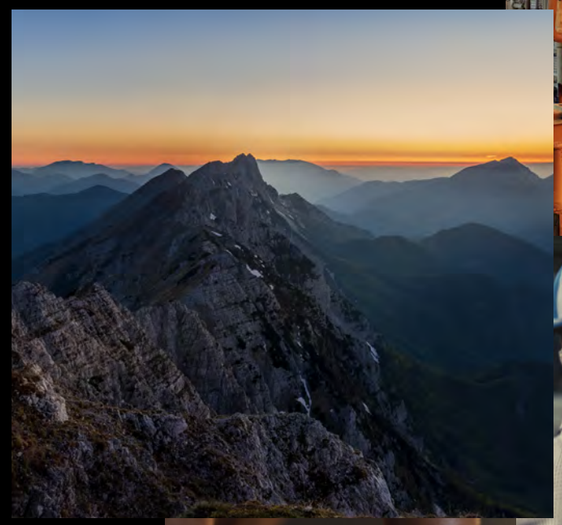
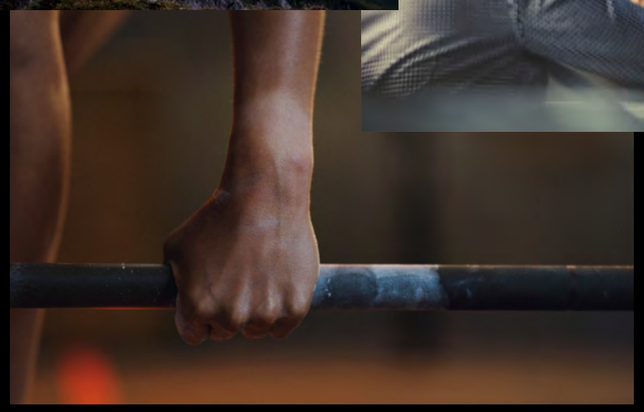

Steel
beyond
limits
HSX®
Swiss
Steel
Group

The highest strength combined with toughness and machinability

Steel beyond limits





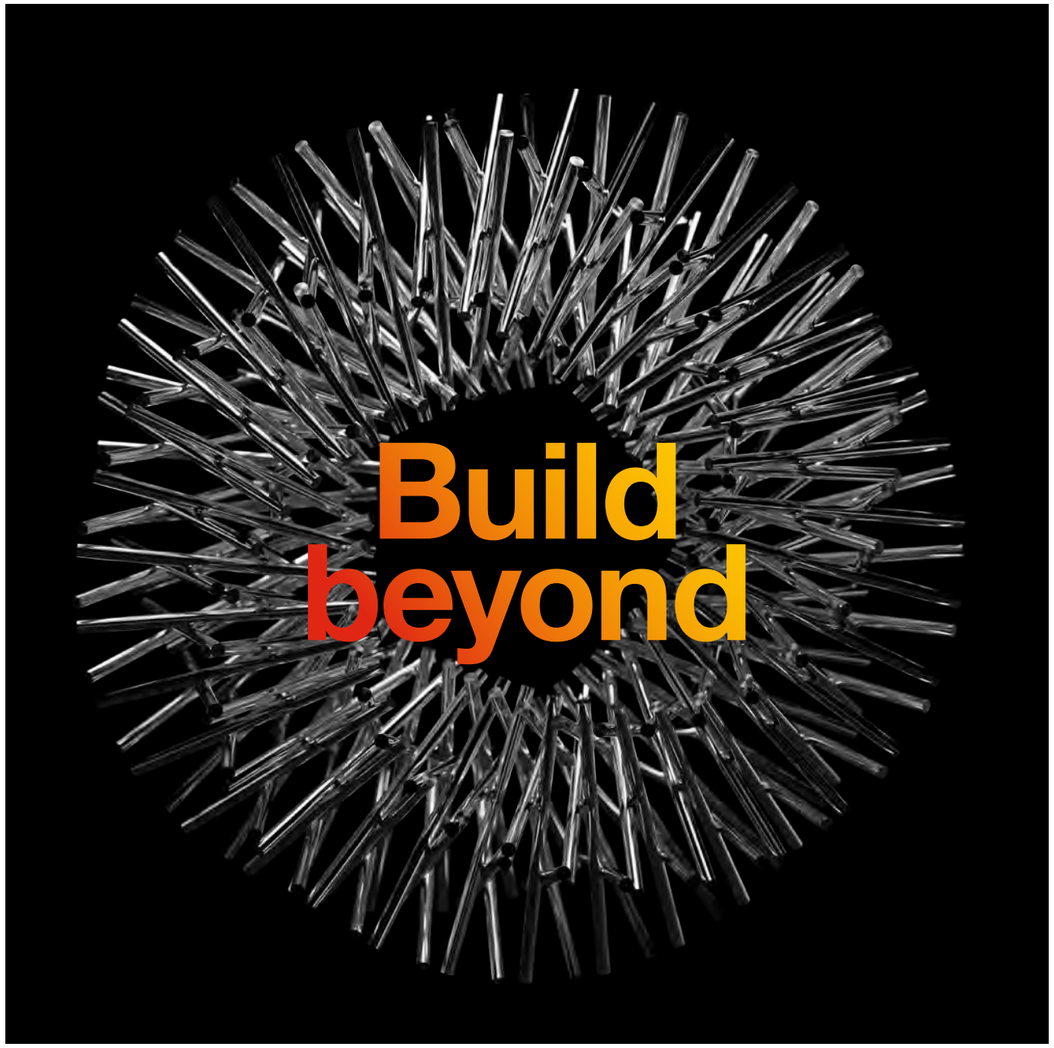
This steel isn’t just steel – it’s a mindset.

