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Allgemeine bauaufsichtliche Zulassung Z-30.3-6 of 20 April 2022

(national technical approval)

„Products, structural components and fasteners made of stainless steels“

EDELSTAHL Rostfrei

Informationsstelle Edelstahl Rostfrei

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About Informationsstelle Edelstahl Rostfrei

The Informationsstelle Edelstahl Rostfrei (ISER) is a joint organisation of companies and institutions from the following sectors

- Stainless steel production (national and european),
- Stainless steel processing,
- Surface finishers,
- Stockholders and service centres,
- Alloying elements industry,
- Services and publishers.

ISER‘s tasks include provision of company-neutral information on properties and applications of stainless steel. The focus of the activities is on

- Practice-oriented, target group-specific technical publications,
- Online information platform,
- Public relations for professional journals and public media,
- Trade Fair participations,
- Performance of training events,
- Establishment of competence centres „Stainless-Steel-Processing“,
- Supplier directories,
- Individual reply to technical questions.

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Approval Body for construction products and construction techniques

National technical approval/ General construction technique permit

(Allgemeine bauaufsichtliche Zulassung/ Allgemeine Bauartgenehmigung)

Date: 20/04/2022

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Number:
Z-30.3-6

Validity
from: **1st May 2022**
to: **1st May 2027**

Applicant:

Informationsstelle Edelstahl Rostfrei
Sohnstrasse 65
40237 Düsseldorf
Germany

Subject of this decision:

Products, structural components and fasteners made of stainless steels

The subject of decision mentioned above is herewith generally approved/authorized in the field of construction.

This decision comprises 20 pages and eight Annexes.

This national technical approval/general construction technique permit *(allgemeine bauaufsichtliche Zulassung/allgemeine Bauartgenehmigung)* replaces the technical approval/general construction technique permit *(allgemeine bauaufsichtliche Zulassung/allgemeine Bauartgenehmigung)* Z-30.3-6 of March 5, 2018. The subject was first generally approved in the field of construction on May 31, 1974.

I GENERAL PROVISIONS

1 This decision confirms the fitness for use and application of the subject of approval within the meaning of the Building Codes of the federal states (*Landesbauordnungen*).

2 This decision does not replace the permits, approvals and certificates required by law for carrying out building projects.

3 This decision is granted without prejudice to the rights of third parties, in particular private property rights.

4 Notwithstanding further provisions in the 'Special Provisions', manufacturers and distributors of the subject of approval shall make copies of this decision available to the user and installer. They shall also indicate that this decision shall be made available at the place of use. Upon request, copies of the decision shall be provided to the authorities involved.

5 This decision may be reproduced in full only. Partial publication requires the consent of Deutsches Institut für Bautechnik. Texts and drawings in promotional material may not contradict this decision. In the event of a discrepancy between the German original of the national technical approval and this authorised translation, the German version shall prevail.

6 This decision may be revoked. The provisions contained herein may subsequently be supplemented and amended, in particular if this is required by new technical findings.

7 This decision is based on the information and documents provided by the applicant. Alterations to this basis are not covered by this decision and shall be notified to DIBt without delay.

II SPECIAL PROVISIONS

1 Subject of concerned and field of use and application

1.1 Subject of approval and field of use

The subject of approval are products, structural components and fasteners made of stainless steels and their connections, which are used for the manufacture of structures or part of structures and which do not fall within the scope of harmonized product standards.

The steel grades to be used for structural components are listed in Annex 1, Table 1.

Similar to structural steels, stainless steels for products and structural components are classified into strength classes S235, S275, S355, S460 and S690. They are available in annealed condition, in cold-worked condition in accordance with the CP classification or in cold-worked condition in accordance with this national technical approval.

The strength classes of the steel grades in Annex 3, Table 3, have been achieved through cold working.

Stainless steels for fasteners are classified into steel groups in accordance with DIN EN ISO 3506-1[1] and DIN EN ISO 3506-2[2] with strength classes 50, 70 and 80. The strength classes are indicated in kN/cm² depending on the tensile strengths R_m.

Structural components may be the products themselves or produced from them in accordance with given rules. Products shall have a minimum thickness of min t or rather min d = 1.5 mm. The thread diameters of the fasteners shall be at least M 6.

1.2 Subject of permit and field of use

Subject of this permit is design, structural analysis and execution of structures or structural components made of stainless steels.

This general construction technique permit applies to structural components and connections under static or quasi static loads and atmospheric conditions.

For assessing their corrosion resistance, stainless steels are classified into five corrosion resistance classes (CRC) in accordance with DIN EN 1993-1-4[3], Annex A. Annex 1, Table 1, shows an overview of this classification. The corrosion resistance classes (CRC) selected in each case shall fulfil the requirements applying to the structural components for corrosion protection, also with regard to the protective life.

The steel grades stated in Annex 1, Table 1 may be applied for temperatures down to -40 °C. For ferritic and austenitic-ferritic steel grades, the provisions given in Section 2.3.2 shall be considered.

2 Provisions for the construction products

2.1 Manufacture, properties and composition of the products, fasteners and structural components

2.1.1 Steel grades, product forms, strength classes

The products consist of the steel grades given in Annex 1, Table 1.

[1]	DIN EN ISO 3506-1:2020-08	Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified grades and property classes
[2]	DIN EN ISO 3506-2:2020-08	Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes
[3]	DIN EN 1993-1-4:2015-10	Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels

A list of the usually available product forms depending on the steel grades and strength classes is given in Annex 7 (informative).

2.1.2 Technical delivery conditions for the prodcuts listed in Table 1, Annex 1

2.1.2.1 Products without cold working

For the products made of austenitic-ferritic steel grades with material numbers 1.4062, 1.4482, 1.4501, 1.4507 and 1.4662, the technical delivery conditions in accordance with DIN EN 10088-2[4] and DIN EN 10088-3[5] shall apply.

2.1.2.2 Products after cold working

For the products made of cold-worked steel grades in accordance with Annex 3, Table 3, which do not comply with the CP classification in accordance with DIN EN 1993-1-4[3], Table 2.2, the technical delivery conditions in accordance with DIN EN 10088-4[6], DIN EN 10088-5[7], DIN EN 10296-2[8] and DIN EN 10297-2[9] shall apply. Furthermore, for the products made of austenitic-ferritic steel grades with material numbers 1.4062 and 1.4662, the technical delivery conditions in accordance with DIN EN 10088-2[4] and DIN EN 10088-3[5] shall apply, whereby, in deviation from the technical delivery conditions, the values in Annex 3, Table 3 of this national technical approval / general construction technique permit shall be considered for the mechanical properties.

2.1.3 Technical terms of delivery for the fasteners listed in Annex 2, Table 2

The technical delivery conditions in accordance with DIN EN 15048-1[10] shall apply to bolts and threaded rods in accordance with DIN EN ISO 3506-1[1] and to nuts and, where applicable, washers in accordance with DIN EN ISO 3506-2[2].

2.1.4 Suitability for welding; filler materials

2.1.4.1 General

Except for steel grades with material numbers 1.4016, 1.4567 and 1.4578, as far as approved filler material is available in accordance with 2.1.4.2 and no restrictions are made in Sections 4.6.2 to 4.6.8, all steels grades may be used for the following welding processes:

Manual metal arc welding (111), TIG welding (141), MIG welding (131), MAG welding (135), MAG welding with flux cored electrode (136), submerged arc welding (12), drawn arc stud welding (783), arc stud welding with tip ignition (786), plasma MIG welding (151), resistance spot welding (21), flash welding (24), resistance butt welding (25), friction welding (42), laser welding (52) and electron beam welding (51).

Welding of the steel grades with material numbers 1.4016, 1.4567 and 1.4578 is not covered by this national technical approval / general construction technique permit.

4	DIN EN 10088-2:2014-12	Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes
5	DIN EN 10088-3:2014-12	Stainless steels - Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
6	DIN EN 10088-4:2010-01	Stainless steels - Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes
7	DIN EN 10088-5:2009-07	Stainless steels - Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes
8	DIN EN 10296-2:2006-02	Welded circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 2: Stainless steel
9	DIN EN 10297-2:2006-02	Seamless steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 2: Stainless steel
10	DIN EN 15048-1:2016-09	Non-preloaded structural bolting assemblies - Part 1: General requirements

2.1.4.2 Welded joints, filler materials

(1) Except for joints of structural components made of the same stainless steel grades in accordance with this national technical approval, such joints of structural components made of different steel grades - hereafter named mixed joints - are permissible. The structural components may be made of:

- different stainless steel grades in accordance with this national technical approval / general construction technique permit
- stainless steel grades in accordance with this national technical approval / general construction technique permit and weldable structural steels in accordance with DIN EN 1993-1-1[11] and DIN EN 1993-1-12[12] each in connection with the National Annex as well as in accordance with national technical approval / general construction technique permit or European Technical Assessment.

