



EC-Material Safety Data Sheet	in accordance with Directives 91/155/EEC, 93/112/EC, 2001/58/EC and TRGS 220
Trade names:	NIROSTA® and THERMAX® (each followed by its figure combination, e. g. NIROSTA® 4301)
Supplier:	ThyssenKrupp Nirosta GmbH
Revised:	January 26, 2006
Edition No. 4 issued:	April 12, 2006
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1. Identification of preparation and company

Preparation: Corrosion resistant or heat-resistant stainless steel (depending on the trade name concerned) supplied as solid, compact and non-inhalable metal in the form of slabs or hot or cold rolled strips.

Application: As a steel material with special corrosion and heat resistance. Supplied in semi-finished form for further processing for products in (e. g.) the consumer-goods sector, vehicle technology, architecture and chemical processing equipment.

Manufacturer/Supplier:

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2. Composition/Ingredients

Iron-based alloy with min. 6.5 % by mass of chromium and other alloying elements where applicable, such as nickel, molybdenum, manganese, copper, silicon, aluminium, carbon, nitrogen. For further information on composition, please refer to the Material Data Sheet of each branded product. Alloys are regarded as preparations within the terms of European Directives 67/548/EEC and 1999/45/EC. Depending on the branded product concerned the material may contain 1 % by mass or more of alloying element nickel which is then regarded as a relevant ingredient under the terms of European Directive 67/548/EEC:

Ingredient	% by mass	EINECS-/EC-No.	CAS-No.	Classification	Hazard symbol
Nickel	< 38	231-111-4	7440-02-0	Carc. Cat. 3, R40, R43 *	Xn

* Text of Risk phrases in Section 16.

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3. Hazard identification

Classification: Many of the stainless steels as in Sect. 1 contain nickel as an alloying element. Directive 67/548/EEC classifies nickel as follows:

- Causes concern owing to possible carcinogenic effects but in respect of which the available information is not adequate for making satisfactory assessment (R40 or category 3 carcinogens).
- May cause sensitisation by skin contact (R43).

According to Directive 1999/45/EC stainless steels containing min. 1 % by mass of nickel are to be assigned this classification, with the proportion of nickel in the alloy as the sole determining factor. Epidemiological studies and tests on animals carried out to date for the relevant methods of absorption (inhaling or swallowing) have not revealed any carcinogenic effect for stainless steels as in Sect. 1. Long-term skin contact to these materials likewise does not result in sensitisation of the skin (cf. Sect. 11).

Additional hazard warnings involving man and environment: In the form in which they are placed into circulation the stainless steels as in Sect. 1 have to date not been found to have any harmful effect on human health or the environment. Thermal and mechanical processing can produce fumes and dust which can, in the event of excessive exposure, lead to acute irritation of the eyes and respiratory organs and to long-term harm, especially to the lungs (cf. Sect. 8, 11).

4. First-aid measures

The stainless steels as in Sect. 1 do not display any harmful effects of a dangerous substance that might require first-aid measures. The following advice refers to the effect of fumes and dust during processing.

Inhalation: Ensure sufficient supply of fresh air and consult a physician if required.

Skin contact: Wash skin with soap and water.

Eye contact: Rinse eye thoroughly with plenty of water and consult a physician if required.

Ingestion: Consult a physician immediately.

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5. Fire fighting measures

Stainless steels as in Sect. 1 are not flammable and thus do not require special fire prevention or fire fighting measures.

6. Accidental release measures

No particular safety precautions required.

7. Handling und storage

General: The handling of stainless steels as in Sect. 1 does not require any of the special safety measures normally applied to dangerous substances. The usual measures for the prevention of physical injury are sufficient.

Storage: No particular requirements.

Special usage: Not applicable.

8. Exposure controls and personal protection

8.1 Exposure limits:

There are no occupational exposure limits for the stainless steels in Sect. 1, although some do apply to certain elements contained in these steels, such as Fe, Ni, Cr, Mn and Mo and/or some of their compounds. An initial guide is provided by the following table which lists the limit values applied in the Federal Republic of Germany to dust, fumes or droplets resulting from processing and machining. Reference should be made to the indications in the corresponding list of dangerous substances drawn up by the "Hauptverband der gewerblichen Berufsgenossenschaften" and/or the relevant "Technische Regeln für Gefahrstoffe" (TRGS) 900, 901 and 905. The relevant national limit specifications should be observed outside Germany.

