1- GENERAL INTRODUCTION

Article 3 of Regulation (EC) No 1935/2004 of 27 October 2004 foresees that food contact materials and articles, including active and intelligent materials and articles, shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could endanger human health, bring about an unacceptable change in the composition of the food or bring about a deterioration in the organoleptic characteristics thereof.

For certain categories of materials, the implementing legislation for this Regulation defines rules (composition, purity standards, etc.) for ensuring compliance with this inertness. In this way, specific directives, such as those concerning ceramic articles and regenerated cellulose films, as regulations, including ones dealing with plastic materials or active and intelligent materials, were adopted.

Moreover, in the absence of specific legislation that is applicable EU-wide for a given type of material, national regulations shall apply, such as those in France relating to stainless steel, aluminium and its alloys, rubbers and silicone elastomers.

Nevertheless, a certain number of materials have not yet been the subject of specific regulations, either at EU or national level, or are regulated in an incomplete fashion.

This is the case for metals and alloys, which are the subject of several European Union provisions in Regulation (EC) No 1895/2005 of 18 November 2005 on the restriction of use of certain epoxy derivatives in materials and articles intended to come into contact with food, and several national pieces of legislation, but which are not fully regulated by a specific text.

In the absence of a specific regulatory text, the DGCCRF has drafted sheets for various types of materials. They are primarily intended for official control departments and laboratories. These sheets specify the means for verifying the food contact suitability of metals and alloys, and more specifically the means for verifying the principle of inertia set out in Article 3 of Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004.

They have been the subject of a prior consultation with stakeholders representatives (competent laboratories in the area of FCMs, manufacturers and processors of such materials, agri-food industries, distributors, etc.).

They are available on the DGCCRF website so that operators can, in complete transparency, become informed about certain criteria and means used by the departments as part of official inspections.

The criteria listed in these sheets are not exhaustive. Other relevant criteria may be taken into account, depending on the nature, origin and composition of the materials, as well as treatments to which they are subjected.

The purpose of this document is to specify the means for verifying the food contact suitability of metals and alloys.

The sheets that make up this document may be distributed and are available on the DGCCRF’s website in the section devoted to food contact materials: http://www.economie.gouv.fr/dgccrf/Materiaux-au-contact-des-denrees-alimentaires

2- SCOPE OF APPLICATION
Reference is made to the lead sheet dealing with the scope of application of the metals and alloys sheet and its general structure.

3- SPECIFIC DEFINITIONS AND ABBREVIATIONS


FCMs: Food contact materials
LEAD METALS AND ALLOYS SHEET

Last update of regulatory texts and reference documents referred to in these sheets: 1 April 2017

Last update of criteria referred to in these sheets: 1 April 2017

These sheets deal with **metals and alloys used in food contact materials** within the meaning of the regulatory framework.

They focus on uncoated metals and alloys, as well as those with metallic (nickel, tin, chrome, etc.) or organic coatings.

They do not address enamelled materials, those with inorganic coatings or those with hybrid organic/inorganic coatings (such as those derived from the sol-gel process).


Other reference documents and texts include:

**Some metals and alloys are covered by a specific sheet.** They are as follows:
- Stainless steel (sheet no. 1)
- Aluminium and aluminium alloys (sheet no. 2)
- Steel for packaging (sheet no. 3) and uncoated steel excluding packaging (sheet no. 4)
- Uncoated steel and stainless steel excluding packaging (sheet no. 5)
- Unalloyed pig-iron (sheet no. 6)
- Tin and tin alloys (sheet no. 7)
- Zinc and zinc alloys (sheet no. 8)
- Articles with various metal coatings (sheet no. 9).

**Release and migration testing** to check whether the metals and alloys covered by a specific sheet are in compliance with Article 3 of Regulation (EC) No 1935/2004 of 27 October 2004 shall be carried out on the basis of the test specifications set out in Appendix II, depending on the nature of the materials and alloys under consideration (bare metals and alloys / metals and alloys with a metallic coating / metals and alloys with an organic coating).

The **Specific Release Limits (SRLs) to be observed** for these metals and alloys are listed in Appendix I.

For the purposes of demonstrating compliance with Article 3 of the aforementioned Regulation of 27 October 2004, migration and release testing take precedence over composition testing. With respect to materials and articles with organic coatings, migration tests performed on the final product take precedence over those performed by placing the coating on an "inert" support.
Nevertheless, metals and alloys that fall within the scope of a specific national regulatory text listing the full set of composition criteria (only for materials and articles in **stainless steel or in aluminium and aluminium alloys**) are not covered by migration testing (except in cases of thermochemical treatment) and should be in compliance with these regulatory criteria. Similarly, packaging must, in all cases, comply with the requirements in terms of concentration levels (lead, cadmium, mercury and hexavalent chromium) set out in Directive 94/62/EC of 20 December 1994 on packaging and packaging waste.

The test specifications and SRLs listed in Appendices I and II may be used as references for checking compliance with Article 3 of the framework regulation for types of metals and alloys listed in Appendix III (which are not the subject of a specific sheet).

From a **food compliance** standpoint and, in the context of the broad application of procedures based on Hazard Analysis and Critical Control Point (HACCP) principles set out in Regulation (EC) No 852/2004, food sector operators must put in place risk analysis procedures in order to check that food placed on the market is not a hazard to human health, particularly due to the migration of chemical substances, similar to risks within the meaning of Regulation (EC) No 852/2004, based on materials (industrial equipment or food packaging).
1. Scope of application

This sheet deals with uncoated stainless steel and with articles consisting exclusively of stainless steel which, as final products, are intended for food contact, including articles and equipment used to produce, process, store and transport food.

The primary examples of usage for the various stainless steel families are set out in Appendix B of standard NF A 36-711.

2. Specific limitations on the use of materials

No specific limitations within the context of this document.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1 Regulatory texts

- Order of 13 January 1976 related to materials and articles made of stainless steel in contact with food products;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts

- standard NF A 36-711: "Non-packaging steel – Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption"
- standard NF EN 10088-1: Stainless steels. List of stainless steels;
- Information document BP A 36 720 "Cleaning stainless steels in food and health applications".

3.2 Criteria

The criteria used are those contained in the Order of 13 January 1976, which foresees composition criteria, but does not foresees migration criteria.

4. Acceptability limits

Minimum chromium content: 13.0%
Additional alloying elements: Ta, Nb, Zr, Mo, Ti, Al and Cu, with the following maximum contents:
- Ta, Nb, Zr: 1%
- Mo, Ti, Al, Cu: 4%

Elements not listed in the Order may be used within the chemical composition limits defined in Tables 1 to 4 in Appendix IV.

NOTE: Some grades of stainless steel are governed by standard NF 36-711: 2002 (confirmed standard unchanged in 2012) while others are governed by standard NF EN 10088-1: 2014. The associated names are taken from standard NF EN 10088-1, but with the contents amended to comply with the composition requirements defined above.
5. Rules for checking the criteria defined in Paragraph 3

5.1 Stainless steel
The stainless steel manufacturer supplies the manufacturer of the final product with the following:
   a) a written declaration of compliance with the Order of 13 January 1976;
   b) An analysis report of the chemical composition, which must be in compliance with the Order of 13 January 1976.

5.2 Final product
The manufacturer must ensure that the composition of the stainless steel is in compliance with the composition criteria in the Order of 13 January 1976, which are listed in Paragraph 4.
If the composition of the stainless steel is in compliance with the composition criteria listed in Tables 1 to 4 in Appendix IV of the present document, it is deemed to have met these criteria.

6. Thermochemical processes
Thermochemical processes are sometimes used on stainless steel to improve their tribological behaviour (resistance to abrasion, adhesion and resistance to scoring). They may include the following processes:
    Nitriding of martensitic stainless steel (hardened coating that is generally 0.3 mm thick)
    Surface enrichment (generally 30 µm) using carbon, nitrogen or both (for austenitic stainless steel);
    Nitrogen enrichment of ferrite (generally up to 2 mm) for austenitic-ferritic stainless steel.

NOTE: As examples:
- "Kolstering" is a process used for the carbon surface enrichment of austenitic stainless steel
- The "Nivox", "Stainihard" and "Expanite Low T" processes are used for the nitrogen and carbon-nitrogen surface enrichment of austenitic stainless steel
- The "IPSEN Solnit" and "Expanite HighT" processes are used for the nitrogen enrichment of ferrite for austenitic-ferritic stainless steel

Whenever such treatments are used, compliance with Article 3 of Regulation (EC) No 1935/2004 is checked on the basis of the test specifications set out in Appendix II (metals and alloys that are uncoated or that have a metallic coating) and the Specific Release Limits (SRLs) given in Appendix I.
1. Scope

This sheet deals with food contact articles in aluminium or aluminium alloy with an organic coating intended to come into contact with food.

It distinguishes between single-use articles intended for long-term contact and repeated-use articles for short-term contact. Single-use articles intended for long-term contact are packaging, the primary examples of which are as follows:

- Food tins
- Drink cans
- Coffee pods
- Pressurised containers
- Varnished lidding foils for dairy products
- Tubes
- Thin foil for cheese products
- Cups

Repeated-use articles for short-term contact include the following:

- Household articles: pots, pans, dishes, flasks, etc.
- Household cooking appliances such as pressure cookers

This document does not deal with hybrid organic/inorganic coatings (such as those derived from the sol-gel process).

2. Specific limitations on the use of materials

No specific limitations within the context of this document

3. Definition of food contact suitability criteria

3.1 Texts

3.1.1. Regulatory texts

- Regulation (EC) No 1895/2005 of 18 November 2005 on the restriction of use of certain epoxy derivatives in materials and articles intended to come into contact with food;
- Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food, amended;
- Act 2010-729 of 30 June 2010 amended by Act 2012-1442 of 24 December 2012 regarding the suspension of marketing of all packaging containing bisphenol A intended to contain food products;
Order of 27 August 1987 related to materials and articles in aluminium or aluminium alloy in contact with food products, foodstuffs and beverages.

3.1.2 Other texts

- The Council of Europe's Framework Resolution ResAP(2004)1 on coatings intended to come into contact with foodstuffs;
- Standard NF EN 601: Aluminium and aluminium alloys – Castings – Chemical composition of castings for use in contact with foodstuffs;
- Standard NF EN 602: Aluminium and aluminium alloys – Wrought products – Chemical composition of semi-final products used for the fabrication of articles for use in contact with foodstuffs;
- Standard NF EN 15136: materials and articles in contact with foodstuffs – Epoxy derivatives subject to limitation – Determination of BADGE, BFDGE and their hydroxylated and chlorinated derivatives in food simulants;
- "Good manufacturing practices for the production of coatings intended to come into contact with food" – European Council of the Paint, Printing Ink and Artists' Colours Industry (CEPE).

3.2 Criteria

3.2.1 Base

Aluminium or aluminium alloy bases meet the composition requirement set out in the Order of 27 August 1987.

3.2.2 Coating only

3.2.2.1 Varnishes / coatings

There is no specific French national legislation or harmonised EU regulation that covers food contact varnishes and coatings, or a positive list of constituents* for such varnishes and coatings.

The following lists of monomers, starting substances and additives are reference lists for varnish constituents:

- Substances (monomers, starting substances and additives) listed in Regulation (EU) No 10/2011 of 14 January 2011, amended, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.)
- Varnishes and coatings substances assessed by the European Food Safety Authority (EFSA) using its own guidelines and which have been the subject of a favourable opinion by the EFSA
- Substances that have been the subject of a favourable opinion by the Scientific Committee on Food (SCF) (Lists 0 to 4) (website: http://ec.europa.eu/food/fs/sc/scf/index_en.html)
- Varnish and coatings substances assessed in application of the European Food Safety Authority’s guidelines, or equivalent guidelines, and which have been the subject of a favourable opinion by a competent scientific body in one of the EU Member States, Turkey
or a State which is party to the agreement on the European Economic Area (taking account of determined restrictions and/or specifications);

- Varnish and coatings substances that are the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted since 1991 in accordance with SCF/EFSA guidelines and which have been the subject of a favourable opinion by a competent scientific body in an EU Member State, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.).

Other constituents may be used in the production of coatings and varnishes, provided that a risk assessment in compliance with internationally-recognised scientific risk assessment principles can be provided to demonstrate compliance with Article 3 of the aforementioned Regulation (EC) No 1935/2004.

Specifically, constituents that have been the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted prior to 1991 applying the criteria existing at the time, may be used provided that supplementary toxicological data can be provided based on the nature of these constituents and their migration and exposure levels, in order to demonstrate compliance with Article 3 of Regulation (EC) No 1935/2004.

Constituents used in the manufacture of varnishes and coatings, including their impurities, which have not been the subject of a scientific risk assessment in accordance with EFSA guidelines or equivalent guidelines and a favourable opinion by the EFSA or a competent scientific body in an EU Member State, must not be classified as Category 1 or 2 carcinogenic, mutagenic and reprotoxic substances (CMRs) in accordance with Regulation (EC) No 1272/2008 of 16 December 2008, amended, and must not be in a nanometric form.

Compliance with the criteria of Regulation (EC) No 1895/2005 of 18 November 2005 concerning BADGE and its derivatives.

Act 2010-729 of 30 June 2010, amended by Act 2012-1442 of 24 December 2012 suspends the import and placing on the market, either free of charge or against payment, of any packaging, container or utensil comprising bisphenol A and intended to come into direct contact with all foodstuffs as from 1 January 2015 (see the DGCCRF’s implementation guidelines).

*NOTE: The term constituent covers substances.

3.2.2.2 Non-stick coating
In the absence of proof of the non-use of chromates in the manufacturing process, search for the presence of chromates in the non-stick coating interface.

