

Stainless Steels

Material safety Data Sheet n°1

In accordance with European Commission Directive 93/112/EEC "safety data sheets" with reference to:

- Directive 67/548/EEC "Dangerous substances"
- Directive 99/45/EC "Dangerous Preparations"
- Directive 89/109/EEC "Food contact materials"
- Directive 94/27/EC "Nickel jewellery"
- And specific national regulations.

Applicability

This Safety Data Sheet is valuable for the stainless steels listed under list 1.

List 1 : Indications of types according to EN 10088 ([®] = trademark)			
Alphanumeric	Numerical	Alphanumeric	Numerical
X6CrNiTi12	1.4516	X1NiCrMoCu31-27-4	1.4563
X6CrNi17-1 [®]	1.4017 [®]	X1NiCrMoCu25-20-5	1.4539
X5CrNiMoTi15-2	1.4589	X1CrNiMoCuN25-25-5	1.4537
X17CrNi16-2	1.4057	X1CrNiMoCuN20-18-7	1.4547
X1CrNiMoCu12-5-2	1.4422	X2CrNiMoCuS17-10-2 ^e	1.4598 ^e
X1CrNiMoCu12-7-3	1.4423	X1CrNiMoCuNW24-22-6	1.4659
X2CrNiMoV13-5-2	1.4415	X1NiCrMoCuN25-20-7	1.4529
X3CrNiMo13-4	1.4313	X2NiCrAlTi32-20	1.4558
X4CrNiMo16-5-1	1.4418	X2CrNiMnMoN25-18-6-5	1.4565
X1CrNiMoAlTi12-9-2	1.4530	X2CrNiN23-4 [®]	1.4362 [®]
X1CrNiMoAlTi12-10-2	1.4596	X2CrNiCuN23-4 [®]	1.4655 [®]
X5CrNiCuNb16-4	1.4542	X3CrNiMoN27-5-2	1.4460
X7CrNiAl17-7	1.4568	X2CrNiMoN29-7-2 [®]	1.4477 [®]
X5CrNiMoCuNb14-5	1.4594	X2CrNiMoN22-5-3 ^e	1.4462 ^e
X6NiCrTiMoVB25-15-2	1.4980	X2CrNiMoCuN25-6-3	1.4507
X5CrNi17-7	1.4319	X2CrNiMoN25-7-4 [®]	1.4410 [®]
X10CrNi18-8	1.4310	X2CrNiMoCuWN25-7-4	1.4501
X9CrNi18-9	1.4325	X2CrNiMoSi18-5-3	1.4424
X2CrNi18-7	1.4318	X8CrNiTi18-10	1.4878
X2CrNi18-9	1.4307	X15CrNiSi20-12	1.4828
X2CrNi19-11	1.4306	X9CrNiSiN21-11-2	1.4835
X5CrNi19-9	1.4315	X12CrNi23-13	1.4833
X2CrNi18-10	1.4311	X8CrNi25-21	1.4845
X5CrNi18-10	1.4301	X15CrNiSi25-21	1.4841
X8CrNiSi18-9 ^e	1.4305 ^e	X12NiCrSiB5-16	1.4864
X6CrNiTi18-10	1.4541	X10NiCrAlTi32-21	1.4876
X6CrNiNb18-10	1.4550	X6NiCrNbCe32-27	1.4877
X4CrNi18-12	1.4303	X25CrMnNiN25-9-7	1.4872
X1CrNi25-21	1.4335	X6CrNiSiN21-19-10	1.4818
X2CrNiMo17-12-2	1.4404	X6NiCrSiN25-35-25 [®]	1.4854 [®]
X2CrNiMoN17-11-2	1.4406	X10NiCrSi35-19	1.4886
X5CrNiMo17-12-2	1.4401	X10NiCrSiNb35-22	1.4887
X1CrNiMoN25-22-2	1.4466	X15CrNiSi25-4	1.4821