Build to create better. Believe in the possibilities of engineering. The smallest component. The longest resilience.

HSX® isn’t just a premium product – it’s a mindset. A symbol of strength, creativity, and potential. For over 30 years, high-strength steels have defined our courage as a company of innovators, visionaries, and limit-pushers, willing to go beyond.

Why choose HSX® steels?

For tougher, compacter components of lower weight. For exacting quality, safety, and reliability of precision parts. HSX® steels take the impossible beyond.



High strength

The higher strength of HSX® steels lies in the range of quenched and tempered steels. How we process the steel guarantees consistent mechanical properties over the entire cross-section and dimension range. As delivered.

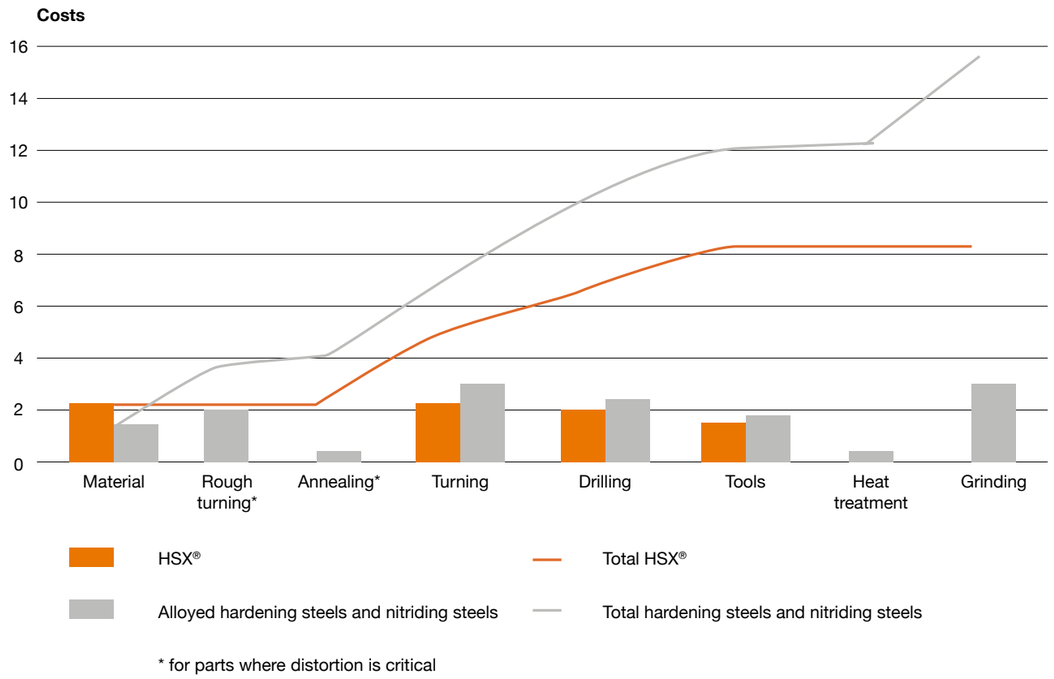
Tailored for complexity

HSX® steels can be tailored to withstand high dynamic or static loading. HSX® steel components withstand high compressive stress and hold up to impact loads and transmission of forces.

Machinability

The process-friendly chipping of HSX® steels supports faster and leaner production practices. Reducing wear on machine tools and improving machine uptimes.