3.2.3 Final product
Materials and articles at the finished-product stage (coated metals) must meet requirements with respect to 1) specific migration* of those coating constituents that are subject to specific limits, 2) specific release limits for metals, alloy components and impurities listed in Appendix I of this document, 3) overall migration limits, and 4) where appropriate, residual contents of constituents, under normal or foreseeable usage conditions.

* Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.
4. Limits of acceptability

4.1 Aluminium and aluminium alloys alone / enamel coating used as an undercoat

The aluminium must comply with the purity criteria foreseen in the Order of 27 August 1987:

- Fe + Si < 1%
- Ti ≤ 0.15%
- For each of the following elements: Cr, Zn, Cu, Mn, Mg, Ni, Sn ≤ 0.10%
- Each of the following elements: Pb, Tl, Be, and each of the impurities: ≤ 0.05%
- The copper content can reach 0.20% of those for chromium and magnesium are less than 0.05%

The aluminium alloy must comply with the following composition limits:

- Si ≤ 13.5%
- Sb ≤ 0.4%
- Sn ≤ 0.10%
- Mg ≤ 11%
- Cr ≤ 0.35%
- As, Ta, Be, Ti, Pb, and each of the other elements present: ≤ 0.05%, total ≤ 0.15%.
- Mn ≤ 4%
- Ti ≤ 0.3%
- Ni ≤ 3%
- Zr ≤ 0.3%
- Fe ≤ 2%
- Zn ≤ 0.25%
- Cu ≤ 0.6%
- Sr ≤ 0.2%

4.2 Final product

The specific migration limits and the maximum and/or residual quantities of monomers, other starting substances and additives are those of Annex I of Regulation (EU) No 10/2011 of 14 January 2011 for the constituents that are listed there, or those found in relevant scientific opinions and assessments.

The specific release limits of metals, alloy components and impurities are those set out in Appendix I of this document.

The limits for epoxy derivatives are those set out in Regulation (EC) 1895/2005.

The overall migration limit is 10 mg/dm² of the food contact area. An exception has been made for food contact materials and articles for infants less than 12 months old and small children one to three years old, for whom the overall migration limit is 60 mg/kg of food simulant.

For hexavalent chromium, the limit is non-detection with a detection threshold of 5 μg/dm² (Opinion by the CSHPF, Session of 13 February 1996, BOCCRF no. 8 of 24 May 1996).

5. Rules for checking the criteria defined in Paragraph 2

5.1 Aluminium and aluminium alloys alone

The manufacturer of aluminium and aluminium alloy shall supply the packaging manufacturer with:

a) A written declaration of compliance with the Order of 27 August 1987
b) An analysis report of the chemical composition, which must be in compliance with the Order of 27 August 1987.
5.2 Coating only

To verify the criteria, the following information must be provided to the laboratory in charge of analyses*, which may have to sign a confidentiality agreement:

- **Coating references** (so as to allow them to be identified), description of the coated metal, coating family;
- **Identity of substances, type of restrictions** for monomers, other starting substances and additives for which SMLs (Specific Migration Limits) or maximum residual quantities have been established, and, where appropriate, the impurities, products of degradation or other substances likely to pose a risk to human health;
- **Information concerning the use of the materials and articles**: type of foodstuffs (of simulants), duration of contact and real contact temperature for these foodstuffs Where appropriate, specific information about labelling and real surface area/volume ratio.

The manufacturer of the coating provides the manufacturer of the material or article with a written declaration of compliance with Regulation (EC) No 1935/2004, attesting to the compliance of the composition and, on the basis of migration tests carried out with the coating applied to an “inert” support (stainless steel or glass), of the overall migration and, where appropriate, the specific migrations of the coating’s constituents that are subject to a specific migration limit, under test conditions that are representative of real usage. In the case of use of dual use additives, these shall be identified.

* in the case of outsourced testing

5.3 Final product

At the stage of the final product, the inertia of the coating is checked on the ready-for-use article (specific migration/release of the constituents and overall migration).

The manufacturer of the final product checks this inertia by means of specific migration/release tests and overall migration tests on the food simulants or foodstuffs on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).

*Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.*

For packaging of foodstuffs with a long shelf life, the match between packaging and foodstuff is checked by means of long-term testing, following a protocol specific to each manufacturer, in such a way as to ensure that the packaging has been effectively adapted to real usage conditions (mechanical and chemical resistance, etc.). These tests can also be in the form of accelerated ageing tests using a methodology based on scientific principles.
SHEET NO. 2: ALUMINIUM AND ALUMINIUM ALLOYS

SHEET No. 2b
UNCOATED ALUMINIUM AND ALUMINIUM ALLOYS
SINGLE USE – LONG-TERM CONTACT
VARIABLE DURATION OF CONTACT

1. Scope
This sheet deals with uncoated food contact articles in aluminium or aluminium alloy intended to come into contact with food.

It distinguishes between single-use articles (packaging) and repeated-use articles (possible anodised). Single-use application essentially relates to:
- Pressurised containers
- Chocolate paper – Tubes – Aluminium for household use
- Trays – Rings (chicken)
- Trays – Staples (sausage)

Examples of repeated-use articles are as follows:
- Household articles: pots, pans, utensils
- Agri-food industry equipment: vats, tankers, piping, work surfaces, machines

2. Specific limitations on the use of materials
For materials and articles intended for the final consumer, usage restrictions are given for contact with highly acidic products.

3. Definition of food contact suitability criteria

3.1. Regulatory texts
- Order of 27 August 1987 related to materials and articles in aluminium or aluminium alloy in contact with food products, foodstuffs and beverages

3.2 Other texts
- standard NF EN 601: Aluminium and aluminium alloys – Castings – Chemical composition of castings for use in contact with foodstuffs
- standard NF EN 602: Aluminium and aluminium alloys – Wrought products – Chemical composition of semi-finished products used for the fabrication of articles for use in contact with foodstuffs.

3.3 Criteria
The criteria used are those contained in the Order of 27 January 1987, which foresee chemical composition criteria, but does not foresee migration limit criteria.

4. Limits of acceptability
The aluminium must comply with the purity criteria foreseen in the Order of 27 August 1987:
- Fe + Si < 1%
- Ti ≤ 0.15%
- For each of the following elements: Cr, Zn, Cu, Mn, Mg, Ni, Sn ≤ 0.10%
- Each of the following elements: Pb, Tl, Be, and each of the impurities: ≤ 0.05%
- The copper content can reach 0.20% of those for chromium and magnesium are less than 0.05%.

The aluminium alloy must comply with the following composition limits:
- Si ≤ 13.5%
- Sb ≤ 0.4%
- Sn ≤ 0.10%
- Mg ≤ 11%
- Cr ≤ 0.35%
- As, Ta, Be, Tl, Pb, and each of the other elements present: ≤ 0.05%, total ≤ 0.15%.
- Mn ≤ 4%
- Ti ≤ 0.3%
- Ni ≤ 3%
- Zr ≤ 0.3%
- Fe ≤ 2%
- Zn ≤ 0.25%
- Cu ≤ 0.6%
- Sr ≤ 0.2%

5. Rules for checking the criteria defined in Paragraph 3

5.1 Aluminium and aluminium alloys
The manufacturer of aluminium and aluminium alloy shall supply the manufacturer of the final product with:
- a) A written declaration of compliance with the Order of 27 August 1987;
- b) An analysis report of the chemical composition, which must be in compliance with the Order of 27 August 1987.

5.2 Final product
The manufacturer of the final product shall ensure compliance with the Order of 27 August 1987.
SHEET NO. 3: STEEL FOR PACKAGING

Sheet No. 3a
UNCOATED STEELS (BLACKPLATE)

1. Scope of application
This sheet deals with materials and articles made of steel (1) which, as final products, are intended for direct food contact.

It does not deal with articles covered by the "Non-packaging steel" and "Stainless steel" sheets.

Application essentially relates to:
• Food product tins (sugar, tea, cakes, chocolate, flour, pasta, etc.) ;
• Tins of oil, barrels, vats, etc.

2. Specific limitations on the use of materials
Use of uncoated blackplate should be limited to contact with oily and/or dry foodstuffs.

For tins sold to non-professional users or to final consumers, the usage limitations with respect to the packaged products must be indicated by the reseller.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1. Regulatory texts
• Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts
• Standard NF 10334: Steel for packaging – flat steel products intended for use in contact with foodstuffs, products and beverages for human and animal consumption – Non-coated steel (blackplate).

(1) Definition according to standard NF EN 10020: Definition and classification of grades of steel
3.2 Criteria

3.2.1 Composition of the steel

Verification of the content of elements that make up the steel.

3.2.2 Maximum content in undesirable elements

In particular, verification of the content in lead, cadmium, arsenic and cobalt.

3.2.3 Specific Release Limits

Release limit for elements added intentionally and undesirable elements.

4. Acceptability limits

4.1 Composition of the steel

The supplier of the steel attests to the compliance with the chemical composition requirements set out in the following table.

Table — Chemical composition according to standard NF 10334 (1) (2)

<table>
<thead>
<tr>
<th>Specified elements</th>
<th>Maximum content in % in mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>Aluminium</td>
</tr>
<tr>
<td>As</td>
<td>Arsenic</td>
</tr>
<tr>
<td>B</td>
<td>Boron</td>
</tr>
<tr>
<td>C</td>
<td>Carbon</td>
</tr>
<tr>
<td>Cd + Pb + Hg + Cr (2)</td>
<td>0.0100</td>
</tr>
<tr>
<td>Cd</td>
<td>Cadmium (2)</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead (2)</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury (2)</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
</tr>
<tr>
<td>Mn</td>
<td>Manganese</td>
</tr>
<tr>
<td>Mo</td>
<td>Molybdenum</td>
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<td>N</td>
<td>Nitrogen</td>
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<td>Nb</td>
<td>Niobium</td>
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<td>Ni</td>
<td>Nickel</td>
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<tr>
<td>P</td>
<td>Phosphorus</td>
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<tr>
<td>S</td>
<td>Sulphur</td>
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<tr>
<td>Si</td>
<td>Silicon</td>
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<tr>
<td>Sn</td>
<td>Tin</td>
</tr>
<tr>
<td>Ti</td>
<td>Titanium</td>
</tr>
<tr>
<td>V</td>
<td>Vanadium</td>
</tr>
<tr>
<td>W</td>
<td>Tungsten</td>
</tr>
<tr>
<td>Zr</td>
<td>Zirconium</td>
</tr>
<tr>
<td>Other elements addressed separately (1)</td>
<td>0.050</td>
</tr>
</tbody>
</table>

(1) The chemical elements included under the heading “Other elements addressed separately” are those which may appear in
extremely small quantities, but which are not added intentionally during the steel manufacturing process. (2) Cadmium, lead, and mercury are not added intentionally during the steel manufacturing process. The specification concerning the sum of these three elements refers to Article R.543-45 of the French Environmental Code (Regulatory part, Book V, Title IV, Chapter II, Section 5) which enacts Directive 94/62/EC of 20 December 1994 on packaging and packaging waste into French legislation. Unless otherwise specified, the individual requirements do not apply.

The manufacturer must ensure that the composition of the steel is consistent with these criteria.

4.2 Maximum content in undesirable elements

- Pb < 0.010%
- Cd < 0.010%
- As < 0.030%
- Co < 0.050%

4.3 Specific Release Limits

Refer to the release limits set in Appendix I and, in particular, the release limits of lead, cadmium, arsenic and cobalt.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Steel

The manufacturer of the steel provides the manufacturer of the packaging with a report analysing the chemical composition.

5.2 Final product

On the final product, inertia is checked on the ready-for-use article (specific release).

The manufacturer of the final product checks this inertia by means of release tests on the foodstuffs or food simulants on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
SHEET NO. 3: STEEL FOR PACKAGING

SHEET No. 3b
TIN-COATED STEEL (TINPLATE)

1. Scope of application

This sheet deals with tin or tin alloys and objects coated exclusively in tin or tin alloy or partially tin-plated, which as final products are intended for food contact (1). It does not deal with articles covered by the "Non-packaging steel" and "Steel and stainless steel with metallic coating (excluding packaging)" sheets.

Application essentially relates to:
- Food tins
- Packaging for dry ingredients

2. Specific limitations on the use of materials

The choice of materials must be in keeping with the conditions of use.

It is forbidden to put any beverages or foodstuffs in direct contact with recipients, utensils and equipment that are tin-plated or welded with tin containing more than 0.5% of lead or more than 3/10,000ths of arsenic or less than 97% of tin determined as metastannic acid. For materials and articles intended for the final consumer, usage restrictions are given for contact with highly acidic products.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1. Regulatory texts
- Order of 28 June 1912, amended, concerning the colouring, preservation and packaging of food products and beverages;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts
- Standard EN 610: Tin and tin alloys – Ingot tin;
- standard NF 10333: Steel for packaging – flat steel products intended for use in contact with foodstuffs, products and beverages for human and animal consumption – Non-coated steel (blackplate).

3.2 Criteria

3.2.1. Composition of the steel and coating
Verification of the content of elements that make up the steel and the coating.

(1) Definition according to standard NF EN 10020: Definition and classification of grades of steel.
3.2.2 Maximum content in undesirable elements

In particular, verification of the content in lead, cadmium, arsenic and cobalt for the steel and lead, cadmium and arsenic for the tin coating.

3.2.3 Specific Release Limits

Release limit for elements added intentionally and undesirable elements.

4. Acceptability limits

4.1. Composition of the steel and coating
The steel meets the chemical composition requirements set out in the "Steel for packaging (blackplate)" sheet.

The chemical composition of the tin used must comply with the requirements given in standard EN 610 for the grade Sn 99.85 with the exception of the lead content, which must be less than 0.0100%.

