

COLD-ROLLED STEEL STRIP

BY voestalpine

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INTRODUCTION

These Technical Terms of Delivery provide a general overview of the production possibilities in the cold rolling mills. The large-scale investment programme in the cold-rolling mill in the amount of EUR 300 million was successfully completed over the past six years. The pickling-tandem link that went into operation in 1997 allows the tightest tolerances in thickness. Startup of the continuous annealing furnace in 1998 widens the spectrum of available product characteristics, weldability and paintability, thus considerably improving the corrosion protection of cold-rolled steel strip. The electron-beam texturing facility that went into operation in 1998 allows delivery of deterministic and pseudo-stochastic surface structures with the narrowest spreads of roughness values.

These technologies make it possible for us to keep up with and make substantial contributions to the developments in the market. These terms of delivery are based on the currently valid standards applicable in the European Union. It is our highest objective to provide steel grades with the qualities that ensure cost-effective and optimal processing to our customers. To achieve this we employ the most economical manufacturing technologies.

The responsible technical department is prepared to review any requirements that go beyond the terms of delivery or conventional shapes. Your contact partners in the responsible sales sectors or technical areas are available at any time to answer your inquiries.

STEEL GRADES

The following contains a general description of the available steel grades and their respective areas of application. All steel grades (with the exception of steels suitable for enamelling) are generally available as uncoated cold-rolled wide strip as well

as electrogalvanised steel strip and/or with corrosion protective coating on one or both sides. Based on specific plant limitations of the electrogalvanising line with respect to the steel grade and coating, some dimensions may not be available.

MILD STEELS FOR COLD FORMING

Mild steels for cold forming make up the largest share of the cold-rolled flat-products market segment. These steel grades are divided into groups according to their cold-forming behaviour and maximum yield

stress. The steel grades standardised in the European Union are contained in the edition of EN 10130/99 for uncoated cold-rolled wide strip.

MECHANICAL PROPERTIES

Mild Steels for Cold Forming

Steel Grade ¹⁾	0.2 %-Yield Strength ^{1) 2)} R _{p 0.2} [MPa]	Tensile Strength R _m [MPa]	Fracture Elongation ³⁾ A ₈₀ (min) [%]	Vertical Anisotropy r ^{4) 5)} (min)	Work hardening exponent n ₁₀₋₂₀ (UE) ⁴⁾ (min)
DC 01	140–280	270–410	28	–	–
DC 03	140–240	270–370	34	1.3	–
DC 04	140–210	270–350	38	1.6	0.18
DC 05	140–180	270–330	40	1.9	0.20
DC 06	120–180	270–350	38	r _m min. 1.8	n _m min. 0.22
DC 07	120–150	260–330	42	r _m min. 2.0	n _m min. 0.23

¹⁾ If the yield point is pronounced, the lower yield point R_{eL} applies.

²⁾ Maximum values of roughly 20 MPa higher are permissible for the 0.2% yield point at thicknesses 0.5 < d ≤ 0.7 mm.
Maximum values of roughly 40 MPa higher are permissible for the 0.2% yield point at thicknesses ≤ 0.5 mm.

³⁾ Lower minimum values by two units are permissible for the yield point at thicknesses 0.5 < d ≤ 0.7 mm.
Lower minimum values by four units are permissible for the yield point at thicknesses ≤ 0.5 mm.

⁴⁾ r₉₀ and n₉₀ or r_m and n_m values apply only to thicknesses ≥ 0.5 mm.

⁵⁾ The r or r_m value is minimised by 0.2 for thicknesses > 2 mm.

⁶⁾ To the extent that no other agreements are made at the time of the order, grades DC 01, DC 03, DC 04 and DC 05 can be delivered as alloyed steels (with boron, titanium, etc.).

The chemical composition complies with the standards defined in EN 10130/99. The standard in DC 06 also applies to DC 07. The mechanical properties apply to sample specimens and only to cold re-rolled condition.

Areas of Application

- DC 01: Application for edging and simple drawing operations (such as for diverse parts in the household appliance industry, barrels, radiators)
- DC 03: Application for simple deep drawing operations (such as for deep-drawn parts in the household appliance industry, more complicated radiators)
- DC 04: Application for simple internal and external automotive parts, more complicated parts in the household appliance industry (such as fronts with porthole doors)
- DC 05: Application for difficult interior and exterior automotive parts
- DC 06: Application for most difficult automotive parts (such as oil pans, side panels, interior door parts)
- DC 07: Application for extremely complicated deep-drawn parts for fast-running, highly automated press lines.

The values for the mechanical characteristics apply for a period of six months for the following steel grades: DC 03, DC 04, DC 05, DC 06 and DC 07.

Longer storage times for products of steel grade DC 01 can lead to alterations in the mechanical properties, particularly to the limited possibility of proper cold forming behaviour.

Freedom from Flow Lines

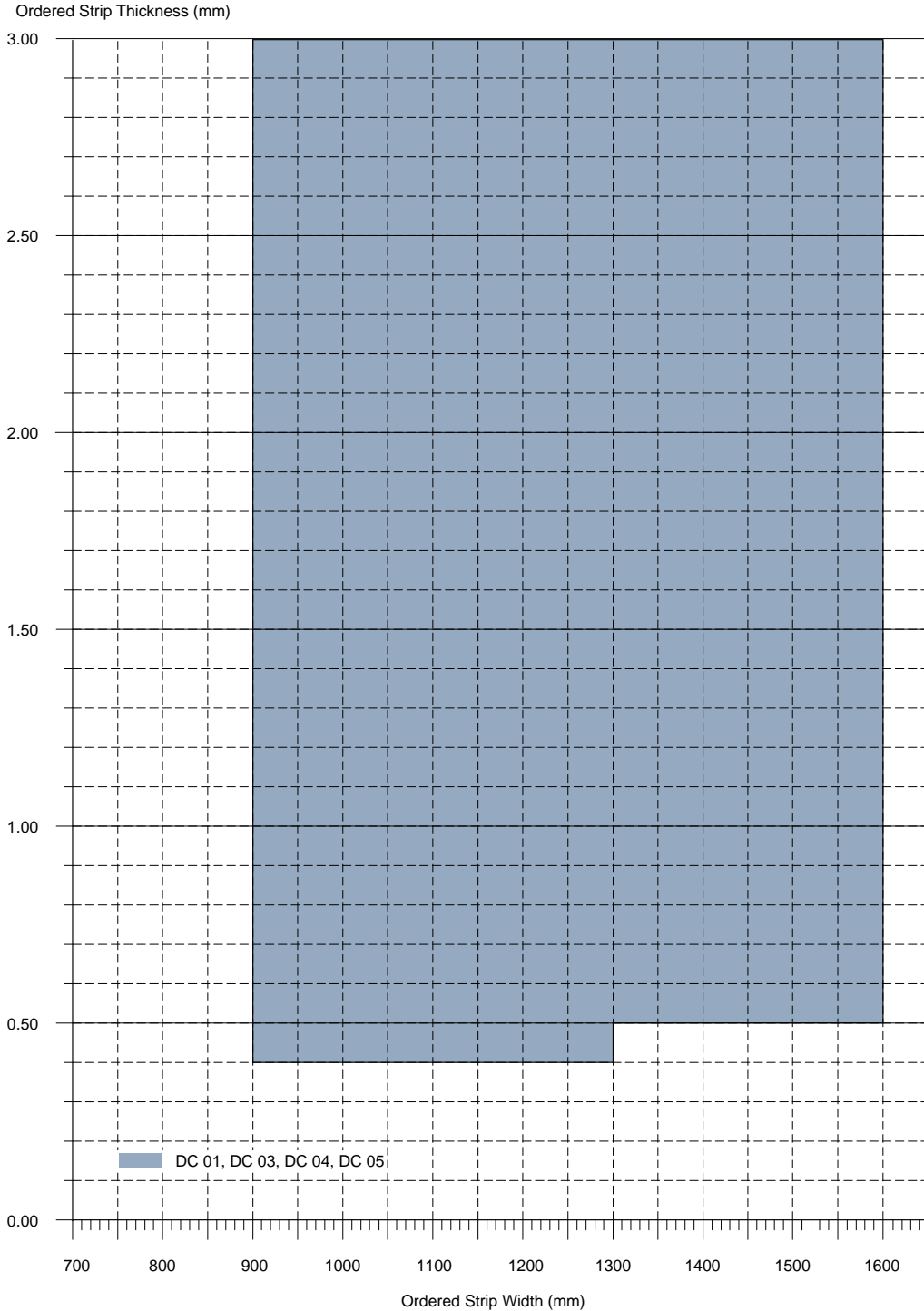
Generally the products are lightly cold re-rolled after annealing in order to avoid flow lines. However, the tendency toward the formation of flow lines can occur once again some time after cold-rolling, for which reason it is in the interest of the consumer to process the products as soon as possible. Products made of steel grades DC 06 and DC 07 show no flow lines. This holds true for cold re-rolled as well as for non-cold re-rolled products.