Comparison of part costs HSX®/alloyed hardening steels and nitriding steels



* for parts where distortion is critical

Advance your component capabilities

Exceptional materials. Impressive attributes.
Substantial cost-saving opportunities.

Up to 50% stronger than standard steels

Very high tensile and yield strengths – as delivered

Good machinability

Machinability and tool life are considerably better compared to standard QT steels. Process time up to 40% shorter

Up to 50% component cost savings

Faster and leaner production processes

Toughness and dynamical resilience

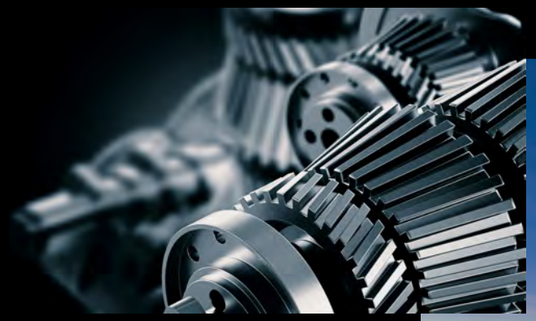
Suitable for parts exposed to high static and dynamic loads

A sustainable solution

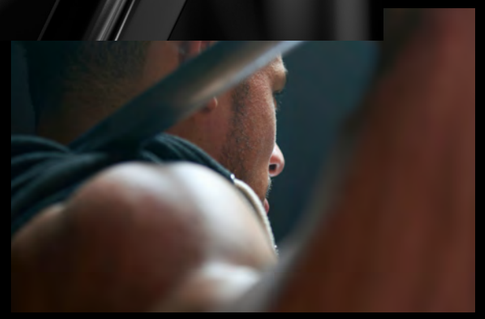
Generally no heat treatment necessary. Reduction of production processes and Co_2. Up to 50% savings on component costs

Component quality and reliability

Consistent properties from batch to batch



Impossible until it’s not



Comparing HSX® to standard steels

HSX® designed to substitute standard grade steels. HSX® steels can be used for a wide range of applications due to their mechanical properties which remain consistent over the entire size range. As shown below, a series of standard grade steels can be replaced with HSX® steels. By utilizing optimized sizes, significant weight and cost reductions can be achieved.

Comparing standard yield strength steel to HSX®
$R_{p0,2}$ [N/mm²] to EN 10277-5, EN 10083-3* and EN 10085**

			Size range (mm)			
Material number	**EN reference**	**Process**	**5-10**	**> 10-16**	**> 16-40**	**> 40-62**
1.7034	34CrS4	+C + QT	–	–	590	460
		+QT + C	700	700	580	510
1.7039	41CrS4	+C + QT	–	–	660	560
		+QT + C	750	670	570	570
1.7213	25CrMoS4	+C + QT	–	–	600	450
		+QT + C	700	700	600	520
1.7227	42CrMoS4	+C + QT	–	–	750	650
		+QT + C	770	750	720	650
1.6582	34CrNiMo6	+C + QT	–	–	900	800
		+QT + C	770	750	720	650
1.8159*	51CrV4	+ QT	–	900	800	700
1.6580*	30CrNiMo8	+ QT	–	1050	1050	900
1.8519**	31CrMoV9	+ QT	–	–	900	800

HSX® guaranteed yield strength

HSX® 110	drawn, round	←	950 →
HSX® 130	drawn, round	←	1200 →
HSX® Z12	peeled, round	←	800 →

1 N/mm² = 1 MPa

Comparing standard steel tensile strength to HSX®
R_m [N/mm²] to EN 10277-5, EN 10083-3* and EN 10085**

			Size range (mm)			
Material number	**EN reference**	**Process**	**5-10**	> **10-16**	> **16-40**	> **40-62**
1.7034	34CrS4	+C + QT	–	–	800 – 950	700 – 850
		+QT + C	900 – 1100	900 – 1100	800 – 950	700 – 850
1.7039	41CrS4	+C + QT	–	–	900 – 1100	800 – 950
		+QT + C	1000 – 1200	1000 – 1200	900 – 1100	800 – 950
1.7213	25CrMoS4	+C + QT	–	–	800 – 950	700 – 850
		+QT + C	900 – 1100	900 – 1100	800 – 950	700 – 850
1.7227	42CrMoS4	+C + QT	–	–	1000 – 1200	900 – 1100
		+QT + C	1000 – 1200	1000 – 1200	1000 – 1200	900 – 1100
1.6582	34CrNiMo6	+C + QT	–	–	1100 – 1300	1000 – 1200
		+QT + C	1000 – 1200	1000 – 1200	1000 – 1200	1000 – 1200
1.8159*	51CrV4	+ QT	–	1100 – 1300	1000 – 1200	900 – 1100
1.6580*	30CrNiMo8	+ QT	–	1250 – 1450	1250 – 1450	1000 – 1300
1.8519**	31CrMoV9	+ QT	–	–	1100 – 1300	1000 – 1200

