and ancillaries not in contact with water intended for human consumption” and as such products should be CE marked.

Scope

EN 598 specifies the requirements and associated test methods applicable to ductile iron pipes, fittings, accessories and their joints for the construction of drains and sewers outside buildings:

— operating without pressure (gravity sewerage), or with positive or negative pressure;

— to be installed below or above ground;

— to convey surface water, domestic waste water and certain types of industrial effluents, either in separate systems or in combined systems.

This technical report:

— explains in more detail the process of testing for the performance tests;

— explains in more detail the benefits of high alumina cement lining;

— explains in more detail the definitions of the different types/levels of attestation to enable customers to ensure their requirements are fulfilled;

— explains in more detail the ways of certification of conformity with EN 598 for a reliable evaluation of the performance of products;

— explains in more detail CE marking and its relevance i.e. the CE mark is not a mark of conformity with a standard but only a self-declaration concerning the CPD essential requirements.

In order to make the use of this Technical Report easier, the clauses of this document refer to the corresponding clause numbers in EN 598.

4.1.3.1 Gasket materials

Gaskets for sewerage application are manufactured from rubber in compliance with EN 681-1 type WC or WG. This ensures that the gasket is unaffected by any hydro-carbons discharged from the sewerage environment. In addition, the designated rubber offers the required resistance to benzene derivatives, such as those contained in oily waste.

4.4.3 Internal lining of high alumina cement mortar

Ductile iron pipes for sewerage applications are internally lined with high alumina cement mortar as standard thus protecting the internal surface of the ductile iron pipes against corrosion and tuberculation. High alumina cement lining provides a high resistance to both chemical and septic (biogenic corrosion of cement mortar lining) attack found in the vast majority of sewers. Similarly, it offers excellent resistance to abrasion brought about by the impact of solid particles contained in the effluent. The performance of both of these is ensured by the tests detailed in EN 598 sub-clauses 5.8 Chemical resistance and 5.9 Abrasion resistance.

Linings with a high compressive strength (min 50 MPa - see 5.10), also exhibit high density, good adhesion and low porosity: all of which parameters are conducive to a long working life.

4.4.4 Coating of joint areas

A possible area of weakness in the corrosion protection in sewer systems could be where the conveyed sewage comes into contact with the “external coating” of the pipe i.e. internal surface of the socket and the external surface of the spigot in the joint area. This is not the case with EN 598 pipes where the joint areas of ductile iron pipes (internal surface of the socket and external surface of the spigot) for sewerage applications are coated with a synthetic resin (epoxy, polyurethane etc.). These coatings conform without failure to the stringent test for chemical resistance to effluents of EN 598 sub-clause 5.8. This ensures that the surface in contact with the effluent does not crack, blister or disbond for the life of the sewer, preventing the onset of biogenic corrosion.

5.6 Flanged joints

The test for flanged joints shall be carried out in accordance with EN 545 on an assembly comprising two pipes or fittings with identical flanges together with a relevant gasket and bolts recommended by the manufacturer. It is important that rubber gaskets shall be shown to have the short and long term properties as defined in EN 681-1, in particular the hardness (IRHD) is within specification. Similarly, it is important that the manufacturer’s jointing instructions are followed for each particular gasket/material as regards torque values and lubrication for the bolts. The sealing of flange joints depends on many factors and the manufacturer should have written specifications for:

— flange joint faces – surface finish, flatness, permissible irregularities;

— flange jointing materials – bolt lengths/grades, recommended gasket materials;

— jointing instructions – bolt torques, lubrication, bolt tightening sequence.

5.7 Pipes with screwed or welded flanges

The test for pipes with screwed or welded flanges shall be carried out in accordance with EN 545 on an assembly comprising two pipes with identical flanges together with a relevant gasket and bolts. This test is primarily a strength test for the weld/screwed connection and as such is very demanding.

Because this is a specialist test on pipes that can only be welded/screwed by the manufacturer, the test can usually only be carried out and third party accredited in the factory.

6.7 Zinc mass

EN 598 requires that a rectangular token of known weight per unit area shall be attached longitudinally along the axis of the pipe before passing through the coating equipment. After zinc coating and trimming, the size of the token shall be 500 mm $\times$ 50 mm. It shall be weighed on a scale having an error limit of $\pm$ 0,01 g. The mean mass is determined in accordance with the remainder of EN 598 sub-clause 6.7.