The following maximum time periods apply for freedom from flow lines:

- Six months after availability of products from steel grades DC 03, DC 04 and DC 05 with surface types A and B
- Three months after availability of products from steel grades DC 03, DC 04 and DC 05 with surface types A and B.

AVAILABLE DIMENSIONS MILD STEELS

DC 01, DC 03, DC 04, DC 05



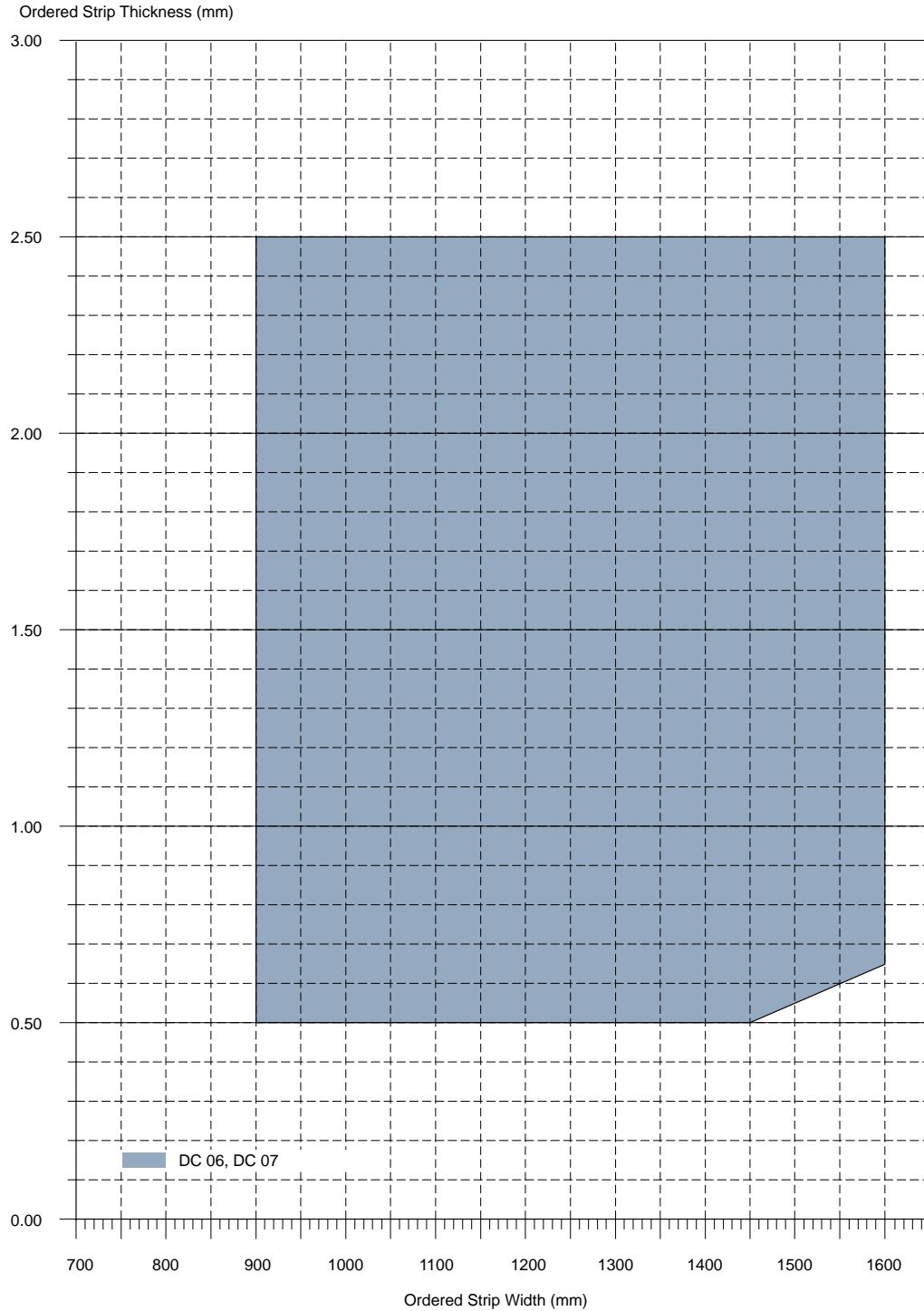
The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

AVAILABLE DIMENSIONS MILD STEELS

DC 06, DC 07



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

HIGHER-STRENGTH STEELS FOR COLD FORMING

A massive trend towards applying higher-strength steels in interior components as well as in the area of the exterior shell has been recognisable in the automotive industry during the past few years. In following this trend, voestalpine Stahl GmbH have introduced to their delivery programme all steel grade families on the market.

New standards are being worked on at a European level in this area. These have been taken into consideration during the creation of these technical terms of delivery. Should you have any further requirements, we ask that you make a respective inquiry.

The mechanical properties of dual-phase, partially martensitic and TRIP steels shall apply for a period of three months. The properties of all other steel grades shall remain valid for up to six months from the time the products are dispatched for delivery.

Freedom from flow lines is guaranteed for a period of three months for all steel grades for which a bake-hardening effect has been guaranteed. A guarantee period of six months from the time the products are dispatched for delivery shall apply to all other steel grades, with the exception of micro-alloyed steels.

The European Norm prEN10325 entitled "Determination of Yield Strength through the Effect of Heat (Bake-Hardening Effect)" is currently being defined.

