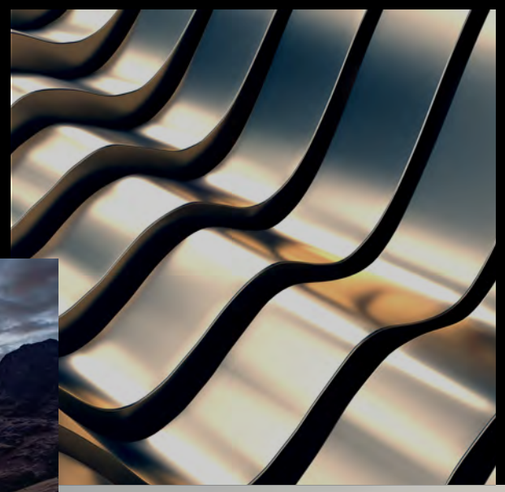
Steel beyond limits

ETG® 25

Swiss Steel Group

The multi-purpose high-strength steel

Steel beyond limits



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

Build to create better. Believe in the possibilities of engineering. Form it. Bend it. Machine it. Weld it.

ETG® 25 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 ETG® 25?

ETG® 25 takes the impossible beyond. By allowing multiple processes to produce complex components.

High strength

Mechanical values similar to strength class 8.8 EN ISO 898-1 – as delivered. No need for additional heat treatment.

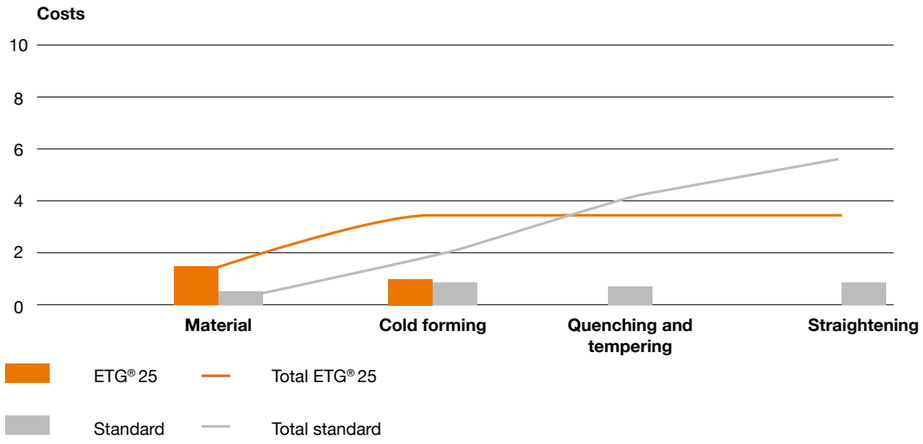
Multipurpose capabilities

Ideal for complex components produced by multiple processes – rolling, machining, and welding are possible. Rejected volumes are significantly reduced.

Cold-formability and bendability

Cold-formable and highly bendable without risk of cracking. Reduced production processes and lower component costs.

Comparison of component costs ETG® 25/Standard



Advance your manufacturing capabilities

Exceptional materials. Impressive attributes.
High strength, machinable, bendable and weldable.

Up to 50% stronger than standard steels

High tensile and yield strengths – mechanical values similar to strength class 8.8 (EN ISO898-1)

Excellent machinability

V_c up to 260 m/min.
Improved chip break-off, good surface finish after machining, low internal stress, and low distortion

Cold formability and benda-bility

No crack initiation on tension side according to bending test DIN 50111

Weldability – CET 0.40

Despite its high strength, ETG® 25 is particularly suited to welding

A sustainable solution

Generally no heat treatment necessary. Reduction of production processes and CO_2. Up to 50 % savings on component costs

Special production process resulting in special properties

Low residual stress, high fatigue strength and high abrasion resistance

A product range of endless possibilities

Product range

Steel category	Process	Size range mm	Tolerance
ETG® 25	drawn, round	≥ 4.0 – ≤ 28.0 > 28 – 40	h9 h11
	ground, round	≥ 4.0 – ≤ 28.0	≥ IT 6

Bar lengths: standard 3 m, other lengths upon request
Color coding end face: cadmium yellow
The surface finish and surface quality class 3 as per EN 10277-1

Regular sizes are available from stock. Other categories to meet special requirements – e.g. mechanical properties – are available to special order.

Chemical composition
Melt analysis in % by weight

Element	C	Si	Mn	P	S
min.	0.24	0.10	1.20	-	0.02
max.	0.29	0.30	1.50	0.04	0.04

Deviation of product analysis from limits specified in cast analysis in accordance with EN 10087.
Killed with aluminium or agents having a similar effect. The analysis complies with SAE 1527, comparable with 28Mn6 (WSt-Nr. 1.1170).