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Limits of airborne substances in the place of work in accordance with TRGS 900

Substance	CAS-No.	Type ⁺	Value * [mg/m ³]
Aluminium	7429-90-5		ASG
Aluminium oxide	1344-28-1		ASG
Chromium (VI) compounds, other than those insoluble in water			
- manual arc-welding with covered rod electrodes		TRK	0,1 E
- other		TRK	0,05 E
Iron (II) oxide	1345-25-1		ASG
Iron (III) oxide	1309-37-1		ASG
Copper	7440-50-8	MAK	1 E
Fumes containing copper	7440-50-8	MAK	0,1 A
Manganese	7439-96-5	MAK	0,5 E
Molybdenum (and other insoluble molybdenum compounds)	7439-98-7		ASG
Nickel in metallic form	7440-02-0	MAK	0,5 E
Nickel compounds in the form of inhalable droplets		TRK	0,05 E
Nickel oxide	1313-99-1	TRK	0,5 E
Niobium (and other insoluble niobium compounds)	7440-03-1	MAK	5 E
Titanium dioxide	13463-67-7		ASG

⁺ MAK: Maximum allowable concentration

TRG: Technical reference concentration

* E: Inhalable fraction

A: Alveolar fraction

ASG: General limit value for dust

The application of airborne-substance limits in the manufacture, processing and handling of nickel alloys is subject in accordance with TRGS 901 to the following recommendations:

- The MAK of 0.5 mg/m³ for nickel in metallic form is to be applied for evaluation with respect to the following processes:
 - Grinding and polishing of alloys containing ≤ 80 % nickel,
 - Rolling of alloys containing ≤ 80 % nickel,
 - Melting and casting of alloys containing ≤ 80 % nickel.

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- A TRK of 0.5 mg/m³ for nickel oxide (counted as Ni) is to be applied for evaluation with respect to the following working procedures:
 - Welding (electrodes or wire) and thermal cutting of alloys with Ni content \geq 5 %,
 - Metal spraying of alloys with Ni content \geq 5 %.
- For alloys with < 5 % nickel the MAK of 0.5 mg/m³ for nickel in metallic form is to be applied.

This regulation may be waived if investigations carried out by the employer determine that even above the content limits of 80 % or 5 % listed here there are no levels of nickel oxide classified as carcinogenic during the manufacture, processing and handling of nickel alloys, or if examination of published sources allows presentation of corresponding research results.

8.2 Limits to and monitoring of exposure in the workplace:

During thermal and mechanical processing (e. g. welding, cutting, grinding) fumes and dust can be produced with constituents underlying certain limit values. Suitable exhausters should be fitted for this reason.

Respiratory protection: If observance of the limits cannot be guaranteed by means of exhausters, personnel should be provided with face or breathing masks.

Eye protection: Suitable goggles should be worn to protect against airborne dust, flying sparks etc.

Hand and body protection: May become necessary depending on the activity being performed.

8.3 Limits to and monitoring of environmental exposure:

Avoid dust emission.

9. Physical and chemical properties

General: Solid with metallic, matt to brilliant grey surface or rarely with scaled, blue-black to black surface. Odourless.

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Important advice regarding health and environmental protection and safety:

Melting point/Melting range: 1370-1520°C

Boiling point/Boiling range: Not known.

Flashpoint, flammability, fire-related properties: The product is not flammable.

Explosion hazard: The product is not explosive.

Vapour pressure, vapour density, vaporisation rate: The product has no measurable vapour pressure.

Density at 20°C: 7.7-8.1 kg/dm³

Solubility in water, liposolubility: Insoluble.

Distribution coefficient n-octanol/water: Cannot be determined due to insolubility in both phases.

Other information: Not required.

10. Stability and reactivity

Stable under normal conditions for the storage and transport of solid substances.