(2) The filler material and welding consumables for joints of structural components with the same stainless steel grades are indicated in Annex 4, Table 4.

(3) In welded joints made of different austenitic steel grades in accordance with Annex 1, Table 1, the filler metals of one as well as of the other steel grade may be applied in accordance with Annex 4, Table 4.

(4) In welded joints of structural components made of austenitic steel grades and such of the ferritic steel grade with material numbers 1.4003 and 1.4512, the filler material in accordance with Annex 5, Table 5, shall be used. Thermal conduction shall be oriented towards austenitic steel.

(5) In mixed joints of structural components made of the ferritic steel grade with material numbers 1.4003 and 1.4512 or austenitic steel grades on the one hand and such made of weldable structural steels in accordance with DIN EN 1993-1-1[11], Table 3.1 and DIN EN 1993-1-12[12], Table 1, each in conjunction with the National Annex as well as in accordance with national technical approval / general construction technique permit or European Technical Assessment on the other hand, the filler materials in accordance with Annex 5, Table 6, shall be used. Thermal conduction is oriented to that for high-strength structural steels, whereby preheat temperatures and interpass temperatures above 150 °C shall be avoided. Apart from that, DIN EN 1011-2[13] shall be taken into account for fine grain steels.

(6) In mixed joints of structural components made of austenitic-ferritic steel grades on the one hand and structural components made of structural steels in accordance with DIN EN 1993-1-1[11], Table 3.1, and DIN EN 1993-1-12[12], Table 1, each in conjunction with the National Annex as well as in accordance with national technical approval / general construction technique permit or European Technical Assessment on the other hand, the filler material given for the austenitic-ferritic steel grades in Annex 4, Table 4, shall be preferred. The filler material in accordance with Annex 5, Table 7, may also be used. Section 5 applies to thermal conduction.

2.1.5 Limit dimensions of the products and fasteners

2.1.5.1 Limit dimensions of the products

The products or rather their sections shall have a thickness of at least 1.5 mm.

Unless no additional restrictions are made in other sections of this decision, the maximum thicknesses of

- annealed products are specified in DIN EN 10088-4[6] and DIN EN 10088-5[7],

[11]	DIN EN 1993-1-1:2010-12	Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings
[12]	DIN EN 1993-1-12:2010-12	Eurocode 3: Design of steel structures - Part 1-12: Additional rules for the extension of EN 1993 up to steel grades S700
[13]	DIN EN 1011-2:2001-05	Welding - Recommendation for welding of metallic materials - Part 2: Arc welding of ferritic steels

- annealed products made of steel grades with material numbers 1.4062, 1.4482, 1.4501, 1.4507 and 1.4662 are specified in DIN EN 10088-24 and DIN EN 10088-35 and
- cold-worked products are specified in Annex 6, Table 8.

The maximum thicknesses for welded components of cold-worked and annealed materials result from Annex 6, Table 8.

2.1.5.2 Limit dimensions of the fasteners

The minimum nominal thread diameter is M 6.

For different steel grades, the maximum nominal diameters result from Annex 2, Table 2. The mechanical properties in accordance with DIN EN ISO 3506-1[1] and DIN EN ISO 3506-2[2] shall also be ensured for nominal thread diameter > M 39 and be checked and monitored in accordance with Section 2.3.

2.1.6 Corrosion protection of the construction products

2.1.6.1 Requirements

(1) For reasons of stability, structural components and fasteners require no corrosion protection, if

- the material used corresponds to the corrosion resistance class in accordance with Annex 1, Table 1, which is at least required for the corrosion load in accordance with DIN EN 1993-1-4[3], Annex A
- no deviating requirements result from Sections 2.1.6.2 to 2.1.6.7 and
- the service and maintenance requirements given in Section 5.2 are met.

Note:

Corrosion resistance classes integrate different alloys showing a comparable corrosion resistance under the same corrosion loads. The selection of materials in accordance with DIN EN 1993-1-4[3], Annex A, only includes regulatory requirements but not decorative consistency (e.g. unwanted discolourations in consequence of a slight corrosive attack).

If there are high optical requirements, particular importance is to be attached to the type of design and surface finish of the structural components. Finely machined, smooth and flawless surfaces shall be ensured. The selection of a higher corrosion resistance class offers no replacement for this. The factory deliverable surfaces 2B, 2R, 1G, 2G, 1K, 2K for sheet/plate and strip or 1G, 2G, 2B and 2P for bars, rods, wire and sections specified in DIN EN 10088-4[6] or DIN EN 10088-5[7] meet these requirements.

(2) In each individual case, it shall be checked what kind of corrosion load can be expected for the particular structure or structural component.

(3) For contact with materials with a ph-value below 4 or over 10, which is outside the application limit of DIN EN 1993-1-4[3], the following additional notes shall apply to the material selection:

- anchorage and fastening elements which penetrate concrete structures shall be chosen in accordance with DIN EN 1993-1-4[3], Annex A. No higher requirements result from contact with the concrete member
- the minimum corrosion resistance class required in accordance with DIN EN 1993-1-4[3], Annex A, may be reduced to corrosion resistance class CRC I if the component is completely surrounded by concrete in accordance with DIN EN 1992[14]
- for contact with timber with a ph-value below 4, at least corrosion resistance class CRC II shall be chosen when the material is exposed to weathering.

[14] DIN EN 1992 Eurocode 2: Design of concrete structures

2.1.6.2 Corrosion protection of structural components and fasteners in indoor swimming pools

Under the conditions mentioned in DIN EN 1993-1-4[3], Annex A, only the steel grades given therein shall be used in indoor swimming pools. Additionally, DIN EN 1993-1-4/NA[15] NCI to A.3 shall be considered.

Splash water and aerosols shall be considered which may reach areas not accessible and not regularly cleaned, e.g. via ventilation, and may lead to high concentrations of corrosive media in these areas.

2.1.6.3 Corrosion protection of welded or thermally cut components

(1) To ensure corrosion protection, a post-treatment of the cutting edge and the welds is necessary to remove annealing colours. Welds shall be constructively arranged in such a way that areas in which annealing colours cannot be removed (e.g. in gaps and in overlaps) are completely closed through the weld. In exceptional cases, open gaps and overlaps can be protected against entry of corrosive media by using suitable sealants.

The removal of annealing colours and the closure of gaps and overlap areas is dispensable if they are constructively arranged in such areas for which input and accumulation of corrosion-causing media can be safely excluded. The appropriate installation situation shall be specified. During the planning phase of the project, it is necessary for the technical planner to ensure that no condensation starts forming in the area of the welds - for example in rear-ventilated facades insulated with mineral wool.

For minimizing on-site welding work, especially for structures for which a suitable post-treatment is aggravated through accessibility, system solutions with a high degree of factory preproduction and defined surface conditions shall be used.

Note: Annealing colours developing on the back of a steel component due to the heat input from the welding process may remain if the affected surface abuts on a solid component and is coupled with it, e.g. welding to anchor plates.

(2) To avoid a sensitization against intergranular corrosion after welding, the highest thicknesses in accordance with Annex 6, Table 8, shall be taken into account for the steel grades with numbers 1.4301 and 1.4401.

(3) For welded joints of stainless steel with another steel grades, the explanations regarding bimetal corrosion (contact corrosion) in Section 2.1.6.5 shall apply.

2.1.6.4 Corrosion protection of mechanically treated components

During mechanical treatment of stainless steels as well as removal of annealing colours in accordance with Section 2.1.6.3, no particles producing extraneous rust shall get into the surface. Thus, the use of tools with which non-alloy or low-alloy steel were previously treated or wire brushes made of such steels shall be avoided. If this is impossible in the individual case, the surface from which the particles producing extraneous rust is to be removed shall be post-processed (e.g. etching, grinding).

Note: Annealing colours developing through mechanical cutting, for example on cut edges, may remain as far as no optical requirements exist.

[15] DIN EN 1993-1-4/NA:2020-11 National Annex - Nationally determined parameters - Eurocode 3: Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels

2.1.6.5 Corrosion protection of connections with other metals

(1) Bimetal corrosion may occur for an electrically conductive contact of different metals. The appearance of bimetal corrosion is bound to the existence of a liquid (electrolyte solution) in the contact area, i.e. a danger basically exists only if the corresponding joint is often and permanently moist. In the most general sense, bimetal corrosion has a bigger significance in an aqueous environment (also in the soil) than at the atmosphere where it is only effective as long as a film of moisture exists. If there are impurities, hydroscopic or constantly damp deposits, self-sucking sealings or constantly dump crevices, damage through bimetal corrosion is possible even under conditions of a usually harmless atmospheric load.