Mechanical properties
Guide values

Static

Dimensions	Ø	mm	≤ 16	> 16 – 30	> 30 – 40
Yield strength	$R_{p0.2}$	N/mm²	≥ 660	≥ 660	≥ 660
Tensile strength	R_m	N/mm²	800 – 950	830 – 950	800 – 950
Ultimate elongation	A_5	%	≥ 12	≥ 12	≥ 12
Reduction of area	Z	%	≥ 45	≥ 45	≥ 45
Hardness	HV10	-	230 – 300	255 – 336	230 – 300
Notched impact energy	Au_{RT} (ISO-U)	J	≥ 22	≥ 22	≥ 22

Dynamic

Tension/compression	σ_{zdw}	N/mm²	–	ca. 360	–
Reverse bending	–	–	–	–	–
Specimen without notch	σ_{bw}	N/mm²	–	ca. 390	–
Specimen with notch $a_k = 4.0$	σ_{bw}	N/mm²	–	ca. 125	–
Torsional reversal	T_{tw}	N/mm²	–	ca. 175	–

1 N/mm² = 1 MPa

Impossible until it’s not

Applications

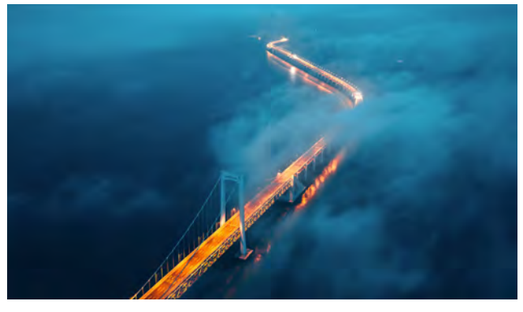
Across industries and across the world, our clients are building the impossible. Together, we're shaping a smarter, greener, and more efficient future for everyone. ETG® 25 steel offers optimum and consistent mechanical properties as drawn – over the entire cross-section and full-size range. And ETG® 25 components are besting standard steels in the most performance-demanding applications.

Go small

Design smaller components that lower overall product weight – without loss of performance.

Go longer

Produce cold-profiled threaded bolts with higher fatigue strengths and resistance for a longer service life of parts.



Go lean

Manufacture complex components with fewer production processes.

Go complex

Combine processing possibilities for complex components meeting the most demanding requirements.

High strength, multipurpose performer

ETG® 25 pushes “ready to use” past the expectations of standard steels. Bend it. Machine it. Refine it. Engineer beyond the common.

Bendability

Despite its high strength, ETG® 25 can be bent without difficulty. No crack initiation is evident on the tension side in the technological bending test to DIN 50111 when ETG® 25 is bent through 180° with a stamp.

Machinability

ETG® 25 is particularly suitable for machining and has the following advantages compared with quenched and tempered parts of a similar strength:

- improved chip break-off
- good surface finish after machining
- low internal stress
- low distortion

Surface finishing

Most surface finishes can be applied to ETG® 25. For example, it can be hot galvanised, chromated, chromium-plated, nickel-plated and alkaline-blackened, etc. At treatment temperatures above 300 °C, it should be noted that the yield strength and tensile strength are reduced somewhat. Pickling to remove oxides can be dispensed with. Providing galvanisation is performed correctly, there is no danger of hydrogen embrittlement. In the case of surface finishing, ground material is recommended.

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

Machining process	v_c / f	Process	ETG® 25
Multi-spindle CNC turning (Carbide tooling, coated)	v_c	roughing	190 – 250
	f		0.20 – 0.60
	v_c	finishing	200 – 260
	f		0.10 – 0.30
	v_c	plunging/ parting-off	160 – 240
	f		0.10 – 0.40
Multi-spindle CAM turning (Straight turning – carbide tooling, coated)	v_c	roughing	150 – 210
	f		0.05 – 0.20
	v_c	finishing	160 – 220
	f		0.03 – 0.15
	v_c	plunging/ parting-off	100 – 160
	f		0.10 – 0.35
Short-bed turning CNC (Carbide tooling, coated)	v_c	roughing	190 – 250
	f		0.20 – 0.60
	v_c	finishing	200 – 260
	f		0.10 – 0.30
	v_c	plunging/ parting-off	160 – 240
	f		0.10 – 0.40
Plain turning CNC (Carbide tooling, coated)	v_c	roughing	130 – 190
	f		0.05 – 0.25
	v_c	finishing	140 – 200
	f		0.03 – 0.15
	v_c	plunging/ parting-off	50 – 90
	f		0.05 – 0.30

Continue →

Technical details

Drilling (Indexable insert drill – Carbide tooling, coated)	v_c	60 – 110
	f	0.05 – 0.30
Drilling (HSS, coated)	v_c	20 – 70
	f	0.05 – 0.20
Reaming (Carbide tooling, coated)	v_c	25 – 30
	f	0.10 – 0.30
Thread (Internal/External threading) Chase threading – Carbide tooling, coated	v_c	40 – 90
Cutting – Carbide tooling, coated	v_c	6 – 9
Forming – HSS, coated	v_c	8 – 20