In the event that the following sections do not fulfil the concrete requirements of the client with respect to the listed steel grades, we ask that a corresponding inquiry be sent to us.

Some steel grades have already been introduced into the delivery programme, however delivery cannot be made until the technical discussion has been completed and an inquiry made.

MICROALLOYED STEELS

Cold-rolled flat products of the HnnnLA series are micro-alloyed fine-grain steels with special cold-forming properties. This material group covers the upper hardness range of the higher-strength cold-rolled sheet, beginning with the guaranteed yield

strength from 260 Mpa up to and including 420 Mpa. The high strength properties of this group of steel grades are adjusted by means of micro-alloying Nb and Ti individually or in combination.

MECHANICAL PROPERTIES

Micro-alloyed higher-strength steels (prEN 10268)

Steel Grade prEN 10268	0.2 %-Yield Strength ^{1) 2)} R _{p0.2} [MPa]	Tensile Strength ²⁾ R _m [MPa]	Fracture Elongation ^{2) 3)} A ₈₀ (min) [%]
H260LA	260–330	350–430	26
H300LA	300–380	380–480	23
H340LA	340–420	410–510	21
H380LA	380–480	440–560	19
H420LA	420–520	470–590	17

¹⁾ If the yield point is pronounced, the lower yield point R_{eL} applies.

²⁾ If agreed upon at the time the order is placed, lower yield point values by 20 MPa, lower tensile strength values by 10 MPa and higher fracture elongation values by 1% will apply for longitudinal test specimens.

³⁾ Lower minimum values by two percent are permissible for fracture elongation at thicknesses $0.5 < d \leq 0.7$ mm.

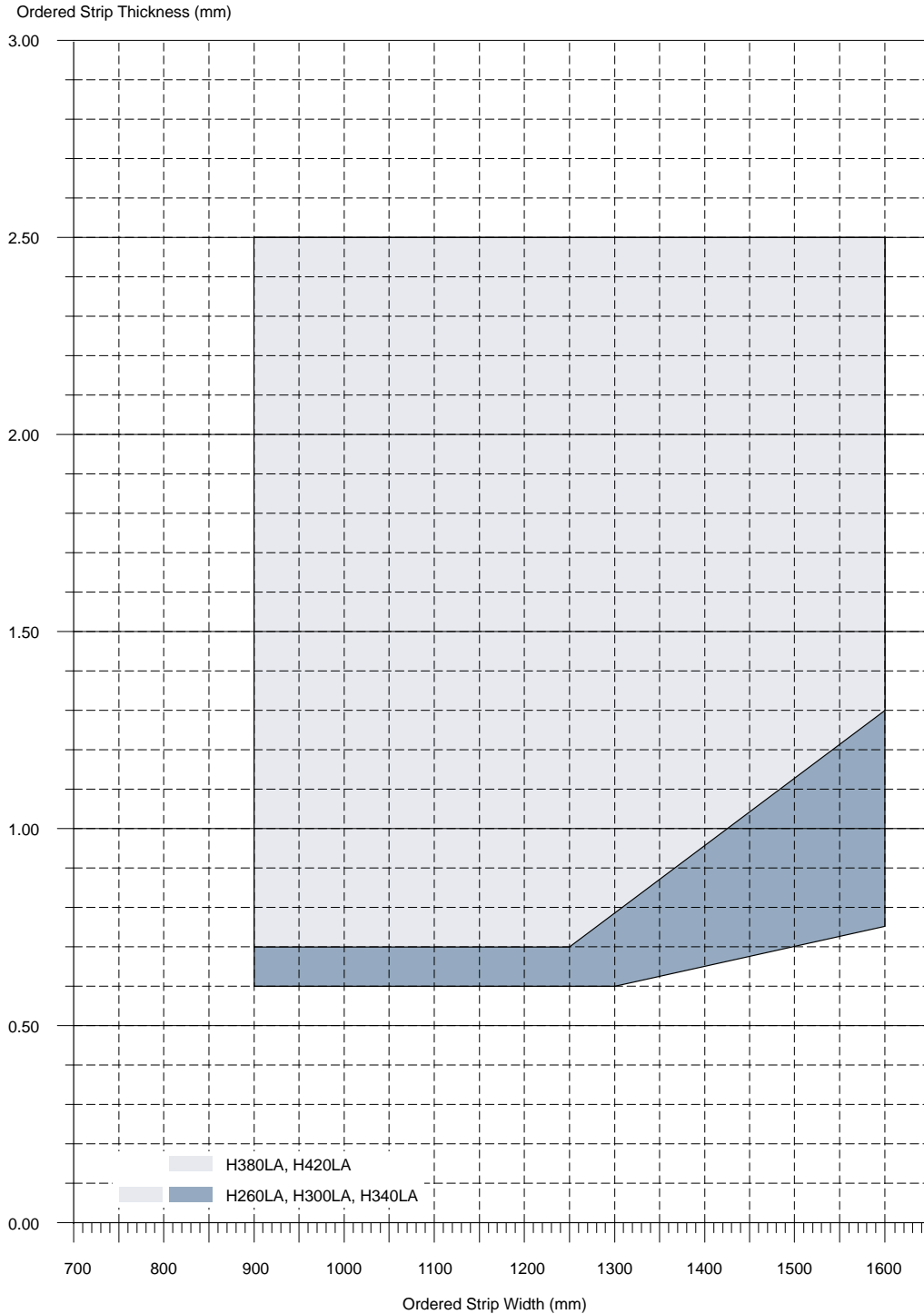
The mechanical properties apply to transverse test specimens.

The chemical composition of this group of steel grades corresponds to the defaults in prEN 10268 as well as SEW 093. This group of steel grades is already very prevalent in the automotive industry today.

Their application is found mainly in the area of crash-relevant structural components. Application in the shell area is not recommended.

AVAILABLE DIMENSIONS MICROALLOYED STEELS

H260LA, H300LA, H340LA, H380LA, H420LA



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

PHOSPHORUS-ALLOYED STEELS

Cold-rolled flat products of the HnnnP series are different from the conventional mild steels for cold forming as a result of their minimum yield strength. The increased strength properties are caused by the formation of fine grains and solid solution hardening, for which phosphorus is excellently suited.

This series of steel grades covers the yield strength range between drawing and deep-drawing grades on the one hand and the microalloyed cold-forming steels (HnnnLA) on the other.

MECHANICAL PROPERTIES

Phosphorus-alloyed steels (prEN 10268)

Steel Type	Reference grade according to SEW 094	0.2%-Yield Strength ¹⁾ R _{p0.2} [MPa]	Tensile Strength R _m [MPa]	Fracture ²⁾ Elongation A ₈₀ (min) [%]	Vertical Anisotropy r ₉₀ ³⁾ (min)	Work hardening exponent n ₁₀₋₂₀ (UE) (min)
H220P	ZStE 220 P	220–270	320–400	32	1.3	0.16
H260P	ZStE 260 P	260–320	360–440	29	-	-
H300P	ZStE 300 P	300–360	400–480	26	-	-

¹⁾ If the yield point is pronounced, the lower yield point R_{eL} applies.

²⁾ Lower minimum values by two percent are permissible for fracture elongation at thicknesses 0.5 < d ≤ 0.7 mm.

