

## 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.

### **IQ-Steel®**

IQ-Steel® is an isotropic quality ultra clean steel optimized for high fatigue strength under multi axial loading.

### Similar designations

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

## Chemical composition

Variant	Cast	Di	Weldability		C%	Si%	Mn%	P%	S%	Cr%	Ni%	Mo%	V%	Ti%	Cu%	Al%
593Q	IC		CEV 1.02 <sub>max</sub>	Min	0.49	0.20	0.85	-	-	1.00	0.15	0.05	0.100	-	-	-
			Pcm 0.69 <sub>max</sub>	Max	0.53	0.30	1.00	0.025	0.002	1.15	0.25	0.10	0.200	-	-	-
593B	IC		CEV 1.02 <sub>max</sub>	Min	0.49	0.20	0.85	-	0.015	1.00	0.15	0.05	0.100	-	-	-
			Pcm 0.69 <sub>max</sub>	Max	0.53	0.30	1.00	0.025	0.030	1.15	0.25	0.10	0.200	-	-	-
SB4292	CC	7.6	CEV 1.01 <sub>max</sub>	Min	0.51	0.25	1.00	-	-	1.10	-	-	0.120	-	-	-
			Pcm 0.7 <sub>max</sub>	Max	0.54	0.40	1.10	0.015	0.015	1.20	0.20	0.06	0.200	0.010	0.25	0.010
SB4290	CC		CEV 0.99 <sub>max</sub>	Min	0.51	0.25	0.95	-	-	1.10	-	-	0.100	-	-	0.015
			Pcm 0.68 <sub>max</sub>	Max	0.55	0.40	1.10	0.020	0.015	1.20	0.20	0.05	0.200	0.010	0.25	0.040
SB4282	CC		CEV 0.93 <sub>max</sub>	Min	0.51	0.20	0.85	-	-	0.95	-	-	0.100	-	-	-
			Pcm 0.66 <sub>max</sub>	Max	0.54	0.30	0.95	0.025	0.025	1.10	0.20	0.06	0.150	0.040	0.25	0.040
SB4212	CC		CEV 0.89 <sub>max</sub>	Min	0.48	0.20	0.85	-	-	0.95	-	-	0.100	-	-	-
			Pcm 0.62 <sub>max</sub>	Max	0.51	0.30	0.95	0.025	0.025	1.05	0.20	0.05	0.150	0.040	0.25	0.022
7408	CC	6.09	CEV 0.93 <sub>max</sub>	Min	0.47	0.20	0.70	-	-	0.95	-	-	0.100	-	-	-
			Pcm 0.65 <sub>max</sub>	Max	0.55	0.30	1.10	0.025	0.025	1.20	0.30	0.06	0.250	0.040	0.25	0.050
51CrV4 EN10089:2002	Std		CEV <sub>max</sub>	Min	0.47	-	0.70	-	-	0.90	-	-	0.100	-	-	-
			Pcm <sub>max</sub>	Max	0.55	0.40	1.10	0.025	0.025	1.20	-	-	0.250	-	-	-

## Mechanical Properties

Variant	Condition	Format	Dimension [mm]	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>
SB4292	+AR	Flat bar	30 < 56	-	-	-	-	< 385 HB	-
		Flat bar	30 < 56	-	-	-	-	328 HB typical	-
		Round bar	30 < 70	-	-	-	-	< 400 HB	-
		Round bar	30 < 70	-	-	-	-	365 HB typical	-
	+QT	Flat bar	30 < 56	1220**	1330-1620	6	30	-	20 °C 16 J (long)
	+S	All formats	-	-	-	-	-	256 HB typical	-
SB4290	+AR	All formats	-	-	-	-	-	< 385 HB	-
		All formats	-	-	-	-	-	339 HB typical	-
	+S	All formats	-	-	-	-	-	244 HB typical	-
	+QT	Flat bar	24 < 56	1250**	1420-1800	6	30	-	20 °C 8 J (long)
SB4282	+AR	All formats	-	-	-	-	-	< 400 HB	-
		Flat bar	5 < 15	-	-	-	-	351 HB typical	-
		Flat bar	15 < 30	-	-	-	-	339 HB typical	-
		Flat bar	30 < 56	-	-	-	-	326 HB typical	-
		Round bar	5 < 30	-	-	-	-	355 HB typical	-
		Round bar	30 < 73	-	-	-	-	338 HB typical	-
SB4212	+AR	Flat bar	< 30	-	-	-	-	< 385 HB	-
		Flat bar	< 30	-	-	-	-	340 HB typical	-
7408	+AR	Round bar	25 < 160	-	-	-	-	< 420 HB	-
	+A	Round bar	25 < 160	-	-	-	-	< 248 HB	-
	+QT	Round bar	25 < 100	700	900-1100	15	50	-	-
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)