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

Weldability

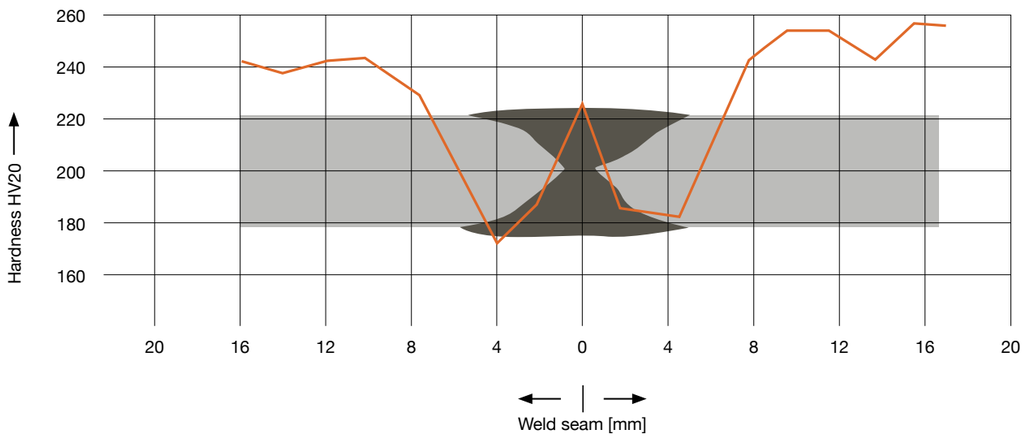
Despite its high strength, ETG® 25 is particularly suited to welding. It must, however, be borne in mind that, depending on the welding conditions and the weld metal, there may be a reduction in strength and an increase in hardness in both the weld itself and the heat-affected zone. The hardness increase is only slight, on account of the chemical composition of ETG® 25, and it can be eliminated through tempering at 400 – 450 °C.

Heat fusion welding

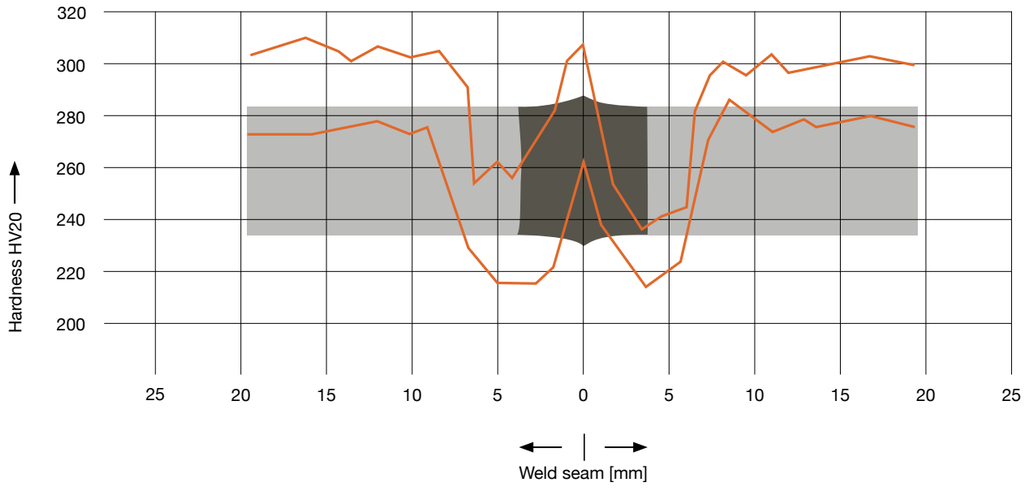
Care should be taken to ensure that welding is performed with the lowest possible level of heat application. The strength reduction is determined not only by the base material but also by the weld metal employed. The best results have been achieved with gas-shielded welding. To take the example of MIG welding.

- ETG® 25 Ø 9 mm
- weld metal Böhler 2.5 Ni-IG (ER 80, S-Ni 2)
- welding point milled into a wedge shape (x-seam)

