

SLOVENSKI STANDARD SIST-TP CEN/TR 10364:2019

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Jeklene in železove litine - Določevanje snovi, navedenih v direktivah 2011/65/EU (RoHS) in 2000/53/ES (ELV) - Omejitve

Steels and cast irons - Determination of substances listed in the directives 2011/65/EU (RoHS) and 2000/53/EC (ELV) - Limitations

Stahl und Gusseisen - Die Bestimmung der Substanzen in den Richtlinien aufgeführt 2011/65/EU (RoHS) und 2000/53/EG (ELV) - Beschränkungen

Aciers et fontes - Déterminations des substances listées dans les directives 2011/65/EU (RoHS) et 2000/53/ECs(ELV)rdslitimites alog/standards/sist/e4dc4324-53f0-43d1-9c7ceb559d5bb9f9/sist-tp-cen-tr-10364-2019

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English Version

Steels and cast irons - Determination of substances listed in the directives 2011/65/EU (RoHS) and 2000/53/EC (ELV) - Limitations

Aciers et fontes - Déterminations des substances listées dans les directives 2011/65/EU (RoHS) et 2000/53/EC (ELV) - Limites Stahl und Gusseisen - Die Bestimmung der Substanzen in den Richtlinien aufgeführt 2011/65/EU (RoHS) und 2000/53/EG (ELV) - Beschränkungen

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CEN/TR 10364:2018 (E)

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European foreword

This document (CEN/TR 10364:2018) has been prepared by Technical Committee ECISS/TC 102 "Methods of chemical analysis for iron and steel", the secretariat of which is held by SIS.

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

This document supersedes CEN/TR 10364:2016.

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1 Scope

The present document gives guidance regarding the chemical composition controls of steels (except chrome plated products) and cast irons in respect of the European legislation, namely Directives 2011/65/EU (RoHS) [1], repealing 2002/95/EU, the Commission Delegated Directive EU 2015/863 amending Annex II to Directive 2011/65/EU [10] and 2000/53/EC (ELV) [2].

These Directives require the characterization of these materials for cadmium (Cd), hexavalent chromium (Cr (VI)), mercury (Hg), lead (Pb), polybrominated biphenyls (PBB), polybrominated diphenyl ethers (PBDE) and the four phthalates DEHP, BBP DBP and DIBP. Nevertheless, the Directives do not reflect the correspondence between these elements/compounds and the normal composition of each material concerned. In other words, for every material there is an obligation to determine all the compounds listed, independently of the relevance of such controls.

2 Normative references

There are no normative references in this document.

3 Terms and Definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Requirements and applicability SIST-TP CEN/TR 10364:2019

4.1 General

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Directive 2011/65/EU, article 4, restricts the following substances to the maximum concentration values to the following :

- Lead: 0,1 %;
- Mercury: 0,1 %;
- Cadmium: 0,01 %;
- Hexavalent chromium: 0,1 %;
- Polybrominated biphenyls (PBB): 0,1 %;
- Polybrominated diphenyl ethers (PBDE): 0,1 %.
- Bis(2-ethylhexyl) phthalate (DEHP): 0,1 %.
- Butyl benzyl phthalate (BBP): 0,1 %.
- Dibutyl phthalate (DBP): 0,1 %.
- Diisobutyl phthalate (DIBP): 0,1 %.

Steel and cast iron manufacturers are often required to state/provide compliance with the Directives above and submit analytical results for each of those elements/compounds. However, due to the manufacturing processes and the inherent properties of the steels and cast irons, the determination of most of the compounds listed is not applicable or relevant.

Subclauses 4.2 and 4.3 details the relevance of these requirements.

4.2 Bulk materials

4.2.1 Lead (Pb)

Due to a 1 755 °C boiling point, lead is the single element among the ten compounds specified in the directives which can be present in relevant amounts in the steels and cast irons and that is also subject to one of the exemptions in Annex II of 2011/65/EU.