*R<sub>p0.2</sub> \* R<sub>eh</sub>, \*\* R<sub>el</sub>*

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

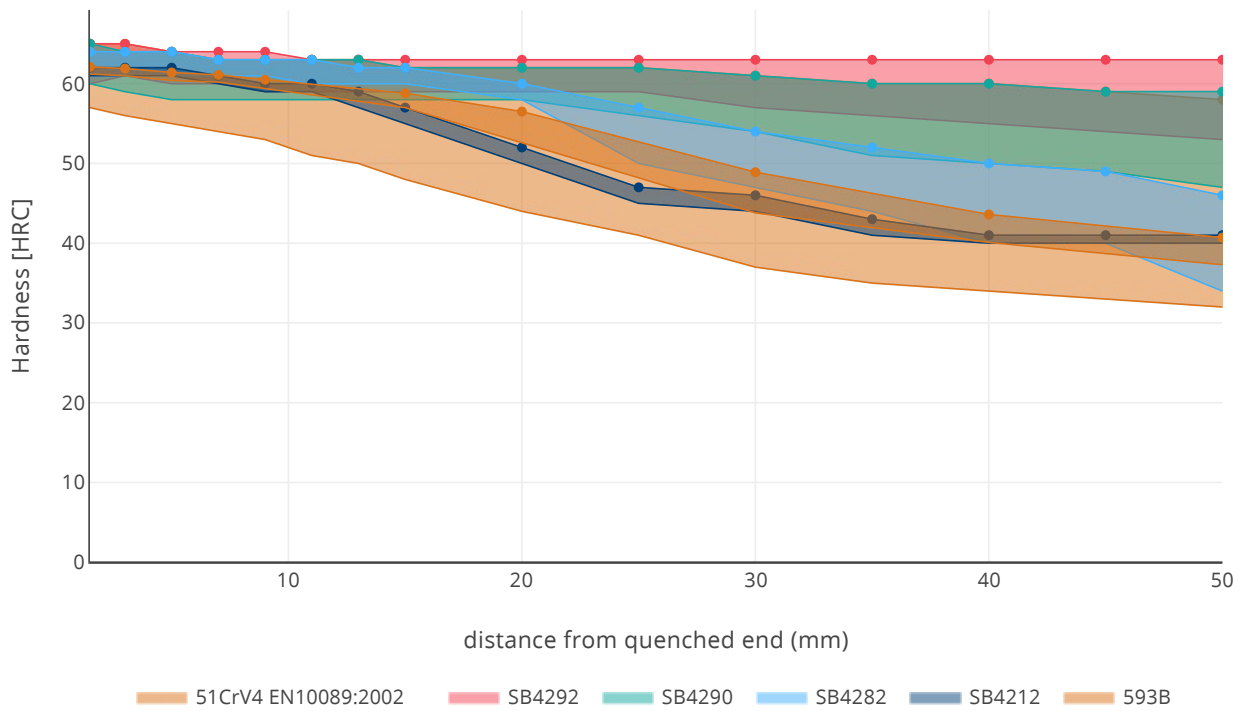
## Transformation temperatures

	Temperature °C
MS	273
AC1	738
AC3	778

## Heat treatment recommendations

Treatment	Condition	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.

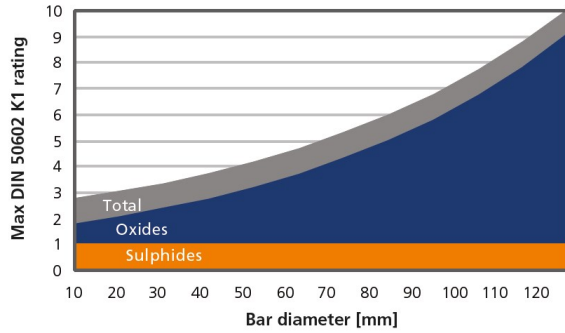
## Steel cleanliness

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	< 1 mm /dm <sup>2</sup>	<5 defects /dm <sup>3</sup> > 0.2 mm FBH

## IQ

### Inclusion limits IQ-processed steel



### 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

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