4.2 Maximum content in undesirable elements

Steel:
- Pb < 0.010%
- Cd < 0.010%
- As < 0.030%
- Co < 0.050%

Tin:
The chemical composition of the tin used must comply with the requirements given in standard EN 610 for the grade Sn 99.85 with the exception of the lead content, which must be less than 0.0100%.

4.3 Specific Release Limits

Refer to the release limits set in Appendix I and, in particular, the release limits of impurities: lead, cadmium, arsenic and cobalt.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Steel
The manufacturer of the steel provides the manufacturer of the packaging with a report analysing the chemical composition. It attests to the compliance with the chemical composition requirements set out in the "Steel for packaging (blackplate)" sheet.

5.2 Coating only
The manufacturer of the tin coating provides the manufacturer of the final products with a report analysing the chemical composition. It attests to the compliance with the specifications set out in 4.1.

5.3 Final product
The manufacturer of the final product verifies the composition of the steel and the tin coating.

At the stage of the final product, the inertia of the coating is checked on the ready-for-use article (specific release).

The manufacturer of the packaging checks this inertia by means of release tests on the food simulants or foodstuffs or on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
**SHEET NO. 3: STEEL FOR PACKAGING**

**Sheet No. 3c**  
COATED STEEL (WITH ORGANIC COATING)

1. **Scope of application**

This sheet deals with steel (tinplate, blackplate and chromium-coated steel) for packaging with an organic coating and articles made of steel (tinplate, blackplate and chromium-coated steel) with an organic coating which, as final products, are intended to come into direct contact with foodstuffs. It does not deal with articles covered by the "Non-packaging steel" and "Steel and stainless steel with metallic coating (excluding packaging)" sheets.

The primary examples of coatings are the following: lacquers, varnishes and polymer films.

Application essentially relates to:
- Drink cans
- Food tins
- Packaging for dry ingredients
- Aerosol dispensers
- Cappings
- Household packaging (interiors of cookie or spaghetti tins)

2. **Specific limitations on the use of materials**

The choice of materials must be in keeping with the conditions of use.

For materials and articles sold to the final consumer, the usage instructions of the packaged products shall be indicated by the reseller.

3. **Definition of food contact suitability criteria**

3.1 Reference texts

3.1.1 Regulatory texts

- Regulation (EC) No 1895/2005 of 18 November 2005 on the restriction of use of certain epoxy derivatives in materials and articles intended to come into contact with food;
- Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food, amended;
- Act 2010-729 of 30 June 2010 amended by Act 2012-1442 of 24 December 2012 regarding the suspension of marketing of all packaging containing bisphenol A intended to contain food products;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments;
- Order of 13 January 1976 related to materials and articles made of stainless steel in contact with food products.

3.1.2 Other texts

- The Council of Europe's Framework Resolution ResAP(2004)1 on coatings intended to come into contact with foodstuffs;
3.2 Criteria

3.2.1 Coating only

3.2.2.1 Varnishes/coatings

There is no specific French national legislation or harmonised EU regulation that covers food contact varnishes/coatings, or a positive list of components* for such varnishes/coatings.

The following lists of monomers, starting substances and additives are reference lists for coating constituents:

- Substances (monomers, starting substances and additives) listed in Regulation (EU) No 10/2011 of 14 January 2011, amended, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.) ;
- Varnishes and coatings substances assessed by the European Food Safety Authority (EFSA) using its own guidelines and which have been the subject of a favourable opinion by the EFSA ;
- Substances that have been the subject of a favourable opinion by the Scientific Committee on Food (SCF) (Lists 0 to 4) (website: http://ec.europa.eu/food/fs/sc/scf/index_en.html) ;
- Varnish and coatings substances assessed in application of the European Food Safety Authority's guidelines, or equivalent guidelines, and which have been the subject of a favourable opinion by a competent scientific body in one of the EU Member States, Turkey or a State which is party to the agreement on the European Economic Area (taking account of determined restrictions and/or specifications) ;
- Varnish and coatings substances that are the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted since 1991 in accordance with SCF/EFSA guidelines and which have been the subject of a favourable opinion by a competent scientific body in an EU Member State, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.).

Other constituents may be used in the production of coatings and varnishes, provided that a risk assessment in compliance with internationally-recognised scientific risk assessment principles can be provided to demonstrate compliance with Article 3 of the aforementioned Regulation (EC) No 1935/2004.

Specifically, constituents that have been the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted prior to 1991 applying the criteria existing at the time, may be used provided that supplementary toxicological data can be provided based on the nature of these constituents and their migration and exposure levels, in order to demonstrate compliance with Article 3 of Regulation (EC) No 1935/2004.

Constituents used in the manufacture of varnishes and coatings, including their impurities, which have not been the subject of a scientific risk assessment in accordance with EFSA guidelines or equivalent guidelines and a favourable opinion by the EFSA or a competent scientific body in an
EU Member State, must not be classified as Category 1 or 2 carcinogenic, mutagenic and reprotoxic substances (CMRs) in accordance with Regulation (EC) No 1272/2008 of 16 December 2008, amended, and must not be in a nanometric form.

Compliance with the criteria of Regulation (EC) No 1895/2005 of 18 November 2005 concerning BADGE and its derivatives.

Act 2010-729 of 30 June 2010, amended by Act 2012-1442 of 24 December 2012 suspends the import and placing on the market, either free of charge or against payment, of any packaging, container or utensil comprising bisphenol A and intended to come into direct contact with all foodstuffs as from 1 January 2015 (see the DGCCRF’s implementation guidelines).

*NOTE: The term constituent covers substances.

3.2.2.2 Non-stick coatings
In the absence of proof of the non-use of chromates in the manufacturing process, search for the presence of chromates in the non-stick coating interface.

3.2.3 Final product
Materials and articles at the finished-product stage (coated metals) must meet requirements with respect to 1) specific migration* of those coating constituents that are subject to specific limits, 2) specific release limits for metals, alloy components and impurities listed in Appendix I of this document, 3) overall migration limits, and 4) where appropriate, residual contents of constituents, under normal or foreseeable usage conditions.

* Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.

4. Acceptability limits

4.1 Steel only
The steel meets the chemical composition requirements set out in the “Uncoated steels for packaging (blackplate)” and “Tin-coated steel” sheets.

In the case of chromium-coated steel, specific requirements are laid out in the standard NF EN 10335.

4.2 Final product
The specific migration limits, maximum and/or residual quantities of monomers, other starting substances and additives are those of in Annex I of Regulation (EU) No 10/2011 of 14 January 2011 for the constituent elements listed therein, or those found in relevant scientific opinions and assessments.

The specific release limits of metals, alloy components and impurities are those set out in Appendix I of this document.

The limits for epoxy derivatives are those set out in Regulation (EC) 1895/2005.

The overall migration limit is 10 mg/dm² of the food contact area. An exception has been made for food contact materials and articles for infants (less than 12 months old) and small children (one to three years old), for whom the overall migration limit is 60 mg/kg of food simulant.

For hexavalent chromium, the limit is non-detection with a detection threshold of 5 μg/dm² (Opinion of the CSHPF, Session of 13 February 1996, BOCCRF no. 8 of 24 May 1996).
5. Rules for checking the criteria defined in Paragraph 3

5.1 Steel only
The manufacturer of the steel provides the manufacturer of the packaging with a report analysing the chemical composition.

5.2 Coating only
To verify the criteria, the following information must be provided to the laboratory in charge of analyses,* which may have to sign a confidentiality agreement:

- **Coating references** (so as to allow them to be identified), description of the coated metal, coating family;
- **Identity of substances, type of restrictions for monomers, other starting substances and additives for which SMLs (Specific Migration Limits) or maximum residual quantities have been established, and, where appropriate, the impurities, products of degradation or other substances likely to pose a risk to human health**;
- **Information concerning the use of the materials and articles**: type of foodstuffs (or simulants), duration of contact and real contact temperature for these foodstuffs. Where appropriate, specific information about labelling and real surface area/volume ratio.

The manufacturer of the coating provides the manufacturer of the material or article with a written declaration of compliance with Regulation (EC) No 1935/2004, attesting to the compliance of the composition and, on the basis of migration tests carried out with the coating applied to an "inert" support (stainless steel or glass), of the overall migration and, where appropriate, the specific migrations of the coating's constituents that are subject to a specific migration limit, under test conditions that are representative of real usage. In the case of use of dual use additives, these shall be identified.

* in the case of outsourced testing

5.3 Final product
At the stage of the final product, the inertia of the coating is checked on the ready-for-use article (specific migration/release of the constituents and overall migration).

The manufacturer of the final product checks this inertia by means of specific migration/release tests and overall migration tests on the food simulants or foodstuffs on the basis of the specifications set out in Appendix II (metals and alloys with an organic coating).

Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.

For packaging of foodstuffs with a long shelf life, the match between packaging and foodstuff is checked by means of long-term testing, following a protocol specific to each manufacturer, in such a way as to ensure that the packaging has been effectively adapted to real usage conditions (mechanical and chemical resistance, etc.). These tests can also be in the form of accelerated ageing tests using a methodology based on scientific principles.
SHEET NO 4: UNCOATED STEEL (EXCLUDING PACKAGING)

1. Scope of application

This sheet deals with materials and articles made of uncoated, non-stainless steel\(^1\) which, as final products, are intended for direct food contact. It does not deal with articles covered by the "Steel for packaging" and "Stainless steel" sheets. Application essentially relates to:

- Household articles: cake moulds, bread boards, frying pans, cutlery, cooking hobs.
- Agri-food industry equipment: silos and containers for dry foodstuffs (rice, etc.) or tubers.

This sheet does not deal with high-alloy steels listed in Appendix III.

2. Specific limitations on the use of materials

It is recommended not to place these materials into contact with very acidic foodstuffs or beverages.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1. Regulatory texts

- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts

- NF A 36-714 "Unpackaged Steel – Flat steel products intended for contact with foodstuffs, food products or beverage for human and animals consumption – Uncoated (and non-stainless) steels"
- NF A 35-596 "Iron and steel products – Carbon steels for cutlery"

3.2 Criteria

3.2.1. Composition of the steel

Verification of the content of elements that make up the steel.

3.2.2 Maximum content in undesirable elements

In particular, verification of the content in lead, cadmium, arsenic and cobalt.

3.2.3 Specific Release Limits

Release limit for elements added intentionally and undesirable elements.

4. Acceptability limits

4.1. Composition of the steel

The supplier of the steel attests to the compliance with the chemical composition requirements set out in the following table.

<table>
<thead>
<tr>
<th>Specified elements</th>
<th>Maximum content in % mass</th>
</tr>
</thead>
</table>

\(^1\) Definition according to the standard NF EN 10020: Definition and classification of grades of steel.
### Symbol, Name, Flat products, Long products

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Flat products</th>
<th>Long products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>Aluminium</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>As</td>
<td>Arsenic</td>
<td>0.030</td>
<td>0.030</td>
</tr>
<tr>
<td>B</td>
<td>Boron</td>
<td>0.050</td>
<td>0.050</td>
</tr>
<tr>
<td>C</td>
<td>Carbon</td>
<td>1.30</td>
<td>1.30</td>
</tr>
<tr>
<td>Cd</td>
<td>Cadmium</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium</td>
<td>1.60</td>
<td>2.50</td>
</tr>
<tr>
<td>Co</td>
<td>Cobalt</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Mn</td>
<td>Manganese</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Mo</td>
<td>Molybdenum</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen</td>
<td>0.100</td>
<td>0.20</td>
</tr>
<tr>
<td>Nb</td>
<td>Niobium</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Ni</td>
<td>Nickel</td>
<td>2.00</td>
<td>4.10</td>
</tr>
<tr>
<td>P</td>
<td>Phosphorus</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>S</td>
<td>Sulphur</td>
<td>0.050</td>
<td>0.40</td>
</tr>
<tr>
<td>Si</td>
<td>Silicon</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Sn</td>
<td>Tin</td>
<td>0.080</td>
<td>0.080</td>
</tr>
<tr>
<td>Ti</td>
<td>Titanium</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>V</td>
<td>Vanadium</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Zr</td>
<td>Zirconium</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Other elements taken individually except iron</td>
<td>0.050</td>
<td>0.050</td>
</tr>
</tbody>
</table>

* The chemical elements included under the heading “Other elements taken individually” are those which may appear in extremely small quantities, but which are not deliberately added during the steel manufacturing process.

### 4.2 Maximum content in undesirable elements

- Pb < 0.05%
- Cd < 0.01%
- As < 0.03%
- Co < 0.05%

### 4.3 Specific Release Limits

Refer to the release limits set in Appendix I and, in particular, the release limits of lead, cadmium, arsenic and cobalt.

### 5. Rules for checking the criteria defined in Paragraph 3

#### 5.1 Steel only

The steel manufacturer provides the manufacturer of the finished article or item with a report analysing the chemical composition.

#### 5.2 Final product

On the final product, inertia is checked on the ready-for-use article (specific release).

The manufacturer of the final product checks this inertia by means of release tests on the foodstuffs or food simulants on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
**1. Scope of application**

This sheet deals with steel\(^1\) or stainless steel with metallic coating and objects made entirely of steel or stainless steel with metallic coating, which as final products are intended for food contact.

It does not deal with articles covered by the "Steel for packaging" and "Stainless steel" sheets.

The main examples of metallic coatings for steel are: gold, silver, tin, aluminium, aluminium-silicon, nickel, chromium, quasicrystal deposits, zinc or zinc alloys. Furthermore, these materials may have a copper undercoat bonding intended to have a coating.

The main examples of stainless steel metallic coatings are: gold, silver, chromium, quasicrystals.

This sheet does not deal with articles in silver-plated metal, pending the outcome of work/discussions ongoing at the Council of Europe, on these types of articles (see Sheet No 9, “Articles coated in sundry metals”).

