Steel

Work-hardening steels WHZ

Product information

thyssenkrupp

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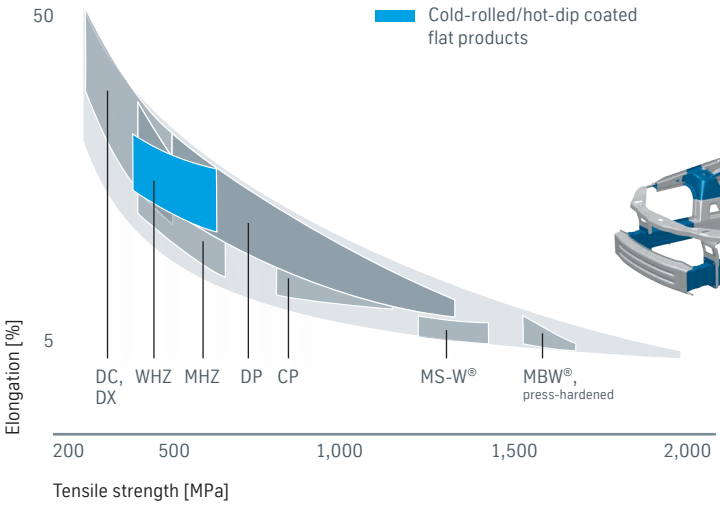
Overview of steel grades



Recommended applications

Content

Areas of application

Cold rolled work-hardening steels by thyssenkrupp have comparatively low yield ratios. This means that work-hardening steels exhibit a good hardening behavior and are particularly suitable for pressed parts with a high stretch-forming component. Compared with microalloyed steels, these steels exhibit improved workability.

Due to their good processing performance, work-hardening steels by thyssenkrupp have proven their value in many applications within the automotive industry. The classical applications are components for the body-in-white, particularly side members, cross members, and pillars.

There are four high-quality surface finishes to choose from for long-term corrosion protection.

Available steel grades

thyssenkrupp supplies the following steel grades as per the product information.

Steel grade designations and surface refinements

		Surface refinements					
		UC	EG	GI	GA	ZM	AS
Steel grade	Reference grade						
● WHZ 300	–	◉	◉	◉	●		
● WHZ 420	–	●	●	●	●		

● Cold-rolled/hot-dip coated flat products
● Serial production for interior parts
◉ Serial production for interior and exterior parts

UC Uncoated
EG Electrogalvanized zinc coating
GI Hot-dip zinc coating
GA Galvannealed
ZM ZM Ecoprotect®
AS Aluminum-silicon coating

Material characteristics

The high yield points and tensile strengths of the alminum-killed, work-hardening steels are achieved by a carbon and manganese alloy. The microstructure mainly consists of ferrite and perlite – a low fraction of transformation microstructure can be included. Compared to micro-alloyed steels of the same tensile strength, WHZ steels offer better workability with higher elongation and n- values.

Technical features

Chemical composition

Mass fractions in ladle analysis	C [%] max.	Si [%] max.	Mn [%] max.	P [%] max.	S [%] max.	Al [%] min.	Ti + Nb [%] max.
Steel grade							
● WHZ 300	0.2	0.6	1.8	0.05	0.02	0.015	0.05
● WHZ 420	0.2	0.6	1.8	0.05	0.02	0.015	0.05

● Cold-rolled/hot-dip coated steel flat products

Mechanical properties

Test direction transverse to rolling direction	Surface refinement [1]	Yield strength $R_{p0.2}$ [MPa] for thicknesses [mm] t < 1,2	Yield strength $R_{p0.2}$ [MPa] for thicknesses [mm] t ≥ 1,2	Tensile strength R_m [MPa] min.	Elongation A_{80} [%] [2] min.	Bake-hardening BH_2 [MPa] min.
Steel grade						
● WHZ 300	UC/EG	300–380	270–350	440–540	25	30
● WHZ 420	UC/EG	420–520		590–700	17	30
● WHZ 300	GI/GA	300–380		440–540	23	30
● WHZ 420	GI/GA	420–520		590–700	17	30

The technological characteristics are valid for the listed state in the thickness range 0.7 to 1.2 mm.
[1] Surface type for interior parts.
[2] Elongation at break is reduced by one unit in surface finishes for exterior parts.