(2) On joints with components made of non-alloy or low-alloy steel, galvanised steel or aluminium for example, a corrosion risk through bimetal corrosion may only exist for the less noble contact materials; bimetal corrosion practically does not occur on stainless steels themselves.

(3) If necessary, bimetal corrosion shall be prevented, e.g. by isolating stainless steel electrically from less noble metal through suitable plastic moulded parts. Electric isolation shall be complete and shall not be abolished indirectly offside the joints. If necessary, several components shall be coated in order to achieve a protection of the less noble partner from bimetal corrosion.

(4) Welds shall be arranged in such a way that no corrosion is expected to form due to the position of the contact area (e.g. inner areas without condensation). Otherwise, the joint shall receive a corrosion protection granting a constant protection for the non-alloy and low-alloy steel depending on the corrosiveness of the environment and the protection period. The corrosion protection selected shall be extended at least to the directly adjacent area of the stainless steel in order to avoid the formation of corrosion cells in the transition area.

2.1.6.6 Protection against liquid metal induced stress corrosion cracking

(1) Hot-dip galvanizing of structural components made of stainless steels shall not be permitted. When stainless steel comes into contact with molten zinc which may occur upon hot-dip galvanizing - i.e. of structural components with mixed joints - or in the event of fire, the risk of an immediate embrittlement exists. Avoiding contact with molten zinc in the event of fire is not necessary if the embrittlement of the stainless steel does not jeopardise the stability of the load-bearing structure.

(2) A contact with molten copper or copper melting on the surface of stainless steel shall be avoided. In this case, liquid metal induced stress corrosion cracking may also occur.

2.1.6.7 Corrosion protection of anchoring in reinforced concrete construction and in masonry construction.

(1) Welded joints and other electrically conductive contact points between stainless steels and other steel grades without additional corrosion protection shall only be permitted if the part of the stainless steel free of annealing colours weaves at least 5 cm into the concrete.

(2) The corrosion resistance class in accordance with DIN EN 1993-1-4[3], Annex A, for components inserted in brickwork and protected against external influences by mortar (e. g. punched tape) may be reduced by one class. But at least one material of corrosion resistance class CRC II shall be selected.

2.2 Packaging, transport, storage and marking of the construction products

2.2.1 Packaging, transport, storage

The products and fasteners as well as the structural components produced from them shall be packed, transported and stored in such a way that the material and corrosion behaviour is considered. The contamination of particles producing extraneous rust getting into the surface shall also be avoided. If this is impossible in the individual case, the surface from which the particles producing extraneous rust is to be removed shall be post-processed (e.g. etching, grinding).

2.2.2 Marking

2.2.2.1 Products

The products made of the steel grades with material numbers 1.4062, 1.4482, 1.4501, 1.4507 and 1.4662 in accordance with DIN EN 10088-2[4] and DIN EN 10088-3[5] as well as the steel grades stated in Annex 1, Table 1, footnote 2, (steel grades with higher strengths achieved by cold working in accordance with DIN EN 1993-1-4/NA[15], Table NA.2) in cold worked condition or the delivery sheets shall be marked by the manufacturer with the national conformity mark (*Ü-Zeichen*) in accordance with the Conformity Marking Ordinances (*Übereinstimmungszeichen-Verordnungen*) of the federal states. The name of the manufacturer and the number of this national technical approval / general construction technique permit shall be stated in the conformity mark. The mark shall only be applied if the conditions given in Section 2.3 are met.

Furthermore, the products shall be marked in accordance with DIN EN 10088-4[6], Table 19, or DIN EN 10088-5[7], Table 23.

The marking shall be preserved if only parts of the products are used. If necessary, the marking shall be transferred to the single parts by a person in charge named by the manufacturer. An in-house defined short mark may be used for the marking of small parts (i.e. small parts of the initial products, such as bars, as opposed to small parts of a manufacturer, such as anchor channels). All cuttings of the products shall be recorded.

All products shall be delivered with an inspection certificate 3.1 in accordance with DIN EN 10204[16].

2.2.2.2 Fasteners

For the CE-marking of bolting assemblies for bolted connections consisting of bolts in accordance with DIN EN ISO 3506-1[1], nuts in accordance with DIN EN ISO 3506-2[2] and, if necessary, washers DIN EN 15048-1[10], Annex ZA shall apply.

Bolting assemblies whose dimensions (e. g. > M39) or materials are not covered by DIN EN ISO 3506-1[1] or DIN EN ISO 3506-2[2] as well as single components of bolting assemblies, like bolts or nuts (e.g. nuts on threaded bars) and other threaded parts, their packaging or their deliver notes shall be marked by the manufacturer with the national conformity mark (*Ü-Zeichen*) in accordance with the Conformity Marking Ordinances (*Übereinstimmungszeichen-Verordnungen*) of the federal states. The name of the manufacturer and the number of this national technical approval / general construction technique permit shall be stated in the conformity mark. The mark shall only be applied if the conditions given in Section 2.3 are met. Furthermore, the fasteners shall be marked with the short mark or material number in accordance with the delivery conditions in Sections 2.1.2 and 2.1.3 of this decision. The bolts, nuts and threaded parts shall be marked in accordance with Annex 2, Table 2, on the basis of DIN EN ISO 3506-1[1] and DIN EN ISO 3506-2[2].

The fasteners shall be delivered with an inspection certificate 3.1 in accordance with DIN EN 10204[16].

The supplier and the customer can also agree on a delivery with inspection document according to DIN EN ISO 16228[17].

[16] DIN EN 10204:2005-01 Metallic products - Types of inspection documents
[17] DIN EN ISO 16228:2018-05 Fasteners - Types of inspection documents

2.2.2.3 Structural components

The delivery notes or other accompanying documents of the structural components manufactured in accordance with this decision shall be marked by the manufacturer with the national conformity mark (*Ü-Zeichen*) in accordance with the Conformity Marking Ordinances (*Übereinstimmungszeichen-Verordnungen*) of the federal states. The mark shall only be applied if the conditions given in Section 2.3 are met.

2.3 Confirmation of conformity

2.3.1 General

2.3.1.1 Products and Fasteners

(1) The following provisions of Section 2.3 apply to the products and fasteners marked with the national conformity mark (*Ü-Zeichen*) in accordance with Section 2.2.2.

(2) The confirmation of conformity of the products and fasteners made of stainless steels with the provisions of the national technical approval covered by this decision, shall be issued for every manufacturing plant in the form of a certificate of conformity *(Übereinstimmungszertifikat)* of an appropriately recognized certification body based on factory production control and regular external surveillance, including initial type-testing in accordance with the following provisions:

(3) To issue the certificate of conformity *(Übereinstimmungszertifikat)* and for external surveillance, including the associated product testing to be carried out in the process, the manufacturer of the product and/or the fastener shall use an appropriately recognized certification body and an appropriately recognized inspection body.

(4) The declaration that a certificate of conformity *(Übereinstimmungszertifikat)* has been granted shall be submitted by the manufacturer through marking of the construction products with the national conformity mark (*Ü-Zeichen*) including statement of the intended use.

(5) A copy of the certificate of conformity *(Übereinstimmungszertifikat)* issued by the certification body shall be sent to Deutsches Institut für Bautechnik. A copy of the initial type-testing report shall also be sent to Deutsches Institut für Bautechnik.

2.3.1.2 Structural components

The confirmation of conformity *(Übereinstimmungszertifikat)* of the structural components manufactured in accordance with the provisions of this decision with the provisions of this decision shall be issued for every manufacturing plant in the form of a declaration of conformity made by the manufacturer based on initial type-testing by the manufacturer and factory production control.

The declaration of conformity *(Übereinstimmungszertifikat)* shall be made by the manufacturer by marking the delivery notes or other accompanying documents with the national conformity mark (*Ü-Zeichen*), stating the intended use.

2.3.2 Factory production control of the construction products

(1) A factory production control system shall be set up and implemented in each manufacturing plant. Factory production control is understood to be continuous surveillance of production by the manufacturer to ensure that the manufactured products and fasteners satisfy the provisions of this national technical approval.