As this test can only be carried out in the factory, conformity certification using this test method can only be acquired and granted in the factory during the manufacturing process and not on a batch of finished products.

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7 Performance test methods

7.1 Compressive strength of the cement mortar lining

This test should be carried out using the actual constituents used in the manufacture of the cement mortar for the pipes. As such the sand, cement and water should be sampled from the dispensing/holding facilities in the factory. Similarly, the sand/cement/water ratios should be identical to those used in the manufacturing process (in the case of the sprayed mortar process, these ratios are identical to the ratio in the mortar mixer, whereas for the centrifugal process, these ratios are those found in the compacted lining after centrifugal spinning). Third party accreditation can thus only be granted once these strict conditions have been established and it is for this reason that it is recommended that these tests are only carried out in the factory.

7.2 Longitudinal bending of pipes

This test is only applicable to pipes with an aspect ratio (length/diameter) equal to or greater than 25; for EN 598 this applies to DN 80 to DN 200 pipe.

Longitudinal bending strength is important for both above and below ground installations:

— above ground pipes are used for river crossings and installed on piers in terrain where trenching is impossible or expensive;

— below ground pipes can be subjected to beam loading when poorly installed with lack of support from the bed or from disturbance from second comer installation and in unstable ground subject to subsidence or earthquakes. Also, the inherent longitudinal bending strength of the pipes ensures that there is no sagging of the pipes maintaining the pipeline gradient for flow of sewerage in gravity mains. Similarly, the longitudinal rigidity eliminates troughs where sewerage could stagnate in low flow gravity mains.

Ductile iron pipes can absorb considerable deflection of the pipe barrel (e.g. possible ground movement) without damage because of the material's high inherent beam strength. The stringent test detailed in EN 598 sub-clause 7.2 is in two parts:

bending moments equivalent to those encountered in service are applied; the pipe is checked to verify that there is no residual deflection or damage to the external coating and internal lining;

the same pipe is then subjected to bending moments equivalent to 1.7 times greater than its intended service loads without failure of the pipe wall.

High bending moment strength also minimizes any problems when transporting, lifting, handling and installing pipes.

7.3 Diametral stiffness of pipes

The diametral stiffness of a pipe is its ability to resist ovalization under top loading. The loading on a buried pipe is the earth loading above the crown plus any surcharge loads from traffic, buildings, railways etc. In general the higher the pipe stiffness the greater the pipe's ability to resist the applied loads. Excessive ovalization can cause coating/lining damage and loss of tightness at joints. Ductile iron pipes are inherently stiff and their allowable pipe ovalization (EN 598 Table 10) is limited to ensure no such coating/lining damage or joint leakage will occur.

The test detailed in EN 598 sub-clause 7.3 is in two parts:

1) the test load corresponding to the minimum diametral stiffness is applied to a pipe section and the pipe is checked to verify that there is no damage to the external coating and the internal lining;

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2) the test load is then increased until the vertical deflection reaches twice the value measured in test (1) without failure of the pipe wall.

The relative high diametral stiffness of ductile iron pipes means that pipes can be laid with depths of cover both shallow (high traffic loads) and deep (high earth loads) see EN 598 Annex D.

In many cases the native soil can be used as the embedment material. From an environmental viewpoint, this means that no imported material is needed with an obvious reduction in the use of lorries with the accompanying elimination of CO_2 emissions and fuel usage.

As ductile iron pipes are not subject to creep, the diametral stiffness value remains constant during the life of the pipeline.

7.4 Leak tightness of components for gravity pipelines

See EN 598.

7.5 Leak tightness of flexible joints to positive internal pressure

The test shall be carried out in accordance with clause 7.5 of EN 598 on an assembled joint comprising two pipe sections, each at least 1 m long. It shall be carried out separately for other components such as fittings if their socket differs from that of the spun pipes. For such a test a flanged socket piece shall be bolted to a flanged pipe of sufficient length to satisfy the requirements of EN 598 sub-clause 7.5. Tests shall be carried out on both unrestrained and restrained joints as necessary.

— Short and long term characteristics of the rubber for the gaskets shall be shown to be in compliance with EN 681-1.

— Relevant designs of socket and gasket throughout all possible tolerance combinations shall:

  — ensure leak tightness at minimum compression under shear and/or angular deflection;

  — ensure both leak tightness and satisfactory anchorage under shear and/or angular deflection.