● Cold-rolled/hot-dip coated flat products
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$R_{p0.2}$ Proof strength at 0.2% plastic elongation
R_m Tensile strength
A_{80} Percentage elongation after fracture using a specimen with gauge length L_0 = 80 mm for sheet thicknesses < 3,0 mm
BH_2 Bake-hardening value after 2% plastic prestrain

Surfaces

Surface refinement, electrogalvanized zinc coating

	Specification	Nominal coating on each side of single spot sample		Coating on each side of single spot sample	
		Mass [g/m²]	Thickness [µm]	Mass [g/m²]	Thickness [µm]
Electrogalvanized zinc coating					
Designation					
EG25/25	DIN EN	18	2,5	≥ 12	≥ 1.7
EG18	VDA 239-100	–	–	18–38	2.5–5.4
EG50/50	DIN EN	36	5,0	≥ 29	≥ 4.1
EG29	VDA 239-100	–	–	29–49	4.1–6.9
EG75/75	DIN EN	54	7,5	≥ 47	≥ 6.6
EG53	VDA 239-100	–	–	53–73	7.5–10
EG100/100	DIN EN	72	10	≥ 65	≥ 9.1
EG70	VDA 239-100	–	–	70–90	9.9–13

On request also available with single-side zinc coating or double-sided with different zinc coatings.

Surface refinement, hot-dip zinc coating

	Specification	Minimum coating mass dual sided [g/m²]		Coating on each side of single spot sample		Informative
		Three spot sample	Single spot sample	Mass [g/m²]	Thickness [µm]	Typical thickness [µm]
Hot-dip zinc coating						
Designation						
GI100	DIN EN	100	85		5–12	7
GI40	VDA 239-100	–	–	40–60	5.6–8.5	–
GI140	DIN EN	140	120		7–15	10
GI60	VDA 239-100	–	–	60–90	8.5–13	–
GI200	DIN EN	200	170		10–20	14
GI85	VDA 239-100	–	–	85–115	12–16	–
Galvannealed						
Designation						
GA100	DIN EN	100	85	–	5–12	7
GA40	VDA 239-100	–		40–60	5.6–8.5	–
GA120	DIN EN	120	100	–	6–13	8
GA50	VDA 239-100	–	–	50–80	7–10	–

Surface finishes and surface qualities

	Finish type	Surface quality
Product		
Cold rolled flat products	Uncoated	A Normal surface
		U Unexposed (interior parts)
		B Best surface
		E Exposed (exterior parts)
Electrolytically zinc coated flat products	Electrogalvanized zinc coating	A Normal surface
		U Unexposed (interior parts)
		B Best surface
		E Exposed (exterior parts)
Hot-dip coated flat products	Hot-dip zinc coating	B Improved surface
		U Unexposed (interior parts)
		C Best surface
		E Exposed (exterior parts)
	Galvannealed	B Improved surface
		U Unexposed (interior parts)

A / B / C as per DIN EN
U / E as per VDA 239-100

Surface treatments

		UC	EG	GI	GA	ZM	AS
Type of surface treatment							
O	Oiled	●	●	●	●		
P	Phosphated		●		●		
µPhos	Micro-phosphated		●				
JAZ®	JFE Advanced Zinc				●		
PO	Phosphated and oiled		●		●		
µPhosO	Micro-phosphated and oiled		●				

● Serial production

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Notes on applications and processing

Forming

Compared to micro-alloyed steels of the same strength class, work-hardening steels offer workability benefits for components that are subject to a higher stretch-forming load. The good n values ensure that failure due to local constriction occurs later, because the deformation zone covers a larger area of material as a result of greater strain hardening.