(2) The technical delivery conditions for products of stainless steels in accordance with Section 2.1.2 of this decision shall apply to testing, the range of tests and sampling. DIN EN 15048-1[10] in conjunction with DIN EN ISO 3506-1[1] and DIN EN ISO 3506-2[2] shall apply to bolts, threaded bars, nuts and washers.

For ferritic and austenitic-ferritic steel grades, a sufficient notched-bar impact energy shall be proved with ISO-V-specimens taken from each batch. For long products, the proof shall be furnished on longitudinal specimens and for flat products on transverse specimens. The value of the notched-bar impact work is determined as the mean value of 3 specimens. One individual value may fall short of the minimum value of 40 J by no more than 30 %. For ferritic steel grades with thicknesses > 6.0 mm DIN EN 1993-1-4/NA15, NDP to 2.1.4(2) Remark 2 shall be considered additionally.

A tightness test (inside pressure test in accordance with DIN EN 10296-2[8] and DIN EN 10297-2[9]) may be omitted for pipes.

DIN EN 1090-2[18] shall be additionally taken into account for structural components.

(3) The results of factory production control shall be recorded and evaluated. The records shall include at least the following information:

- designation of the construction product or the starting materials and the components,
- type of check or test,
- date of manufacture and testing of the construction product or the starting materials and the components,
- results of the checks and tests and, where applicable, comparison with requirements,
- signature of the person responsible for factory production control.

(4) The records shall be kept for at least five years and be submitted to the inspection body used for external surveillance. They shall be submitted to Deutsches Institut für Bautechnik and the competent supreme building authority upon request.

If the test result is unsatisfactory, the manufacturer shall immediately take the necessary measures to resolve the problem. Construction products which do not meet the requirements shall not be used and be handled in such a way that they cannot be confused with compliant products. After the defect has been remedied, the relevant test shall be repeated immediately - where technically feasible and necessary to show that the defect has been eliminated.

2.3.3 External surveillance of products structural components and fasteners

(1) The factory production control system shall be inspected regularly, i.e. at least once a year, by means of external surveillance at each manufacturing plant.

Initial type-testing of the products and fasteners shall be carried out within the scope of external surveillance. Samples for random testing shall also be taken. Sampling and testing shall be the responsibility of the recognised inspection body.

(2) In the framework of external surveillance, the following tests shall be carried out on the products released for delivery:

- at least 3 tensile tests at ambient temperature,
- for the ferritic and austenitic-ferritic steel grades in accordance with Annex 1, Table 1, at least one set (3 specimens) of charpy tests at longitudinal specimens,
- visual check of surface conditions,
- check of geometry,
- product analyses.

(3) For fasteners, DIN EN 15048[10] shall apply in conjunction with DIN EN ISO 3506-1[1] and DIN EN ISO 3506-2[2].

[18] DIN EN 1090-2:2018-09 Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures

(4) For structural components with mixed joints between stainless steel and reinforcing steel, DIN EN ISO 17660-1[19] and DIN EN ISO 17660-2[20] shall apply, particularly the clauses 13 and 14.

(5) Further details shall be taken from the technical delivery conditions in accordance with Section 2.1.2 and 2.1.3

(6) The results of certification and external surveillance shall be kept for at least five years. They shall be presented by the certification or inspection body to Deutsches Institut für Bautechnik and the competent supreme building authority upon request.

3 Provisions for design, structural analysis and execution

3.1 General

DIN EN 1993-1-4[3] in conjunction with National Annex DIN EN 1993-1-4/NA[15] and the Technical Building Rules shall apply unless otherwise specified below. The provisions for design and structural analysis in Section 4 of this decision shall be taken into account as well.

If different steel grades are used in a structure, the different coefficients of thermal expansion shall be considered. This shall apply to temperature changes due to working processes or weather as well as for such occurring during production, e.g. through welding, and in the event of fire.

For façade components and their anchorage and fastening elements under swelling or alternating loading due to atmospheric temperature changes DIN EN 1993-1-4/NA[15], NCI to 8 Fatigue shall be considered.

3.2 Design

3.2.1 Bolted connections

Pre-loaded screwed connections and friction grip connections are not the subject of this decision.

If welding is envisaged on fasteners, they shall basically be classified into strength class 50.

3.2.2 Welded joints

3.2.2.1 Limitation of weld thicknesses

For welded joints of structural components made of austenitic steels with those made of ferritic steels, the weld thickness may be not more than 16 mm unless the qualification for the bigger values has been proven by an earlier production control test in accordance with DIN EN ISO 15613[21].

For cross-section parts with thicknesses of $1.5\ \text{mm} \leq t < 2\ \text{mm}$, the fillet weld thickness shall be $a = \min t$.

3.2.2.2 Welding in cold-formed areas

Welding in cold-formed areas shall be admissible taking into account Section 4.3.

Regarding the ferritic steel grade with the material number 1.4003 cold forming of 5 % at maximum shall be admissible for welded structural components since, with higher cold forming and additional heating, a grain growth with loss of ductility may occur.

[19] DIN EN ISO 17660-1:2006-12 Welding - Welding of reinforcing steel - Part 1: Load-bearing welded joints Amendment 1:2007-08

[20] DIN EN ISO 17660-2:2006-12 Welding - Welding of reinforcing steel - Part 2: Non load-bearing welded joints Amendment 1:2007-08

[21] DIN EN ISO 15613:2004-09 Specification and qualification of welding procedures for metallic materials - Qualification based on pre-production welding test

3.3 Structural analysis

3.3.1 General

For structural analysis, the provisions in DIN EN 1993-1-4[3] in conjunction with the National Annex DIN EN 1993-1-4/NA[15] shall apply unless otherwise specified below.

3.3.2 Structural analysis of bolted connections

The shear resistance of a bolt, $F_{v,Rd}$ can be determined as follows:

$$F_{v,Rd} = \frac{\alpha f_{ub} A}{\gamma_{M2}}$$

where

A is the shank cross-sectional area of the bolt (if the shear plane passes through the non-threaded part of the bolt) or the stress cross-sectional area A_s of the bolt (if the shear joint passes through the threaded part of the bolt)

f_{ub} is the tensile strength of a bolt according to Table 1

α is given in Table 2 and applies regardless of whether the shank or the thread of the bolt is in the shear plane.

Table 1 Nominal values of f_{yb} and f_{ub} for stainless steel bolts

Material groups	Property class to DIN EN ISO 3506	0.2-%-proof strength f_{yb} N/mm²	Ultimate tensile strength f_{ub} N/mm²
Austenitic	50	210	500
Austenitic and duplex	70	450	700
Austenitic and duplex	80	600	800
Austenitic and duplex	100	800	1000

Table 2 Values for α

Property class	Austenitic	Duplex
50	0.8	-
70	0.7	0.8
80	0.7	0.7
100	0.6	0.6

The tensile strength of a bolt, $F_{t,Rd}$ can be determined as follows:

$$F_{t,Rd} = \frac{k_2 f_{ub} A_s}{\gamma_{M2}}$$

where

k_2 = 0.63 for countersunk bolts, otherwise k_2 = 1.0;

A_s is the stress cross-sectional area of a bolt.

Bolts subjected to combined shear and tensile stress shall meet the following criteria depending on the location of the shear plane:

If the threaded part of the bolt is located in the shear plane or this cannot be safely excluded:

$$\left(\frac{F_{v,Ed}}{F_{v,Rd}}\right)^{1.7} + \left(\frac{F_{t,Ed}}{F_{t,Rd}}\right)^{1.7} \leq 1.0 \qquad \text{but} \qquad \frac{F_{t,Ed}}{F_{t,Rd}} \leq 1.0$$

If the threaded part of the bolt is not in the shear plane:

$$\left(\frac{F_{v,Ed}}{F_{v,Rd}}\right)^{1.7} + \left(\frac{F_{t,Ed}}{1{,}25F_{t,Rd}}\right)^{1.7} \leq 1.0 \qquad \text{but} \qquad \frac{F_{t,Ed}}{F_{t,Rd}} \leq 1.0$$

3.4 Fire protection

3.4.1 Reaction to fire

The structural steels covered by this national technical approval satisfy the regulatory requirements applying to non-flammable materials.

3.4.2 Resistance to fire

For the proof of resistance to fire of structures made of stainless steels in accordance with this national technical approval, the provisions of DIN EN 1993-1-2[22] in conjunction with the National Annex of DIN EN 1993-1-2/NA[23] shall apply.

4 Provisions for execution of the structural components

4.1 General

DIN EN 1090-2[18] shall apply unless otherwise specified below.