³⁾ Lower values by 0.2 are permissible the r value at thicknesses > 2 mm.

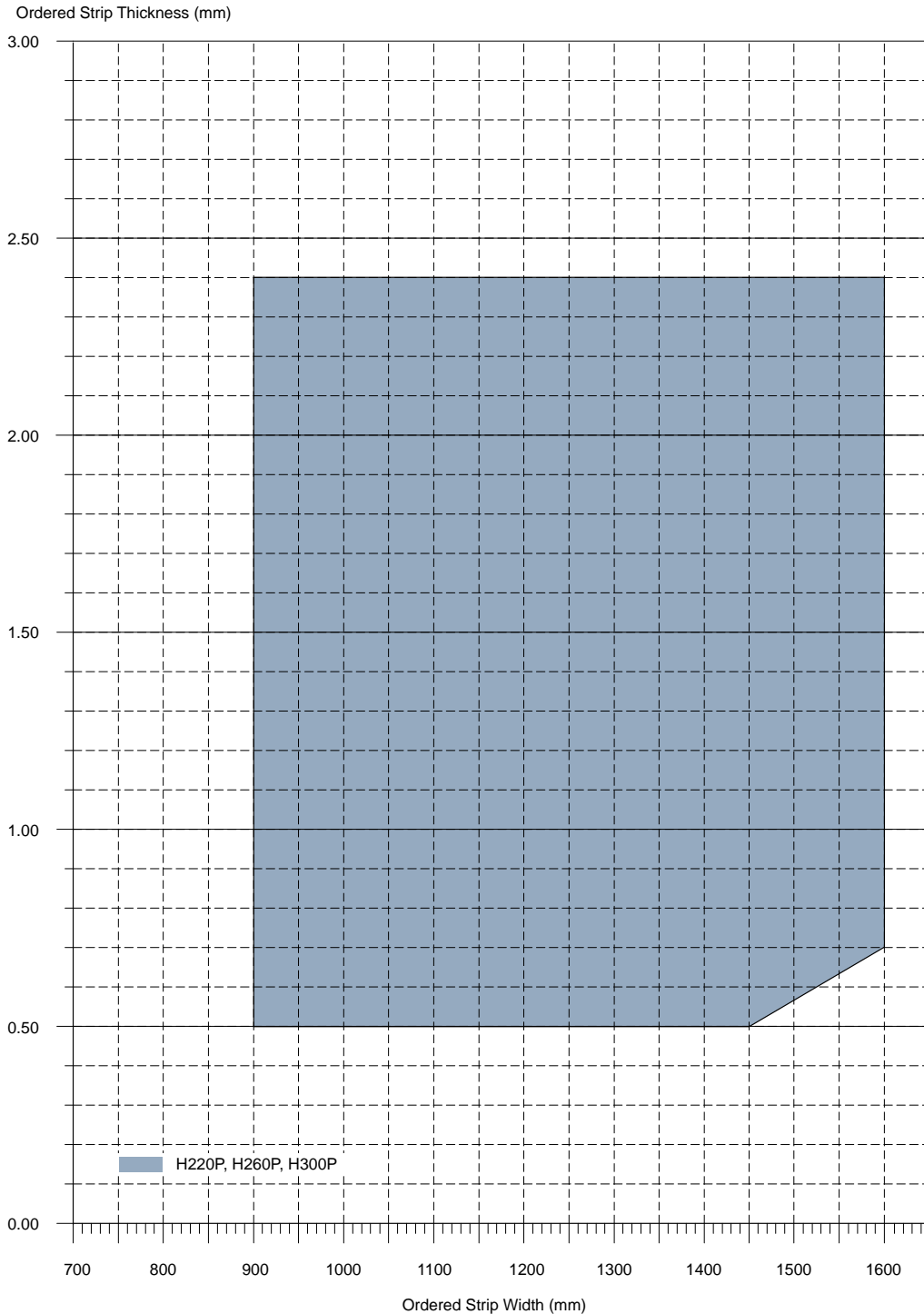
The mechanical properties apply to transverse test specimens.

The chemical composition of this group of steel grades corresponds to the defaults in prEN 10268 (see comparison of standards in the attachment). This group of steel grades is applied predominantly where higher stiffness of the material sustainably improves the processing and properties of use (such as in shelf and rack construction

or exterior parts in the household appliance industry). These steels are also suitable in the lower yield strength range (H220P) for less complex large-surface exterior shells in the automotive industry, as well as for structural components with less forming stress.

AVAILABLE DIMENSIONS PHOSPHORUS-ALLOYED STEELS

H220P, H260P, H300P



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

BAKE-HARDENING STEELS

This steel grade group has gained much more significance during the past few years in the automotive industry in interior as well as exterior components. HnnnB steels are characterised by their excellent ductility and the advantage of the additionally increased yield strength with respect to the bake-hardening effect. This enables a large range of applications in the manufacturing of car bodies.

While the higher classes of yield strength (H260B, H300B) are primarily intended for interior components, the H180B and H220B steel grades are especially suitable for exterior car bodies because the bake-hardening effect in these steels when compared to mild steels yields significantly improved dent resistance. Dent stiffness (increased E module) can also be increased.

MECHANICAL PROPERTIES

Bake-hardening steels (prEN 10268)

Steel Type	Reference grade according to SEW 094	0.2 %-Yield Strength ¹⁾ R _{p 0.2} [MPa]	Tensile Strength R _m [MPa]	Fracture Elongation ²⁾ A ₈₀ (min) [%]	Vertical Anisotropy r ₉₀ (min)	Work hardening exponent n ₁₀₋₂₀ (UE) (min)	Bake hardening Value BH ₂ (min) [MPa]
H180B	ZStE 180 BH	180-230	300-360	34	1.6	0.17	40
H220B	ZStE 220 BH	220-270	320-400	32	1.5	0.16	35
H260B	ZStE 260 BH	260-320	360-440	29	–	–	35
H300B	ZStE 300 BH	300-360	400-480	26	–	–	30

¹⁾ If the yield point is pronounced, the lower yield point R_{eL} applies.

