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Environmental aspects of ductile iron pipe systems for water and sewerage applications

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Environmental aspects of ductile iron pipe systems for water and sewerage applications

Aspects environnementaux des systèmes de canalisations en fonte ductile pour l'eau et l'assainissement

Umweltrelevante Aspekte von Rohrleitungssystemen aus duktilem Gusseisen für die Wasserversorgung und die Abwasserentsorgung

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Foreword

This document (CEN/TR 16470:2013) has been prepared by Technical Committee CEN/TC 203 “Cast iron pipes, fittings and their joints”, the secretariat of which is held by AFNOR.

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1 Scope

This Technical Report applies to all water and sewerage applications of ductile iron pipe systems and provides a structure on how to identify and consider environmental aspects and potential environmental impacts of ductile iron pipe systems throughout their life cycle.

This Technical Report gives guidance on how the life cycle of ductile iron pipelines should be considered in accordance with EN ISO 14044. This Technical Report also includes health and safety aspects related to the production, use and recycling of ductile iron pipe systems.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15804, *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

EN ISO 14044, *Environmental management — Life cycle assessment — Requirements and guidelines (ISO 14044)*

ISO/TR 14062, *Environmental management — Integrating environmental aspects into product design and development*

CEN Guide 4:2008, *Guide for addressing environmental issues in product standards*

3 General guidance

3.1 Provisions dealing with the introduction of environmental aspects into European Standards

European Standards concerning ductile iron pipe systems currently exist without any direct reference for the user to environmental awareness and the possible environmental aspects and potential impacts. This does not necessarily lead to pipe systems which are less environmentally friendly, because the user has other incentives when considering environmental aspects, such as installation considerations, legal requirements etc. However, the inclusion of environmental provisions encourages the consideration of environmental aspects in cases where such incentives do not exist.

In many cases, it is sufficient to include the necessary provisions when revising European Standards dealing with ductile iron pipe systems by the inclusion of a new clause or sub-clause where the relevant environmental aspects are formulated or by reference to this Technical Report.

Environmental impacts related to ductile iron pipe systems are affected by product standardisation. Any such impacts should be considered together with other factors, such as:

a) product function;

b) performance;

c) health and safety;

d) total cost of ownership/life cycle costing;

e) quality;

f) legal and regulatory requirements.

The technological innovation of ductile iron pipe systems has resulted in:

g) the new pressure classification for pipe systems (EN 545:2010) permitting a reduction in wall thickness leading to an optimum balance between pressure resistance and mechanical robustness;

h) trenchless applications of ductile pipes, using improved restrained joints, being easily and safely achieved;

i) high performance coatings improving durability and reducing the installation cost (e.g. no requirement for imported backfill…).

As a result, substantial energy reduction and resource optimisation are possible without compromising the fitness for purpose and longevity of the pipe systems.

3.2 Life cycle approach (LCA) for ductile iron pipe systems

Any inclusion of environmental aspects into product standards shall consider the life cycle of the product. As such, all stages of the life cycle of the relevant ductile iron product should be considered, including:

a) product stage:

    1) production from raw material;

    2) transport;

    3) manufacturing of final products;

b) construction process stage:

    1) transport of the pipe systems and laying;

c) use stage:

    1) transportation of water/sewage;

d) end of life (including recycling).

Guidance on how to treat ductile iron pipe systems in LCAs is given in EN ISO 14044, with special regard to recycling issues.

3.3 Assessment of environmental impacts of ductile iron pipe systems

For the design of ductile iron pipe systems, the guidance given in ISO/TR 14062 is to be considered.

In accordance with CEN Guide 4, additional environmental aspects, specific for the relevant design and product life cycle, shall be identified by the applicable screening procedures as defined in EN 15804.

Assessment of the environmental impacts shall be in accordance with construction product standards.

4 Overview of environmental aspects of ductile iron pipe systems in water and sewerage applications

4.1 General

Environmental aspects shall be considered in European Standards mainly for cases where requirements are specified for ductile iron pipe systems with a clearly defined application.