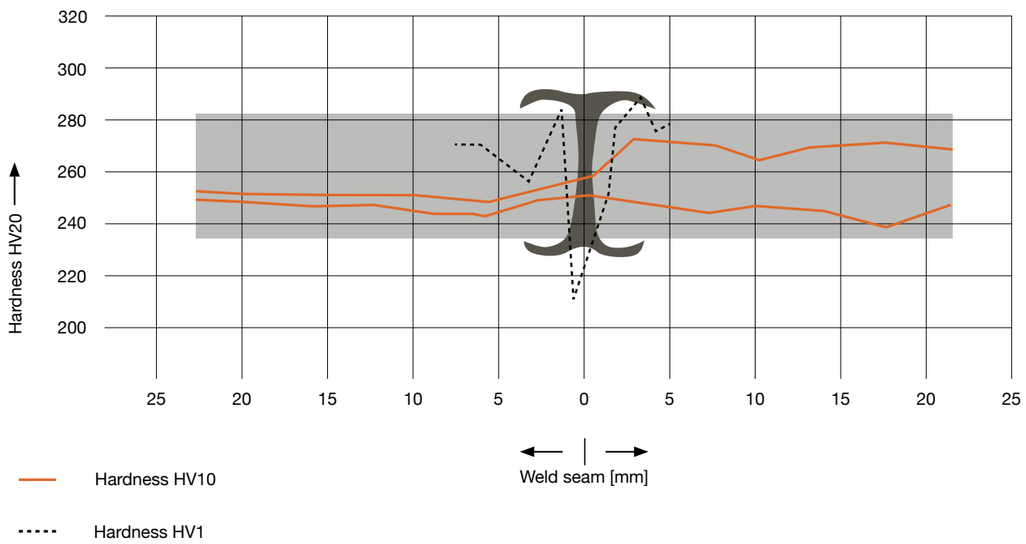
Heat fusion welding

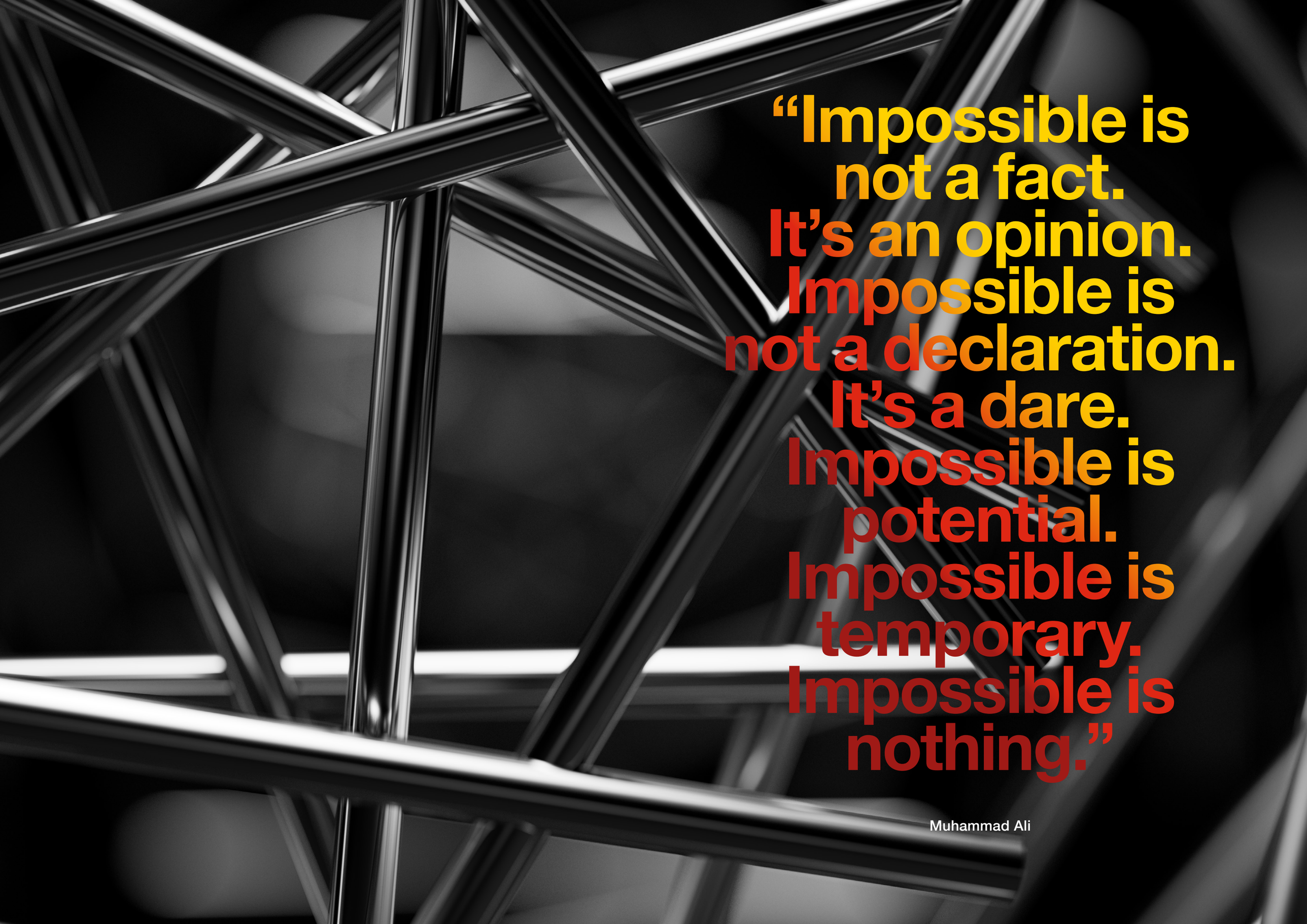


Pressure welding
Butt welding and flash butt welding
Example: flash butt welding ETG® 25, Ø 18.25 mm