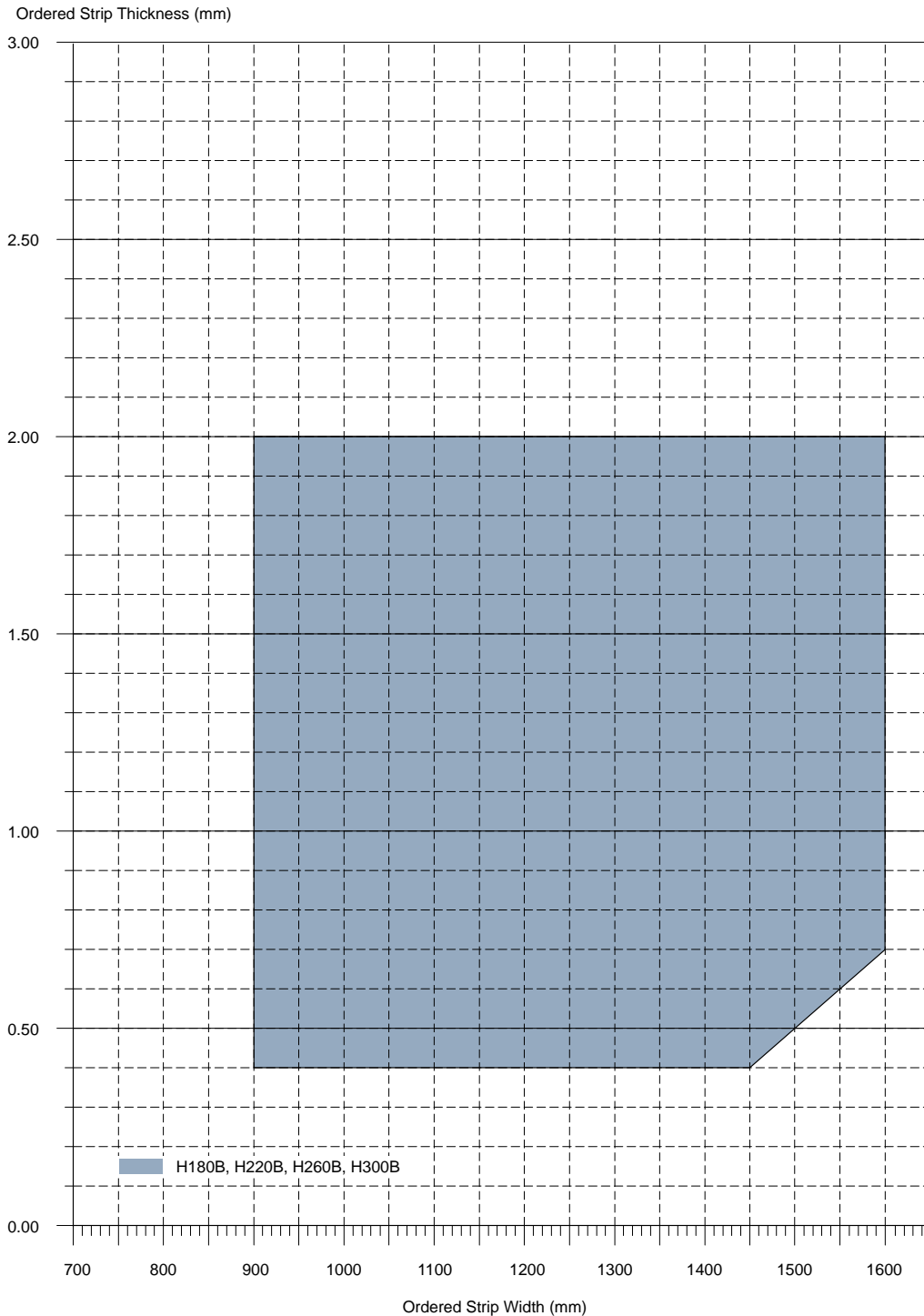
²⁾ Lower minimum values by two percent are permissible for fracture elongation at thicknesses 0.5 < d ≤ 0.7 mm.

The mechanical properties apply to transverse test specimens.

The chemical composition of this group of steel grades corresponds to the defaults in prEN 10268 (see comparison of standards in the attachment).

AVAILABLE DIMENSIONS BAKE-HARDENING STEELS

H180B, H220B, H260B, H300B



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

ISOTROPIC STEELS

A cooperation agreement for the further development, marketing and sales of I steels makes it possible for voestalpine Stahl GmbH to offer this family of higher-strength steels with a yield strength ranging between 220 and 310 Mpa. The I stands for isotropic. This isotropy leads to a homogenous flow in all directions of strain during forming and thus leads to excellent stretch forming behaviour.

This group of steel grades is generally intended for exterior components. However, forming properties are downgraded to a certain extent because of the required high degree of tempering in comparison to interior applications.

MECHANICAL PROPERTIES

Isotropic Steels

Steel Type	0.2 %-Yield Strength ¹⁾ $R_{p0.2}$ [MPa]	Tensile Strength R_m [MPa]	Fracture Elongation ²⁾ A_{80} (min) [%]	Work hardening exponent n_{10-20} (UE) ³⁾ (min)
H220I	220–270	300–380	34	0.18
H260I	260–310	320–400	32	0.17

¹⁾ If the yield point is pronounced, the lower yield point R_{eL} applies.

²⁾ Lower minimum values by two percent are permissible for thicknesses of ≤ 0.7 mm.

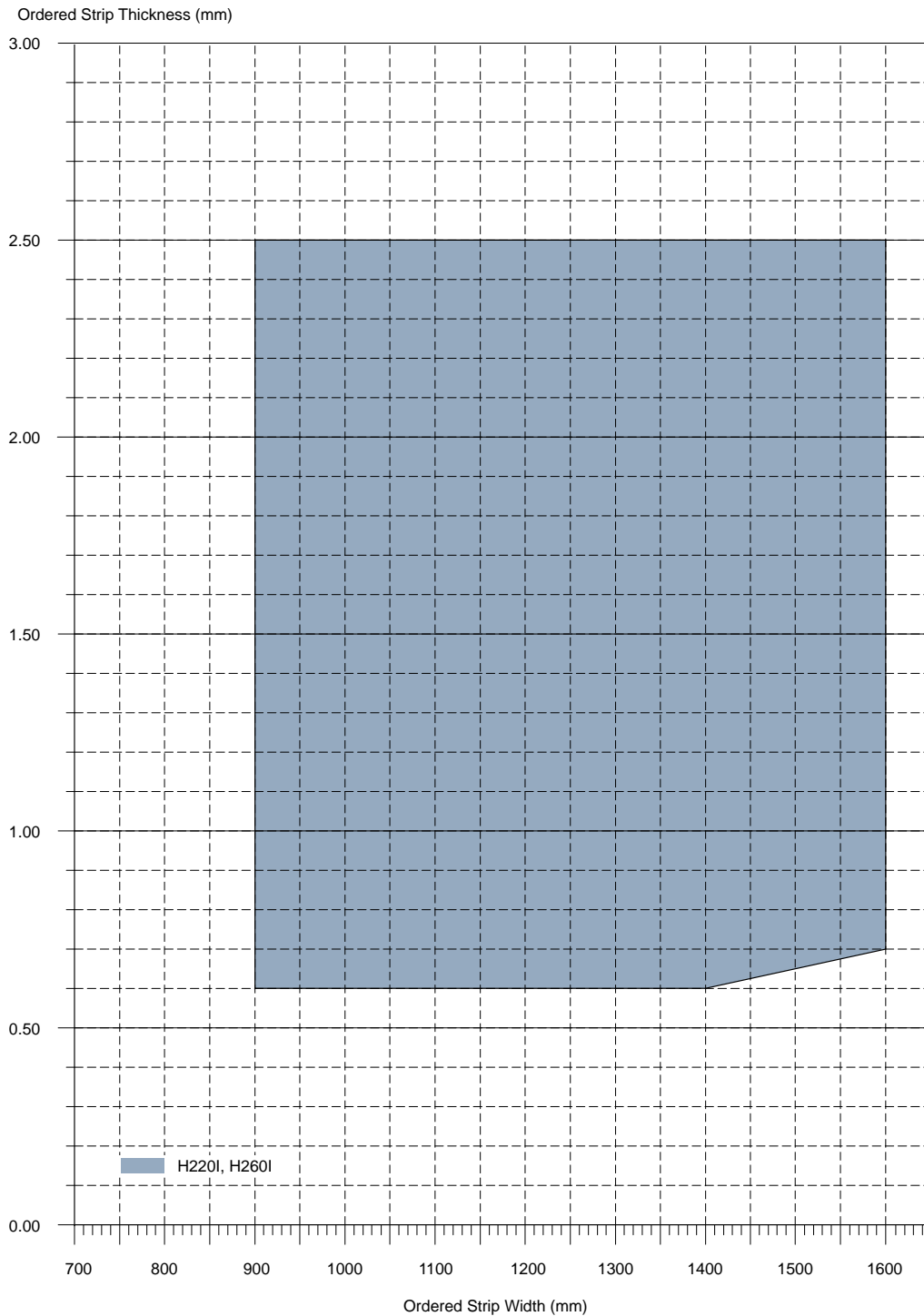
³⁾ Lower minimum values by 0.01 are permissible the n value for surface type B.