Conditions and substances to be avoided: When subjected to strong acids, possible violent reaction in connection with heat development and release of fumes. These fumes are toxic (nitrogen oxide) or capable of forming an explosive mixture in air (hydrogen).

Hazardous decomposition products: No hazardous decomposition products known.

11. Toxicological information

11.1 If inhaled or swallowed:

The stainless steels as in Sect. 1 are compact solids and normally cannot be breathed in or swallowed. Regardless of this, there would be no acute toxic affect if these would be breathed in or swallowed.

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With respect to the alloying elements in Sect. 2, metallic nickel is classified under the terms of Directive 67/548/EEC as a category 3 carcinogen (i. e. "a substance which causes concern owing to possible carcinogenic effects but in respect of which the available information is not adequate for making satisfactory assessment"). The here relevant form of absorption is inhalation. According to Directive 1999/45/EC preparations containing min. 1 % by mass of nickel are subject to the same outline dangerous-substance classification as metallic nickel (cf. Sect. 3), despite the fact that for example stainless steels have totally different chemical properties in comparison with the alloying elements of which they consist. So no carcinogenic effect could be verified for the manufacture, use, processing or handling of the stainless steels as in Sect. 1, either in epidemiological studies or in animal tests carried out under extreme conditions.

Mechanical and thermal working processes (e. g. grinding, cutting or welding) can give rise to fumes and dust containing oxides of the various alloying metals. They can have an acute affect on health under extreme circumstances (metal fume fever) and also a chronic affect, chiefly on the lungs. Studies of workers who have been exposed to dust and fumes containing nickel during the production of nickel alloys and stainless steels did not reveal any increased risk of suffering cancer of the respiratory organs.

Processing operations such as welding or flame cutting which bring the material up to high temperatures can lead to the formation of compounds containing chromium VI. Certain compounds containing chromium VI are carcinogenic. Epidemiological studies of welders have nevertheless shown that the welding of stainless steels does not lead to any greater risk of cancer than the slight risk associated with the welding of chromium-free steels.

11.2 Incorporation by skin contact:

Directive 67/548/EEC classifies nickel as a skin sensitizer, i.e. prolonged direct contact with the skin (e. g. when wearing articles of jewellery) can lead to sensitisation of susceptible individuals. According to Directive 1999/45/EC all preparations containing min. 1 % nickel by mass are in principle likewise to be classified as sensitizers (cf. Sect. 3). This also applies to nickel-alloyed stainless steels as in Sect. 1, although tests have shown them not to be sensitising. Furthermore these types of steel do not cause allergic reactions, if accordingly surface finished, even after prolonged direct skin contact on already sensitized skin.

11.3 Other observations:

Decades of experience have shown that stainless steels are particularly suitable for high-spec applications with respect to corrosion resistance and hygienic and non-toxic material characteristics (e. g. in food industry).

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12. Ecological information

No harmful effects known. No special preventative measures required. Not a substance hazardous to waters according to German WGK-categorisation (WGK: Class of hazard to water).

13. Disposal considerations

Stainless steel scrap is a valuable raw material and easy to recycle for reuse. Disposal in waste dumps is not harmful to the environment, but it is a waste of valuable natural resources and should therefore be avoided.

The stainless steels as in Sect. 1 do not cause contamination of the packaging materials employed.

14. Transport information

Not classed as hazardous cargo in terms of transport regulations.

15. Regulatory information

Stainless steels as in Sect. 1 containing less than 1 % nickel by mass are not dangerous preparations within the terms of Directive 1999/45/EC. Stainless steels as in Sect. 1 containing a minimum of 1 % nickel by mass are to be classified in the same way as nickel (see below). However, as these materials in their solid form (i.e. the form in which they are normally handled) are neither harmful due to their physical chemical properties nor harmful to human health or environment, they do not require special labelling according to Directives 1999/45/EC and 67/548/EEC.

Substance	CAS-No.	Indication of danger	Risk phrases	Safety phrases
Nickel	7440-02-0	Xn (Harmful)	R40 Limited evidence of a carcinogenic effect.	S22 Do not breathe dust.
			R43 May cause sensitisation by skin contact.	S36 Wear suitable protective clothing.