Processing instructions for joining

In terms of joining work-hardening steels, the processor can choose from a large number of joining processes. WHZ steels are suitable for welding both in same type and hybrid joints. The precondition is welding parameters matched to the material.

Resistance spot welding

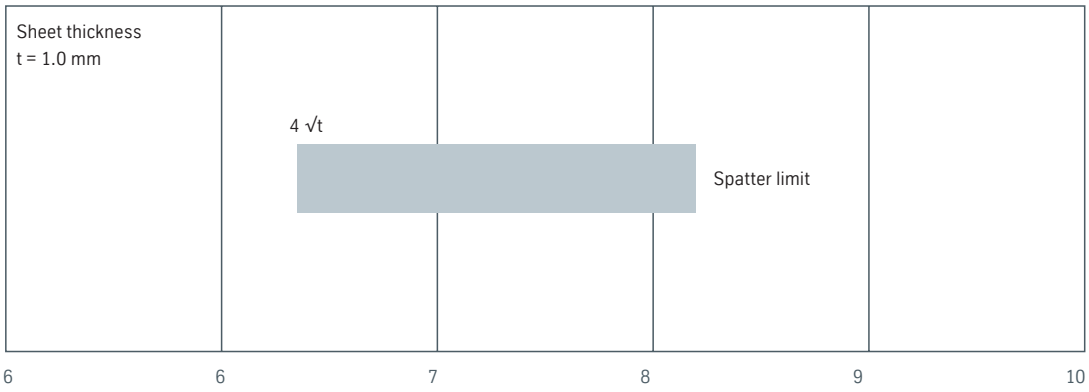
The focus has traditionally been on resistance spot welding, especially in car body manufacture. Especially thin sheets with a thickness of less than 3 mm can be joined more economically and with greater process assurance using this mass production processes. However, doing so typically involves modifying the joint parameters welding current, welding time and electrode force. What is of particular interest here is the influence of the electrode force and welding time on the weld area. To ensure a sufficiently large weldarea, as sheet thickness and strength increases, higher electrode forces and longer welding times are normally required.

Similarly, multi-pulse welding can be used in accordance with DIN EN ISO 18278-2. For zinc and zinc alloy coatings, the electrode forces, welding currents and welding times compared to the non-alloyed base material need to be increased to compensate for contraction of the weld area through the coating. The width of the weld region not only depends on the sheet grade, surface and thickness combination, process parameters such as the current type and electrode geometry also play a significant role.

MIG arc brazing

Information sheet DVS 0938-2 “Arc brazing” describes brazing of steels up to a tensile strength Rm of approximately 500 MPa. As the material lies above this tensile strength, it is advisable to check the component-specific suitability of brazing.

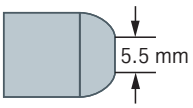
Typical welding ranges of work-hardening steels