Application essentially relates to:
- household articles: flatware, tableware, inner rotisseries, baking sheets, chip fryer dripping pans and vapour barriers
- agri-food industry equipment: tankers, grain silos, etc.

**2. Specific limitations on the use of materials**

It is recommended not to use steel or stainless steel coated in zinc or zinc alloys in contact with acidic foodstuffs.

To avoid incorrect conditions of use, the temperature limit for use must be specified on the labelling of the objects. For example, zinc- or zinc-alloy-based coatings shall not be used at temperatures above 100°C.

**3. Definition of food contact suitability criteria**

**3.1. Reference texts**

**3.1.1 Regulatory texts**
- Order of 13 January 1976 related to materials and articles made of stainless steel in contact with food products ;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments ;
- Order of 28 June 1912 concerning the colouring, preservation and packaging of food products and beverages.

**3.1.2 Other texts**
- NF EN 610: Tin and tin alloys – Ingot tin ;

\(^1\)Definition according to the standard NF EN 10020: Definition and classification of grades of steel
- NF A 36 712-1: Unpackaged Steel – metallic coated flat steel products intended for contact with foodstuffs, food products and beverages for human and animal consumption – Part 1: zinc or zinc alloy coated (non-stainless) steels;
- NF A 36 712-2: Unpackaged Steel – metallic coated flat steel products intended for contact with foodstuffs, food products and beverages for human and animal consumption – Part 2: aluminium or aluminium alloy coated (non-stainless) steels;
- NF A 36 712-3: Unpackaged Steel – metallic coated flat steel products intended for contact with foodstuffs, food products and beverages for human and animal consumption – Part 3: chromium-coated (non-stainless) steels;
- NF A 36 712-5: Unpackaged Steel – metallic coated flat steel products intended for contact with foodstuffs, food products and beverages for human and animal consumption – Part 5: tin-coated (non-stainless) steels.

3.2 Criteria

3.2.1. Composition of the steel
Verification of the content of elements that make up the steel.

3.2.2 Maximum content in undesirable elements
Verification of the content in undesirable elements: lead, cadmium and arsenic.

3.2.3 Specific Release Limits
In particular, release limits of nickel, chrome or zinc when the coating has a nickel, chrome or zinc base; copper when a copper undercoat is used to improve adhesion, or depending on the composition of coatings.

4. Acceptability limits

4.1. Composition of the steel
The steel used as a support meets the chemical composition requirements set out in the “Non-packaging steel” and “Stainless steel” sheets.

4.2. Maximum content in undesirable elements
- Pb < 0.010%
- Cd < 0.010%
- As < 0.030%

4.3 Specific Release Limits
Refer to the release limits set in Appendix I and, in particular, the release limits of nickel, chromium, zinc and copper according to the composition of the items, and the release limits of impurities: lead, arsenic and cadmium.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Steel and stainless steel only
The steel or stainless steel manufacturer supplies the manufacturer of the final product with the following:
- a) A written declaration of compliance with the Order of 13 January 1976 for stainless steels;
- b) An analysis report of the chemical composition, which must be in compliance with the Order of 13 January 1976 for stainless steels.

5.2 Final product
On the final product, inertia is checked on the ready-for-use article (specific release).

The manufacturer of the final product checks this inertia by means of release tests on the foodstuffs or food simulants on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
1. Scope of application

This section deals with steel or stainless steel with organic coating and objects made entirely of steel or stainless steel with organic coating, which as final products are intended for food contact.

It does not deal with articles covered by the "Steel for packaging" sheet.

It does not deal with steel with organic coating used in the following applications: outside covers of electrical household appliances; false ceilings; extractor hoods; walls and fittings of rooms; interiors of cold rooms, refrigerated or isothermic lorries.

Application essentially relates to:
- household articles such as pots and pans
- agri-food industry equipment: vats, tankers.

The primary examples of coatings are the following: lacquers, varnishes and polymer films (PTFE, resins, silicons, etc.).

2. Specific limitations on the use of materials

To avoid incorrect conditions of use for materials and articles intended for end consumers, the temperature limit for use must be specified on the labelling of objects.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1 Regulatory texts

- Regulation (EC) No 1895/2005 of 18 November 2005 on the restriction of use of certain epoxy derivatives in materials and articles intended to come into contact with food;
- Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food, amended;
- Act 2010-729 of 30 June 2010 amended by Act 2012-1442 of 24 December 2012 regarding the suspension of marketing of all packaging containing bisphenol A intended to contain food products;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments;
- Order of 13 January 1976 related to materials and articles made of stainless steel in contact with food products.

3.1.2 Other texts

- The Council of Europe's Framework Resolution ResAP(2004)1 on coatings intended to come into contact with foodstuffs;

1 Definition according to the standard NF EN 10020:Definition and classification of grades of steel.
3.2 Criteria

3.2.1 Support/enamel coating used as an undercoat

Verification of the content of elements that make up the steel used as a support.

Where applicable, the composition of the enamel coating used as an undercoat must be compatible with use in contact with food for the organic coating (content in undesirable elements, notably lead, cadmium and arsenic). Nevertheless, inertia is tested on the ready-for-use article.

3.2.2 Coating only

3.2.2.1 Varnishes/coatings

There is no specific French national legislation or harmonised EU regulation that covers food contact varnishes/coatings, or a positive list of components* for such varnishes/coatings.

The following lists of monomers, starting substances and additives are reference lists for coating constituents:

- Substances (monomers, starting substances and additives) listed in Regulation (EU) No 10/2011 of 14 January 2011, amended, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.)
- Varnishes and coatings substances assessed by the European Food Safety Authority (EFSA) using its own guidelines and which have been the subject of a favourable opinion by the EFSA
- Substances that have been the subject of a favourable opinion by the Scientific Committee on Food (SCF) (Lists 0 to 4), website: [http://ec.europa.eu/food/fs/sc/scf/index_en.html](http://ec.europa.eu/food/fs/sc/scf/index_en.html)
- Varnish and coatings substances assessed in application of the European Food Safety Authority's guidelines, or equivalent guidelines, and which have been the subject of a favourable opinion by a competent scientific body in one of the EU Member States, Turkey or a State which is party to the agreement on the European Economic Area (taking account of determined restrictions and/or specifications)
- Varnish and coatings substances that are the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted prior to 1991 applying the criteria existing at the time, may be used provided that supplementary toxicological data can be provided based on the nature of these constituents and their migration and exposure levels, in order to demonstrate compliance with Article 3 of Regulation (EC) No 1935/2004.

Other constituents may be used in the production of coatings and varnishes, provided that a risk assessment in compliance with internationally-recognised scientific risk assessment principles can be provided to demonstrate compliance with Article 3 of the aforementioned Regulation (EC) No 1935/2004.

Specifically, constituents that have been the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted prior to 1991 applying the criteria existing at the time, may be used provided that supplementary toxicological data can be provided based on the nature of these constituents and their migration and exposure levels, in order to demonstrate compliance with Article 3 of Regulation (EC) No 1935/2004.
Constituents used in the manufacture of varnishes and coatings, including their impurities, which have not been the subject of a scientific risk assessment in accordance with EFSA guidelines or equivalent guidelines and a favourable opinion by the EFSA or a competent scientific body in an EU Member State, must not be classified as Category 1 or 2 carcinogenic, mutagenic and reprotoxic substances (CMRs) in accordance with Regulation (EC) No 1272/2008 of 16 December 2008, amended, and must not be in a nanometric form.

Compliance with the criteria of Regulation (EC) No 1895/2005 of 18 November 2005 concerning BADGE and its derivatives.

Act 2010-729 of 30 June 2010, amended by Act 2012-1442 of 24 December 2012 suspends the import and placing on the market, either free of charge or against payment, of any packaging, container or utensil comprising bisphenol A and intended to come into direct contact with all foodstuffs as from 1 January 2015 (see the DGCCRF’s implementation guidelines).

*NOTE: The term constituent covers substances.

3.2.2.2 Non-stick coating
In the absence of proof of the non-use of chromates in the manufacturing process, search for the presence of chromates in the non-stick coating interface.

3.2.3 Final product
Materials and articles at the final-product stage (coated metals) must meet requirements with respect to 1) specific migration* of those coating constituents that are subject to specific limits, 2) specific release limits for metals, alloy components and impurities listed in Appendix I of this document, 3) overall migration limits, and 4) where appropriate, residual contents of constituents, under normal or foreseeable usage conditions.

* Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.

4. Acceptability limits

4.1 Steel or stainless steel only
The steel used as a support meets the chemical composition requirements set out in the “Uncoated steels for packaging (blackplate)” or “Tin-coated steel” sheets or in the standard NF EN 10335 for chromed steel.

Stainless steel must meet the chemical composition requirements set out in the Order of 13 January 1976.

The manufacturer verifies this composition.

The supplier of the stainless steel attests to the compliance with the chemical composition requirements, and the manufacturer checks these compositions.

4.2 Final product
The specific migration limits, maximum and/or residual quantities of monomers, other starting substances and additives are those of Annex I of Regulation (EU) No 10/2011 of 14 January 2011 for the constituents listed therein, or given in other relevant scientific assessments and opinions.

The specific release limits of metals, alloy components and impurities are those set out in Appendix I of this document.
The limits for epoxy derivatives are those set out in Regulation (EC) 1895/2005.

The overall migration limit is 10 mg/dm² of the food contact area. An exception has been made for food contact materials and articles for infants less than 12 months old and small children one to three years old, for whom the overall migration limit is 60 mg/kg of food simulant.

For hexavalent chromium, the limit is non-detection with a detection threshold of 5 μg/dm² (Opinion of the CSHPF, Session of 13 February 1996, BOCCRF no. 8 of 24 May 1996).

5. Rules for checking the criteria defined in Paragraph 3

5.1 Steel or stainless steel only

The steel or stainless steel manufacturer supplies the manufacturer of the final product with the following:

a) An analysis report of the chemical composition and a written declaration of compliance with the Order of 13 January 1976 for stainless steels;

b) An analysis report of the chemical composition for steel.

5.2 Coating only

To verify the criteria, the following information must be provided to the laboratory in charge of analyses,* which may have to sign a confidentiality agreement:

- Coating references (so as to allow them to be identified), description of the coated metal, coating family;
- Identity of substances, type of restrictions for monomers, other starting substances and additives for which SMLs (Specific Migration Limits) or maximum residual quantities have been established, and, where appropriate, the impurities, products of degradation or other substances likely to pose a risk to human health;
- Information concerning the use of the materials and articles: type of foodstuffs (or simulants), duration of contact and real contact temperature for these foodstuffs Where appropriate, specific information about labelling and real surface area/volume ratio.

The manufacturer of the coating provides the manufacturer of the material or article with a written declaration of compliance with Regulation (EC) No 1935/2004, attesting to the compliance of the composition and, on the basis of migration tests carried out with the coating applied to an "inert" support (stainless steel or glass), of the overall migration and, where appropriate, the specific migrations of the coating’s constituents that are subject to a specific migration limit, under test conditions that are representative of real usage. In the case of use of dual use additives, these shall be identified.

* in the case of outsourced testing

5.3 Final product

At the stage of the final product, the inertia of the coating is checked on the ready-for-use article (specific migration/release of the constituents and overall migration).

The manufacturer of the final product checks this inertia by means of specific migration/release tests and overall migration tests on the food simulants or foodstuffs on the basis of the specifications set out in Appendix II (metals and alloys with an organic coating).

Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.

For packaging of foodstuffs with a long shelf life, the match between packaging and foodstuff is checked by means of long-term testing, following a protocol specific to each manufacturer, in such a way as to ensure that the packaging has been effectively adapted to real usage conditions.
(mechanical and chemical resistance, etc.). These tests can also be in the form of accelerated ageing tests using a methodology based on scientific principles.
1. **Scope of application**

This sheet deals with cast iron (an alloy of iron and carbon, with carbon content ranging from 2.1% to 6.7%), unalloyed, and either uncoated or not with a metallic coating, as well as objects made exclusively of unalloyed cast iron (uncoated or not with a metallic coating) which as final products are intended for food contact.

The main examples of metallic coatings are: nickel and chromium

Application essentially relates to:
- Household articles: cooking hobs, baking sheets, cooking utensils, grills, grinders, etc.
- Agri-food industry equipment: pipes, machine casings, cooking elements, etc.

2. **Specific limitations on the use of materials**

Do not leave utensils in contact with acidic foodstuffs before or after cooking.

3. **Definition of food contact suitability criteria**

3.1 Regulatory texts

Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.2 Criteria

3.1.2. Maximum content (cast iron only + coating where applicable)

Verification of the content in undesirable elements. In particular, verification of the content in lead, cadmium and arsenic.

3.2.2 Specific Release Limits

In particular, the release limits of lead, cadmium, arsenic, iron, and in the presence of a metallic coating, chromium and nickel.

4. **Acceptability limits**

4.1 Maximum content (medium + coating where applicable)

\[
Pb \leq 0.050\% \\
Cd \leq 0.010\% \\
As \leq 0.030\%
\]

4.2 Specific Release Limits

Refer to the release limits set in Appendix I and, in particular, the release limits of lead, cadmium, arsenic, iron, and in the presence of a metallic coating, chromium and nickel.

5. **Rules for checking the criteria defined in Paragraph 3**

5.1 Cast iron only/metallic coating

The manufacturer of the cast iron provides the manufacturer of the final product with a report analysing the chemical composition.
The manufacturer of the metallic coating provides the manufacturer of the final product with a report analysing the chemical composition.

5.2 Final product
The manufacturer of the final product verifies the composition of the cast iron and, where applicable, the metallic coating.

On the final product, inertia is checked on the ready-for-use article (specific release of metals, alloy components and impurities).