HSX® guaranteed tensile strength

HSX® 110	drawn, round	←	1050 – 1200 →
HSX® 130	drawn, round	←	1250 – 1400 →
HSX® Z12	peeled, round	←	950 – 1200 →

1 N/mm² = 1 MPa

Comparing standard steel elongation to HSX®
A_5 [%] to EN 10277-5, EN 10083-3* and EN 10085**

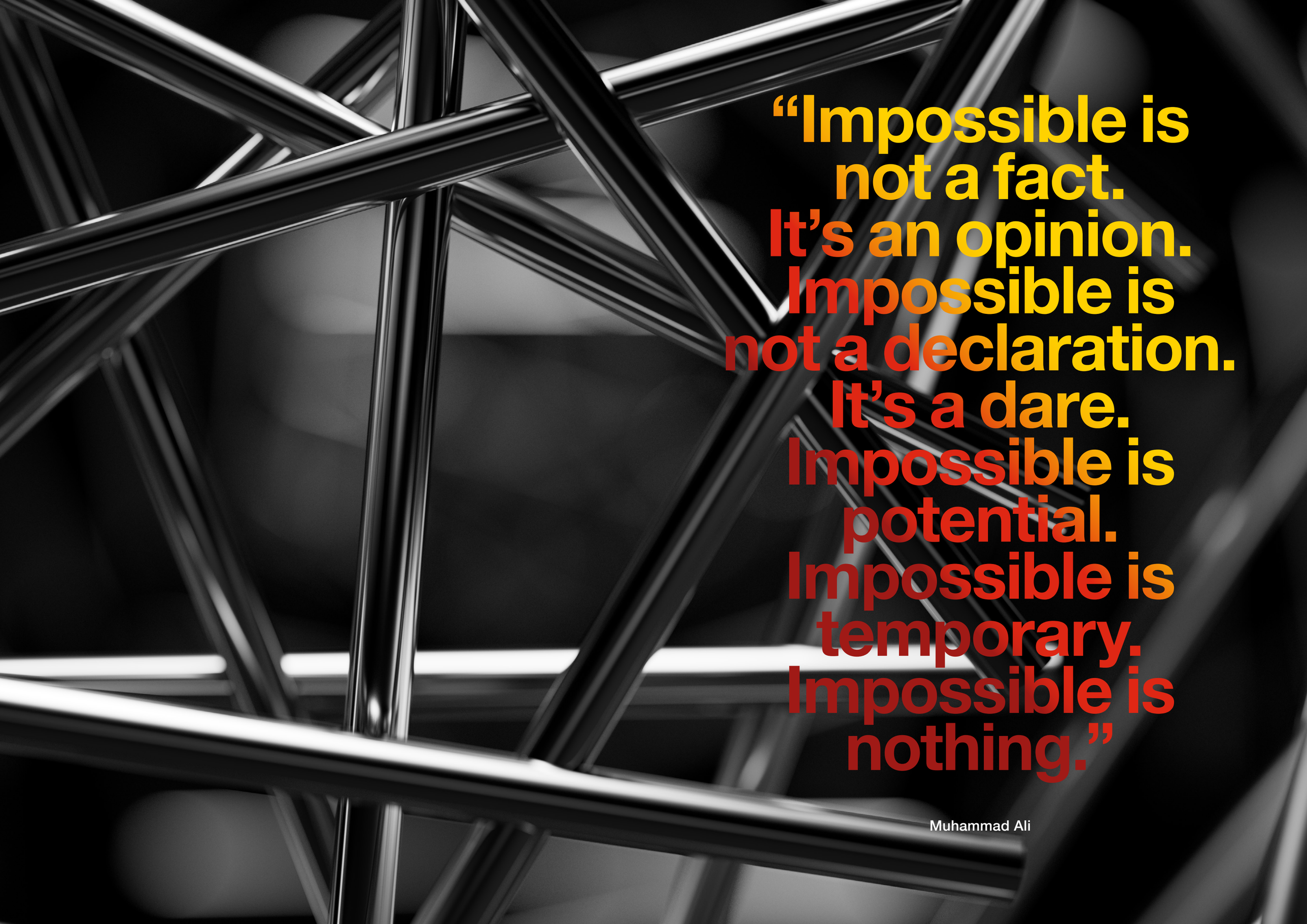
			Size range (mm)			
Material number	**EN reference**	**Process**	**5-10**	> **10-16**	> **16-40**	> **40-62**
1.7034	34CrS4	+C + QT	–	–	14	15
		+QT + C	8	9	9	10
1.7039	41CrS4	+C + QT	–	–	12	14
		+QT + C	8	8	9	10
1.7213	25CrMoS4	+C + QT	–	–	14	15
		+QT + C	9	9	10	11
1.7227	42CrMoS4	+C + QT	–	–	11	12
		+QT + C	8	8	9	10
1.6582	34CrNiMo6	+C + QT	–	–	10	11
		+QT + C	8	8	9	10
1.8159*	51CrV4	+ QT	–	9	10	12
1.6580*	30CrNiMo8	+ QT	–	9	9	10
1.8519**	31CrMoV9	+ QT	–	–	9	10