Ductile iron pipe systems are used for water and sewerage applications. Increasing the lifetime of the pipe system reduces the environmental impacts, because more frequent replacement/repair means additional extraction of energy resources, emissions and waste.

Examples of beneficial environmental aspects applying to ductile iron pipe systems:

a) the avoidance of unnecessary material shall be a general requirement for the design of the product;

b) reduction in traffic resulting in avoidance of traffic jams and delays and reduction in CO_2 emissions;

c) high mechanical performance i.e. the robustness of ductile iron pipe systems allows energy saving from the reduced mechanisation required during installation i.e. no specialised equipment or on-site welding. Similarly, the need for imported material for bed and surround is avoided/minimised, with the subsequent savings associated with the unnecessary use of natural resources and transportation costs.

4.2 Ductile iron pipe systems for water supply and pressurised sewers

4.2.1 Energy savings

For the most part, the main potential environmental impacts of products for water application are related to the energy consumption and the associated emissions in the operating stage.

The energy consumption of a pipe system depends on its head losses and leakages. Each head loss reduction leads to energy savings on the whole life cycle of the pipe and consequently, significant consideration needs to be paid to the head losses of the water mains.

The leak tightness and the lowest failure rates offered by the flexible joints of the ductile iron pipe systems result in obvious energy savings.

Appropriate models shall consider:

a) patterns of consumption; e.g. number of litres/inhabitants/days;

b) physical interrelations describing the energy consumption of water mains, number of joints, e.g. fittings can be avoided by angular deflection of pipe joints;

c) sensitivity analysis, e.g. by use of different models.

An important requirement for appropriate models for the operating stage is the transparency and declaration of the assumptions used.

4.2.2 Recycling

Recycling usually consists of four steps, namely excavation from the trench, transportation, shredding and re-melting.

The recycling process of ductile iron pipe systems is simple, routine and organised by a worldwide network of scrap dealers. Ductile iron pipe systems can be recycled several times without losing any of the properties of the metal itself.

The recycled material advantages are:

a) cheaper/easier manufacturing processes;

b) reduction in mining;

c) reduction in emissions and air pollution;

d) conservation of natural resources;

e) reduction in landfill usage;

f) cheaper finished product.

The inert properties of ductile iron means that pipe systems not in service can also be left in the ground with no adverse environmental impact.

4.3 Ductile iron pipes for gravity sewerage applications

4.3.1 Construction and service stages

During these stages, leaks in the network cause problems such as water or soil pollution and/or unnecessary sewerage treatment.

The leakage of raw sewage directly leads to environmental damage such as:

a) soil and groundwater pollution (i.e. rivers, lakes, sea);

b) potential damage to adjacent structures (i.e. buildings, roads, other underground services);

c) pollution of drinking water.

Similarly, a broken sewer or a leaking joint allows the ingress of groundwater leading to:

d) increased treatment costs;

e) lower groundwater levels;

f) possible surface flooding as the sewer pipe fills.

4.3.2 Recycling

Similar rules apply for recycling as shown in 4.2.2.

4.4 Trenchless applications of ductile iron pipe systems

4.4.1 General

Trenchless applications of ductile iron pipe systems include repair, renovation and replacement as well as new installations. These techniques are horizontal directional drilling, pipe bursting, press pull, and pipe-jacking. Such installations result in considerable savings in economic, ecologic and social aspects.

4.4.2 Advantages

a) avoidance of pipe damage and therefore water loss;

b) reduction in environmental damage;

c) reduction in hazardous operational conditions.

4.4.3 Direct savings

a) reduction in road construction waste;

b) reduction in installation time;

c) minimal excavated material and associated transportation savings;

d) reduction in pipeline removals;

e) minimisation of any relevant ground water pumping.

4.4.4 Economic savings

a) reduction in CO_2 emissions;

b) avoidance of imported backfill material;

c) avoidance of traffic jams and delays;

d) reduction in noise;

e) reduction in accident frequency;

f) reduction in damage to adjacent structures/services;

g) possibility of installation regardless of weather conditions;

h) protection of environment.

Bibliography

[1] EN 545:2010*, Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

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

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