

50CrMo4 All

General Information

Ovako 528E and 528Q is a high tensile quench and tempering steel with high wear resistance and good toughness. The grade is mainly used for axis and machine components. Ovako 528Q is produced with the quality class IQ (isotropic quality). This ensures a very low number of elongated sulphide inclusions which will give more isotropic properties. The oxidic cleanliness is high and the steel could therefore meet same high demands as for remelted qualities. Through hardenability corresponding to a bar with approx. Ø75mm (oil quenched) Suitable for flame or induction hardening. Delivered as rolled, soft annealed normalized or quench and tempered. Weldable under certain conditions.

IQ-Steel®

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

Similar designations

4150, 1.7228

Chemical composition

Variant	Cast		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Cu %
528E	IC	Min	0.50	0.15	0.60	-	0.030	0.90	0.18	0.18	-
		Max	0.52	0.40	0.90	0.035	0.050	1.20	0.25	0.25	0.35
528Q	IC	Min	0.50	0.15	0.60	-	-	0.90	-	0.15	-
		Max	0.55	0.40	0.90	0.025	0.001	1.20	0.25	0.25	0.35
50CrMo4 EN ISO 683-2	Std	Min	0.46	0.10	0.50	-	-	0.90	-	0.15	-
		Max	0.54	0.40	0.80	0.025	0.035	1.20	-	0.30	0.40

Mechanical Properties

Variant	Condition ⓘ	Format	Dimension [mm]	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A ₅ [%]	Reduction of area Z _{min} [%]	Hardness
528E	+AR	Round bar	-	320	< 590	29	72	< 190 HB
	+QT	Round bar	< 50	1100	< 1300	8	-	< 400 HB
		Round bar	50 < 100	800	< 1000	11	45	< 320 HB
		Round bar	> 100	700	< 900	13	45	< 300 HB
528Q	+AR	Round bar	< 100	320	< 590	29	72	< 190 HB
	+QT	Round bar	< 50	1100	< 1300	8	-	< 400 HB
		Round bar	50 < 100	800	< 1000	11	45	< 320 HB
		Round bar	> 100	700	< 900	13	45	< 300 HB

$R_{p0.2}$ * R_{eh} ** R_{el}

Transformation temperatures

	Temperature °C
MS	289
AC1	736
AC3	775

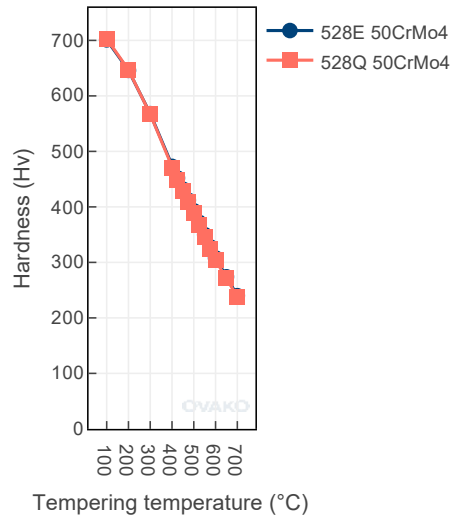
Heat treatment recommendations

Treatment	Condition ⓘ	Temperature cycle	Cooling/quenching
Hot forging		850-1100	In still air
Normalizing	+N	840-880	In still air
Soft annealing	+A	700-730/2h	15°C/h to 600°C, then still air
Stress relieve annealing	+SRA	525-620	In still air
Hardening	+Q	830-860	In oil
		820-850	In water
Tempering	+T	525-625/1h	

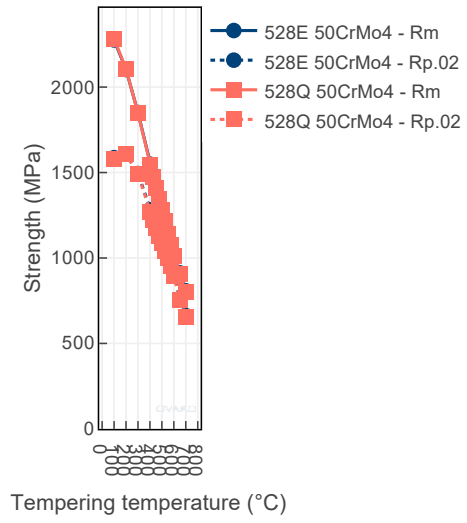
Heat Treatment Guide generated Graphs

The following graphs are generated from a theoretical model. For further info see the Heat treatment guide module. Select a specific grade version for individual display.

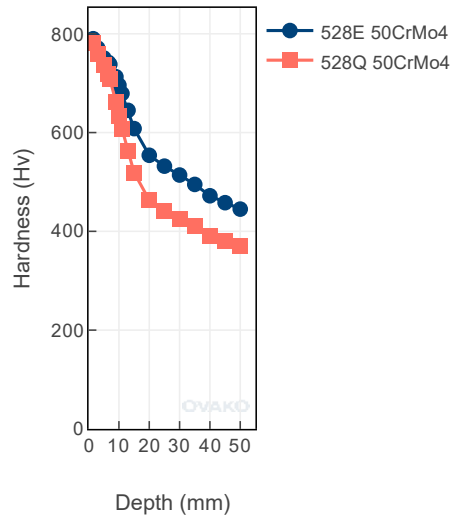
Tempering Diagram (hardness)



