

## STEEL GRADE

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51CrV4 All**General Information**

51CrV4 is a high strength quench and tempering steel suitable for quenched and tempered springs. What Ovako offer includes a number of variants with tight chemical composition, suitable for different applications and material thicknesses. They all meet the overall requirements set by EN10089.

Variant SB4292 is a strong variant with hardenability in the upper part of the +HH band and low content of non-metallic inclusions.

Variant SB4290 has somewhat lower hardenability, but is still strong.

Variant SB4282 has medium hardenability and is a good start for applications with normal requirements.

Variant SB4212 which has a good surface hardness, but it will not through harden for thicker dimensions. It is instead a good pick for thin sections.

Variants Ovako 593B and 593Q are also mainly used for springs, but frequently used for shafts and machine components.

Ovako 593Q is an IQ (isotropic quality) variant.

**Similar designations**

1.8159, 735A51, SS2230, SB4292 - 52CrMn5-4, SB4290 - 52CrMn5-4, SB4282 - 52CrMn4-4, SB4212-50CrMn4-4, AISI 6150

**Chemical composition**

Variant	Cast		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	V %
51CrV4 EN10089:2002	Std	Min	0.47	-	0.70	-	-	0.90	-	-	0.100
		Max	0.55	0.40	1.10	0.025	0.025	1.20	-	-	0.250

## Mechanical Properties

Variant	Condition <sup>i</sup>	Format	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A <sub>5</sub> [%]	Reduction of area Z <sub>min</sub> [%]	Hardness	Impact (ISO-V) strength <sub>min</sub>
51CrV4 EN10089:2002	+S	All formats	-	-	-	-	< 280 HB	-
	+A	All formats	-	-	-	-	< 248 HB	-
	+AC	All formats	-	-	-	-	< 230 HB	-
	+QT	All formats	1200	1350-1650	6	30	-	20 °C 8 J (long)

$RP_{0.2}$  \*  $R_{eh}$  \*\*  $R_{el}$

Impact tests in +QT normally performed on U-notched samples.

The reference treatment for 51CrV4 EN10089:2002 is quench from 850 °C followed by tempering at 450 °C