Friction welding
ETG® 25 to ETG® 25, Ø 18.25 mm




“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

ETG® 25 for formed parts

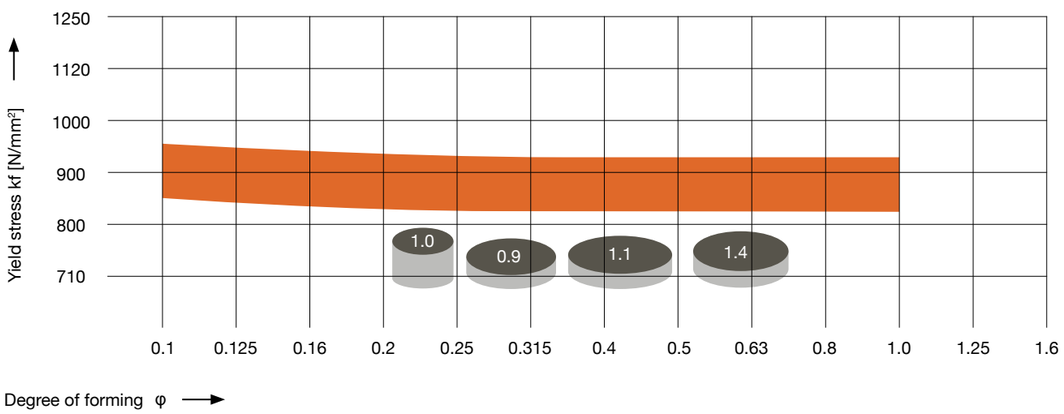
Cold forming

As with all finally-formed parts, care must be taken with upset parts to ensure that forming is conducted in the same direction as the load that will be acting on the part when in service. If the load acts in the opposite direction, a reduction in the yield strength may result (Bauschinger effect). The strength and hardness are unaffected. Subsequent tempering at 350 °C can reverse this effect. The yield strength then returns to its original value.

Flow curve

Established in the cylinder upset test (Ø 10 x 16 mm), Range ± 50 N/mm². The special production process gives ETG® 25 non-standard flow properties. The material's high yield strength means that relatively high forming forces are required even for low degrees of forming. Contrary to the case for conventionally-produced steels, the flow resistance remains constant up to high degrees of forming.

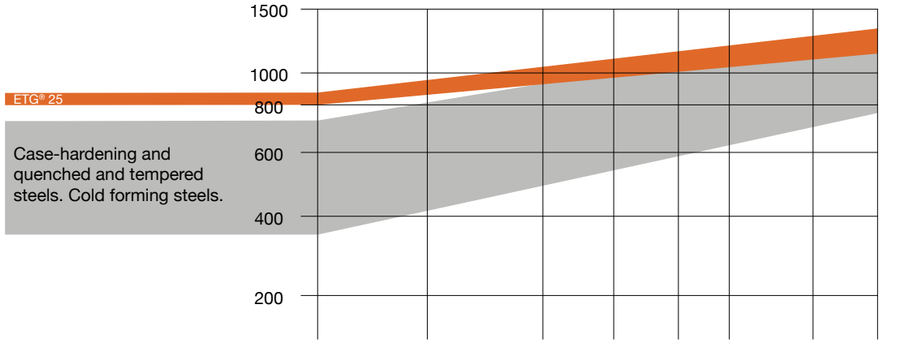
Flow curve ETG® 25



Mechanical properties after cold forming

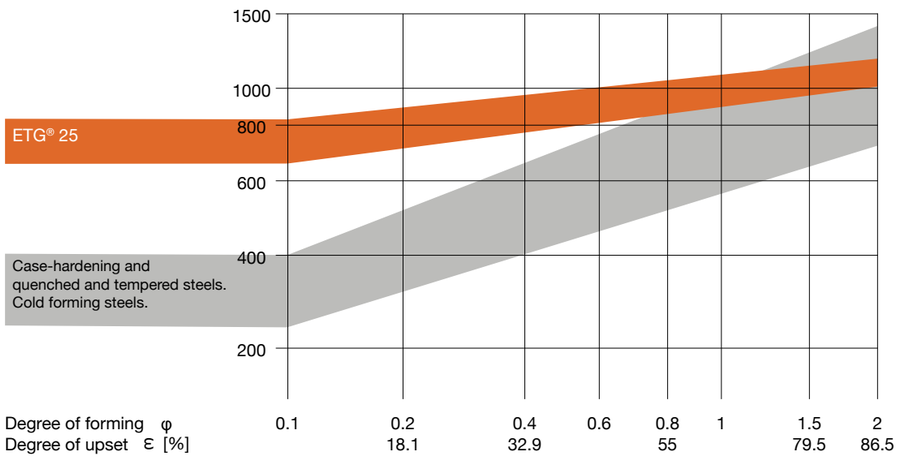
Mean values for ETG® 25 as a function of the degree of forming and upset by comparison to conventionally-produced steels.