4.2 Suitability for cutting

All steels of this decision may be machined, mechanically or thermally cut or separated. Flame cutting with an oxy-acetylene burner is not possible for stainless steels. When stipulating the operation parameters for machining, such as the geometry of the cutting tools, cutting speed and feed rate, the micro structure of the respective steel grade shall be taken into account in accordance with Annex 1, Table 1.

Oxide films or annealing colors developed during thermal cutting processes shall be removed in accordance with the corrosion protection requirements (cf. Section 2.1.6.3).

The maximum depth of softening measured from the cutting surface shall be as follows:

- for austenitic steels 1.5 mm,
- for austenitic-ferritic steels 2.0 mm,
- for ferritic steels 3.0 mm.

These softening zones shall be taken into account for the verification of the load-bearing capacity when they comprise more than 10% of the load-bearing cross sectional area.

If smaller softening zones shall be considered for the calculation when applying other thermal cutting processes such as laser beam or electron-beam cutting processes, they shall be proven by tests.

4.3 Thermal treatment

Thermal treatments of ferritic steels may become necessary after cold forming, see Section 4.4.

[22] DIN EN 1993-1-2:2010-12 Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design

[23] DIN EN 1993-1-2/NA:2010-12 National Annex - Nationally determined parameters - Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design

Thermal treatments of austenitic and austenitic-ferritic steels during further processing shall not be permitted, except in individual cases after hot forming, see Section 4.5.

4.4 Cold forming

During cold forming of components no cracks shall occur.

As a reference value for the minimum inside bend radii r regarding flat products up to a thickness of 3 mm, the following shall apply to annealed stainless steels:

- for austenitic grades r = 0
- for austenitic-ferritic as well as for ferritic grades r = t

In addition, during cold forming through bending of sheet and strip as well as for bending of flat bars and rods, the following shall apply to the minimum radius r

$$r = (4.2 - A_5/10) \cdot t$$

where

r = inside bend radius

A_5 = minimum elongation at fracture in % in accordance with the technical delivery terms for annealed grades and for cold-worked grades in accordance with Annex 3, Table 3, whereby for values bigger than 42, the value 42 shall be inserted

t = plate thickness or diameter of rods

If the values of elongation at fracture A_5 are lower in transverse direction, this shall be taken into account when bending in transverse direction by using these values in the formula above.

Lower radii r shall be permitted if for appropriate bending procedures the suitability (no cracks) is proven by an expertise of a recognized body.

4.5 Hot forming

If hot forming is necessary in individual cases, the conditions shall be determined through tests. The test results shall be recorded in the manufacturing book.

Hot forming shall not be permitted for structural components made of the steel grade 1.4016.

4.6 Welding procedure

4.6.1 General

Welding plants shall have a manufacturer qualification which conforms to the production, see Section 4.7. Welding shall be carried out in accordance with current welding procedure specifications.

During welding, the higher thermal expansion of the austenitic steels and the lower thermal conductivity of all steels in accordance with Annex 1, Table 1, shall be taken into account compared to low-alloy and non-alloy structural steels.

For drawn arc stud welding, arc stud welding with tip ignition, resistance spot welding, resistance flash welding, resistance butt welding and for friction welding, component-specific production tests shall be carried out before production is resumed after a longer production interruption (more than 6 months). Also during continuous production, such production tests shall be necessary at least once a year. The results of these production tests and, where necessary, additional routine manufacturing tests shall be recorded in a manufacturing book that shall be available in the workplace and be submitted to the recognized body for information and examination purposes on demand.

If an expert report of a recognized body is required, the recognized body shall provide Deutsches Institut für Bautechnik with a copy of such expert report.

4.6.2 Arc welding (111, 121, 131, 135, 136, 141)

With the exception of the steel grades with material numbers 1.4301, 1.4307, 1.4541, 1.4401, 1.4404, 1.4571 of strength class S235 as well as joints of these steels with non-alloy structural steels and joints of these materials among each other, procedure tests in accordance with DIN EN ISO 15614-1[24] shall be carried out before production is started. This procedure test shall also include the verification of the proof strength $R_{p0.2}$ for the respective application. The procedure test shall be carried out with a recognized body.

In order to avoid hot cracks and to limit the drop in strength for cold-worked steels, the energy per unit length shall be kept as low as possible. For the steel grades with material numbers 1.4003, 1.4539, 1.4439, 1.4529 and 1.4565 as well as for all cold-worked steel grades, 15 kJ/cm shall not be exceeded.

In addition, DIN EN 1011-3[25] shall be taken into account.

4.6.3 Resistance spot welding (21)

An expert report of a recognized body shall be necessary in which the design resistance of the welded joint is defined.

4.6.4 Flash welding (24) and resistance butt welding (25)

Only cross-sections of nearly the same shape may be connected. An expert report of a recognized body shall be necessary in which the welding quality requirements and the design resistance of the welded joint are defined.

4.6.5 Arc stud welding (78)

4.6.5.1 General

DIN EN ISO 13918[26] shall apply unless otherwise specified below.

The studs shall be made of stainless steel in accordance with DIN EN ISO 13918[26].

Arc stud welding shall only be permitted on structural components made of:

- stainless austenitic or austenitic-ferritic steels in accordance with Annex 1, Table 1, with the exception of the steel grades with material numbers 1.4567 and 1.4578 as well as
- weldable structural steel grades in accordance with DIN EN 1993-1-1[11], Table 3.1, or in accordance with DIN EN 1090-2[18].

Note: As a result of arc stud welding on austenitic-ferritic steel grades, a change in the microstructure in the welding area and heat-effected zone may occur with a reduction of the corrosion resistance.

At least the standard quality requirements in accordance with DIN EN ISO 3834-3[27] shall be fulfilled.

The arc stud welding test shall be carried out in accordance with DIN EN ISO 14555[28], clause 11.

24	DIN EN ISO 15614-1:2012-06	Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys
25	DIN EN 1011-3:2001-01	Welding - Recommendations for welding of metallic materials - Part 3: Arc welding of stainless steels
26	DIN EN ISO 13918:2008-10	Welding - Studs and ceramic ferrules for arc stud welding
27	DIN EN ISO 3834-3:2006-03	Quality requirements for fusion welding for metallic materials - Part 3: Standard quality requirements
28	DIN EN ISO 14555:2014-08	Welding - Arc stud welding of metallic materials

4.6.5.2 Additional rules for arc stud welding on the weldable structural steel grades in accordance with DIN EN 1993-1-1[11] or DIN EN 1090-2[18]

The following conditions shall be observed:

- weld diameter ≤ 12 mm,
- arc stud welding with shielding gas or ceramic ferrule,
- when using a ceramic ferrule, studs shall have an aluminum addition at the welding nozzle,
- only dry studs, ceramic ferrules and parts shall be processed. Ceramic ferrules which have already become wet shall no longer be used even after drying,
- the risk of condensates caused by temperature changes shall be considered,
- the welding area shall be grinded metallically bright directly before welding,
- only power sources with a constant power source characteristic shall be used,
- the equipment for arc stud welding including stud gun shall be calibrated in accordance with DIN EN ISO 17662[29],
- the original corrosion protection of the supporting structure shall be restored and embed the welding bead.

4.6.6 Friction welding (42)

The welding plant shall be suitable for welding components made of stainless steels (e.g. machine size and clamping technology) and shall be able to record welding data continuously, i.e. parameter monitoring shall be ensured.

An expert report of a recognized body is necessary in which the welding technology quality requirements and the design resistance of the welded joint are defined.

4.6.7 Laser welding (52)

At present, laser welding is applied for the steel grades with material numbers 1.4301, 1.4307, 1.4541, 1.4401, 1.4404 and 1.4571. Here, application is limited to strength class S235 and welding depths ≤ 12 mm. Welded joints between carbon steels and stainless steels by laser welding are not the subject of this decision.

Only strength class S235 shall be applied for the design resistances.

4.6.8 Electron beam welding (51)

At present, electron beam welding for butt welds is applied for the steel grades with material numbers 1.4301, 1.4307, 1.4541, 1.4401, 1.4404 and 1.4571. Here, application is limited to wall thicknesses up to 20 mm. Welded joints between carbon steels and stainless steels by electron beam welding are not the subject of this decision.

An expert report of a recognized body is necessary in which the welding technology quality requirements are defined. Only strength class S235 shall be applied for the design resistance of the welded joint.

4.6.9 Flame-straightening

Flame straightening of structural components made of stainless steels should be avoided. If it cannot be avoided, the maximum temperatures shall be kept as low as possible and the soak times as short as possible. In addition, the following items shall be taken into account:

The surface shall be free from sulfurous agents and other impurities such as labeling, iron dust and grease.