Frequency: 50 Hz
Electrode force: 2.8 Kn

Lead-in time: 30 periods
Current time: 12 periods
Dwell time: 5 periods

F16x20
flattened

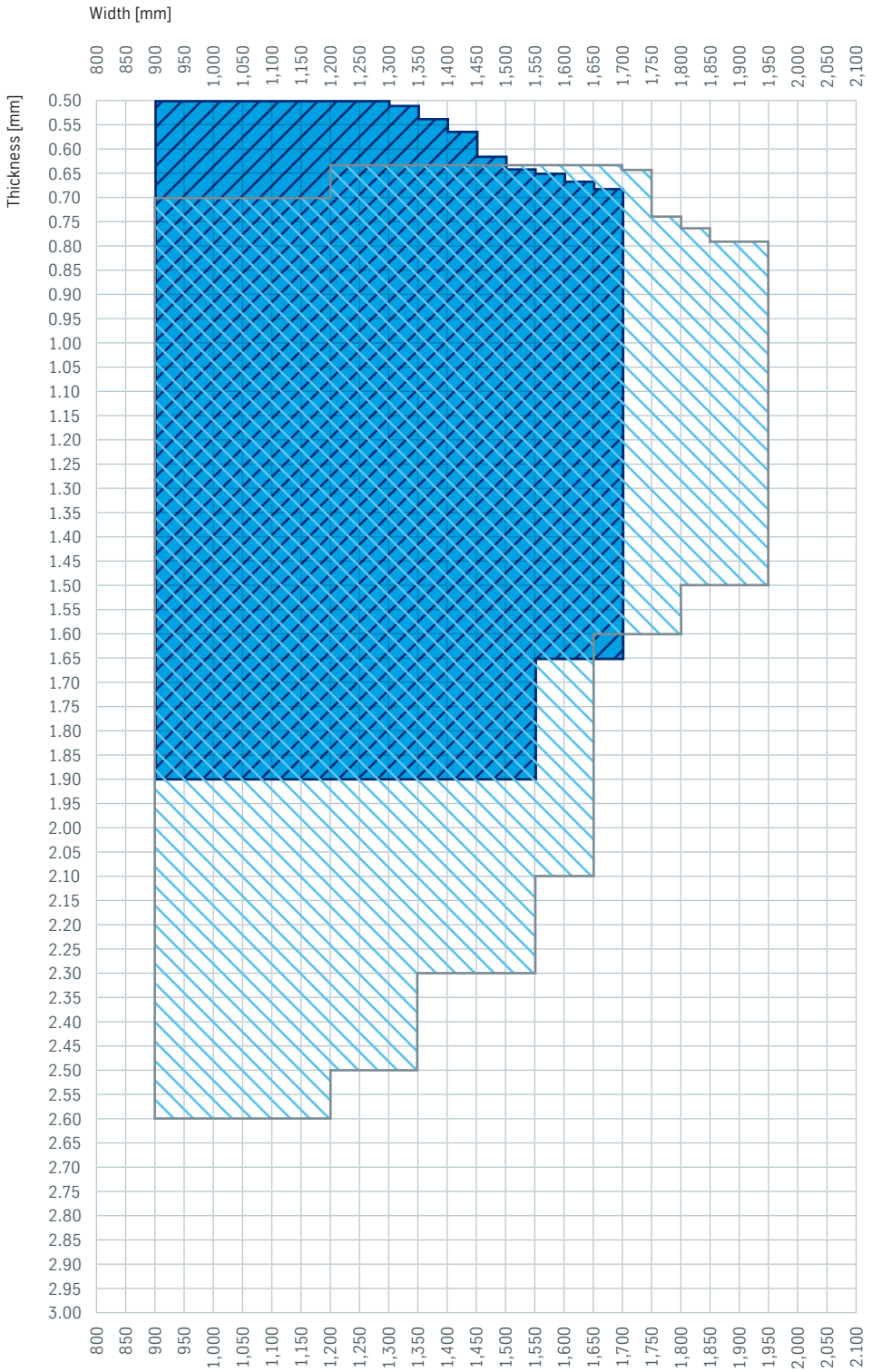


Fatigue strength and crash performance

Because of the increased work-hardening potential, higher crash energy absorption capabilities can be observed in the worked area compared to steel grades with the same initial strength.