The manufacturer of the final product checks this inertia by means of release tests on the foodstuffs or food simulants on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
1. **Scope of application**

This sheet deals with unalloyed cast iron (an alloy of iron and carbon, with carbon content ranging from 2.1% to 6.7%), with an organic coating, with or without an intermediary coating (of metal or enamel), as well as objects made exclusively of unalloyed cast iron with an organic coating which as final products are intended for food contact (repeated use or not).

The primary examples of coatings are the following: lacquers, varnishes and polymer films (PTFE, resins, silicons, etc.)

Application essentially relates to:
- Household articles: serving dishes, fryers, cooking utensils
- Agri-food industry equipment: cooking elements, etc.

This sheet does not deal with articles with hybrid organic/inorganic coatings (such as those derived from the sol-gel process).

2. **Specific limitations on the use of materials**

To avoid incorrect conditions of use, the temperature limit for use must be specified on the labelling of the objects.

3. **Definition of food contact suitability criteria**

3.1 Reference texts

3.1.1. Regulatory texts

- Regulation (EC) No 1895/2005 of 18 November 2005 on the restriction of use of certain epoxy derivatives in materials and articles intended to come into contact with food;
- Commission Regulation (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food, amended;
- Act 2010-729 of 30 June 2010 amended by Act 2012-1442 of 24 December 2012 regarding the suspension of marketing of all packaging containing bisphenol A intended to contain food products (the case for household articles for this sheet);

3.1.2 Other texts

- The Council of Europe's Framework Resolution ResAP(2004)1 on coatings intended to come into contact with foodstuffs;
- NF EN 15136: Materials and articles in contact with foodstuffs – Epoxy derivatives subject to limitation – Determination of BADGE, BFDGE and their hydroxylated and chlorinated derivatives in food simulants;
- French archive documents on varnishes: see Sheet No 2a;
- "Code of Practice for Coated Articles Where the Food Contact Layer Is a Coating" – European Council of the Paint, Printing Ink and Artists’ Colours Industry – CEPE;

3.2 Criteria

3.2.1 Support/enamel coating used as an undercoat

Verification of the content of elements that make up the cast iron used as a support.
Where applicable, the composition of the enamel coating used as an undercoat must be compatible with use in contact with food for the organic coating (content in undesirable elements, notably lead, cadmium and arsenic).

Nevertheless, tests are carried out on the ready-for-use article.

### 3.2.2 Coating only

#### 3.2.2.1 Varnishes/coatings

There is no specific French national legislation or harmonised EU regulation that covers food contact varnishes/coatings, or a positive list of components* for such varnishes/coatings.

The following lists of monomers, starting substances and additives are reference lists for coating constituents:

- Substances (monomers, starting substances and additives) listed in Regulation (EU) No 10/2011 of 14 January 2011, amended, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.);
- Varnishes and coatings substances assessed by the European Food Safety Authority (EFSA) using its own guidelines and which have been the subject of a favourable opinion by the EFSA;
- Substances that have been the subject of a favourable opinion by the Scientific Committee on Food (SCF) (Lists 0 to 4), website: [http://ec.europa.eu/food/fs/sc/scf/index_en.html](http://ec.europa.eu/food/fs/sc/scf/index_en.html);
- Varnish and coatings substances assessed in application of the European Food Safety Authority's guidelines, or equivalent guidelines, and which have been the subject of a favourable opinion by a competent scientific body in one of the EU Member States, Turkey or a State which is party to the agreement on the European Economic Area (taking account of determined restrictions and/or specifications);
- Varnish and coatings substances that are the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted since 1991 in accordance with SCF/EFSA guidelines and which have been the subject of a favourable opinion by a competent scientific body in that EU Member State, taking account of determined restrictions and/or specifications (SMLs, residual contents, purity criteria, etc.).

Other constituents may be used in the production of coatings and varnishes, provided that a risk assessment in compliance with internationally-recognised scientific risk assessment principles can be provided to demonstrate compliance with Article 3 of the aforementioned Regulation (EC) No 1935/2004.

Specifically, constituents that have been the subject of an authorisation in a regulatory text by an EU Member State concerning food contact varnishes, based on a scientific assessment conducted prior to 1991 applying the criteria existing at the time, may be used provided that supplementary toxicological data can be provided based on the nature of these constituents and their migration and exposure levels, in order to demonstrate compliance with Article 3 of Regulation (EC) No 1935/2004.

Constituents used in the manufacture of varnishes and coatings, including their impurities, which have not been the subject of a scientific risk assessment in accordance with EFSA guidelines or equivalent guidelines and a favourable opinion by the EFSA or a competent scientific body in an EU Member State, must not be classified as Category 1 or 2 carcinogenic, mutagenic and reprotoxic substances (CMRs) in accordance with Regulation (EC) No 1272/2008 of 16 December 2008, amended, and must not be in a nanometric form.

Compliance with the criteria of Regulation (EC) No 1895/2005 of 18 November 2005 concerning BADGE and its derivatives.
Act 2010-729 of 30 June 2010, amended by Act 2012-1442 of 24 December 2012 suspends the import and placing on the market, either free of charge or against payment, of any packaging, container or utensil comprising bisphenol A and intended to come into direct contact with all foodstuffs as from 1 January 2015 (see the DGCCRF’s implementation guidelines).

*NOTE: The term constituent covers substances.*

3.2.2.2 Non-stick coating
In the absence of proof of the non-use of chromates in the manufacturing process, search for the presence of chromates in the non-stick coating interface.

3.2.3 Final product
**Materials and articles** at the final-product stage (coated metals) must meet requirements with respect to 1) specific migration* of those coating constituents that are subject to specific limits, 2) specific release limits for metals, alloy components and impurities listed in Appendix I of the present sheet, 3) overall migration limits, and 4) where appropriate, residual contents of constituents, under normal or foreseeable usage conditions.

* Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.

4. Acceptability limits

4.1 Cast iron only
The supplier of the cast iron attests to the compliance with the chemical composition requirements set out in the “Unalloyed cast iron uncoated or with metallic coating” sheet. The manufacturer verifies this composition.

4.2 Final product
The **specific migration limits** and the maximum and/or residual quantities of monomers, other starting substances and additives are those of Annex I of Regulation (EU) No 10/2011 of 14 January 2011 for the constituents that are listed there, or those found in relevant scientific opinions and assessments.

The **specific release limits of metals, alloy components and impurities** are those set out in Appendix I of this document.

The limits for epoxy derivatives are those set out in Regulation (EC) 1895/2005.

The **overall migration limit** is 10 mg/dm² of the food contact area. An exception has been made for food contact materials and articles for infants less than 12 months old and small children one to three years old, for whom the overall migration limit is 60 mg/kg of food simulant.

For hexavalent chromium, the limit is non-detection with a detection threshold of 5 μg/dm² (Opinion of the CSHPF, Session of 13 February 1996, BOCCRF no. 8 of 24 May 1996).

5. Rules for checking the criteria defined in Paragraph 3

5.1 Cast iron only
The manufacturer of the cast iron provides the manufacturer of the final product with a report analysing the chemical composition.
5.2 Coating only
To verify the criteria, the following information must be provided to the laboratory in charge of analyses,* which may have to sign a confidentiality agreement:

- **Coating references** (so as to allow them to be identified), description of the coated metal, coating family;
- **Identity of substances, type of restrictions** for monomers, other starting substances and additives for which SMLs (Specific Migration Limits) or maximum residual quantities have been established, and, where appropriate, the impurities, products of degradation or other substances likely to pose a risk to human health;
- **Information concerning the use of the materials and articles**: type of foodstuffs (of simulants), duration of contact and real contact temperature for these foodstuffs. Where appropriate, specific information about labelling and real surface area/volume ratio.

The manufacturer of the coating provides the manufacturer of the material or article with a written declaration of compliance with Regulation (EC) No 1935/2004, attesting to the compliance of the composition and, on the basis of migration tests carried out with the coating applied to an "inert" support (stainless steel or glass), of the overall migration and, where appropriate, the specific migrations of the coating's constituents that are subject to a specific migration limit, under test conditions that are representative of real usage. In the case of use of dual use additives, these shall be identified.

* in the case of outsourced testing

5.3 Final product
The manufacturer of the final product verifies the composition of the cast iron.

At the stage of the final product, the inertia of the coating is checked on the ready-for-use article (specific migration/release of the constituents and overall migration).

The manufacturer of the final product checks this inertia by means of specific migration/release tests and overall migration tests on the food simulants or foodstuffs on the basis of the specifications set out in Appendix II (metals and alloys with an organic coating).

*Verification of specific migration limits provided shall not be compulsory, if it can be established that the migration potential, calculated based on the residual content of the substance in the material or article and assuming complete migration of this substance (or by applying generally recognised diffusion models based on scientific evidence that are established in a way as to overestimate real migration levels) does not exceed the specific migration limit.*
1. Scope of application

This sheet deals with tin or tin alloys and articles coated exclusively in tin or tin alloy or partially tin-plated, which as final products are intended for food contact.

- This sheet does not deal with tin-coated articles covered by the “Steel for packaging with metallic coating” and “Steel and stainless steel with metallic coating (excluding packaging)” sheets and foodstuffs in tins and beverages in cans whose maximum tin content is regulated by Regulation (EC) No 1881/2006 of 19 December 2006.

Application essentially relates to:

- Household articles: Measuring instruments, pots, dishes, plates, utensils, etc.
- Agri-food industry equipment, closures for metal tins, etc.

2. Specific limitations on the use of materials

- It is forbidden to put any beverages or foodstuffs in direct contact with recipients, utensils and equipment that are tin-plated or welded with tin containing more than 0.5% of lead or more than 3/10,000ths of arsenic or less than 97% of tin determined as metastannic acid (Order of 28 June 1912);
- It is recommended not to use these materials in contact with highly-acidic or highly-alkaline foodstuffs or to heat the foodstuffs to temperatures of over 150°C;
- Moreover, it is not advisable to preserve foodstuffs in household articles or agri-foodstuff equipment made from tin or tin alloy or coated in tin or tin alloy.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1 Regulatory texts

- Commission Regulation (EC) No 1881/2006 of 19 December 2006 (amended) setting maximum levels for certain contaminants in foodstuffs;
- Order of 28 June 1912 concerning the colouring, preservation and packaging of food products and beverages;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts

- Decree no. 76-492 of 28 May 1976 implementing the Act of 1 August 1905 on fraud control, in respect of trading in tin articles;
- Standard NF EN 611-1 Tin and tin alloys - Pewter and pewterware - Part 1: Pewter (to be reviewed).

3.2 Criteria

3.2.1 Maximum content

In particular, check the content in tin, lead, cadmium, arsenic, antimony and copper.

3.2.2 Specific Release Limits

In particular, release limits of tin, antimony, arsenic, copper, lead and cadmium.
4. Acceptability limits

4.1 Maximum content
Sn $\geq$ 97%
Pb $\leq$ 0.050%
Cd $\leq$ 0.010%
As $\leq$ 0.030%
Sb $\leq$ 2.5%
Cu $\leq$ 1.5%

4.2 Specific Release Limits
Refer to the release limits set in Appendix I and, in particular, those for tin, antimony, arsenic, copper, lead and cadmium.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Tin or tin alloy alone
The manufacturer of the tin or tin alloy provides the manufacturer of the finished material or article with a report analysing the chemical composition.

5.2 Final product
The manufacturer of the final product verifies the composition of the tin or tin alloy.
On the final product, inertia is checked on the ready-for-use article (specific release).
The manufacturer of the final product checks this inertia by means of release tests on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
1. Scope of application

This sheet deals with zinc or zinc alloys and articles constituted exclusively of zinc or zinc alloys, and zinc-coated metals, which as final products are intended for food contact.

This sheet does not deal with zinc-coated objects covered by the “Steel and stainless steel with metallic coating (excluding packaging)” sheet.

- Application essentially relates to:
  - Household articles: measuring instruments, etc.
  - Agri-food industry equipment: measuring instruments, chocolate, confectionery production, etc.

2. Specific limitations on the use of materials

- It is forbidden to put any beverages or foodstuffs in direct contact with zinc and galvanised iron, except for producing or preserving chocolate and confectionery products which do not contain liquid acidic substances and for distillery operations. Direct use of zinc and galvanised iron has been extended to roots, tubers, bulbs, fruit with husks, seeds, dry vegetables and leaf vegetables.
- Use restricted to the field of application.
- It is recommended not to use other metals and alloys coated in zinc or zinc alloys for contact with acidic foodstuffs.

3. Definition of food contact suitability criteria

3.1 Reference texts

3.1.1 Regulatory texts

- Order of 28 June 1912 concerning the colouring, preservation and packaging of food products and beverages;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2 Other texts

- Standard EN 1179 - Zinc and zinc alloys - Primary zinc - September 2003 (characteristics of zinc);
- Standard EN 12844 - Zinc and zinc alloys - Castings - Specifications - February 1999 (characteristics of zinc alloys);
3.2 Criteria

3.2.1 Composition of zinc (articles only in zinc)
Verification of the content in impurities (lead, cadmium, iron, tin, copper, aluminium).

3.2.2 Maximum content in undesirable elements
In particular, verification of the content in lead, cadmium and arsenic.

3.2.3 Specific Release Limits
In particular, release limits of zinc, lead, cadmium and arsenic.

4. Acceptability limits

4.1 Content in impurities (articles in zinc alone)
Total of content in impurities $\leq 0.15\%$ (lead, cadmium, iron, tin, copper, aluminium).