HSX® guaranteed tensile elongation

HSX® 110	drawn, round	←	8 →
HSX® 130	drawn, round	←	6 →
HSX® Z12	peeled, round	←	12 →

1 N/mm² = 1 MPa

+ C cold drawn
+ C + QT cold drawn and quenched and tempered
+ QT + C quenched and tempered and cold drawn
+ QT quenched and tempered


“Impossible is
not a fact.
It’s an opinion.
Impossible is
not a declaration.
It’s a dare.
Impossible is
potential.
Impossible is
temporary.
Impossible is
nothing.”
Muhammad Ali

Comparing standard steel notch impact energy to HSX®
A_v [J] as per key to steel, EN 10083-3* and EN 10085**

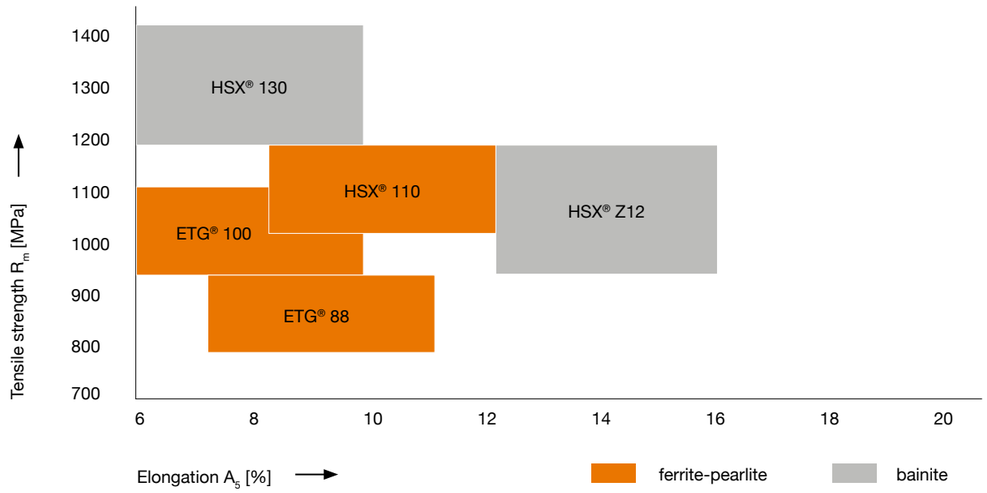
			Size range (mm)		
Material number	**EN reference**	**Process**	**> 10-16**	**> 16-40**	**> 40-62**
1.7034	34CrS4	+ QT	30	35	35
1.7039	41CrS4	+ QT	30	35	35
1.7213	25CrMoS4	+ QT	45	50	50
1.7227	42CrMoS4	+ QT	30	35	35
1.6582	34CrNiMo6	+ QT	35	45	45
1.8159*	51CrV4	+ QT	–	30	30
1.6580*	30CrNiMo8	+ QT	–	30	35
1.8519**	31CrMoV9	+ QT	–	25	30

+ QT quenched and tempered

HSX® guaranteed notch impact energy

HSX® 110	drawn, round	←	ap. 15 →
HSX® 130	drawn, round	←	ap. 20 →
HSX® Z12	peeled, round	←	ap. 40 →

Tensile strength vs. elongation at fracture



HSX® 110: higher strength, improved toughness
HSX® 130: significantly higher strength, good toughness
HSX® Z12: significantly higher toughness, good strength

Due to their expanded range of material properties, the HSX® 110, HSX® 130 and HSX® Z12 steels are particularly suitable for highly-loaded or stressed parts. The higher strength of HSX® 110 and HSX® 130 is particularly suitable for parts subject to high static and dynamic loading, such as transmission components, camshafts, drive shafts and hydraulic and pneumatic components.