**List 1 : Indications of types according to EN 10088
(^{*)} = trademark)**

Alphanumerical	Numerical	Alphanumerical	Numerical
X6CrNiMoTi17-12-2	1.4571	X12CrNiMoV12-3	1.4938
X6CrNiMoNb17-12-2	1.4580	X3CrNiMoBN17-13-3	1.4910
X2CrNiMo17-12-3	1.4432	X7CrNiNb18-10	1.4912
X2CrNiMoN17-13-3	1.4429	X6CrNiMoB17-12-2	1.4919
X3CrNiMo17-13-3	1.4436	X6CrNiTiB18-10	1.4941
X3CrNiMo18-12-3	1.4449	X6CrNiWNB16-16	1.4945
X2CrNiMo18-14-3	1.4435	X6CrNi18-10	1.4948
X2CrNiMoN18-12-4	1.4434	X6CrNi23-13	1.4950
X2CrNiMo18-15-4	1.4438	X6CrNi25-20	1.4951
X2CrNiMoN17-13-5	1.4439	X5NiCrAlTi31-20	1.4958
X1CrNiMoCuN24-22-8 ^{*)}	1.4652 ^{*)}	X8NiCrAlTi32-21	1.4959
X1CrNiSi18-15-4	1.4361	X8CrNiNb16-13	1.4961
X11CrNiMnNi9-8-6	1.4369	X12CrNiWTiB16-13	1.4962
X12CrMnNiN17-7-5	1.4372	X12CrCoNi21-20	1.4971
X2CrMnNiN17-7-5	1.4371	X6NiCrTiMoVB25-15-2	1.4980
X12CrMnNiN18-9-5	1.4373	X8CrNiMoNb16-16	1.4981
X8CrMnNiN18-9-5	1.4374	X10CrNiMoMnNbVB15-10-1	1.4982
X8CrMnCuNB17-8-3 ^{*)}	1.4597 ^{*)}	X6CrNiMoTiB17-13	1.4983
X3CrNiCu19-9-2	1.4560	X7CrNiMoBNb16-16	1.4986
X2CrNiCu19-10	1.4650	X8CrNiMoVNB16-13	1.4988
X6CrNiCuS18-9-2 ^e	1.4570 ^e	X7CrNiTi18-10	1.4940
X3CrNiCu18-9-4	1.4567	X6CrNiMo17-13-2	1.4918
X3CrNiCuMo17-11-3-2	1.4578		

1. Identification of preparation and company

Stainless Steel Corrosion, heat and creep resisting grades with ferritic, martensitic, duplex or austenitic microstructure in massive product forms: semi-finished products, plate, sheet, strip, bar, rod, tube, fittings. The products are mainly used for manufacturing of consumer products or applications in process industry, transport, building and construction, power and energy, and food and beverage industry. They are marked with designations according to European standards (e.g. EN 10088) or specific (e.g. EN 10028-7 for pressure equipment).

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2. Composition – Information on ingredients

Iron alloy with 10,5 – 30% Cr
max. 38% Ni
max. 11% Mn
max. 8% Mo

Other elements may be present, such as Si, Cu, Ti. These are not classified as hazardous, or are below the concentration levels for classification of these alloys as hazardous.

3. Hazard classification

Stainless steels according table 1 contain nickel with a content of more than 1%.

Nickel is classified in EC Directive 67/548/EEC as a:

"Carcinogen category 3 – R40" (suspect carcinogen);

"Skin sensitizer – R43".

The classification rules of EC Directive 99/45/EC dictate that any preparations with equal to or more than 1% content of nickel must automatically be classified as "suspect carcinogens" (R40).

Stainless steels according to table 1 do not cause nickel sensitisation by prolonged skin contact in humans. Nevertheless, all stainless steels with 1% or more nickel must be classified as skin sensitizers (R43).

Description of hazards

There are no hazards of concern for man or the environment from stainless steels in the forms supplied.

For the Stainless Steels of table 1 clinical studies reveal no allergic dermatological reactions, even by prolonged skin contact.

No carcinogenic effects resulting from exposure to stainless steels have been reported, either in epidemiological studies or in tests with animals.