4.2 Maximum content in undesirable elements
$\text{Pb} \leq 0.05\%$
$\text{Cd} \leq 0.010\%$
$\text{As} \leq 0.030\%$

4.3 Specific Release Limits
Refer to the release limits set in Appendix I and, in particular, the release limits of zinc, lead, cadmium and arsenic.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Zinc and zinc alloys
The manufacturer of the zinc or zinc alloy provides the manufacturer of the final products with a report analysing the chemical composition.

5.2 Final product
On the final product, inertia is checked on the ready-for-use article (specific release).

The manufacturer of the final product checks this inertia by means of release tests on the foodstuffs or food simulants on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
1. Scope of application

This sheet deals with metals and alloys with a metallic coating ("white metal"), other than those already covered by the other sheets on metals, which as final products are intended for food contact.

**White metal:** metallic article covered with a fine white deposit (thin layer) such as silver, nickel, tin, chromium, copper, or a combination of these elements.

The main examples of metal mediums are as follows: copper or copper alloy, zinc or zinc alloy, tin or tin alloy, stainless steel.

The main examples of contact metallic coatings are nickel, silver, gold, copper, tin and chromium.

Application essentially relates to: tea or coffee services, bowls, tumblers, trays, cake tongs and servers, pie dishes, cutlery, etc.

This sheet also deals with other sundry metal articles with a metallic coating.

This sheet does not deal with articles in solid silver or silver-plated metal, pending the outcome of work/discussions ongoing at the Council of Europe on these types of articles.

Only articles (excluding jewellery) that are at least 500 thousandths silver-coated, bearing a manufacturer’s hallmark and that are at least 10 microns thick, may be classified as silver-plated articles. Silver-coated articles that do not meet these criteria may not be called "silver-plated metal" but "white metal".

2. Specific limitations on the use of materials

- It is recommended not to use articles in sundry metals coated in white metal for contact with acidic foodstuffs.
- Where applicable, refer to the restrictions on use set out in the sheets on single metals (zinc and tin).

3. Definition of food contact suitability criteria

3.1. Reference texts

3.1.1. Regulatory texts

- Order of 28 June 1912 concerning the colouring, preservation and packaging of food products and beverages;
- Order of 15 November 1945 establishing a list of materials that may be used without harm to public health for the production of measuring instruments.

3.1.2. Other texts

- Decree no. 84-623 of 16 July 1984 on regulations for the guarantee of fineness of materials and pieces in platinum, gold or silver;
- Standards of the NF EN ISO 8442 series - Materials and articles in contact with foodstuffs - Cutlery and table holloware (cutlery in white metal/silver-plated metal);
3.2. Criteria

3.1.2. Maximum content (medium + coating where applicable)
In particular, verification of the content in nickel, silver, copper, tin, chromium, zinc and in undesirable elements: lead, arsenic and cadmium.

3.2.2 Specific Release Limits
In particular, release limits of nickel, silver, copper, tin, chromium, zinc, lead, arsenic and cadmium according to the composition of the articles.

4. Acceptability limits

4.1. Maximum content in undesirable elements
\[ \text{Pb} \leq 0.050\% \]
\[ \text{Cd} \leq 0.010\% \]
\[ \text{As} \leq 0.030\% \]

4.2 Specific Release Limits
Refer to the release limits set in Appendix I and, in particular, the release limits of nickel, silver, copper, tin, chromium, zinc, lead, arsenic and cadmium according to the composition of the articles.

5. Rules for checking the criteria defined in Paragraph 3

5.1 Support
The manufacturer of the support and/or coating provides the manufacturer of the finished material or article with a report analysing the chemical composition.

5.2 Final product
On the final product, inertia is checked on the ready-for-use article (specific release).

The manufacturer of the final product checks this inertia by means of release tests on the basis of the specifications set out in Appendix II (uncoated metals and alloys or those with a metallic coating).
# APPENDIX I: Specific Release Limits (SRLs)

Criteria update date: 01/04/2017

## Metals and alloy components

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Chemical name</th>
<th>Specific Release Limit* (SRL) [mg/kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag</td>
<td>Silver</td>
<td>0.08</td>
</tr>
<tr>
<td>Al</td>
<td>Aluminium</td>
<td>5**</td>
</tr>
<tr>
<td>Co</td>
<td>Cobalt</td>
<td>0.02</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium (total)</td>
<td>0.250</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
<td>4</td>
</tr>
<tr>
<td>Fe</td>
<td>Iron</td>
<td>40</td>
</tr>
<tr>
<td>Mg</td>
<td>Magnesium</td>
<td>-</td>
</tr>
<tr>
<td>Mn</td>
<td>Manganese</td>
<td>1.8</td>
</tr>
<tr>
<td>Mo</td>
<td>Molybdenum</td>
<td>0.12</td>
</tr>
<tr>
<td>Ni</td>
<td>Nickel</td>
<td>0.14</td>
</tr>
<tr>
<td>Sn***</td>
<td>Tin</td>
<td>100</td>
</tr>
<tr>
<td>Ti</td>
<td>Titanium</td>
<td>-</td>
</tr>
<tr>
<td>Zn</td>
<td>Zinc</td>
<td>5</td>
</tr>
</tbody>
</table>

* Details on the toxicological data used to draw up these SRLs are available in the Technical Guide to Resolution CM/Res(2013)9 on metals and alloys.

** Value established temporarily using the ALARA principle.

*** For tin, with the exception of the cases covered by Regulation (EC) No 1881/2006 of 19 December 2006.

## Contaminants and impurities

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Chemical name</th>
<th>Specific Release Limit* (SRL) [mg/kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>Arsenic</td>
<td>0.002</td>
</tr>
<tr>
<td>Ba</td>
<td>Barium</td>
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</tr>
<tr>
<td>Be</td>
<td>Beryllium</td>
<td>0.01</td>
</tr>
<tr>
<td>Cd</td>
<td>Cadmium</td>
<td>0.005</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury</td>
<td>0.003</td>
</tr>
<tr>
<td>Li</td>
<td>Lithium</td>
<td>0.048</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
<td>0.010</td>
</tr>
<tr>
<td>Sb</td>
<td>Antimony</td>
<td>0.04</td>
</tr>
<tr>
<td>Tl</td>
<td>Thallium</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
APPENDIX II: Test conditions

Criteria update date: 01/04/2017

Verification of the compliance of metals and alloys with Article 3 of Regulation (EC) No 1935/2004 of 27 October 2004 is carried out on foodstuffs or food simulants and according to the test criteria and conditions set out in parts I and II below:

I Foodstuffs and/or food simulants

Prevalence of test results**: migration/release tests in foodstuffs > migration/release tests in food simulants > composition specifications of materials and articles*.

* The composition specifications of materials and articles are in particular of interest when it is impossible to conduct migration/release tests.

** This is not applicable to materials and articles composed exclusively of stainless steel or aluminium or aluminium alloy, covered by a specific regulation.

▶ Tests on foodstuffs

As regards the choice of foodstuffs, taking account of the natural metal content in the foodstuffs and the tests on the packaging of foodstuffs, reference should be made to the Technical Guide to Resolution CM/Res(2013)9.

Test are conducted as a priority on foodstuffs in the following cases:

- When the article is already in contact with the foodstuff, for instance tinned food, beer kegs, etc. or is specifically intended for packaging (i.e. tins destined for the agri-food industry). Insofar as possible, tests are conducted on the foodstuffs’ sell-by-date;
- When the material or article is not in contact with a foodstuff (uses excluding packaging, for instance utensils used for food processing) but where the planned use of the foodstuffs or groups of foodstuffs is clearly indicated or is in no doubt (i.e. garlic crusher, tea infuser, etc.);
- When extreme physical conditions or abrasion takes place as part of normal use and cannot be reproduced under laboratory test conditions (i.e. pepper mills, coffee grinders or other devices for grinding nuts, grains, etc.).

If the “natural” metal content in the foodstuffs can have a substantial impact on the outcome of the analysis, it may be necessary to use a food simulant or another foodstuff, the choice of which, in this case, must be justified from a scientific standpoint.

In foodstuffs, release from packaging is affected by the properties of the packaging material, the physical and chemical properties of the foodstuffs and the atmospheric conditions (heat treatment of filled recipients, duration and temperature of preservation and the presence of residual oxygen after sealing, etc.). As a result, analyses are carried out in conditions representing the worst case scenario that is reasonably foreseeable and that encourages the release of metals as part of normal or reasonably foreseeable use factoring in, in particular, the contact time and temperature, and composition of the foodstuffs (especially pH and the nature of any salt or acid present).

Where applicable, checks are conducted on the foodstuff after it is put into contact with the industrial equipment by taking account of its life cycle (storage, transport, use, etc.) or on the packaged foodstuff until its use by date (UBD) or at least until its minimum durability date (MDD).
Tests on food simulants

Food simulants are used:
- When the material or article may enter into contact with a wide range of foodstuffs that cannot be classified in a specific food category, such as kitchen utensils;
- When use with specific foodstuffs or groups of foodstuffs is not known or clearly indicated;
- When it is not possible to test release using materials or articles directly in the foodstuffs either for technical reasons (for instance, when laboratory analysis is technically impossible) or for practical reasons (for instance, when the foodstuffs are unavailable).

The simulants used are those:
- of table 1 below for specific release tests of the constituent elements of uncoated metals and alloys or those with a metallic coating:

<table>
<thead>
<tr>
<th>Type of foodstuff</th>
<th>Simulant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with all foodstuffs, including acidic foodstuffs</td>
<td>Citric acid 5 g/L*</td>
</tr>
<tr>
<td>Contact with non-acidic foodstuffs (including dry foodstuffs)</td>
<td>Artificial tap water**</td>
</tr>
</tbody>
</table>

* Monoanhydride
** Standard NF EN 16889 July 2016 - Food hygiene - Production and distribution of hot beverages from hot beverage appliances - Hygiene requirements, migration test.
Approximate ion concentrations: calcium 16.4 mg/L, magnesium 3.3 mg/L, sodium 16 mg/L, hydrogen carbonate 44 mg/L, chloride 28.4 mg/L, sulphate 13 mg/L.
The pH value must be corrected to 7.5. In the event of technical impossibility, distilled water should be used.

- of table 2 below for specific migration/release tests of the constituent elements of metals or alloys with an organic coating:

<table>
<thead>
<tr>
<th>Type of foodstuff</th>
<th>Simulant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with all non-acidic foodstuffs (including dry foodstuffs)</td>
<td>Simulants A, C, D1, D2 and E of table 1 of Annex III to Regulation (EU) No 10/2011, selected according to the relevant foodstuffs</td>
</tr>
<tr>
<td>Acidic foodstuffs (pH ≤ 4.5)</td>
<td>Citric acid 5 g/L*</td>
</tr>
</tbody>
</table>

Table 2.

- of table 3 below for overall migration tests for metals and alloys with an organic coating:

<table>
<thead>
<tr>
<th>Type of foodstuff</th>
<th>Simulant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with all non-acidic foodstuffs***</td>
<td>Simulants A, C, D1, and D2 of table 1 of Annex III to Regulation (EU) No 10/2011, selected according to the relevant foodstuffs</td>
</tr>
<tr>
<td>Acidic foodstuffs (pH ≤ 4.5)</td>
<td>Ethanol 10%* for light foodstuff packaging (beverage cans, food tins, aerosols, yogurt lids, etc.)</td>
</tr>
<tr>
<td></td>
<td>Acetic acid 3%** for other uses such as household utensils and articles (frying pans, saucepans, dishes, etc.) and equipment</td>
</tr>
</tbody>
</table>

Table 3.
* Tests are ongoing to confirm the use of citric acid 5 g/L for the overall migration for foodstuff packaging (beverage cans, food tins) with a method under which overall migration represents the loss of mass of the can/tin after contact with the simulant.

** Should the overall migration limit be exceeded with the acetic acid 3% simulant, it is possible to estimate, if applicable, the contribution of the metallic medium’s attack to overall migration, by quantifying the metallic fraction of the extract. If this fraction is significant and higher than the overall migration limit, an extraction of chloroform from the organic part of the migration residue may be carried out. The mass of this extract is then compared with the 10 mg/dm² overall migration limit.

*** Dry foodstuffs are not concerned by overall migration tests.

II Migration/release test conditions in the laboratory

The contact time and temperature of the tests constitute the worst case scenario foreseen or reasonably foreseeable. These conditions are based on the rules for specific migration testing set out in Regulation (EU) No 10/2011 of 14 January 2011.

First, reference should be made to table 4 below for the choice of these conditions:

<table>
<thead>
<tr>
<th>Type of articles</th>
<th>Test conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1) Testing for overall migration/release</strong></td>
<td></td>
</tr>
<tr>
<td>a) Articles than can be filled</td>
<td></td>
</tr>
<tr>
<td>Long-term use at room temperature (without hot-fill)</td>
<td>10 days at 40°C</td>
</tr>
<tr>
<td>Hot-fill then, where applicable, short-term preservation at room temperature</td>
<td>2 hours at 70°C then, if applicable, 24 hours at 40°C</td>
</tr>
<tr>
<td>Examples: foodstuff packaging, bowls, dishes, etc.</td>
<td></td>
</tr>
<tr>
<td>Boiled liquids (articles and utensils used for cooking, flasks, etc.)</td>
<td>24 hours after hot-filling (simulant’s reflux temperature)</td>
</tr>
<tr>
<td>Storage at room temperature</td>
<td></td>
</tr>
<tr>
<td>Any other use</td>
<td>Refer to the specific migration testing conditions set out in Annex V to</td>
</tr>
<tr>
<td>Articles for cold service (champagne or wine tumbler, ice cream bowl or spoon, etc.) with T&lt;20°C</td>
<td>Regulation (EU) No 10/2011.</td>
</tr>
<tr>
<td></td>
<td>2 hours at 22°C(+/−2°C)</td>
</tr>
<tr>
<td>b) Articles that cannot be filled, with the S/V ratio impossible to estimate</td>
<td></td>
</tr>
<tr>
<td>Utensils for preparing and serving food, tableware, cutlery, etc.</td>
<td>2 hours at 70°C</td>
</tr>
<tr>
<td>Articles with short-term contact such as scissors, stirrers, etc.</td>
<td>30 minutes at 70°C</td>
</tr>
<tr>
<td>Table knives and forks</td>
<td>30 minutes at 70°C</td>
</tr>
<tr>
<td>Tea or table spoons</td>
<td>Work/discussions are ongoing at the Council of Europe concerning the test</td>
</tr>
<tr>
<td></td>
<td>conditions for these types of articles</td>
</tr>
<tr>
<td>Utensils for preparing food at room temperature for a short period of time</td>
<td>30 minutes at 40°C</td>
</tr>
</tbody>
</table>
Examples: garlic crusher, cheese grater, nutcracker, vegetable peeler, tin opener, etc.