The significantly increased toughness of HSX® Z12 is most advantageous when used in parts required to withstand a combination of dynamic and static loading and subject to impact loads in addition to the transmission of forces. These can include hydraulic components and also screw joints with a defined torque moment, or parts under high compressive stress.

Chemical composition
Melt analysis % by weight (typical values)

	C	Si	Mn	S	Cr	Mo
HSX® 110	0.39	0.75	1.40	0.035	–	–
HSX® 130	0.18	1.20	1.60	0.15	1.20	0.30
HSX® Z12	0.18	1.20	1.60	0.15	1.20	0.30

Mechanical properties
Typical values

Static				HSX® 110	HSX® 130	HSX® Z12
Yield strength	$R_{p0.2}$	N/mm²	min.	950	1200	800
Tensile strength	R_m	N/mm²	min.	1050	1250	950
		N/mm²	max.	1200	1400	1200
Elongation	A_5	%	min.	8	6	12
Hardness						
HRC			ap.	35	42	31
HB			ap.	330	395	300
Notched impact energy	Av_{RT}	J	ap.	10	20	40
	$Av_{-20°C}$	J	ap.	8	16	20

Dynamic				HSX® 110	HSX® 130	HSX® Z12
Tension/compression	σ_w	N/mm²	ap.	485	545	485
Pulsating	σ_{sch}	N/mm²	ap.	385	445	385
Reverse bending	σ_{bw}	N/mm²	ap.	515	585	525

The fatigue limits were established on smooth specimens.
1 N/mm² = 1 MPa

Product range

Steel category	Processes	Size range mm	Tolerance
HSX® 110	drawn, round	8 – 50	h11
HSX® 130	drawn, round	17 – 55	h11
HSX® Z12	peeled, round	18 – 62	h11

Bar lengths: standard 3 m, other lengths upon request.
Color coding end face: HSX® 110 traffic orange, HSX® 130 ruby red, HSX® Z12 traffic purple.
Other categories to meet special requirements (e. g. mechanical properties) are available to special order.

Let’s defy convention

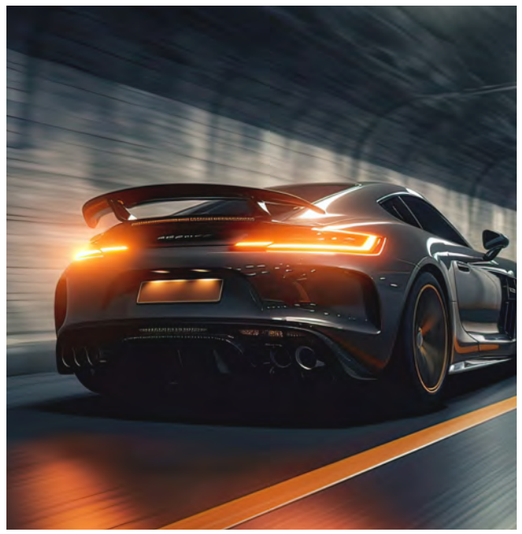
Applications

Across industries and across the world, our clients are building the impossible. Together, we’re shaping a smarter, greener, and more efficient future for everyone.

Mobility

Go small. Downsize components with the same transmitting forces and lower overall product weight – in anything that moves.

HSX® steel components are besting standard steels in anything that moves.



Mechanical engineering

Get precise. Produce precision components for complex, load-bearing parts and systems.

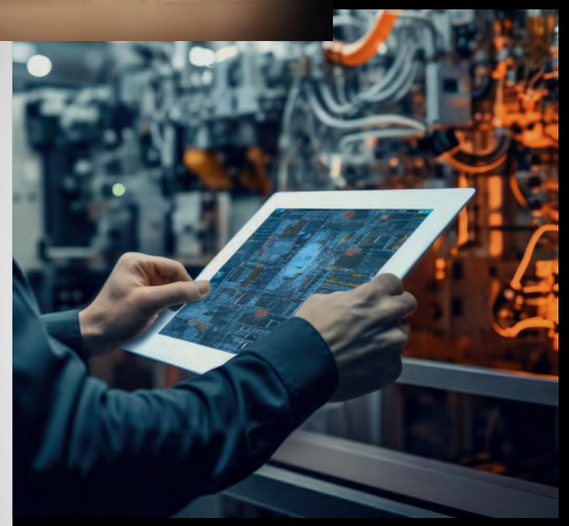
With HSX® steels, the manufacturing process becomes shorter and safer.