Dust and fume may be generated during processing e.g. in welding, cutting and grinding. If airborne concentrations of dust and fume are excessive, inhalation over long periods may affect workers' health, primarily of the lungs.

4. First Aid Measures

Inhalation

Not applicable to stainless steels in the massive form.

Inhalation of dust and/or fume from grinding, cutting and welding operations is unlikely to generate the need for specific first aid.

Skin and eye contact

There are no special symptoms or effects associated with stainless steel.

In the event of physical injury to the skin seek appropriate medical attention.

In the event of physical injury to the eyes, seek immediate medical attention. Austenitic stainless steel particles are non-magnetic or only slightly magnetic and may not respond to a magnet placed over the eye. In such cases seek hospital treatment.

Ingestion

Does not apply to stainless steel in the massive form.

5. Fire fighting measures

Stainless steels are not combustible.

There are no special hazards or precautions associated with stainless steels if in the vicinity of a fire.

6. Accidental release measures

Not applicable.

7. Handling and storage

There are no special technical measures involved for handling stainless steels. Normal precautions should be taken to avoid physical injury from coiled or bundled products, possibly with sharp edges:

- Straps or bands, used to secure some products, should not be used for lifting. Coils and bundled products (e.g. sections, rods, bars etc.) may spring apart when the banding is removed and the banding itself could cause eye or other injury when tension is released.
- Certain products may, as a result of processing, be brittle or have residual stress that might cause fracture or significant deformation.
- All products are likely to have sharp edges that could cause lacerations and flying particles may be produced when shearing.
- Suitable protective clothing and equipment, such as hand and eye protection, should be worn and systems of work adopted to take account of any hazards arising from the risk of fracturing or the release of tension when breaking open banding.
- Suitable racks should be used to ensure stability when stacking narrow coils.

8. Exposure controls/Personal protection

There are no occupational exposure limits for stainless steels.

Occupational exposure limits apply to some constituent elements (Ni, Cr, Mn, Cu, Mo, ...) and certain of their compounds. Table 1 shows limits acceptable according to current legislation in France and Germany.

**Occupational
exposure limits**

Table 1. Occupational exposure limits (mg/m³) France / Germany

((E) = einatembar – (A) = alveolengängig)

Substance	France Average Value mg/m ³	France Max. value mg/m ³	Germany Average Value mg/m ³	Germany Max. value mg/m ³
Chromium (metal)	0,5		-	-
Chromium (trioxyde), en Cr	0,05		-	-
Chromium VI, en Cr	0,05		0,05 (E)	0,2
Copper (dust), en Cu	1	2	1 (E)	4
Copper (fumes)	0,2		0,1 (A)	0,4
Manganese (fumes), en Mn	1		0,5 (E)	2
Molybdenum (soluble compounds) en Mo	5	10	5 (E)	20
Nickel (metal)	1		0,5 (E)	2
Nickel (tetra carbonyl)	0,12		-	-
Nickel (oxide), en Ni	1		0,5 (E)	2
Nickel (sulphide) en Ni	0,1		0,5 (E)	2

Exposure controls

In the processing of all metallic materials, exposure to fume and dust must be kept below any legally imposed limits in each country.

Dust and fume may be generated in use, e.g. by cutting, grinding and welding processes, which may contain materials subject to exposure limits.

To ensure these limits are not exceeded, adequate general or local ventilation or fume extraction should be provided.

Personal protection

In accordance with European and national health and safety regulations, it is necessary to assess the need for personal protection equipment and appropriate approved respiratory protection should be provided for those workers at risk of inhalation.

Suitable hand and eye protection should be worn where there is a risk of laceration, flying particles, burning or welding radiation or contact with oils during processing.

9. Physical and chemical properties

Appearance: Solid - metallic grey, ranging from dull to bright polished. Occasionally supplied with oxidised, blue/black surfaces.