Articles such as kitchen utensils, colander, potato masher, etc.

Flat articles (chopping sheet, board, etc.)

Work surfaces

Baking sheets: cooking followed by long-term preservation at room temperature

Any other use

| 
| Full test by immersion in a depth of simulant representing actual use. Test conditions are chosen on the basis of specific use. |
| Test by immersing the entire article or part of the article with surface area of approximatively 1 dm². For chopping boards, it is assumed that contact with hot food is of short duration. The test is conducted for 2 hours at 70°C. |
| Long-term contact is assumed. The testing conditions are 10 days at 40°C. |
| 2 hours at 100°C then 10 days at 40°C |
| Specific migration testing conditions set out in Annex V to Regulation (EU) No 10/2011 |

2) **Overall migration tests to be carried out** on metals and alloys with an organic coating

All articles and uses

| 
| Overall migration testing conditions set out in Annex V to Regulation (EU) No 10/2011 |

Table 4.

* Contact for less than 30 minutes at a temperature of under 100°C.

III Conducting migration/release tests

For **articles used repeatedly**, if the tests are carried out on food simulants, contact is made three times in each tested sample, using a new portion of the simulant each time. The article should be rinsed with distilled water between each migration.

For uncoated metals or those with a metallic coating that are used repeatedly, compliance with the specific release limit of each element is verified from the simulant used during the third contact with the material. Nevertheless, the total outcomes for the first and second test must not exceed exposure equivalent to daily use for a week, i.e. seven times the specific release limit.

When **labelling information** is provided and recommends treatment of the materials and articles prior to their use (i.e. cleaning), such recommendations shall be complied with provided, nevertheless, that they do not depart from the conditions for use that may be reasonably foreseeable by the final consumer (refer also to chapter 3 of Resolution CM/Res(2013)9).

This labelling must be suitable, be connected with use that may be reasonably foreseeable by the consumer having regard to the nature of the article, as well as being sufficiently clear for the consumer.

- **Method of analysing for uncoated metals and alloys or those with a metallic coating**
  To measure specific release, the **determination method** put forward in chapter 3 of the Technical Guide to Resolution CM/Res(2013)9 should be used.
  This method should be aligned with the analytical technique (ICP or ICP-MS) and according to the limit of detection (LOD) and limit of quantification (LOQ) for each element to be determined.

- **Method of analysing metals and alloys with an organic coating**
  Overall migration methods: Refer to standards of the series NF EN 1186.
Specific migration methods: Refer to standards of the series EN 13130 for certain methods for measuring specific migration. Also refer to standard XP CEN/TS 14234 of March 2003 (Polymer coverings on paper and board).

- **Calculating the results of release tests**

For kitchen articles whose surface area is difficult to calculate, the “envelope volume” method (Annex II to the Technical Guide on metals and alloys to Resolution Res(2013)9) should be used. This method enables a migration result in mg/kg to be obtained by using a basic calculation.

For all articles that cannot be filled and for which the S/V ratio is impossible to estimate, the conventional surface area/volume ratio of 6 dm² for 1 kg of food or 1L of simulant applies by default.

For materials and articles subject to dynamic contact (such as certain implements and equipment used in the agri-food industry), verification of compliance is carried out according to the results of the migration/release in static contact, on the basis of actual conditions of use that are known (volume of mass of foodstuffs, integrated contact time, temperature, etc.) or are the most detrimental (instance of multi-use).

Where applicable, dynamic contact may be factored in following the results of the static test, by calculation, on the basis of the flow rate of the foodstuff in the article or, where applicable, if the flow rate can be variable, a minimum flow rate may be calculated enabling the specific limit to be complied with.
APPENDIX III

Update date: 01/04/2017

The following table lists the materials (in solid state and/or in the form of a thick coating (stellite)) which are not covered by a specific sheet and for which the test specifications and specific release limits set out in Appendices I and II may be used as a reference to check compliance with Article 3 of the Framework regulation.

The compliance of these metals and alloys with Article 3 of the Framework regulation must be verified before they are marketed.

<table>
<thead>
<tr>
<th>Metals and alloys</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper alloys</td>
<td>Phosphorous-copper, silver-copper, low alloyed copper alloys (less than 5% alloying elements), copper-aluminium alloys (aluminium bronzes), copper-nickel alloys (cupro-nickel), copper–nickel–zinc alloys (nickel silver or mailleshort), copper-tin alloys (bronzes), binary copper-zinc alloys (binary brass), copper-zinc-lead alloys (lead brass) and complex copper-zinc alloys (complex brass). (definitions in standard XP CEN/TS 13388)</td>
</tr>
</tbody>
</table>
| Titanium and titanium alloys | Titanium is usually graded according to its structure:  
  - Alpha alloys (compact hexagonal structure) which include unalloyed titanium (for instance, ASTM grades 1 to 4) and titanium alloyed with palladium (for instance, ASTM grades 7 and 11).  
  - Near-alpha alloys which contain a small amount of beta phase (body-centred cubic structure) such as ASTM grade 12 (Ti-0.3%Mo0.8Ni), Ti-3%Al-2.5%V, etc.  
  - Alpha and beta alloys that enable high mechanical properties to be obtained, such as Ti-6%Al-4%V, the most-produced titanium alloy.  
  - Beta alloys such as Ti-3%Al-8%V-6%Cr-4%Zr-4%Mo, Ti-15%V-3%Cr-3%Sn-3%Al, etc. |
| Nickel alloys | Although there are different systems for describing nickel alloys, they are mainly referred to by their commercial names.  
  - There are four main groups of nickel and nickel alloys:  
    - Commercially pure nickel with at least 99% nickel content. A three-figure number (2xx, 3xx) is used for the commercial reference.  
    - Nickel-copper alloys with around 30% copper content.  
    - NB: These are called “Monel”. Those with added titanium and aluminium that are precipitation hardenable.  
    - Nickel-chromium-iron alloys that are not hardenable by heat treatment. They contain between 15% to 22% of chromium and up to 46% of iron.  
    - NB: They are referenced under the names “Inconel (Inconel 600)”, “Incoloy” or “Hastelloy”. But, alloys containing more iron than nickel are stainless steels.  
    - Nickel-chromium-iron alloys that are hardenable by heat treatment.  
    - NB: Their capacity to be precipitation hardenable is due to the presence of alloy elements such as aluminium, titanium and silicon. They are referenced under the names “Nimonic”, “Inconel (Inconel X-750)”, “Udimet”, “Waspaloy”, “Rene” and “Astroloy”. |
| **Cobalt alloys** | There are also cast nickel alloys whose composition is similar to that of the ASTM A-494 GR CY5SnBiM grade (around 13% of chromium, 4% of tin, 4% of bismuth and 3% of molybdenum).  
NB: Cobalt alloys that may be used are principally stellites, “Tribaloys” or “Haynes 25”.  
The matrix is a cobalt and chromium solid solution (around 30% of chromium for stellite 6B, 8.5% for “Tribaloy T-400” and 17.5% for “Tribaloy T-800”) or cobalt-chromium-nickel (20% chromium and 10% nickel) for “Haynes 25” with carbides dispersed in the matrix (essentially tungsten carbides for the stellites or “Haynes 25” and molybdenum for the “Tribaloys”.  
Stellites are used either in solid state or as a coating. |
| **Magnesium alloys** | Unalloyed magnesium is defined by standard NF EN 12421.  
The chemical composition of magnesium alloy ingots and castings is defined by standard NF EN 1753*.  
Wrought magnesium alloys are defined by standard ISO 3116 and cast alloys by standard ISO 16220.  
Cast unalloyed magnesium is defined by standard ISO 8287.  
The main alloy elements used are aluminium, zinc, manganese, zirconium and sometimes copper, silver, silicon and rare-earth metals (neodymium, cerium). |
| **Carbides** | Metal matrix composites containing carbides and, most often, tungsten.  
NB: The metal bond is usually cobalt but a nickel bond is generally used for food contact. |
| **High-alloy steels** | These are high-alloy steels (often classified amongst "tool" steels) with carbon content of over 1.20% which can therefore not be classified as stainless steels. They contain carburigen elements (W, Mo, V, etc.) with variable chromium content. |
### APPENDIX IV

#### Table 1 - Chemical composition (casting analysis)\(^a\) of ferritic stainless steels

<table>
<thead>
<tr>
<th>Description of the steel</th>
<th>Name</th>
<th>Number</th>
<th>C max.</th>
<th>Si max.</th>
<th>Mn max.</th>
<th>P max.</th>
<th>S</th>
<th>N max.</th>
<th>Cr % in mass</th>
<th>Mo</th>
<th>Nb</th>
<th>Ni</th>
<th>Ti</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1CrNi15</td>
<td>1.4595</td>
<td>0.020</td>
<td>1.00</td>
<td>1.00</td>
<td>0.025</td>
<td>0.004</td>
<td>≤ 0.015</td>
<td>4(C+N)+0.15 ≤ 0.80 (^c)</td>
<td>0.20 to 0.60</td>
<td>14.00 to 16.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
</tr>
<tr>
<td>X6Cr13</td>
<td>1.4000</td>
<td>0.08</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>13.00 to 14.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6CrAl13</td>
<td>1.4002</td>
<td>0.08</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>13.00 to 14.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrTi17</td>
<td>1.4510</td>
<td>0.05</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6Cr17</td>
<td>1.4511</td>
<td>0.05</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6CrMoTi17-1</td>
<td>1.4513</td>
<td>0.025</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi18-2</td>
<td>1.4521</td>
<td>0.025</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi18-3</td>
<td>1.4517</td>
<td>0.08</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi18-4</td>
<td>1.4526</td>
<td>0.08</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi18-5</td>
<td>1.4590</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi18-6</td>
<td>1.4605</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi20</td>
<td>1.4607</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrTi18-2</td>
<td>1.4509</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6CrMoNi17-1</td>
<td>1.4526</td>
<td>0.08</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6CrMoNi17-2</td>
<td>1.4592</td>
<td>0.025</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoNiTi12</td>
<td>1.4600</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00 to 1.50</td>
<td>0.040</td>
<td>0.015</td>
<td>≤ 0.015 (^h)</td>
<td>16.00 to 18.00</td>
<td>1.00 to 1.50</td>
<td>1.00 to 1.50</td>
<td>0.030</td>
<td>0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi21</td>
<td>1.4611</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.050</td>
<td>0.050</td>
<td>19.00 to 22.00</td>
<td>0.50</td>
<td>Cu: 0.50 Al: 0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrMoTi24*</td>
<td>1.4613*</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.050</td>
<td>0.050</td>
<td>22.00 to 25.00</td>
<td>0.50</td>
<td>Cu: 0.50 Al: 0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrNiCu21</td>
<td>1.4621</td>
<td>0.030</td>
<td>1.00</td>
<td>1.00</td>
<td>0.040</td>
<td>0.040</td>
<td>20.00 to 21.50</td>
<td>0.50</td>
<td>Cu: 0.50 Al: 0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2CrNiTi15</td>
<td>1.4630</td>
<td>0.030</td>
<td>0.20 to 1.50</td>
<td>0.050</td>
<td>0.050</td>
<td>13.00 to 16.00</td>
<td>0.50</td>
<td>Cu: 0.50 Al: 0.05</td>
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<tr>
<td>X2CrCuNi8-2</td>
<td>1.4608</td>
<td>0.030</td>
<td>1.50</td>
<td>1.00</td>
<td>0.040</td>
<td>0.040</td>
<td>17.00 to 19.00</td>
<td>0.50</td>
<td>Cu: 1.50 to 2.50</td>
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<tr>
<td>X2CrAlSiNi8-16</td>
<td>1.4634</td>
<td>0.020</td>
<td>1.50</td>
<td>1.00</td>
<td>0.050</td>
<td>0.050</td>
<td>17.50 to 18.50</td>
<td>0.50</td>
<td>Cu: 0.50 Al: 0.20 to 1.50</td>
<td></td>
<td></td>
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</tbody>
</table>

\(^a\) Elements not appearing in this table shall not be voluntarily added to the composition of the steel without the buyer's agreement, with the exception of those intended to produce the casting. All precautions must be taken to avoid addition from scrap and raw materials used to produce elements that could affect the mechanical properties and the steel's capacity for use.

\(^b\) For the relevant bars, wire rods, sections and semi-finished products, a maximum sulphur content of 0.030% applies.

\(^c\) For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised.

\(^d\) Stabilisation can be carried out using titanium and/or niobium and/or zirconium. Owing to the atomic mass of these elements and the carbon and nitrogen content, the equivalence should be as follows:

\[
\frac{Ti}{4} = \frac{Nb}{4} = \frac{Zr}{4}
\]

\(^*\) Patented steel grade
For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised. Scrap and raw materials used to produce elements that could affect the mechanical properties and the steel's capacity for use.