Hydraulics

Load up. Improve the robustness of industrial hydraulic systems.

HSX® steels meet demands for high static and dynamic loads, pressure pulses, and fluctuating forces.

Feel the heat of progress



Very high strength, tough performer

HSX® steels are tough performers for complex components. Engineered beyond the common, they combine steel and production know-how.

Orientation values for various machining processes
Machining guidelines V_C [m/min] and f [mm/E]

Machining process	v_c / f	Process	HSX® 110	HSX® 130	HSX® Z12
Multi-spindle CNC turning (Carbide tooling, coated)	v_c	roughing	190 – 250	190 – 250	200 – 260
	f		0.20 – 0.60	0.20 – 0.60	0.20 – 0.60
	v_c	finishing	200 – 260	200 – 260	210 – 270
	f		0.10 – 0.30	0.10 – 0.30	0.10 – 0.30
	v_c	plunging/ parting-off	120 – 200	120 – 200	140 – 220
	f		0.15 – 0.40	0.10 – 0.40	0.10 – 0.40
Multi-spindle CAM turning (Straight turning – carbide tooling, coated)	v_c	roughing	150 – 210	130 – 190	160 – 220
	f		0.05 – 0.20	0.05 – 0.20	0.05 – 0.20
	v_c	finishing	160 – 220	140 – 200	170 – 230
	f		0.03 – 0.15	0.03 – 0.15	0.03 – 0.15
	v_c	plunging/ parting-off	100 – 160	90 – 150	80 – 140
	f		0.10 – 0.35	0.10 – 0.35	0.10 – 0.35

Short-bed turning CNC (Carbide tooling, coated)	v_c	roughing	190 – 250	190 – 250	200 – 260
	f		0.20 – 0.60	0.20 – 0.60	0.20 – 0.60
	v_c	finishing	200 – 260	200 – 260	210 – 270
	f		0.10 – 0.30	0.10 – 0.30	0.10 – 0.30
	v_c	plunging/ parting-off	120 – 200	120 – 200	140 – 220
	f		0.15 – 0.40	0.10 – 0.40	0.10 – 0.40
Plain turning CNC (Carbide tooling, coated)	v_c	roughing	130 – 190	110 – 170	140 – 200
	f		0.05 – 0.25	0.05 – 0.25	0.05 – 0.25
	v_c	finishing	140 – 200	120 – 180	150 – 210
	f		0.05 – 0.25	0.05 – 0.25	0.05 – 0.25
	v_c	plunging/ parting-off	50 – 90	40 – 80	30 – 70
	f		0.05 – 0.30	0.05 – 0.30	0.05 – 0.30
Drilling (Insert drill bit – Carbide tooling, coated)	v_c		110 – 170	90 – 150	100 – 160
	f		0.10 – 0.30	0.10 – 0.30	0.10 – 0.30
Drilling (HSS, coated)	v_c		30 – 70	25 – 65	20 – 60
	f		0.05 – 0.20	0.05 – 0.20	0.05 – 0.20
Reaming (Carbide tooling, coated)	v_c		25 – 30	25 – 30	25 – 30
	f		0.10 – 0.30	0.10 – 0.30	0.10 – 0.30
Thread (Internal/External threading) Chase threading – Carbide tooling, coated	v_c		60 – 150	50 – 140	40 – 130
Cutting – Carbide tooling, coated	v_c		6 – 9	6 – 9	6 – 9
Forming – HSS, coated	v_c		8 – 20	8 – 20	8 – 20

Values depending on the machine statics, cutting edge geometry, cooling lubricant, dimensions and drill diameter

General recommendations

Recommendations for HSX® steels

- Avoid hardening over sharp edges, keyways and lateral holes.
- Do not harden thin-walled components.
- End faces or spherically-shaped areas should be stress-relieved at 180 – 200 °C before hardening like all rolled-and-drawn material, HSX® 110 has a slightly decarburised boundary zone, which means that the induction hardening effect in this zone is reduced.
- Hardening of the drawn surfaces should be avoided due to the possible presence of surface imperfections. Due to the notch effect, hardening stresses at the imperfections can cause cracks.
- When hardening gear wheels, the tooth root should also be hardened to a depth of 0.2 mm.
- To avoid the occurrence of hardening cracks due to hardening stresses, the hardened components should be tempered (~140 °C, 1h).