Available dimensions

WHZ 300



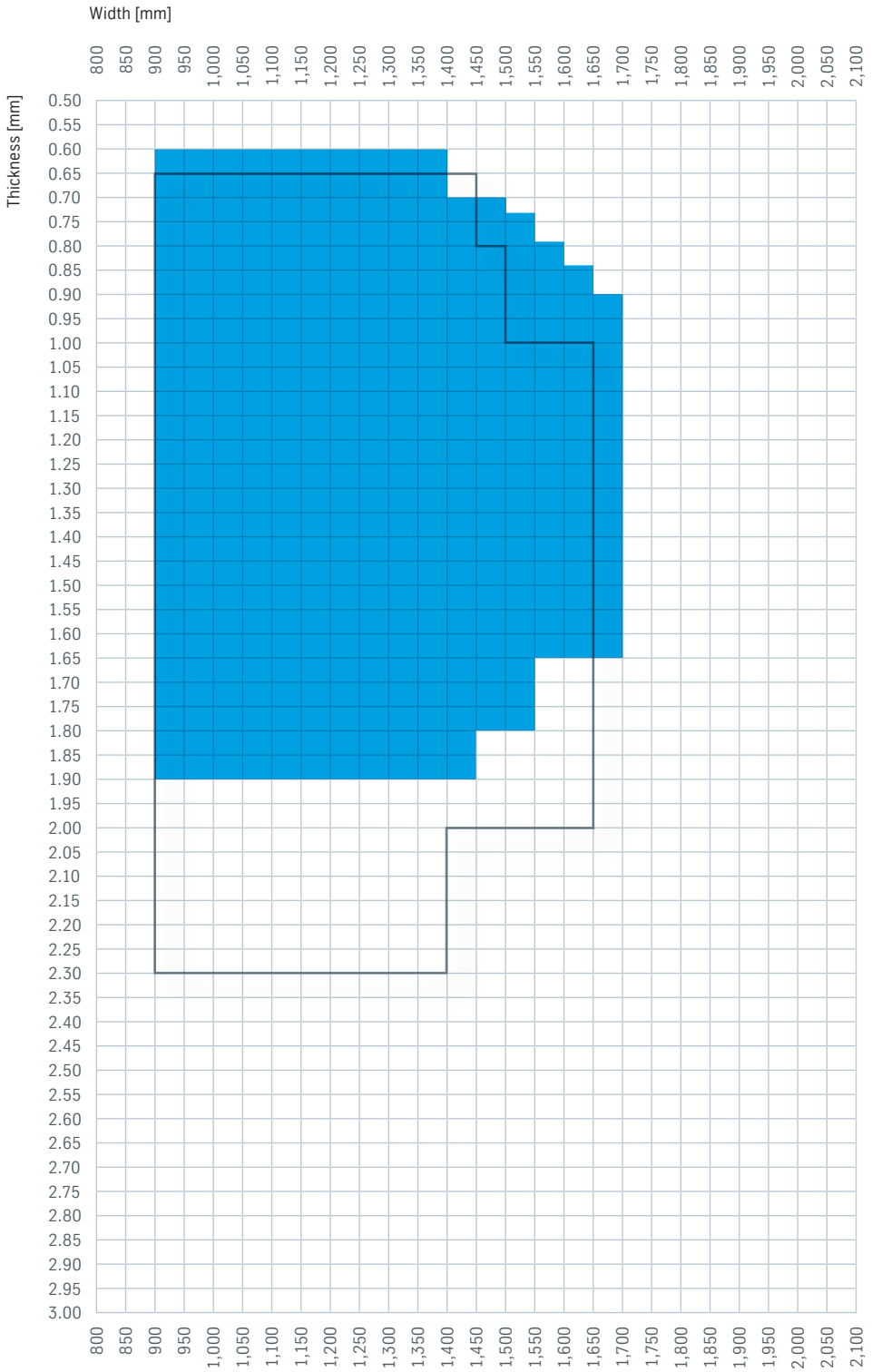
EG Electrolytically galvanized
GI Hot-dip galvanized
GA Galvannealed

GA trimmed
GI trimmed
EG trimmed
Uncoated with mill edge

For interior parts
Typical dimensions for automotive customers.

For exterior parts
Similar to figure in the range thickness of 0.50 to 1.20 mm and 900 to 1,800 mm.
Restrictions may apply for limit dimensions. Further dimensions on request.

WHZ 420



GA Galvannealed

GA trimmed
Uncoated wirh mill edge

For interior parts
Typical dimensions for automotive customers. Further dimensions on request.

Special mill grades are supplied subject to the special conditions of thyssenkrupp. Other delivery conditions not specified here will be based on the applicable specifications. The specifications used will be those valid on the date of issue of this product information brochure.

General information

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