The acetylene oxygen flame shall be adjusted neutrally or slightly oxygen-excessive but by no means gas-excessive.

[29] DIN EN ISO 17662:2016-09 Welding - Calibration, verification and validation of equipment used for welding, including ancillary activities

The thermal exposure time (preheating + time at temperature + cooling off time) should be as short as possible. Cooling off shall be done by using water or compressed air. For the respective steel grades the conditions of Table 3 shall be observed:

Table 3 Conditions for flame-straightening

Steel grade	Temperature of flame straightening*)	Radiant heat color
Austenitic steels	650 °C - 750 °C	Brown-red to dark red
1.4003 1.4062 1.4162 1.4362 1.4462 1.4662	500 °C - 600 °C	Blue-grey until start dark red
*) time at temperature max. 12 minutes for austenitic steels, max. 8 minutes for 1.4062, 1.4162,1.4362 and 1.4462 as well as 4 minutes for 1.4003 and 1.4462		

Arresters or striking tools as well as other tools should consist of CrNi-steel or should be chrome-plated.

After straightening, annealing colors and oxide scales shall be completely removed through suitable measures. Flame straightening shall only be carried out by trained staff under supervision of the welding coordinator.

In case of cold-worked steels, softening due to flame straightening shall be taken into consideration for the verifications of the load-bearing capacity. This can be achieved by simply using the strength parameters of the steel for the annealed condition for the heated zone.

Flame-straightening shall not be permitted for structural components made of the steel grade 1.4016.

4.7 Requirements applying to the welding plants

4.7.1 General

Welding work on structural components made of stainless steels may only be carried out by welding plants having a welding certificate extended for the scope of stainless steels in accordance with DIN EN 1090-1[30] in conjunction with DIN EN 1090-2[18] for the execution classes (EXC) resulting from classification features in Section 4.7.2, the type of structural components and the welding process.

4.7.2 Welding certificate in accordance with DIN EN 1090-1[30] - General

The allocation of the structural components to the execution classes EXC1 to EXC4 in accordance with DIN EN 1993-1-1/NA[31] shall apply unless otherwise specified below.

4.7.3 Welding certificate in accordance with DIN EN 1090-1[30] - Execution classes

Welding in execution class EXC1:

Only joints of the same stainless steels shall be permitted and the use shall be restricted to steels with material numbers 1.4301, 1.4307, 1.4541, 1.4401, 1.4404 and 1.4571 in strength class S235.

[30] DIN EN 1090-1:2012-02 Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components

[31] DIN EN 1993-1-1/NA:2015-08 National Annex - Nationally determined parameters - Eurocode 3: Design of steel structures - Part 1-1

Welding in execution class EXC2:

Mixed joints of stainless steels, taking into account the strength levels, and mixed joints made of non-alloy structural steels up to and including strength class S355 with stainless steels shall be permitted, but use shall be restricted to stainless steels with material numbers 1.4301, 1.4307, 1.4541, 1.4401, 1.4404 and 1.4571 up to and including strength class S355.

Welding in execution class EXC3 or EXC4:

Joints with all material combinations mentioned in this decision may be executed.

All execution classes shall be restricted to static or quasi-static loads acting on the structural components.

4.7.4 Manufacturer´s qualification for welding plants producing welded joints between stainless steels and reinforcing steels

For welding stainless steels on reinforcing steels, DIN EN ISO 17660-1[18] and DIN EN ISO 17660-2[19] shall apply in connection with DVS guideline DVS 1708:2009[32] and the provisions of this decision, especially Section 4.7.1.

4.7.5 Prerequisite for welding stainless steels

4.7.5.1 Plant equipment

The plant shall be provided with equipment and devices necessary for welding, see DIN EN ISO 3834-3[27], clause 9.

4.7.5.2 Applied welding processes

For applying welding processes in accordance with Sections 4.6.3, 4.6.5, 4.6.6 and 4.6.8, the expert reports required therein shall be available. For arc welding in accordance with Section 4.6.2, procedure tests shall exist if this is required by Section 4.6.2. For welding processes in accordance with Sections 4.6.3 to 4.6.8, welding procedure tests shall always be required.

4.7.5.3 Welding coordinator

The required level of technical knowledge regarding the welding coordinator ensues from Table 15 of DIN EN 1090-2[18]. In addition, the welding coordinator shall prove in a technical discussion with the recognized body that he/she has the required knowledge on how to weld and process stainless steels, including welded joints between stainless steels and structural steels.

4.7.5.4 Welder

For performing welding work, only appropriately trained and approved welders in accordance with DIN EN ISO 9606-1[33] as well as trained and approved operators and set-up men in accordance with DIN EN ISO 14732[34] shall be deployed. Welders carrying out fillet welding shall have welded a fillet weld test specimen. The welding plant is obliged to ensure, if necessary through work samples, that the welder meets the quality requirements applying to the structural component.

For the extension of validity of the welder´s qualification test in accordance with DIN EN ISO 9606-1[33] and DIN EN ISO 14732[34] the same rules shall apply as for the welders who are deployed in terms of DIN EN 1090-2[18].

32	DVS-1708:2009-09	Prerequisites and procedures for obtaining constructor's qualification for welding of reinforced steel according to DIN EN ISO 17660-1:2006-12 or to DIN EN ISO 17660-2:2006-12
33	DIN EN ISO 9606-1:2013-12	Qualification testing of welders - Fusion welding - Part 1: Steels
34	DIN EN ISO 14732:2013-12	Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials

5 Provisions for acceptance, service and maintenance

5.1 Acceptance

For acceptance, bolts and welds shall be accessible. For welded joints that are no more accessible during final acceptance, an interim acceptance shall be provided. Before acceptance, welds shall receive no or only a transparent coating.

5.2 Service and maintenance

To guarantee the ultimate limit state of the structural components, the steel surface of such structural components classified as accessible shall be checked and, if necessary, be cleaned metallically bright at suitable intervals based on their individual utilization during the working life of the building. If optical requirements exist, shorter intervals may ensue.

If a regular check and cleaning was envisaged for the selection of material with regard to corrosion, the designer shall inform the user about this in writing. The performed checks and cleanings shall be documented.

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Hahn

Table 1 Overview of the steel grades according to DIN EN 10088

Steel grades [1]			Micro-structure	Corrosion resistance class CRC [3] [4]
No.	Material number	Name		
1	1.4003 [2]	X2CrNi12	ferritic	I / low
2	1.4016	X6Cr17	ferritic	
3	1.4512	X2CrTi12	ferritic	
4	1.4301 [2]	X5CrNi18-10	austenitic	II / moderate
5	1.4306	X2CrNi19-11	austenitic	
6	1.4307 [2]	X2CrNi18-9	austenitic	
7	1.4567 [2]	X3CrNiCu18-9-4	austenitic	
8	1.4541 [2]	X6CrNiTi18-10	austenitic	
9	1.4318 [2]	X2CrNiN18-7	austenitic	
10	1.4311	X2CrNiN18-10	austenitic	
11	1.4482	X2CrMnNiMoN21-5-3	austenitic-ferritic [5]	
12	1.4401 [2]	X5CrNiMo17-12-2	austenitic	III / medium
13	1.4404 [2]	X2CrNiMo17-12-2	austenitic	
14	1.4578 [2]	X3CrNiCuMo17-11-3-2	austenitic	
15	1.4571 [2]	X6CrNiMoTi17-12-2	austenitic	
16	1.4406	X2CrNiMoN17-11-2	austenitic	
17	1.4429 [6]	X2CrNiMoN17-13-3	austenitic	
18	1.4432	X2CrNiMo17-12-3	austenitic	
19	1.4435	X2CrNiMo18-14-3	austenitic	
20	1.4362 [2]	X2CrNiN23-4	austenitic-ferritic [5]	
21	1.4062 [2]	X2CrNiN22-2	austenitic-ferritic [5]	
22	1.4162 [2]	X2CrMnNiN21-5-1	austenitic-ferritic [5]	
23	1.4662 [2]	X2CrNiMnMoCuN24-4-3-2	austenitic-ferritic [5]	
24	1.4439	X2CrNiMoN17-13-5	austenitic	IV / high
25	1.4462 [2]	X2CrNiMoN22-5-3	austenitic-ferritic [5]	
26	1.4539 [2]	X1NiCrMoCu25-20-5	austenitic	
27	1.4565	X2CrNiMnMoN25-18-6-5	austenitic	V / very high
28	1.4529 [2]	X1NiCrMoCuN25-20-7	austenitic	
29	1.4547 [2]	X1CrNiMoCuN20-18-7	austenitic	
30	1.4410 [6]	X2CrNiMoN25-7-4	austenitic-ferritic [5]	
31	1.4501 [6]	X2CrNiMoCuWN25-7-4	austenitic-ferritic [5]	
32	1.4507 [6]	X2CrNiMoCuN25-6-3	austenitic-ferritic [5]	