Tensile strength R_m [N/mm²]



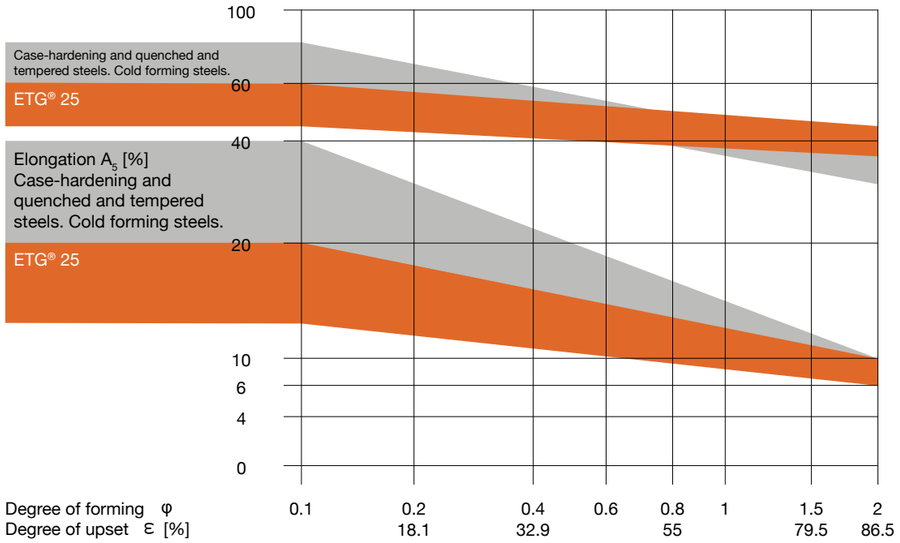
Degree of forming φ	0.1	0.2	0.4	0.6	0.8	1	1.5	2
Degree of upset ε [%]		18.1	32.9		55		79.5	86.5

Yield strength $R_{p0.2}$ [N/mm²]

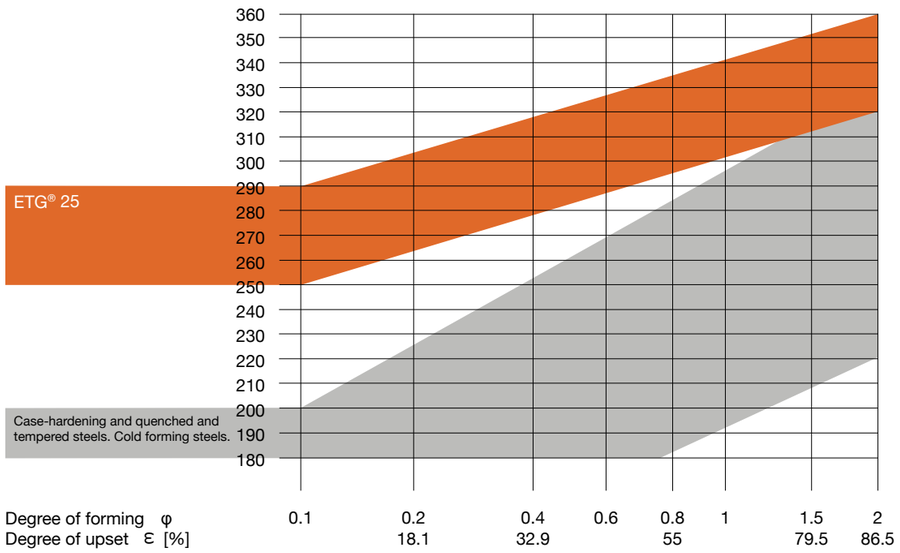


Degree of forming φ	0.1	0.2	0.4	0.6	0.8	1	1.5	2
Degree of upset ε [%]		18.1	32.9		55		79.5	86.5

Reduction of area Z [%], Elongation A_5 [%]