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Evaluation of stainless steels as in Sect. 1 in accordance with national legislation for the Federal Republic of Germany:

Information on occupational limitations: No limitations.

Classification according to TA Luft (emission standard): Not applicable.

Classification according to Störfallverordnung (statutory order on hazardous incidents): Not applicable.

Wassergefährdungsklasse (water hazard class): Not hazardous to water.

Information regarding Directive 1999/13/EC governing limits on emissions of volatile organic substances (VOC Directive): Not applicable.

According to Directive 76/769/EEC, the stainless steels as in Sect. 1 are subject only to the following limitations on use:

- They may be used for post assemblies, which are inserted into pierced ears and other pierced parts of the human body during epithelisation of the wound caused by piercing, only if the nickel release rate of such post assemblies is less than $0.2 \mu\text{g}/(\text{cm}^2 \times \text{week})$ (release rate value).
- They may be used for products intended to come into direct and prolonged contact with the skin if the nickel release rate is less than $0.5 \mu\text{g}/(\text{cm}^2 \times \text{week})$ when tested in accordance with EN 1811. The stainless steels as in Sect. 1 fulfil this requirement if accordingly surface finished.

Laws, directives and regulations covered by this material safety data sheet:

EC: Dangerous Preparations Directive 1999/45/EC,
Classification and Labelling Directive 67/548/EEC with amendments up to 2001/59/EC,
MSDS Directive 91/155/EEC with amendments 93/112/EC and 2001/58/EC,
Marketing and Use Directive 76/769/EEC

FRG: Chemikaliengesetz (Chemicals Law) of 20/06/2002 (last amended 13/05/2004),
Gefahrstoffverordnung (Dangerous Substances Regulation), Edition 23/12/2004 with amendment of same date,
Bundes-Immissionsschutzgesetz (Federal Emission Control Act of 15/03/1974 with amendments up to 25/06/2005,
Technische Regeln für Gefahrstoffe – Sicherheitsdatenblatt (Technical Rules for Dangerous Substances – Safety Data Sheet), TRGS 220,
Edition April 2002 with amendments up to BarbBI, Issue 1/2003,

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Technische Regeln für Gefahrstoffe – “Luftgrenzwerte” (Technical Rules for Dangerous Substances – Airborne Substance Limits in the Workplace), TRGS 900, Edition October 2000 with amendments up to ArbStoffl, Issue 7/8-2004,
Technische Regeln für Gefahrstoffe – Begründungen und Erläuterungen zu Grenzwerten in der Luft am Arbeitsplatz (Technical Rules for Dangerous Substances – Principles and Explanations regarding Airborne Substance Limits in the Workplace), TRGS 901, Edition April 1997 with amendments up to ArbStoffl, Issue 6/2004,
Technische Regeln für Gefahrstoffe – Verzeichnis krebserzeugender, erbgutverändernder oder fortpflanzungsgefährdender Stoffe (Technical Rules for Dangerous Substances – Index of Carcinogenic, Mutagenic or Fertility-Impairing Materials), TRGS 905, Edition July 2005,
BIA-Report 1/2004: Gefahrstoffliste 2004 – Gefahrstoffe am Arbeitsplatz (List of Dangerous Substances 2004 – Dangerous Substances in the Workplace)

16. Other information

Wording of Risk phrases of Sect. 2: R40: Limited evidence of a carcinogenic effect.
R43: May cause sensitisation by skin contact.

References:

The initial work involves a composition based on knowledge available until 1998 regarding health aspects of the manufacture, processing and handling of stainless steels.

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.
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Chromium in Stainless Steel Welding Fumes. The Chromium File No. 9, April 2002,
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3. R. Doll et al.:
Report of the International Committee on Nickel Carcinogenesis in Man. Scand. J. of Work Environment and Health. 1990, 16, 1-82.
4. P. Haudrechy et al.:
Nickel Release from Nickel-plated Metals and Stainless Steels. Contact Dermatitis. 1990, 31, 249-255.

This material safety data sheet describes products of ThyssenKrupp Nirosta GmbH with respect to their safety requirements. The details given are based on the information and experience available, but they do not provide or imply guarantees regarding product characteristics, nor do they suppose a legal or contractual obligation of any kind.