— Using an established gasket, the relevant designs of sockets/spigots shall be shown to be compatible throughout all possible tolerance combinations and shall:

ensure short and long term characteristics of the rubber for the gaskets are in compliance with EN 681-1;

ensure leak tightness at minimum compression under shear and/or angular deflection;

ensure both leak tightness and satisfactory anchorage under shear and/or angular deflection – especially important where different suppliers of pipes/fittings and gaskets are involved.

The following joint parameters are considered vital to the performance of a joint and shall be checked to be in accordance with the relevant specifications:

— spigot wall thickness;

— spigot external diameter;

— socket functional internal diameters;

— socket depth;

— gasket diameter, thickness and hardness.

7.6 Leak tightness of flexible joints to negative internal pressure

See 7.5

7.7 Leak tightness of flexible push-in joints to positive external pressure

See 7.5

7.8 Leak tightness of flexible joints to dynamic internal pressure

See 7.5

7.9 Chemical resistance to effluents

See EN 598.

7.10 Abrasion resistance

See EN 598.

9 Evaluation of conformity

9.1 General

EN 598 defines that the manufacturer has the responsibility to demonstrate the conformity of his or her products with this standard by:

— carrying out performance tests; and

— controlling the manufacturing process with quality control requirements.

Performance tests

The performance tests specified in Clauses 5 and 7 of EN 598 are carried out either by the manufacturer or, at his or her request, by a competent testing institute in order to demonstrate compliance with the requirements of that standard. Full reports of these tests are retained by the manufacturer as evidence of compliance.

The performance tests alone are not proof of the product conformity with the standard; they are absolutely necessary, but are only one part of the much wider conformity requirements set out in EN 598.

Quality control

In order to fulfil the quality control requirements, it is recommended that:

— the manufacturer’s quality system conforms to EN ISO 9001;

— the certification body is accredited to EN ISO/IEC 17021 by an accreditation body which has signed the European Accreditation agreement.

If third party certification is involved to deliver an attestation of conformity of the products to EN 598, it is recommended that the certification body is accredited to EN 45011 by an accreditation body which has signed the European Accreditation agreement.

Annex E – Root penetration

Root penetration of ductile iron joints complying with EN 598 is not an issue. The performance test for positive external hydrostatic pressure (EN 598 sub-clause 5.5, Table 7 and sub-clause 7.7) ensures that the joint even under its most adverse dimensional and sheared condition will support an external pressure of 2 bars for 2 hours without failure. This has been shown to be far in excess of that required to prevent the ingress of roots into the joint.

Annex ZA and CE marking

For EN 598 the CE marking on a product is the manufacturer's self declaration that the product meets only the essential requirements of the Construction Products Directive for that standard. In certain member states, upon publication of the harmonized standard, CE marking of the product is mandatory.

CE marking is neither a certificate of conformity to EN 598 delivered by a third party nor a quality mark; both of which are voluntary.

The essential requirements identified for the harmonized EN 598 are as listed in Annex ZA, Table ZA.1:

1) Dimension tolerances on external diameter – Sub-clause 4.2.2.1

2) Internal pressure strength (tensile strength) – Sub-clause 4.3 and Table 3

3) Impact resistance – Sub-clauses 4.3.1 (tensile strength) and 4.3.2 (hardness)

4) Longitudinal bending strength – Sub-clause 5.2

5) Maximum load for admissible deformation – Sub-clause 5.3

6) Tightness – Sub-clause 5.5 and Table 7

7) External coating for pipes and fittings – Sub-clauses 4.4.1 and 4.5 1

8) Internal lining for pipes and fittings – Sub-clauses 5.8 and 5.9.

The above only forms part of the requirements within the standard with no stipulations as regards other necessary qualifications e.g.

— other dimensional requirements – internal diameter, lengths, pipe straightness;

— flange joints;

— works leak tightness tests;

— cement mortar strength.

Although only CE marking is required on the actual product, documentation giving comprehensive information must be provided in accordance with EN 598 Clause ZA.3 - CE marking and labelling. EN 598 Figure ZA.2 gives an example of the information for the documentation.

Bibliography

[1] EN 598, *Ductile iron pipes, fittings, accessories and their joints for sewerage applications — Requirements and test methods*

[2] EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

[3] EN 545, *Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

[4] EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2008)*

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

[6] EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996)*

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