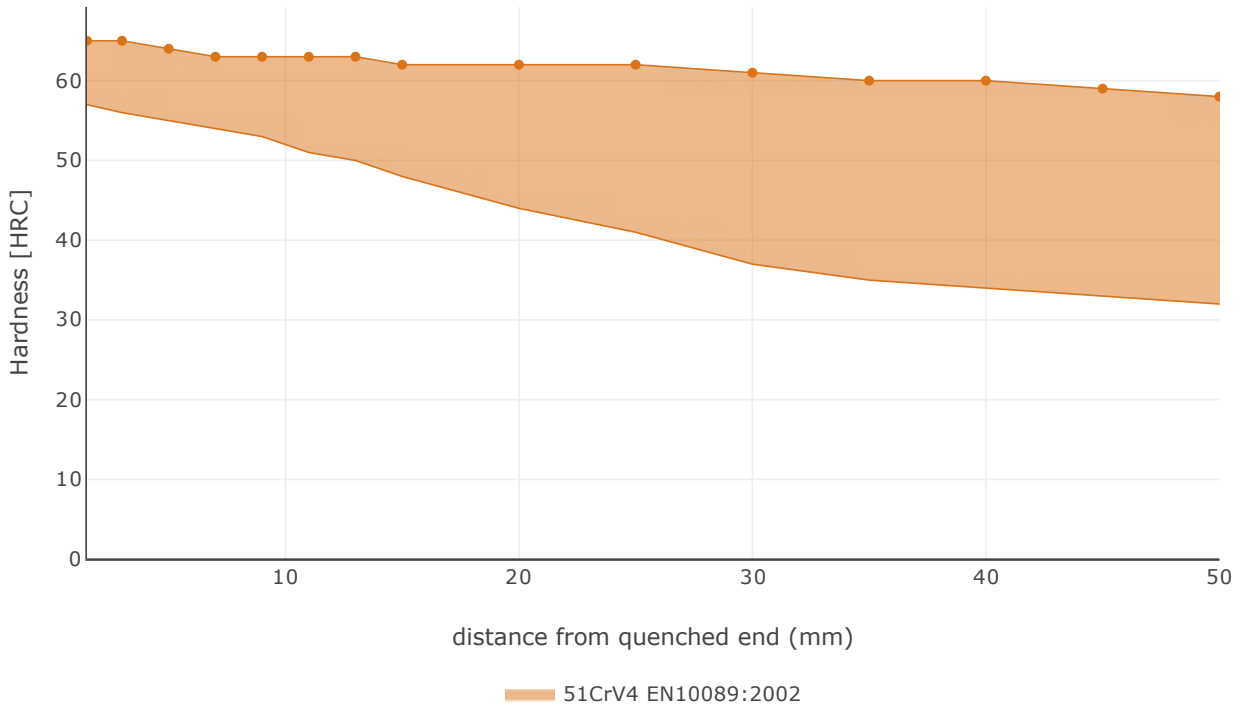
## Transformation temperatures

	Temperature °C
MS	273
AC1	738
AC3	778

## Heat treatment recommendations

Treatment	Condition <sup>i</sup>	Temperature cycle	Cooling/quenching
Hot forging	+AR	Soaking 800-1100°C	In still air
Normalizing	+N	Soaking at 840-880°C	In still air
Soft annealing	+A	Soaking at 730-750°C for 2 hrs	20°C/h to 650°C and then in still air
Stress relieve annealing	+SRA	Soaking at 550-650°C	In still air
Hardening	+QO	Soaking at 830-860°C	Quenching in oil
Tempering	+QT	Tempering 380-680°C for 1 h	In air

## Hardenability



593B: Average value with +/- standard deviation.

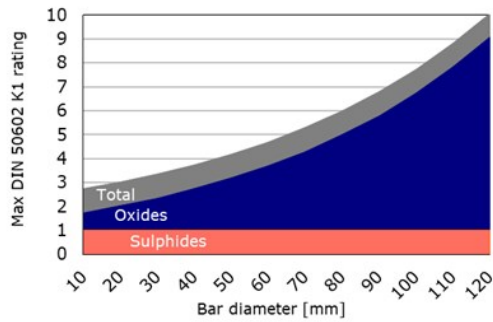
## Steel cleanliness

Micro inclusions - 593B									Macro inclusions - 593B	
Applied standard	ASTM 45								Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295								Sampling	Statistical testing on billets
Maximum average limits	A		B		C		D		Limits	< 5 mm/dm <sup>2</sup>
	Th	He	Th	He	Th	He	Th	He		
	2.5	1.5	1.5	0.5	0	0	1.0	0.5		

Micro inclusions - IQ - 593Q						Macro inclusions - IQ - 593Q			
Applied standard	DIN 50602 K1					Applied standard	ISO 3763 (Blue fracture)	10 M Hz UST (Ovako internal procedure)	
Sampling	Six random samples from final product dimension					Sampling	Statistical testing on billets		
Limits	The limit is dimension dependent. The average rating of six samples should not exceed the limits given in the graph					Limits	< 1mm /dm <sup>2</sup>	<5 defects /dm <sup>3</sup> > 0.2 mm FBH	

## IQ

**Inclusion limits IQ-processed steel**



## SUSTAINABILITY-ENVIRONMENTAL IMPACT DATA

At Ovako sustainability and reduction of our environmental impact is a major focus in everything we do.

Further information is found [here](#).

Steel works	Hofors	Smedjebacken	Imatra
CO2e/kg	120	62	76

To get the full picture of our products environmental impact we have to look at all of our CO<sub>2</sub> emission sources.

Not only the steel work Scope 1-2 itself, but all operations downstream in our production, heating and heat treatment furnaces etc (full scope 1-2) as well as all the emission from input material, eg. alloys, scope 3.

Steel Grade	Format	Condition	Scope 1-3 (CO2e kg /1000 kg steel)
593	Round bar	+AR	602
593	Round bar	+N	615
593	Tube,wall	+AR	628
593	Tube,wall	+N	630
SB9292	Flat bar	+AR	440
SB9290	Flat bar	+AR	446
SB9212	Flat bar	+AR	419
7408	Round bar	+AR	607

All above data are to be seen as typical values for the specified format and condition. Detailed information about your specific product please contact your sales contact.

### Other properties (typical values)

Youngs module (GPa)	Poisson´s ratio (-)	Shear module (GPa)	Density (kg/m3)
210	0.3	80	7800
Average CTE 20-300°C (µm/m°K)	Specific heat capacity 50/100°C (J/kg °K)	Thermal conductivity Ambient temperature (W/m°K)	Electrical resistivity Ambient temperature (µΩm)
12	460 - 480	40 - 45	0.20 - 0.25

### Contact us

Would you like to know more about our offers? Don´t hesitate to contact us:

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For more detailed information please visit <http://www.ovako.com/en/Contact-Ovako/>

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