The mechanical properties apply to transverse test specimens.

The chemical composition of this group of steel grades corresponds to the defaults in prEN 10268 (see comparison of standards in the attachment).

AVAILABLE DIMENSIONS ISOTROPIC STEELS

H220I, H260I



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

HIGHER-STRENGTH IF STEELS

Higher-strength interstitial-free steels are based on basic vacuum-decarburised IF analysis stabilised with Ti and/or Nb and used to determine the desired hardness ranges with P and Mn. This basic IF analysis lends this group of steel grades higher values of vertical anisotropy (r value) when compared to other steel grades. The anisotropy value is important for deep-drawing strain.

Particularly the high r values in diagonal direction lead to a certain degree of isotropic behaviour during forming. The main area of application for higher-strength interstitial-free steels is found in formed automotive components, such as in the interior wheel arch, longitudinal supports that are difficult to form, or in bottom plates in the area of the tunnel. The manufacturing route through the continuous annealing line in connection with the excellent forming properties also predestines this steel grade for exterior skin applications such as doors, hatches and roofs.

MECHANICAL PROPERTIES

Higher-Strength Interstitial-Free Steels (prEN 10268)

Steel Type	0.2 %-Yield Point $R_{p0.2}$ [MPa]	Tensile Strength R_m [MPa]	Fracture Elongation ¹⁾ A_{80} (min) [%]	Vertical Anisotropy r_{90} (min)	Work hardening exponent n_{10-20} (UE) (min)
H180Y	180–230	340–400	36	1.7	0.19
H220Y	220–270	350–420	34	1.6	0.18
H260Y	260–320	380–440	32	1.4	0.17

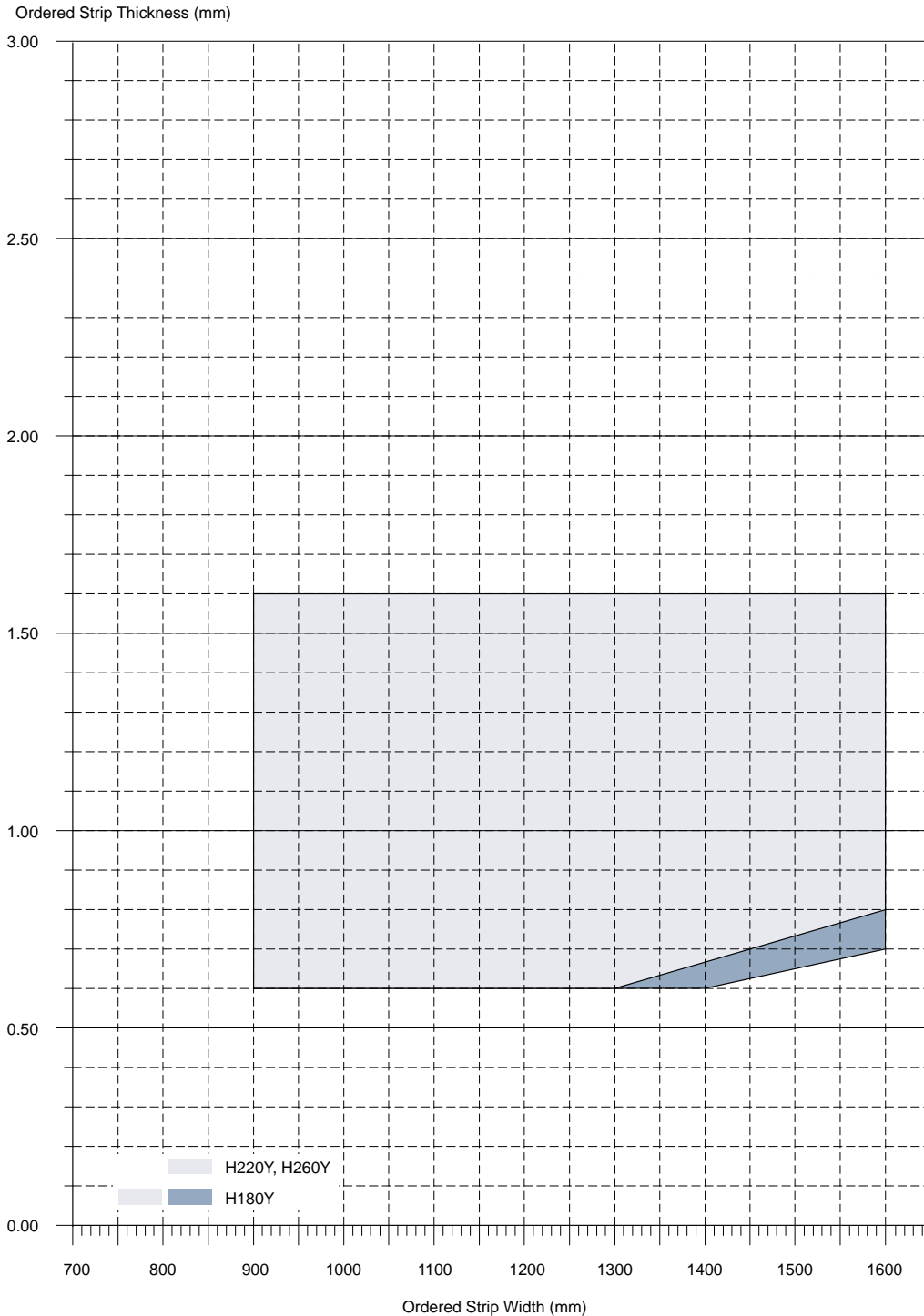
¹⁾ Lower minimum values by two percent are permissible for fracture elongation at thicknesses $0.5 < d \leq 0.7$ mm.

The mechanical properties apply to transverse test specimens.

The chemical composition of this group of steel grades corresponds to the defaults in prEN 10268 (see comparison of standards in the attachment).

AVAILABLE DIMENSIONS HIGHER-STRENGTH IF STEELS

H180Y, H220Y, H260Y



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

DUAL PHASE STEELS

Dual-phase steels consist of a multi-phase base material microstructure of which the main components are ferrite (80–90%) and martensite (10–20%). Other phases can be available in smaller amounts. The special characteristic of dual-phase steels is that particularly low yield ultimate ratios can be obtained with high ultimate tensile strengths. Compared to microalloyed steels of the same ultimate tensile strength, this series of steel grades shows substantially higher fracture elongations and hardening exponents.