Odour: odourless

Water solubility: insoluble

Melting: 1370°C to 1520°C

Density: 7,7 – 8,1 kg/dm³

Thermal expansion (RT to 100°C) : 10 – 16 x 10⁻⁶ m/m°C

Thermal conductivity (RT) : 12 – 30 W/m°C

Magnetic : Austenitic stainless steels are non-magnetic in most supply conditions, but may be para-magnetic in some supply conditions (Permeability 1,005 – 1,1). Duplex, ferritic and martensitic stainless steels are ferro-magnetic.

10. Stability and reactivity

Stainless steels are stable and non-reactive under normal ambient atmospheric conditions. They may react in contact with strong acids to release gaseous acid decomposition products (e.g. hydrogen, oxides of nitrogen). When heated to very high temperatures fumes may be produced (e.g. by cutting, welding or melting operations).

11. Toxicological data

Chronic toxicity, oral or inhalation

Stainless steels according to table 1 contain nickel, which has been classified in EC Directive 67/548/EEC as a suspect carcinogenic substance, Category 3 (i.e. "causing concern for man... but available information is not adequate for making a satisfactory assessment").

The exposure route of concern is inhalation.

These stainless steel products are in massive form, not capable of being inhaled.

The requirements of EC Directive 99/45/EC are such that all mixtures, solutions and alloys with more than 1% nickel must be classified in the same way as nickel itself, by default.

There is no direct evidence of carcinogenic effects of stainless steels in man, nor indirect evidence from animals tested by relevant routes, i.e. inhalation or ingestion.

In other studies, using non-relevant routes in animals, alloys with up to 40% nickel caused no significant increase in cancer.

During mechanical working, flame cutting or welding, stainless steel dust, or fumes containing complex or mixed oxides (spinel) of its constituents, may be formed.

Over long periods, inhalation of excessive airborne levels may have long term health effects, primarily affecting the lungs.

However, studies of workers exposed to nickel powder and dust and fumes generated in the production of nickel alloys and stainless steels have not indicated a respiratory cancer hazard.

Welding and flame cutting fumes may contain hexavalent chromium compounds. Studies have shown that some hexavalent chromium compounds can cause cancer. However, epidemiological studies amongst welders indicate no extra increased risk of cancer when welding stainless steels, compared with the slightly increased risk when welding steels that do not contain chromium.

Dermatological toxicity

Nickel is classified as a skin sensitizer. It causes skin sensitisation in susceptible individuals through prolonged intimate contact with the skin (e.g. wearing of jewellery). The requirements of EC Directive 99/45/EC are that all mixtures, solutions and alloys with 1% or more of nickel must, by default, also be classified as skin sensitizers.

Numerous patch tests have established that the stainless steels according to list 1 do not cause sensitisation.

Other observations

Long-term experience of stainless steels in the most varied applications has demonstrated that these very resistant materials are eminently suitable where hygiene is of paramount importance (e.g. food processing and food preparation).

12. Ecological data

No known harmful effects. No special precautions are required.

13. Disposal considerations

Surplus and scrap (waste) stainless steel is valuable and in demand for the production of prime new stainless steel.

Recycling routes are well-established, and recycling is therefore the preferred disposal route. Disposal to landfill is not harmful to the environment, but it is a waste of resources and therefore less desirable than recycling.

14. Transport data

No special precautions required.

15. Regulatory references

Classification and labelling requirements

Stainless steels with a specified nickel content less than 1% are not classified "as dangerous for supply" under EC Directive 67/548/EEC.

Stainless steels containing 1% or more of nickel are classified in the same way as nickel (Table 2).

However, in recognition of their essentially non-hazardous nature, stainless steels in the massive form are not required to be labelled as hazardous.

Classification of nickel

N° CAS	Substance	Danger symbol	Risk phrases	Safety phrases
7440-02-0	Nickel	Xn (harmful)	R40 limited evidence of carcinogenic effect R43 may cause sensitisation by skin contact	S22 do not breathe dust S36 wear suitable protective clothing

Other

The use of products that contain nickel and which come into direct and prolonged contact with the skin are limited by EC Directive 94/27/EC. Posts inserted into pierced ears and other parts of the body during epithelization of the wound must not contain more than 0,05% nickel.