[1] according to DIN EN 10088-1

[2] for these steel grades higher strength classes achieved by cold-working are available according to DIN EN 1993-1-4/NA

[3] for the required corrosion resistance class see DIN EN 1993-1-4, Annex A

[4] applies to metallic bright surfaces only

[5] austenitic-ferritice steel grades are also called duplex steel grades

[6] there are no information to 0,2%-proof strength and tensile strength for these steel grades in DIN EN 1993-1-4 or in DIN EN 1993-1-4/NA

Table 2 Overview of fastening elements in stainless steels

Steel grade			Micro-structure	Group	Corrosion resistance class	max. available nominal diameter for fasteners [2] according to DIN EN ISO 3506-1 and for nuts according to DIN EN ISO 3506-2 Strength class			
No [1]	Material number	Short name				50	70	80	100
2	1.4016	X6Cr17	ferritic	F1	I low	≤ M24	---	---	---
4	1.4301	X5CrNi18-10	austenitic	A2	II moderate	≤ M64	≤ M45	≤ M39	---
6	1.4307	X2CrNi18-9	austenitic	A2		≤ M64	≤ M45	≤ M39	---
7	1.4567	X3CrNiCu18-9-4	austenitic	A2		≤ M39	≤ M39	≤ M39	---
8	1.4541	X6CrNiTi18-10	austenitic	A3		≤ M64	≤ M39	≤ M39	---
12	1.4401	X5CrNiMo17-12-2	austenitic	A4	III medium	≤ M64	≤ M45	≤ M39	≤ M39
13	1.4404	X2CrNiMo17-12-2	austenitic	A4		≤ M64	≤ M45	≤ M39	≤ M39
14	1.4578	X3CrNiCuMo17-11-3-2	austenitic	A4		≤ M39	≤ M39	≤ M39	≤ M39
15	1.4571	X6CrNiMoTi17-12-2	austenitic	A5		≤ M64	≤ M45	≤ M39	≤ M39
19	1.4435	X2CrNiMo18-14-3	austenitic	A4		≤ M36	≤ M36	≤ M36	≤ M30
20	1.4362	X2CrNiN23-4	duplex	D4		---	≤ M64	≤ M39	≤ M39
21	1.4062	X2CrNiN22-2	duplex	D4		---	≤ M39	≤ M39	≤ M39
22	1.4162	X2CrMnNiN21-5-1	duplex	D4		---	≤ M39	≤ M39	≤ M39
23	1.4662	X2CrNiMnMoCuN24-4-3-2	duplex	D4		---	≤ M39	≤ M39	≤ M39
24	1.4439	X2CrNiMoN17-13-5	austenitic	A8	IV high	≤ M64	≤ M39	≤ M39	≤ M39
25	1.4462	X2CrNiMoN22-5-3	duplex	D6		---	≤ M64	≤ M39	≤ M39
26	1.4539	X1NiCrMoCu25-20-5	austenitic	A8		≤ M64	≤ M45	≤ M39	≤ M39
27	1.4565	X2CrNiMnMoN25-18-6-5	austenitic	--- [3]	V very high	≤ M64	≤ M64	≤ M39	≤ M39
28	1.4529	X1NiCrMoCuN25-20-7	austenitic	A8		≤ M64	≤ M45	≤ M39	≤ M39
29	1.4547	X1CrNiMoCuN20-18-7	austenitic	A8		≤ M39	≤ M39	≤ M39	≤ M39
30	1.4410	X2CrNiMoN25-7-4	duplex	D8		---	≤ M39	≤ M39	≤ M39
31	1.4501	X2CrNiMoCuWN25-7-4	duplex	D8		---	≤ M39	≤ M39	≤ M39
32	1.4507	X2CrNiMoCuN25-6-3	duplex	D8		---	≤ M39	≤ M39	≤ M39

[1] According to Annex 1, Table 1

[2] According to DIN EN ISO 3506, the term fasteners includes screws with shank and with thread to head, studs and threaded bolts

[3] Because there are no regulations so far, these steel grades shall be marked with the material number.

Table 3 Mechanical properties of the products after cold working

Strength class	Steel grade [1]		$R_{p0,2}$ [N/mm²]	R_m [N/mm²]	A_5 [2] [%]	
	No. acc. to Table 1	Material number			Strip, plate flat products	Rods, wire, pipes, sections, hollow sections
S275	1	1.4003	275	550	-	25
	2	1.4016			-	25
	4	1.4301			40	25
	6	1.4307			40	25
	7	1.4567			-	25
	8	1.4541			40	25
	12	1.4401			40	25
	13	1.4404			40	25
	14	1.4578			-	25
	15	1.4571			40	25
	26	1.4539			40	25
S355	1	1.4003	350	600	-	20
	4	1.4301			30	20
	6	1.4307			30	20
	7	1.4567			-	20
	8	1.4541			30	20
	12	1.4401			30	20
	13	1.4404			30	20
	14	1.4578			-	20
	15	1.4571			30	20
	26	1.4539			-	20
	28	1.4529			30	30
	29	1.4547			30	-
S460	1	1.4003	460	600	-	10
	4	1.4301		650	20	12
	6	1.4307		650	20	12
	7	1.4567		650	-	12
	8	1.4541		650	20	12
	9	1.4318		650	20	12
	12	1.4401		650	20	12
	13	1.4404		650	20	12
	14	1.4578		650	-	12
	15	1.4571		650	20	12
	26	1.4539		650	-	12
	28	1.4529		650	-	22
S690	13	1.4404	690	800	-	10
	15	1.4571		800	-	10
	20	1.4362		800	-	10
	21	1.4062		800	-	10
	22	1.4162		800	-	10
	23	1.4662		800	-	10
	25	1.4462		800	-	10
	26	1.4539		800	-	10
	27	1.4565		800	-	10
	28	1.4529		850	-	15

[1] For steel grades not listed DIN EN 1993-1-4 and DIN EN 1993-1-4/NA do not provide provisions for products in cold-worked state.

[2] If no value is given, the product is not available in this strength class or is not available in cold-worked state.

Table 4 Filler materials for welding of stainless steels

Parent material	**Rod electrode acc. to DIN EN ISO 3581**	**Wire electrodes, wire and rods acc. to DIN EN ISO 14343**	**Filler wire electrodes acc. to DIN EN ISO 17633**
1.4003 1.4512	19 9 L 18 8 Mn	19 9 L 18 8 Mn	19 9 L 18 8 Mn
1.4301	19 9 19 9 L 19 9 Nb	 19 9 L 19 9 Nb	 19 9 L 19 9 Nb
1.4307, 1.4306	19 9 L	19 9 L	19 9 L
1.4541, 1.4318, 1.4311	19 9 L 19 9 Nb	19 9 L 19 9 Nb	19 9 L 19 9 Nb
1.4401	19 12 2 19 12 3 L 19 12 3 Nb	 19 12 3 L 19 12 3 Nb	 19 12 3 L 19 12 3 Nb
1.4404, 1.4406 1.4429, 1.4432, 1.4435,	19 12 3 L	19 12 3 L	19 12 3 L
1.4571	19 12 3 L 19 12 3 Nb	19 12 3 L 19 12 3 Nb	19 12 3 L 19 12 3 Nb
1.4539	NiCr22Mo9Nb[1)]	20 25 5 Cu N L NiCr22Mo9Nb[2)]	-
1.4439	18 16 5 N L	18 16 5 N L	18 16 5 N L
1.4362, 1.4462 1.4662, 1.4410, 1.4501, 1.4507	22 9 3 N L	22 9 3 N L	22 9 3 N L
1.4062, 1.4162, 1.4482	22 9 3 N L 23 7 N L	22 9 3 N L 23 7 N L	22 9 3 N L 23 7 N L
1.4529	NiCr23Mo16[1)] NiCr22Mo9Nb[1)]	NiCr23Mo16Cu2[2)] NiCr22Mo9Nb[2)]	-
1.4547, 1.4565	NiCr22Mo9Nb[1)]	NiCr22Mo9Nb[2)]	-

[1)] according to DIN EN ISO 14172:2016-02
[2)] according to DIN EN ISO 18274:2011-04

Table 5 Allocation of filler material to mixed joints between austenitic steels and ferritic steel grades with material number 1.4003 and 1.4512