Because of the pronounced offset strain hardening, particularly at the beginning of forming, dual-phase steels are especially predestined for forming stress in the

stretch forming area. An additional positive characteristic is the achievable bake-hardening effect, which leads to an additional increase in the yield strength after forming during paint baking. This series of steel grades is currently available in five classes of tensile strength, from 450 MPa to 980 Mpa. Based on the characteristic property profile of dual-phase steels, this series of steel grades is especially suitable for crash-relevant structural components such as longitudinal supports, cross members, as well as supports for A, B or C columns.

Dual-phase steels demonstrate special potentials in significantly contributing to weight reduction as well as increased passive safety in automotive structures.

MECHANICAL PROPERTIES

Dual-Phase Steels (prEN 10336)

Steel Type	Reference grade according to SEW 097	Reference grade prEN 10336	0.2 %-Yield Point $R_{p 0.2}$ [MPa]	Tensile Strength R_m [MPa] (min)	Fracture Elongation ¹⁾ A_{80} (min) [%]	Work hardening exponent n_{10-20} (UE) (min)	Bake hardening Value BH_2 (min) [MPa]
HT450X	H 260 X	HT450X	250–330	450	27	0.16	30
HT500X	H 300 X	HT500X	290–370	500	24	0.15	30
HT600X	H 340 X	HT600X	330–410	600	21	0.14	30
HT800X ²⁾	–	HT800X	420–550	780	15	–	30
HT1000X ²⁾	–	HT1000X	550–700	980	10	–	30

¹⁾ Lower minimum values by two percent are permissible for fracture elongation at a product thickness of ≤ 0.7 mm.

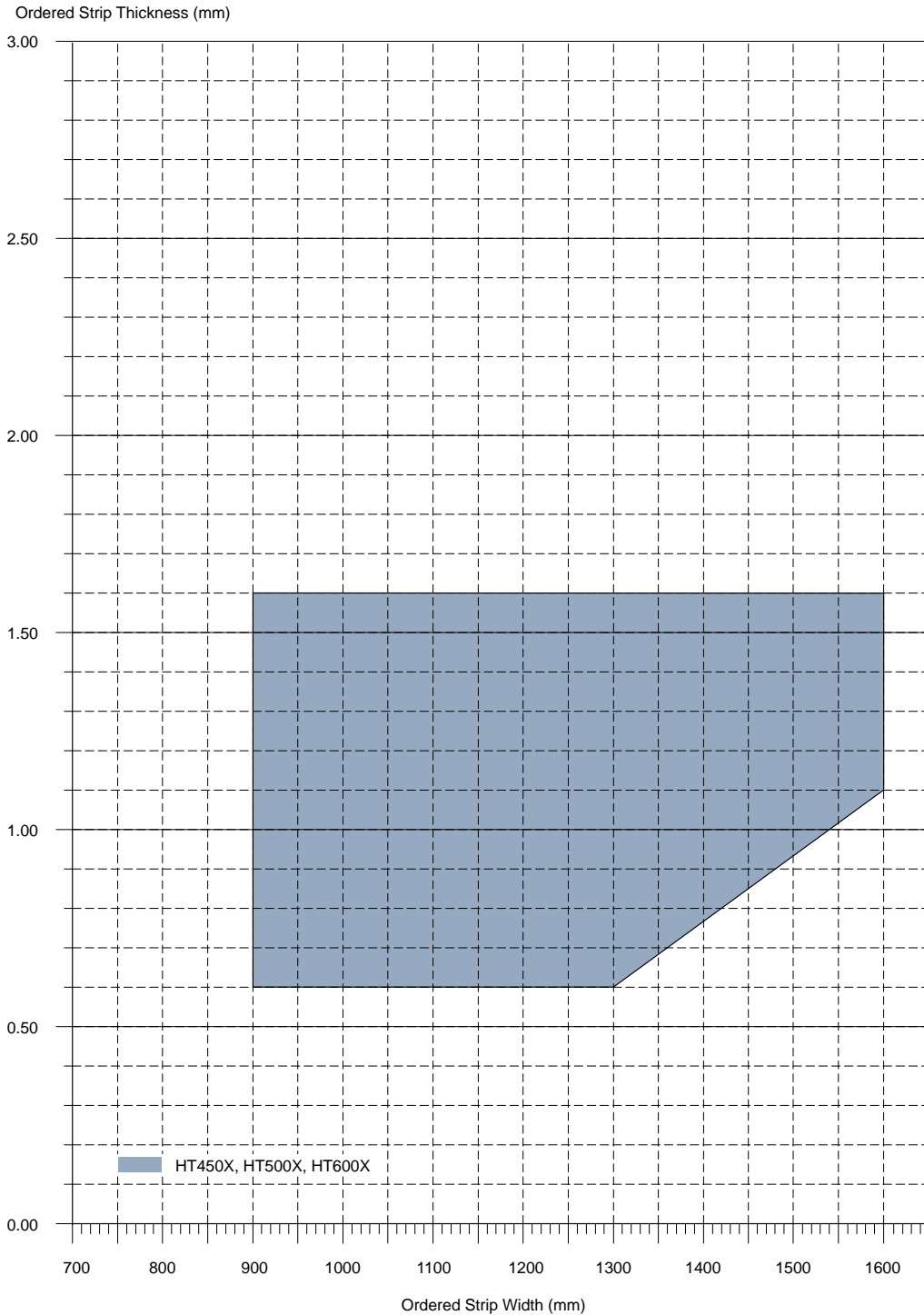
²⁾ Deliverable dimensions upon request.

The mechanical properties apply to longitudinal test specimens. The chemical composition of this group of steel grades corre-

sponds to the definitions in SEW 097 as well as to prEN 10336 (see comparison of standards in the attachment).

AVAILABLE DIMENSIONS DUAL PHASE STEELS

HT450X, HT500X, HT600X



The graphic refers to thickness values with symmetrical thickness tolerances.

The maximum width is reduced by 20 mm if the width tolerance is limited or if the edge is cut.

Please contact our sales departments for dimensions in widths below 900 mm (production scheduling for cross and longitudinal cutting lines).

PARTIALLY MARTENSITIC STEELS

The availability of the partially martensitic steel series is to be seen as an addition to the dual-phase steels. These are steel grades with a minimum tensile strength ranging from 600 to 980 Mpa. The partially martensitic steels are multi-phase steels whose microstructure is characterised by the fact that the hard martensite particles are distributed in a soft ferrite matrix. Bainitic phases can also occur in addition to the martensite.

When compared with the dual-phase steels, the partially martensitic steels show a higher yield strength at the same tensile strength and thus a higher elastic limit tensile strength ratio. The guaranteed fracture elongation values lie lower than those of dual-phase steels. The partially martensitic

steels and the dual-phase steels demonstrate, though to a small degree, a pronounced work-hardening behaviour. The bake-hardening effect remains as it does in dual-phase steels.