Other nickel-containing products in direct and prolonged contact with the skin must release no more than 0,5 µg/cm²/week of nickel as defined in CEN 1811.

On 15th July 2004, the European Commission Working Group "Limitations on the Marketing and Use of Dangerous Substances and Preparations" met to discuss, amongst other issues, the proposed revision of Directive 94/27/EC (ie the Nickel or Jewellery Directive). The proposal was intended to improve consumer protection by amending the criterion for pierced post assemblies from nickel content to nickel release.

After long and detailed discussions the meeting voted in favour of the proposed change to a migration limit based on nickel release. The conclusion of the meeting may be summarised as follows.

1. New scientific information (LGC study, CSTE opinion, Ingber paper etc.) justified the consideration of an ATP (Adaptation to Technical Progress) to the Jewellery Directive (94/27/EC) with the objective of improved consumer protection. New research has revealed that that there is no correlation between sensitisation and the nickel content of a pierced post assembly.

2. Member State representatives endorsed the EC proposal to amend the criterion, for pierced post assemblies, from nickel content to nickel release, at a rate of 0.2µg/cm²/week, measured in accordance with EN 1811:1999. The proposal to apply this criterion to all post assemblies, even after epithelisation, was also approved.

3. The Commission will support the revision by CEN of the standard EN 1811:1999 (designed for items in prolonged and direct contact with skin, but now also to be used for determining nickel release for post assemblies).

4. Future research will be considered for a further ATP, notably on a tolerance/correction factor.

The acceptance of the proposed amendments means that, upon adoption of the revised Directive, nickel-containing stainless steels that release nickel at levels below the migration limit of 0.2µg/cm²/week will be suitable for pierced post assemblies (eg ear studs, body piercing jewellery).

Further updates of the progress towards publication and adoption of the revised Directive will follow.

16. Other information

Food contact materials

The Council of Europe published "Guidelines on metals and alloys used as food contact materials" in April 2001 as a reference document to ensure that metallic materials used in contact with food comply with the provisions of Article 2.2 of Directive 89/109/EEC (materials destined to contact with food). The document includes a section on stainless steels.

In France, materials in stainless steel destined to contact with food are regulated by the decree of 13 January 1976 fixing the acceptable limits of composition (Cr, Mo, Cu, Ti). These provisions are supplemented by standard NFA 36711.

References to key data

Note that all of the data on the potential health effects of stainless steel, including those which might occur during manufacture and processing, which were available up to 1998 are reviewed in the reference No. 1 below.

- 1) H J Cross, J Beach, L S Levy, S Sadhra, T Sorahan, C McRoy: Manufacture, processing and use of stainless steel: A Review of the Health Effects. Prepared for Eurofer by the Institute of Occupational Health, University of Birmingham, 1999.
- 2) N Becker: Cancer mortality among arc welders exposed to fumes containing chromium and nickel. Results of a third follow-up: 1989-1995.
- 3) Report of the International Committee on Nickel Carcinogenesis in Man: Scand J, Work Environ Health 1990, 16; 1-82
- 4) International Agency for Research on Cancer. Chromium, nickel and welding. 'IARC Monograph on the Evaluation of Carcinogenic Risks to Humans'. Lyon: IARC 1990.

References to national regulations

France : decree of 13 January 1976 concerning stainless steels that come in contact with food.

EN 1811: Reference test method for release of nickel from products intended to come into direct and prolonged contact with skin.

Declaration

The information given in this safety data sheet is based on the present level of our knowledge and experience. The data sheet describes the products with respect to safety requirements.

The data given is not intended as a confirmation of product properties and does not constitute a legal contractual relationship, nor should it be used as the basis for ordering these products.

Terms and definitions (Ref. Guide ISO 51)

Harm:	Physical injury or damage to health of people or damage to property or the environment
Hazard:	Potential source of harm
Risk:	Combination of the probability of occurrence of harm and the severity of that harm
Safety:	Freedom from unacceptable risk