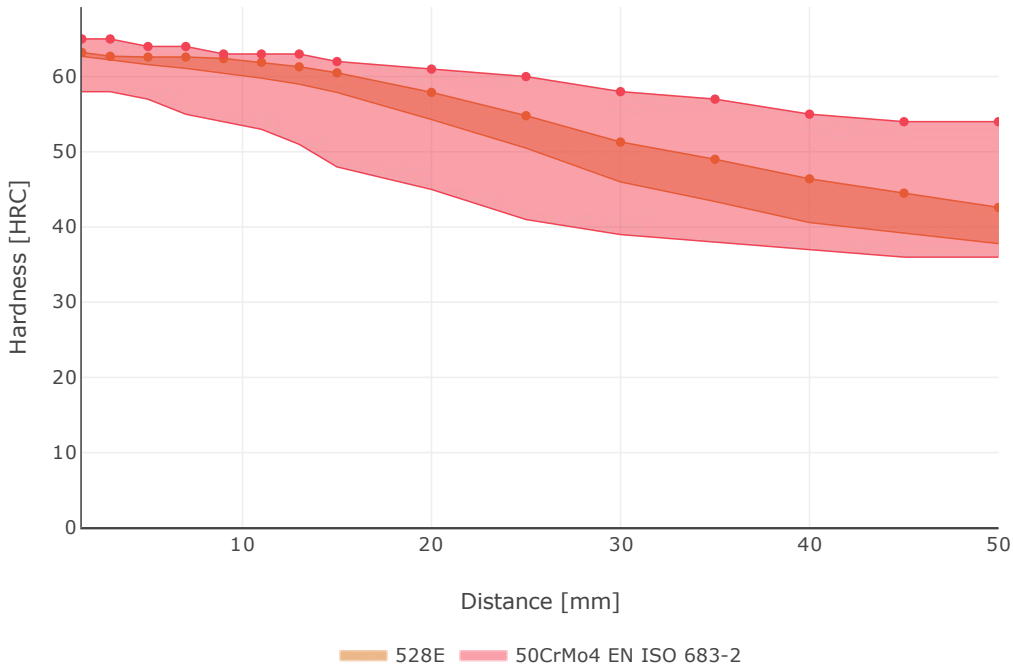
Tempering Diagram (strength)



Jominy

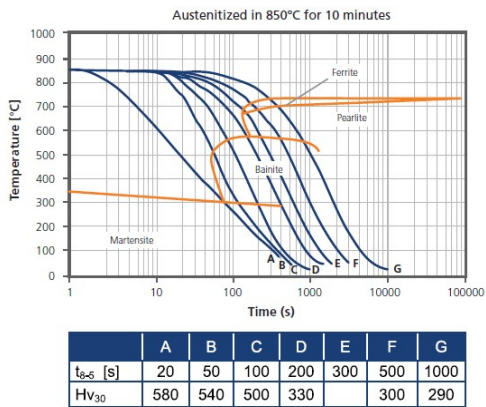


Hardenability

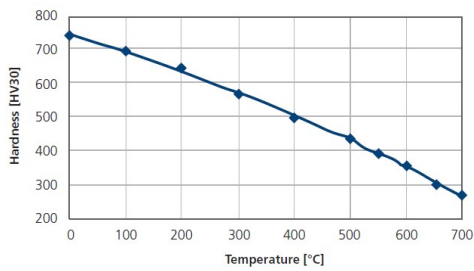


528E: Jominy hardenability according to ASTM A255. Average value with +/- standard deviation.

CCT - 528E and 528Q



Tempering response - 528E and 528Q



Austenitized at 850°C for 20 minutes, quenched in oil.
Tempered 1h at each temperature level.

Steel cleanliness

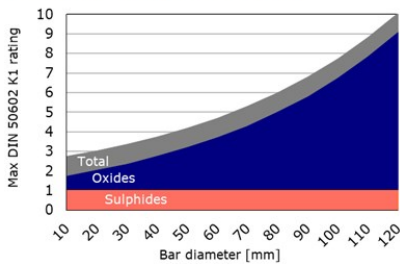
Micro inclusions - 528E								Macro inclusions - 528E	
Applied standard	ASTM E45							Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295							Sampling	Statistical testing on billets
Maximum average limits	A		B		C		D		
	Th	He	Th	He	Th	He	Th	He	
	2.5	1.5	1.5	0.5	0	0	1.0	0.5	
Limits								Limits	< 5 mm/dm ²

Steel cleanliness

Micro inclusions - IQ		Macro inclusions - IQ	
Applied standard	DIN 50602 K1	Applied standard	10 M Hz UST (Ovako internal standard)
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	< 5 defects/dm ³ > 0,2 mm FBH

IQ

Inclusion limits IQ-processed steel



Fatigue properties - 528Q, 35 mm bar

Test method:	Rotating beam
Stress level:	Stair-case 25 MPa steps
Specimen:	Hourglass shape Ø 9.5 mm
Specimen data	
Material:	528Q IQ Ø35 mm
Structure:	Tempered martensite
Hardness:	53 HRC
Reference data	
Material:	300M VAR Ø35 mm
Structure:	Tempered martensite
Hardness:	53 HRC



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 CO₂ 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 (CO ₂ e kg /1000 kg steel)
528	Round bar	+AR	616
528	Round bar	+QT	622
528	Tube,wall	+AR	633
528	Tube,wall	+QT	639

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/m ³)
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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Via telephone: +46 8 622 1300

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

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