1	2	3	4
Rod electrodes acc. to DIN EN ISO 3581	**Wire electrodes, wire and rods acc. to DIN EN ISO 14343**	**Filled wire electrodes acc. to DIN EN ISO 17633**	**Yield strength $f_{y,k}$ [1)]** **N/mm²**
23 12 L	23 12 L	23 12 L	320
23 12 2 L	23 12 2 L	23 12 2 L	350
20 10 3	20 10 3	20 10 3	400
18 8 Mn	18 8 Mn	18 8 Mn	350
NiCr20Mn3Nb[2)]	NiCr20Mn3Nb[3)]	-	355
NiCr16Fe12NbMo[2)]	NiCr20Mo15[3)]		355

1) Shall be used as characteristic value for calculation of load bearing capacity of welded joins.
2) according to DIN EN ISO 14172:2016-02
3) according to DIN EN ISO 18274:2011-04

Table 6 Allocation of filler material to mixed joints between stainless steels with the material numbers 1.4003, 1.4512, 1.4301, 1.4306, 1.4311, 1.4482, 1.4307, 1.4401,1.4541, 1.4571, 1.4404, 1.4406, 1.4429, 1.4432, 1.4435,1.4318, 1.4539, 1.4547, 1.4439, 1.4529, 1.4565 and carbon steels/fine grain steels

1	2	3	4
Rod electrodes acc. to DIN EN ISO 3581	**Wire electrodes, wire and rods acc. to DIN EN ISO 14343**	**Filled wire electrodes acc. to DIN EN ISO 17633**	**Yield strength $f_{y,k}$ [1)]** **N/mm²**
18 8 Mn	18 8 Mn	18 8 Mn	350
20 10 3	20 10 3	20 10 3	400
23 12 L	23 12 L	23 12 L	320
23 12 2 L	23 12 2 L	23 12 2 L	350
NiCr20Mn3Nb[2)]	NiCr20Mn3Nb[3)]	-	355
NiCr16Fe12NbMo[2)]	NiCr20Mo15[3)]		355
NiCr23Mo16[2)]	NiCr23Mo16Cu2[3)]	-	355
NiCr22Mo9Nb[2)]	NiCr22Mo9Nb[3)]		355
NiCr19Mo15[2)]	NiCr20Mo15[3)]	-	355

1) Shall be used as characteristic value for calculation of load bearing capacity of welded joins.
2) according to DIN EN ISO 14172:2016-02
3) according to DIN EN ISO 18274:2011-04

Table 7 Allocation of filler material to mixed joints between austenitic-ferritic steels and austenitic steels as well as carbon steels/fine grain steels

1	2	3	4
Rod electrodes acc. to DIN EN ISO 3581	**Wire electrodes, wire and rods acc. to DIN EN ISO 14343**	**Filled wire electrodes acc. to DIN EN ISO 17633**	**Yield strength $f_{y,k}$ [1)]** **N/mm²**
22 9 3 N L	22 9 3 N L	22 9 3 N L	450
NiCr20Mn3Nb[2)]	NiCr20Mn3Nb[3)]	-	355
NiCr16Fe12NbMo[2)]	NiCr20Mo15[3)]		355

1) Shall be used as characteristic value for calculation of load bearing capacity of welded joins.
2) according to DIN EN ISO 14172:2016-02
3) according to DIN EN ISO 18274:2011-04

Table 8 Maximum thickness for welded structural components

Plate, strip and hollow sections			**Rods and wire, extruded and cold-formed sections**		
No. acc. to Table 1	Material number	max t[1)] mm	No. acc. to Table 1	Material number	max t[1)] mm
1	1.4003	12	1	1.4003	25
4	1.4301	6[2)]	4	1.4301	25[2)]
12	1.4401		12	1.4401	
6	1.4307	30	6	1.4307	45
8	1.4541		8	1.4541	
9	1.4318		9	1.4318	
13	1.4404		13	1.4404	
15	1.4571		15	1.4571	
24	1.4439	12	24	1.4439	25
26	1.4539		26	1.4539	
27	1.4565		27	1.4565	
28	1.4529		28	1.4529	
29	1.4547				
20	1.4362	30	20	1.4362	45
21	1.4062	30	21	1.4062	40
22	1.4162	30	22	1.4162	40
23	1.4662	30	23	1.4662	40
25	1.4462	30	25	1.4462	45

1) For larger thicknesses a welding procedure qualification for each thickness and kind of welded joint is required.
2) For larger thicknesses the resistance against intergranular corrosion shall be proved according to DIN EN ISO 3651.

Table 9 Available product forms for the single strength classes

No.	Material number	Strength class [1] and product forms [2]				
		S235	S275	S355	S460	S690
1	1.4003	B, Ba, H, P	D, H, S, W	D, S	D, S	---
2	1.4016	D, S, W	---	---	---	---
4	1.4301	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	B, Ba, D, H, S	Ba, D, H, S	S
6	1.4307	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	Ba, D, H, S	Ba, D, S	S
7	1.4567	D, S, W	D, S	D, S	D, S	---
8	1.4541	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	Ba, D, H, S	Ba, D, H, S	---
9	1.4318	---	---	B, Ba, D, H, P, S	B, Ba, H	---
12	1.4401	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	Ba, D, H, S	Ba, D, S	S
13	1.4404	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	Ba, D, H, S	Ba, D, H, S	D, S
14	1.4578	D, S, W	D, S	D, S	D, S	---
15	1.4571	B, Ba, D, H, P, S, W	B, Ba, D, H, P, S	Ba, D, H, S	Ba, D, H, S	D, S
20	1.4362	---	---	---	B, Ba, D, S, W	D, S
21	1.4062	---	---	---	B, Ba, D, S, W	D, S
22	1.4162	---	---	---	B, Ba, D, S, W	D, S
23	1.4662	---	---	---	B, Ba, D, S, W	D, S
24	1.4439	---	B, Ba, D, H, S, W	---	---	---
25	1.4462	---	---	---	B, Ba, D, P, S, W	D, S
26	1.4539	B, Ba, D, H, P, S, W	B, Ba, D, P, S	D, P, S	D, S	D, S
27	1.4565	---	---	---	B, Ba, D, S	---
28	1.4529	---	B, D, S, W	B, D, H, P, S	D, P, S	D, S
29	1.4547	---	B, Ba	B, Ba	---	---

[1] The strength classes higher than the lowest are achieved by cold-working.

[2] B = Plate; Ba = Strip and plates made of strips; D = Wire, drawn; H = Hollow sections; P = Sections; S = Rods; W = Wire, rolled

For steel grades not listed in Table 9 DIN EN 1993-1-4 and DIN EN 1993-1-4/NA do not provide provisions for products in cold-worked state. If required, the availability of product forms of these steel grads should be asked at the mills or at the stockists.

The delivery of the cross marked products requires to full fill the specific provisions to the verification of conformity of this national technical approval.

Company		Plate	Strip		Long products[1)]		Wire		Sections[2]	Hollow sections (pipes)	Fastening elements and dowels
Name	**Postcode/Location Internet**		**cold rolled**	**hot rolled**	**rolled**	**drawn (bright steel)**	**rolled**	**drawn**			
Aperam Stainless Services & Solutions Germany GmbH	D-42781 Haan www.aperam.com	X	X	X							
Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG	D-58452 Witten www.dew-stahl.com				X	X	X	X			
EWG Edelstahlschraubenfabrik Winterberg GmbH	D-42 Wuppertal www.ewg-winterberg.de				X	X					X
Hagener Feinstahl GmbH	D-58089 Hagen www.hagener-feinstahl.de					X	X	X			
Wilhelm Modersohn GmbH & Co. KG	D-32139 Spenge www.modersohn.eu								X	X	X
Montanstahl AG	CH-6855 Stabio www.montanstahl.com				X	X			X		
Outokumpu Nirosta GmbH	D-47807 Krefeld www.outokumpu.com	X	X	X	X	X	X	X			
Friedrich Schroeder GmbH & Co. KG	D-58809 Neuenrade www.schroeder-neuenrade.de										X
Tobsteel GmbH	D-74613 Öhringen www.tobsteel.com										X
Valbruna Edel Inox GmbH	D-41542 Dormagen www.valbruna.de				X	X	X	X			
Walzwerke Einsal GmbH	D-58769 Nachrodt www.einsal.com				X	X		X	X		

1) forged long products as well

2) hot rolled and also from hot rolled plates cut profiles, edged/bended profiles, laser beam welded profiles as well as hot extruded special profiles

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