Hardness HV10

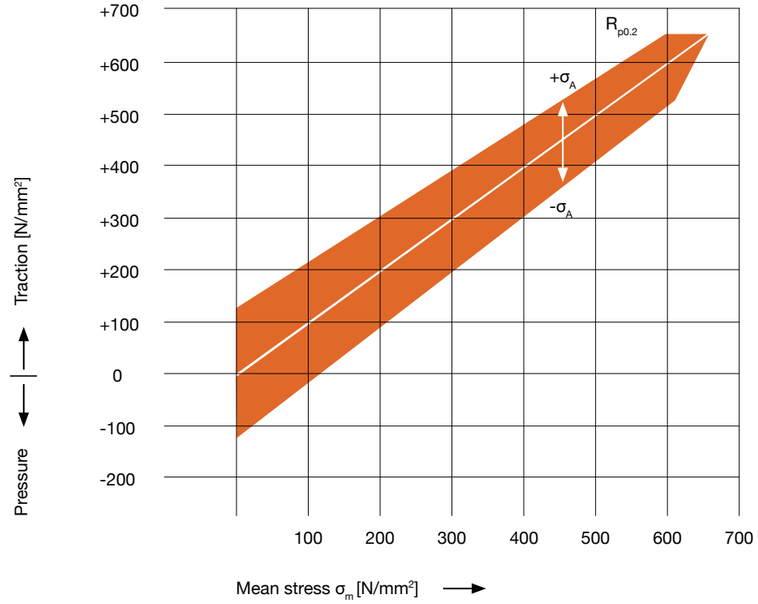


Characteristic values for threaded bolts

			RT	RT	-20 °C	-20 °C	-40 °C	-40 °C
Size		mm	≤ M 16	> M 16	≤ M 16	> M 16	≤ M 16	> M 16
Tensile strength	R_m	N/mm²	≥ 810	≥ 830	820	840	830	850
Yield strength	$R_{p0.2}$	N/mm²	≥ 660	≥ 660	–	–	–	–

1 N/mm² = 1 MPa

Fatigue strength of ETG® 25



ETG® 25 for cold-profiled threaded bolts with higher fatigue strengths

Non-cut formed threads

Non-cut formed threads have a strain-hardened screw root with compressive internal stresses. The yield strength is thus somewhat lower and the fatigue strength somewhat higher than for the starting material.

Fatigue stressing as a function of the maximum endured stress amplitude ± σ_A without fatigue fracture.

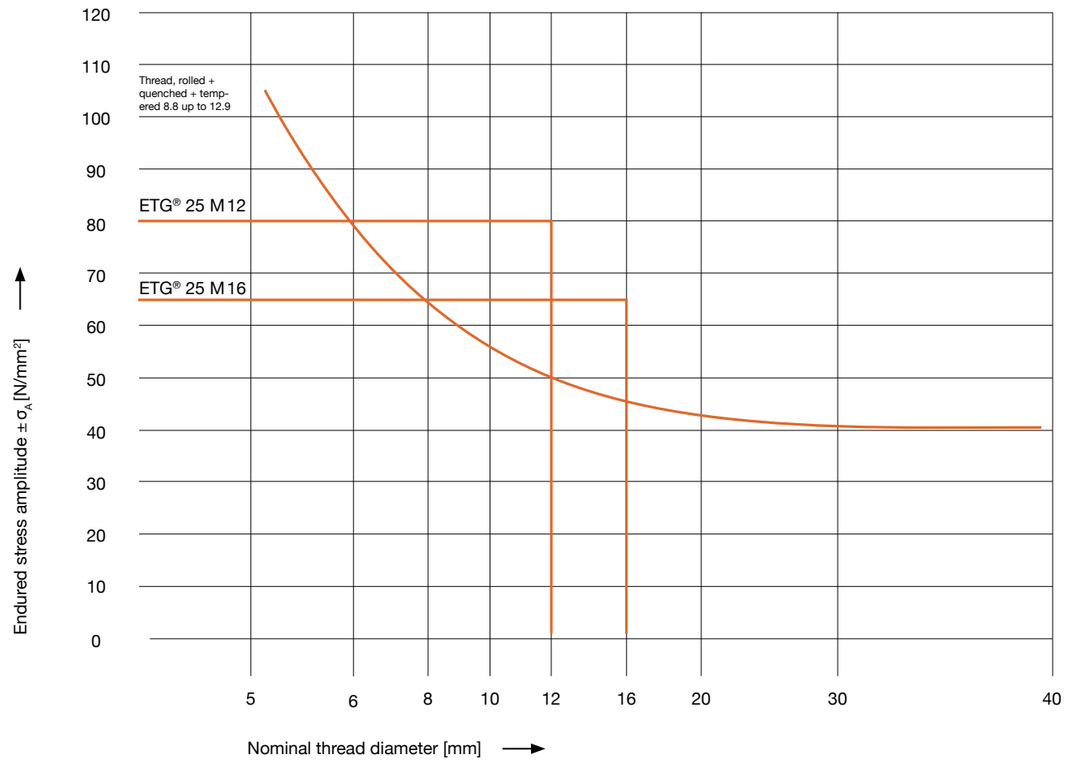
- stress cycle > $2 \cdot 10^6$
- M12 threaded connection
- bolts, ETG® 25, rolled thread
- nut, DIN 934 class 8

