MATERIAL DATA SHEET

STEEL GRADE

Last revised: Thu, 30 Jan 2025 11:28:41 GMT

OVAKO

66SiMnCrMo6-6-4* All

General Information

Ovako 677L & 677Q is an air-hardening bearing steel with high mechanical strength and fatigue properties. By using gas cooling or air-hardening it is possible to reduce the amount of distortion. Additionally the use of quenching medias such as oil and salt can be avoided, which improves both safety and environment.

- Through hardenability corresponding to a bar with approx. ∅40 mm (cooling in still air)
- Can be induction or flame hardened
- Good machinability in soft annealed condition
- Machinable in hardened condition using hard-turning techniques
- Good dimensional stability
- Corresponds to BQ and IQ specifications
- Delivered in soft annealed condition

Ovako 677L - BQ (Bearing Quality) - Standard

Ovako 677Q - IQ (Isotropic Quality) - Due to a reduced sulphide inclusion content and a finer oxide inclusion distribution, Ovako 677Q is a steel with isotropic properties with excellent fatigue strength in both transverse and longitudinal directions.

IQ-Steel®
IQ-Steel® is an isotropic quality ultra clean steel optimized for high fatigue strength under multi axial loading.
BQ-Steel®
BQ-Steel® is a bearing quality clean steel optimized for fatigue strength and is also ideal for new design solutions outside the bearing industry.

Similar designations

66SiMnCrMo6-6-4

Chemical composition

Variant	Cast		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %
677Q	IC	Min	0.63	1.40	1.35	-	-	1.00	-	0.23
		Max	0.70	1.60	1.55	0.025	0.001	1.20	0.25	0.27
677L	IC	Min	0.65	1.45	1.35	-	0.004	1.00	-	0.23
		Max	0.70	1.55	1.55	0.025	0.015	1.10	0.25	0.27

Mechanical Properties

Variant	Condition	Format	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A_5 [%]	Hardness
677Q	+SA	Round bar	-	-	-	220 HB typical
	+Q	Round bar	1700	2300 typical	2	61 HRC typical
677L	+SA	Round bar	-	-	-	220 HB typical
	+Q	Round bar	1700	2300 typical	2	61 HRC typical