### Narrower carbon content brackets

For the relevant bars, wire rods, sections and semi-finished products, a maximum sulphur content of 0.030% applies. For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised.

### Table 2 - Chemical composition (casting analysis)\(^a\) of martensitic and precipitation hardenable stainless steels

<table>
<thead>
<tr>
<th>Description of the steel</th>
<th>Name</th>
<th>Number</th>
<th>C(^b)</th>
<th>Si max.</th>
<th>Mn max.</th>
<th>P max.</th>
<th>S</th>
<th>Cr</th>
<th>Cu</th>
<th>Mo</th>
<th>Nb</th>
<th>Ni</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>X12Cr13</td>
<td>1.4006</td>
<td>0.08 to 0.15</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 13.50</td>
<td>≤ 0.75</td>
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<td></td>
</tr>
<tr>
<td>X20Cr13</td>
<td>1.4021</td>
<td>0.16 to 0.25</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 14.00</td>
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<tr>
<td>X30Cr13</td>
<td>1.4028</td>
<td>0.26 to 0.35</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 14.00</td>
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<tr>
<td>X38CrMo14</td>
<td>1.4419</td>
<td>0.36 to 0.42</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 14.50</td>
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<tr>
<td>X39Cr13</td>
<td>1.4031</td>
<td>0.36 to 0.42</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 14.50</td>
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<tr>
<td>X45Cr13</td>
<td>1.4034</td>
<td>0.43 to 0.50</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>13.00 to 14.50</td>
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<tr>
<td>X50CrMoV15</td>
<td>1.4116</td>
<td>0.45 to 0.55</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>14.00 to 15.00</td>
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<td>X70CrMo15</td>
<td>1.4109</td>
<td>0.65 to 0.75</td>
<td>0.70 ≤ 1.00</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>14.00 to 16.00</td>
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<tr>
<td>X39CrMo17-1</td>
<td>1.4112</td>
<td>0.33 to 0.45</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>15.50 to 17.50</td>
<td>≤ 1.00</td>
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<td>X105CrMo17</td>
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<td>0.95 to 1.20</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>16.00 to 18.00</td>
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<td>X90CrMoV18</td>
<td>1.4112</td>
<td>0.85 to 0.95</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>17.00 to 19.00</td>
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<td>X17CrNi16-2</td>
<td>1.4057</td>
<td>0.12 to 0.22</td>
<td>1.00 ≤ 1.50</td>
<td>0.040 ≤ 0.015(^c)</td>
<td>15.00 to 17.00</td>
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<td>X2CrNiMoV13-5-2</td>
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<td>≤ 0.03</td>
<td>≤ 0.50</td>
<td>0.040 ≤ 0.015</td>
<td>13.00 to 13.50</td>
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<td>1.4313</td>
<td>≤ 0.04</td>
<td>0.70 ≤ 1.50</td>
<td>0.040 ≤ 0.015</td>
<td>13.00 to 14.00</td>
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<td>X4CrNiMo16-5-1</td>
<td>1.4418</td>
<td>≤ 0.04</td>
<td>0.70 ≤ 1.50</td>
<td>0.040 ≤ 0.015</td>
<td>15.00 to 17.00</td>
<td>3.00 to 4.00</td>
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<td>X5CrNiCuNb16-4</td>
<td>1.4542</td>
<td>≤ 3.00</td>
<td>0.70 ≤ 1.50</td>
<td>0.040 ≤ 0.015</td>
<td>15.00 to 17.00</td>
<td>3.00 to 4.00</td>
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<td>X6CrNiTiMoV25-15-2</td>
<td>1.4980</td>
<td>0.03</td>
<td>1.00 ≤ 1.50</td>
<td>0.025 ≤ 0.015</td>
<td>13.50 to 16.00</td>
<td>5 x C to 0.45</td>
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<td>0.040 ≤ 0.015</td>
<td>16.00 to 18.00</td>
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<td>≤ 0.10</td>
<td>0.70</td>
<td>0.040 ≤ 0.015</td>
<td>14.00 to 16.00</td>
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<td>X9CrNiMoCu14-5</td>
<td>1.4594</td>
<td>≤ 0.07</td>
<td>0.70</td>
<td>0.040 ≤ 0.015</td>
<td>13.00 to 15.00</td>
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</tbody>
</table>

\(^a\) Elements not appearing in this table shall not be voluntarily added to the composition of the steel without the buyer's agreement, with the exception of those intended to produce the casting. All precautions must be taken to avoid addition from scrap and raw materials used to produce elements that could affect the mechanical properties and the steel's capacity for use.

\(^b\) Narrower carbon content brackets can be decided upon at the time of the invitation to tender and the order.

\(^c\) For the relevant bars, wire rods, sections and semi-finished products, a maximum sulphur content of 0.030% applies. For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised.

\(^d\) For better cold deformability, the upper limit may be increased up to 8.30%.
### Table 3 - Chemical composition (casting analysis) of austenitic stainless steels

<table>
<thead>
<tr>
<th>Description of the steel</th>
<th>Number</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>N</th>
<th>Cr</th>
<th>Cu</th>
<th>Mo</th>
<th>Nb</th>
<th>Ni</th>
<th>Ti</th>
</tr>
</thead>
<tbody>
<tr>
<td>X5CrNi17-7</td>
<td>1.4319</td>
<td>≤ 0.07</td>
<td>≤ 1.00</td>
<td>≤ 2.00</td>
<td>0.045</td>
<td>≤ 0.030</td>
<td>≤ 0.11</td>
<td>16.00 to 18.00</td>
<td>6.00 to 8.00</td>
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<tr>
<td>X10CrNi18-9</td>
<td>1.4325</td>
<td>0.04 to 0.15</td>
<td>≤ 1.00</td>
<td>≤ 2.00</td>
<td>0.045</td>
<td>≤ 0.030</td>
<td>≤ 0.11</td>
<td>17.00 to 19.00</td>
<td>8.00 to 10.00</td>
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<td>1.4310</td>
<td>0.05 to 0.15</td>
<td>≤ 0.20</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>16.00 to 19.00</td>
<td>≤ 0.80</td>
<td>6.00 to 9.50</td>
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<td>1.4318</td>
<td>≤ 0.030</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.10 to 0.20</td>
<td>16.50 to 18.50</td>
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<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>17.50 to 19.50</td>
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<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.11 to 0.14</td>
<td>18.00 to 20.00</td>
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<td>≤ 0.030</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.12 to 0.22</td>
<td>17.00 to 19.50</td>
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<td>1.4301</td>
<td>≤ 0.07</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>17.00 to 19.50</td>
<td>8.50 to 11.50</td>
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<td>0.030 to 0.08</td>
<td>0.50</td>
<td>1.50 to 4.0</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.03 to 0.11</td>
<td>18.00 to 19.00</td>
<td>1.30 to 2.00</td>
<td>5.5 to 6.9</td>
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<td>1.4541</td>
<td>≤ 0.08</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.03 to 0.11</td>
<td>17.00 to 19.00</td>
<td>9.00 to 12.00</td>
<td>5xC to 0.70</td>
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<td>1.4550</td>
<td>≤ 0.08</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.03 to 0.11</td>
<td>17.00 to 19.00</td>
<td>10xC to 1.00</td>
<td>9.00 to 12.00</td>
<td>5xC to 0.70</td>
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<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>17.00 to 19.00</td>
<td>11.00 to 13.00</td>
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<td>≤ 0.25</td>
<td>≤ 0.20</td>
<td>0.025</td>
<td>≤ 0.010</td>
<td>≤ 0.11</td>
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<td>≤ 0.20</td>
<td>20.00 to 22.00</td>
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<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>16.50 to 18.50</td>
<td>2.00 to 2.50</td>
<td>10.00 to 13.00</td>
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<td>≤ 0.030</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.12 to 0.22</td>
<td>16.50 to 18.50</td>
<td>2.00 to 2.50</td>
<td>10.00 to 12.00</td>
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<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>16.50 to 18.50</td>
<td>2.00 to 2.50</td>
<td>10.00 to 13.00</td>
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<td>≤ 0.20</td>
<td>≤ 0.20</td>
<td>0.025</td>
<td>≤ 0.010</td>
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<td>24.00 to 26.00</td>
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<td>0.045</td>
<td>≤ 0.015</td>
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<td>16.50 to 18.50</td>
<td>2.00 to 2.50</td>
<td>10.50 to 13.50</td>
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<td>≤ 0.08</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.30 to 0.34</td>
<td>16.50 to 18.50</td>
<td>2.00 to 2.50</td>
<td>10.50 to 13.50</td>
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<td>≤ 0.030</td>
<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>≤ 0.11</td>
<td>16.50 to 18.50</td>
<td>2.50 to 3.00</td>
<td>10.50 to 13.00</td>
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<td>≤ 0.10</td>
<td>≤ 0.20</td>
<td>0.045</td>
<td>≤ 0.015</td>
<td>0.12 to 0.22</td>
<td>16.50 to 18.50</td>
<td>2.50 to 3.00</td>
<td>11.00 to 14.00</td>
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<td>0.30 to 0.60</td>
<td>0.90 to 1.00</td>
<td>0.035</td>
<td>≤ 0.030</td>
<td>0.250 to 0.320</td>
<td>17.50 to 18.50</td>
<td>0.40 to 0.50</td>
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<td>X8CrMoNiCu18-7-3</td>
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<td>≤ 0.10</td>
<td>≤ 2.00</td>
<td>6.00 to 9.00</td>
<td>0.040</td>
<td>≤ 0.030</td>
<td>0.10 to 0.30</td>
<td>15.00 to 18.00</td>
<td>2.00 to 3.50</td>
<td>5.00 to 6.00</td>
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<td>1.00</td>
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<td>0.30</td>
<td>17.0 to 20.5</td>
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<td>X11CrNiMnN19-8-6</td>
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<td>0.07 to 0.15</td>
<td>0.50 to 1.00</td>
<td>5.0 to 7.5</td>
<td>0.030</td>
<td>≤ 0.015</td>
<td>0.20 to 0.30</td>
<td>17.50 to 19.50</td>
<td>6.50 to 8.50</td>
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*continued overleaf*
### Table 3 - Chemical composition (casting analysis)\(^a\) of austenitic stainless steels (continued)

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<thead>
<tr>
<th>Description of the steel Name</th>
<th>Number</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P max</th>
<th>S</th>
<th>N</th>
<th>% in mass</th>
<th>Cr</th>
<th>Cu</th>
<th>Mo</th>
<th>Nb</th>
<th>Ni</th>
<th>Ti</th>
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<td>≤0.015 (^b)</td>
<td>≤0.11</td>
<td>16.50 to 18.50</td>
<td>2.50 to 3.00</td>
<td>10.50 to 13.00 (^c)</td>
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<td>≤2.00</td>
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<td>≤0.015 (^b)</td>
<td>≤0.11</td>
<td>17.00 to 19.00</td>
<td>2.50 to 3.00</td>
<td>12.50 to 15.00</td>
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<td>&lt; 4.00</td>
<td>10.50 to 14.00 (^c)</td>
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<td>≤0.11</td>
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<td>&lt; 4.00</td>
<td>13.00 to 16.00 (^c)</td>
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<td>14.00 to 16.00</td>
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<td>≤0.015</td>
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<td>0.15 to 0.25</td>
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<td>≤0.11</td>
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<td>≤0.015 (^b)</td>
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<td>17.00 to 19.00</td>
<td>3.00 to 4.00</td>
<td>8.50 to 10.50</td>
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<td>≤1.00</td>
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<td>≤0.015</td>
<td>≤0.11</td>
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<td>2.00 to 2.50</td>
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<td>16.50 to 19.00</td>
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<td>10.5 to 12.5</td>
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<td>≤0.015 (^b)</td>
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<td>17.0 to 19.0</td>
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<td>0.50</td>
<td>3.5 to 4.5</td>
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<tr>
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<td>≤0.70</td>
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</table>

\(^a\) Elements not appearing in this table shall not be voluntarily added to the composition of the steel without the buyer's agreement, with the exception of those intended to produce the casting. All precautions must be taken to avoid addition from scrap and raw materials used to produce elements that could affect the mechanical properties and the steel's capacity for use.

\(^b\) For the relevant bars, wire rods, sections and semi-finished products, a maximum sulphur content of 0.030% applies. For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised.

\(^c\) When for special reasons, for instance forgeability for manufacturing tubes without welding or low magnetic permeability, it is necessary to limit the delta ferrite content, the maximum Ni content may be increased by the following values:

- 0.50% (m/m): 1.4571
- 1.00% (m/m): 1.4306, 1.4406, 1.4429, 1.4434, 1.4436, 1.4438, 1.4541, 1.4550
- 1.50% (m/m): 1.4404

\(*\) Patented steel grade. The boron content is: B: 0.0005 to 0.0050
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<tr>
<th>Description of steel</th>
<th>% in mass</th>
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<td>C max</td>
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<td>X2CrMnNiN21-5-1*)</td>
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<tr>
<td>X2CrNiCuN23-4*</td>
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<tr>
<td>X2CrNiMoN29-7-2</td>
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<td>X2CrNiMoSi18-5-3</td>
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<td>X3CrNiMo27-5-2</td>
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<tr>
<td>X2CrCuNiN25-2-2*)</td>
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</table>

a) Elements not appearing in this table shall not be voluntarily added to the composition of the steel without the buyer's agreement, with the exception of those intended to produce the casting. All precautions must be taken to avoid addition from scrap and raw materials used to produce elements that could affect the mechanical properties and the steel's capacity for use.

b) For the relevant bars, wire rods, sections and semi-final products, a maximum sulphur content of 0.030% applies.

For all products destined to be processed, a controlled sulphur content of between 0.015% and 0.030% is recommended and authorised.

*) Patented steel grade.