At elevated temperatures established on turned bolts Typical values

			+100 °C	+200 °C	+300 °C
Tensile strength	R_m	N/mm²	815	815	800
Yield strength	$R_{p0.2}$	N/mm²	665	665	635
Elongation at fracture	A_5	%	13	12	18

1 N/mm² = 1 MPa

Permitted static stressing on thread



Static stressing of threaded bolts in ETG® 25 with a rolled thread. Testing in accordance with EN ISO 898-1 on the threaded bar. Strength values expressed in terms of the stressed cross-section.

$$A_S = \frac{\pi}{4}\left(\frac{d_2+d_3}{2}\right)^2$$

Cold-profiled threaded bolts in ETG® 25 have a significantly higher fatigue strength than those made of conventional finally tempered material.

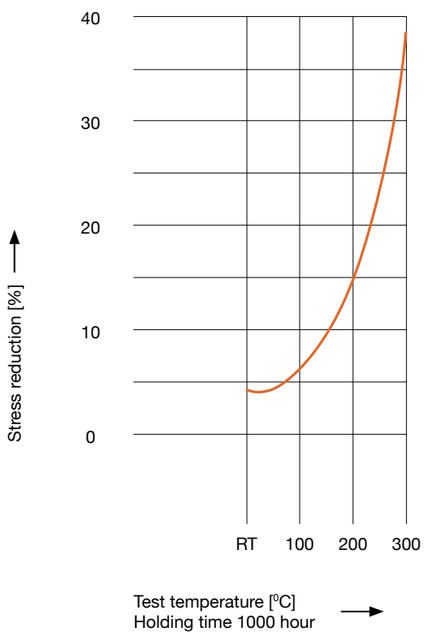
- mean stress σ_m 450 [N/mm²]
- M 12 thread σ_A ±80 [N/mm²]
- M 16 thread σ_A ±65 [N/mm²]

Comparison with rolled and quenched and tempered thread in strength classes 8.8 to 12.9.

Relaxation behaviour

A key property, especially for the production of threaded parts, is the behaviour of the material in respect of stress relaxation. The following diagram shows the relaxation behaviour of ETG® 25 in the form of the relative percentage stress reduction after 1000h storage at temperatures of between RT and 300 °C. The specimens used were M 12 threaded bars pretensioned at 0.7 x $R_{p0.2}$.

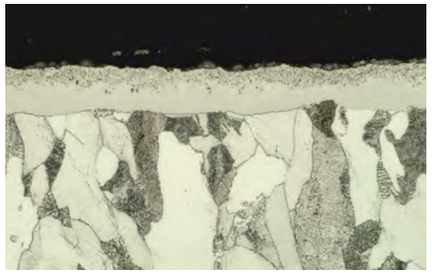
Stress relaxation of ETG® 25



Nitriding of ETG® 25

Nitrocarburising

Nitrocarburising improves the resistance of the steel to both wear and corrosion. It also increases the material's bending fatigue strength. ETG® 25 can be nitrocarburised by the salt bath, plasma or gas processes. In one study, ETG® 25 was nitrocarburised in a pit furnace at 520 °C and 570 °C for 10h and 40h and for 0.5h and 4h respectively. In each case an atmosphere with a nitriding potential of K_N = 2 was used. 2.5 % CO_2 was added at 570 °C.



ETG® 25, 520 °C 10h, K_N = 2, Nital etchant

In applications with tight tolerances on dimensional stability, the material should undergo prior heat treatment at 520 – 570 °C. Plasma nitriding can also be used, as the process involves lower temperatures (approx. 480 – 510 °C). As the temperatures used in the plasma process are lower, there is less reduction in the core strength.

ETG® 25 exhibits a compact compound layer with little pore formation. The core hardness is approximately 225 HV/0.5. Nitrocarburising typically results in a reduction in tensile strength of around 200 MPa.

Nitrocarburising

Treatment	Compound layer thickness	Porous zone	Thickness of nitriding layer	Case hardness
	µm	µm	mm	HV 0.5
520 °C N 10h	10.5	4.6	0.38	450
520 °C N 40h	11.7	4.4	0.62	480
570 °C NC 0.5h	8.4	3.2	0.29	375
570 °C NC 4h	21.0	7.6	0.29	440

Depending on the nitrocarburising process used, it may be necesary to temper the material at 350 °C for at least 2 hours to remove any hydrogen that has been introduced.

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

ETG® 25 is produced at Steeltec AG and Steeltec GmbH

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