NOTE For stainless steels production using the Argon Oxygen Decarburization (AOD) converter process or equivalent, the lead content in the alloy will be considerably decreased to orders of magnitude below the directives requirements levels.

In contrast to cadmium and mercury, lead is also possible to detect and quantify on a reproducible base by using standardized methods as EN 10181 [3], EN 62321 [4], EN 62321-1 [5] or ISO 16918-1 [6].

4.2.2 Cadmium (Cd) and mercury (Hg)

With high temperature required during the melting processes and because of their physic-chemical properties, cadmium (Cd) and mercury (Hg) are normally absent in steels and cast irons.

The temperature required for melting iron based alloys is at least 1 400 °C, whereas the boiling temperatures of Cadmium (Cd) and mercury (Hg) are 767 °C and 357 °C respectively. In other words, these elements will evaporate during the melting process and cannot be present in an easily quantifiable amount in the steels and cast irons. <u>SIST-TP CEN/TR 10364:2019</u>

There are analytical techniques available and appropriate for the determination of both these elements below 1 μ g/g as, for example, inductively coupled plasma mass spectrometry (ICP-MS), cold vapor atomic absorption spectrometry or electrothermal atomic absorption spectrometry (ETAAS). However, for the physical reasons above, i.e. the "absence of content", it remains impossible to verify the robustness of the procedures for such aims: selecting the most appropriate dissolution procedures and also the fact that appropriate reference materials are not available.

4.2.3 Hexavalent chromium [Cr (VI)]

According to the document "Hexavalent chromium in steels, cobalt, nickel and zirconium based alloys" [7] the occurrence of hexavalent chromium (Cr (VI)) in steel is purely hypothetical. This is due to the physical nature of metallic bonding where ions cannot exist.

4.2.4 Polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)

The most common types of polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) homologues are penta-, octo- and deca-bromodiphenyl and hexa-, octo- and deca-bromodiphenylether. They are extremely stable compounds with boiling points in the range of about 300 to 500 °C. Investigations [8] have shown that polybrominated biphenyls (PBB) decompose by pyrohydrolysis at temperatures ranging from 600 to 900 °C, i.e. significantly lower than in the steel making process and that the main part of polybrominated diphenyl ethers (PBDE) in fly ash from electric arc furnaces are destroyed or removed by thermal treatment at 1 450 °C [9].

Thus, it shall be concluded that these compounds cannot be present in the steel (or cast iron) itself.

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4.2.5 Phthalates (DEHP, BBP, DBP and DIBP)

Phthalates, or esters of phthalic acid, are organic molecules and are used mainly as plasticizers but can be found in many other applications as well. The above regulated ones all have boiling points below 400 °C, i.e. significantly lower than the temperature used in the steel making process [11]. The thermal decomposition of DEHP has been studied [12] and was found to begin at 250 °C in an atmosphere of nitrogen.

Thus, it shall be concluded that these compounds cannot be present in the steel (or cast iron) itself.

4.3 Surface

4.3.1 General

The as-delivered products from the steel plants or foundries are controlled and protected.

However, as for any material, the surface of steel and cast iron products may get contaminated or may undergo surface reactions. In some circumstances, due to further processing or treatments, this may result in presence of un-wanted substances on the surface.

4.3.2 Hexavalent chromium [Cr (VI)]

Due to some surface treatment, hexavalent chromium (Cr (VI)) is the single substance among the ten elements/compounds specified in the directives which may be found on the surface of the steels and cast irons.

However, a positive detection of this ion on the surface of any steel or cast/iron shall not be put in correspondence with the bulk material composition. For the control of this ion, standardized methods are available as, for example, EN 62321.

5 Recommendation

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When receiving requirements related with Directives 2011/65/EU (RoHS) including amendments, 2002/95/EU and 2000/53/EC, it is recommended to take the information given in the present Technical Report into account.

In other words, the single compounds relevant to be determined are:

- lead in the bulk materials (see NOTE in 4.2.1);
- hexavalent chromium (Cr (VI)) on the surface of some products (see 4.3.2).