Heat treating

Information on heat treating HSX® steels

The high strength of HSX® steels is in the same range as that of tempered steels, which means that, in most cases, no additional heat treatment is necessary. If greater abrasion resistance or fatigue strength is needed, various surface hardening processes can be used. The high basic strength guarantees a good underlying structure and thus ideally fulfils the prerequisites for the following heat treatment processes:

- HSX® 110: induction hardening nitrocarburising
- HSX® 130: nitrocarburising
- HSX® Z12: nitrocarburising

Induction hardening HSX® 110 (HF)

- Treatment temperature: 930 – 980 °C
- Quench medium: polymer
- Attainable hardness: 50 – 55 HRC

The depth of hardening should be kept to a minimum, generally not more than 1 mm. For complicated parts, an initial stress-relieving operation at 550 – 580 °C is recommended. Using water as a quench medium results in a higher hardness, although there is a danger that quench cracking may occur.

Nitrocarburising

Nitrocarburising

Nitrocarburising improves the resistance of the steel to both wear and corrosion. It also increases the material's bending fatigue strength.

Gas nitrocarburising (two-stage)

- Treatment temperatures: Stage 1: 500 – 520 °C Stage 2: 530 – 550 °C
- Atmosphere: Stage 1: 70 – 75% NH_3 Stage 2: 50 – 80 % NH_3
- Treatment duration: 24 – 48h
- Thickness of compound layer: approx. 15 µm
- Quench medium: gas cooling, water, oil

Nitrocarburising HSX® 110 and HSX® 130 typically results in a reduction in tensile strength of around 10 – 20 %.

Plasma nitrocarburising

- Treatment temperature: 480 – 510 °C
- Treatment duration: 20 – 36h
- Thickness of compound layer: up to 10 µm This process – glow-discharge nitrocarburising in a vacuum – has produced good results with HSX®.

Due to the lower treatment temperature, there is less reduction in the core strength than with gas nitrocarburising.

Nitrocarburising

Process	Material	Surface hardness $HV_{0.5}$ *	Core hardness $HV_{0.5}$	Nitriding hardness depth mm at limit hardness	
				24 h	48 h
Gas nitrocarburising	HSX® 110	450 – 600	300	0.40	0.50
Gas nitrocarburising	HSX® 130 HSX® Z12	600 – 800	330	0.40	0.45
Plasma nitrocarburising	HSX® 130 HSX® Z12	600 – 850	350	0.30	0.55

All values are typical values.
* measured at a distance from 0.1 mm from the edge

Depending on the nitrocarburising process employed, tempering at 350 °C for at least 2 hours may be necessary to remove the hydrogen that has been introduced.

Processing Information

Surface finish

The surface finish of HSX® corresponds to the EN 10277-1 specification. HSX® steels are tested for cracks as standard. We guarantee a surface finish of class 3. Please note that, for standard bars, the ends of the bar (up to 50 mm) cannot be tested.

If surface imperfections might cause problems (e.g. notch stress concentration effect with surface hardening), the surface of the material must be removed to at least the permitted depth of imperfection.

Surface finishing

Most surface finishes can be applied to HSX® 110. It can, for example, be hot galvanised, chromated, chromium-plated, nickel-plated or alkaline-blackened without difficulty. Due to the manganese sulphide it contains, special care must be taken during pickling and neutralisation. The temperature at which surface finishing is carried out should not exceed 500 °C. An optimum result will only be obtained with ground material.

Due to the chemical composition of HSX® 130 and HSX® Z12, it is essential for the refining process and the surface preparation to be specifically coordinated.

Steel beyond limits

Beyond common mindset

A creative mindset we share with passion.

Beyond common steels, paired with innovation, support and services to match. With free calculations on process-saving potential and cost-free trials, we go beyond for our customers, enabling them to produce leaner, safer and more competitively.

Swiss Steel Group

Our people

For over 30 years, we have partnered with customers and suppliers, universities and research institutes, to reach beyond the common mindset. Together, we push boundaries. Together, we redefine expectations.

Our network

Global reach. Local touch. Access to our expertise and experience helps you operate lean and efficiently. On-site or remote, our quality technical services offer accessibility and fast communications so you operate leaner.

Our production

We monitor our production processes to operate as lean and efficiently as possible. To keep our products as reliable as possible.

Our testing process

Stringent production testing and quality control checks guarantee the consistency of high quality within very close tolerances.

Together. For a future that matters.

We reserve the right to make changes and technical improvements without notice. Errors and omissions excepted. The product-specific data sheets take priority over the details given in the catalogue. The desired performance characteristics are only binding if they had been agreed upon exclusively at the time that the contract was made.

Swiss Steel Group

HSX® is produced at Steeltec AG and Steeltec GmbH

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