Structural components with lower forming stress show higher yield strengths with this series of steel grades in comparison to the dual-phase steels.

Thus during component design it is possible to achieve an increase in strength induced by stronger deformation in the dual phase steels, but at lower amounts of working. For this reason, partially martensitic steels are preferred for high-strength special sections and safety-related structural components with lower forming stresses.

MECHANICAL PROPERTIES

Partially Martensitic Steels (prEN 10336)

Steel Type	Reference Grade pr EN 10336	0.2 %-Yield Point $R_{p0.2}$ [MPa]	Tensile Strength R_m [MPa] (min)	Fracture Elongation ¹⁾ A80 [%] (min)	Bake hardening Value BH ₂ (min) [MPa]
HT600C	HT600C	350–470	600	16	30
HT800C	HT800C	500–640	780	10	30
HT900C	HT900C	580–740	880	8	30
HT1000C	HT1000C	660–860	980	6	30

Partially martensitic steels and deliverable dimensions are available upon request after technical review.

(Range of products comparable with that of dual-phase steels.)

¹⁾ Lower minimum values by two percent are permissible for fracture elongation at a product thickness of ≤ 0.7 mm.

The mechanical properties apply to longitudinal test specimens. The definitions as

found in prEN 10336 are applicable for the chemical composition.

TRIP STEELS

TRIP (transformation induced plasticity) steels are comprised of a ferritic matrix (roughly 75%), bainite (approximately 10%) and metastable residual austenite (up to 15%).

The portion of the hard phase (bainite) as well as the stability of the austenite during forming influence the spectrum of the mechanical-technological values. Transformation-induced plasticity means that the metastable, "soft" austenite is transformed into "hard" martensite during plastic forming (such as during deep drawing).

This makes local constriction difficult and increases the values for uniform elongation.

This is the basis for the well-known excellent formability of TRIP steels with high initial tensile strength. The increased bake-hardening effect achieved by temperature treatment additionally increases the potential weight savings.

This series of steel grades is available in three classes with minimum tensile strengths of 600 MPa, 700 MPa and 780 Mpa. TRIP steels with a minimum tensile strength of 980 MPa are currently in development and can be delivered on an individual basis.

TRIP steels are particularly suited for crash-relevant applications or safety components with increased forming stress in the manufacturing process.

MECHANICAL PROPERTIES

TRIP Steels (prEN 10336)

Steel Type	Reference Grade prEN 10336	0.2%-Yield Point $R_{p0.2}$ [MPa]	Tensile Strength R_m [MPa] (min)	Fracture Elongation A_{80} (min) [%]	Work hardening exponent n_{10-20} (UE) [MPa] (min)	Bake hardening Value BH_2 [MPa] (min)
HT600T ¹⁾	HT600T	380–480	600	26	0.20	40
HT700T ¹⁾	HT700T	410–510	700	24	0.19	40
HT800T ¹⁾	HT800T	440–560	780	22	0.18	40
HT1000T ²⁾	HT1000T	upon request	980	18	0.14	40

¹⁾ Deliverable dimensions upon request.

²⁾ Delivery upon request.

The mechanical properties apply to longitudinal test specimens. The definitions as

found in prEN 10336 are applicable for the chemical composition.

SURFACE

SURFACE TYPE

The products are delivered with one of the two surface types: A or B.

SURFACE TYPE A

All defects are permissible such as pores, small scratches, small nipples, shallow grooves and slight discolouration, as long as these do not hinder the suitability of the material with respect to forming and regarding the adhesion of surface coatings.

SURFACE TYPE B

The better side must be free of defects to such a degree that the uniform appearance of a quality paint coat or electrolytically

applied coating is not negatively impacted. The other side of the material must at least meet the requirements of Surface Type A. In the event not otherwise agreed, the better side of the material is located on the top side of the sheet or outside of the strip.

SURFACE QUALITY

The surface quality can be rough, mat or smooth. In the event respective information is not available at the time the product is ordered, the surface quality will be mat. The median roughness values in the following table correspond to the three surface qualities named above:

SURFACE QUALITY

Surface Quality	Median roughness value Ra (µm)
smooth	≤ 0.9
mat	0.6–1.9
rough	> 1.6

Determination of the median roughness value Ra is subject to a wavelength limit of 2.5 mm in accordance with prEN 10049, 2003 edition (standard measuring length of

12.5 mm). Other median roughness value margins for special applications can be agreed upon when ordering.

PRESERVATION

As a rule, oiling is performed using an anti-corrosive oil which can be removed with alkaline or other conventional cleaning agents. Depending on the stress during treatment, one of the following types of oil application will be possible.

- slightly oiled approx. 0.7 g/m² per side
- oiled approx. 1.2 g/m² per side
- heavily oiled approx. 1.6 g/m² per side

In the event that no other data are provided at the time of the order, 1.2 g/m² will be applied per side. Although the oil is distributed evenly, a certain degree of oil distribution occurring across the length and width of the strip is technically unavoidable during transportation and storage. Other oil applications ranging between 0.5 and 2.0 g/m² per side can be agreed upon at the time of ordering. No liability can be assumed for corrosive damage of material that is delivered in unoiled condition.

AVAILABLE SHAPES AND DIMENSIONS

COLD-ROLLED WIDE STRIP IN COILS

Thickness ¹⁾ [mm]		Width [mm]		Maximum outside diameter [mm]	Inner diameter roughly ca. [mm]	Coil weight [t] (max)
≥ 0.40	≤ 3.00	≥ 600	≤ 785	2000	600 / 500	–
≥ 0.40	≤ 3.00	> 785 ²⁾	< 900 ²⁾	2000	600 / 500	–
≥ 0.40	≤ 3.00	≥ 900	≤ 1600 ³⁾	2000	600 / 500	32

¹⁾ Inner diameter roughly 500 only up to < 2.50 mm (for thicknesses ≥ 2.50 only upon request).

²⁾ Width range between > 785 and < 900 mm only upon request.

³⁾ With limited width tolerance 1580 mm maximum.

TEST CERTIFICATES

CERTIFICATE OF MATERIAL TESTS

In the event a certificate is desired, one of the test certificates defined in EN 10204 shall be agreed upon.

TEST UNIT

Specific tests shall be restricted to a test unit of 20 tons or a portion of 20 tons of the same rolling unit. In the case of strip, a coil of more than 20 t shall be considered as a test unit.

EN 10130 shall apply to all test procedures.

PROCESSING INSTRUCTIONS

FORMING

The selection of materials depends on the demands on strength and formability as well as the component-specific requirements. Steels in the higher strength range exhibit more pronounced elastic recovery after forming.

JOINING

All conventional thermal and mechanical joining technologies as well as adhesive technologies can be used as methods of connecting. All steels are especially suitable for welding in accordance with conventional industrial welding technologies. Slight shifts in the optimum welding range can occur during resistance spot welding as a result of the chemical composition of the various steels. The electrode clamping forces must be adapted to the respective strengths. Intended torch welding must be indicated at the time the order is placed.

SUITABILITY FOR APPLYING SURFACE COATINGS

All products are suited to being surface coated. Materials are to be pre-treated respectively. In the event the metal sheet is intended to be metallically coated, this must be specially indicated at the time the material is ordered.