*$Rp_{0.2}$ * R_{eh}, ** R_{el}*

Transformation temperatures

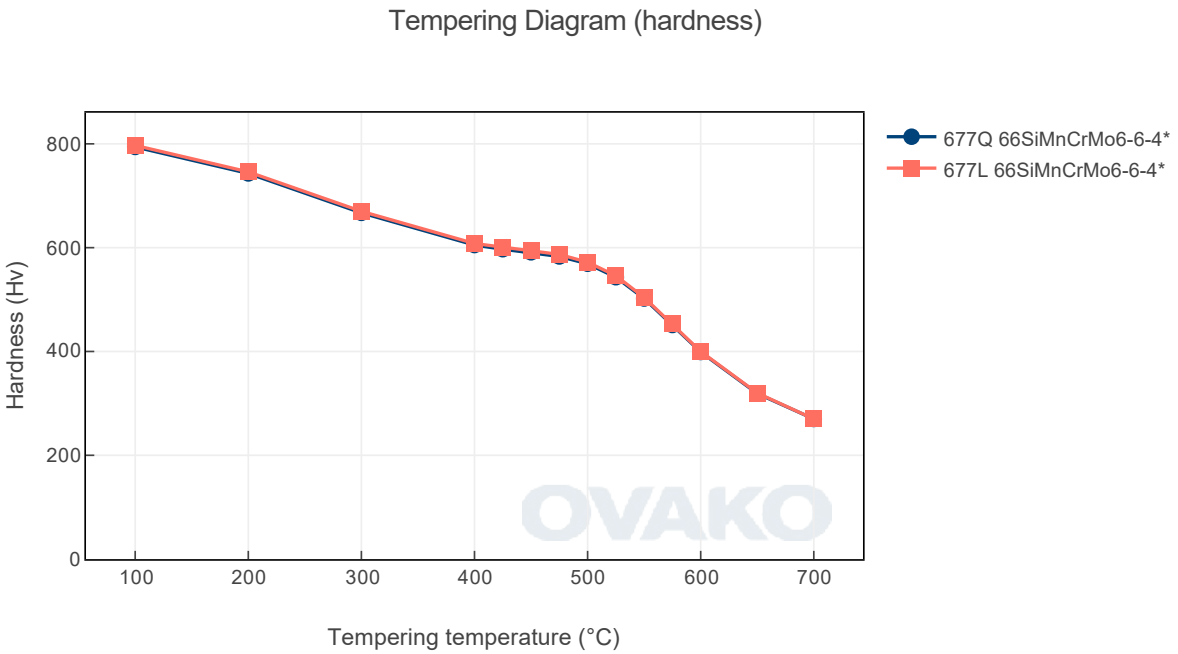
	Temperature °C
MS	193
AC1	768
AC3	792

Heat treatment recommendations

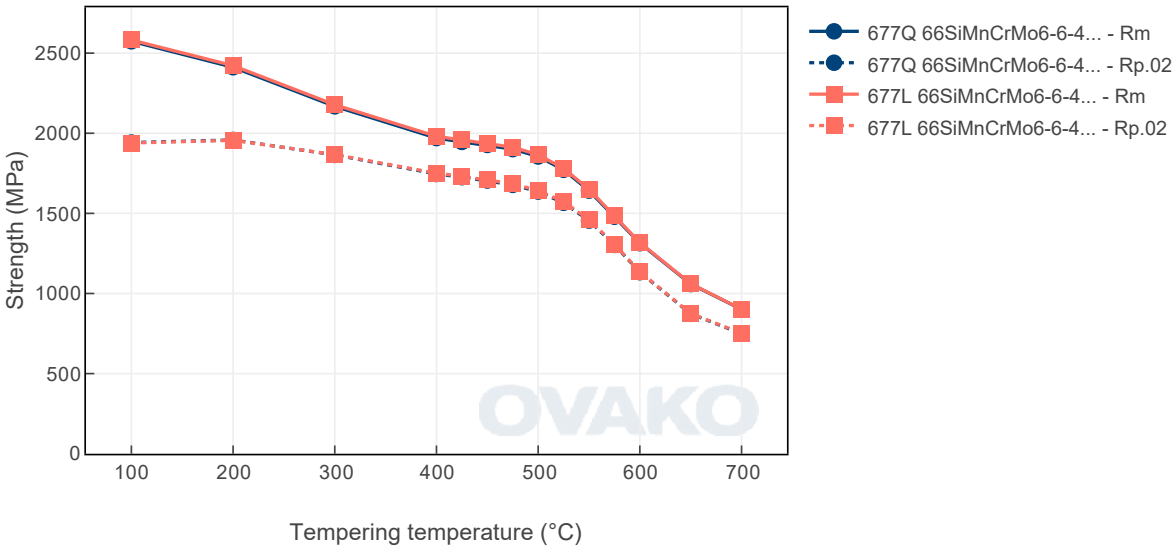
Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging	+AR	900-1200°C	Slowly or in air
Soft annealing	+SA	775°C / 1h	Slowly to 650ºC in 8h
Hardening	+QT	880-1000°C	Directly hardened in air or by gas quenching
Tempering	+QT	150-710°C	In air

Heat Treatment Guide generated Graphs

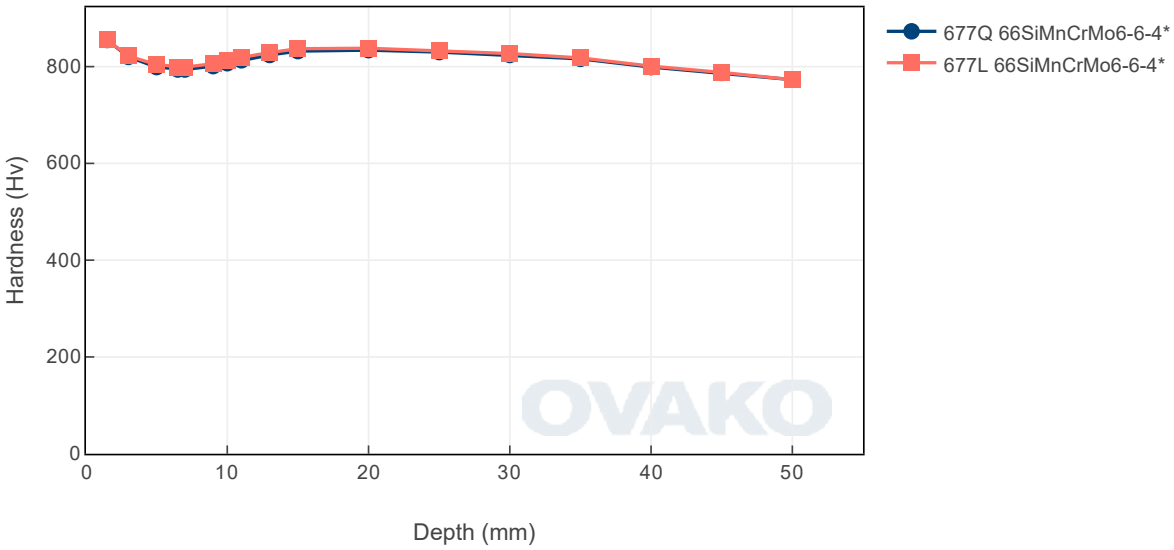
The following graphs are generated from a theoretical model. For further info see the Heat treatment guide module. Select a specific grade version for individual display.



Tempering Diagram (strength)



Jominy


Hardness (Hv)
800
600
400
200
0
0
10
20
30
40
50
Depth (mm)
677Q 66SiMnCrMo6-6-4*
677L 66SiMnCrMo6-6-4*
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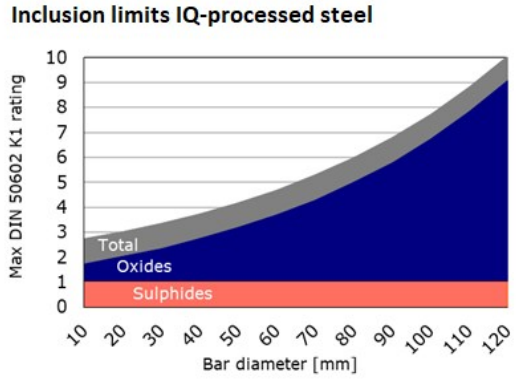
Steel cleanliness

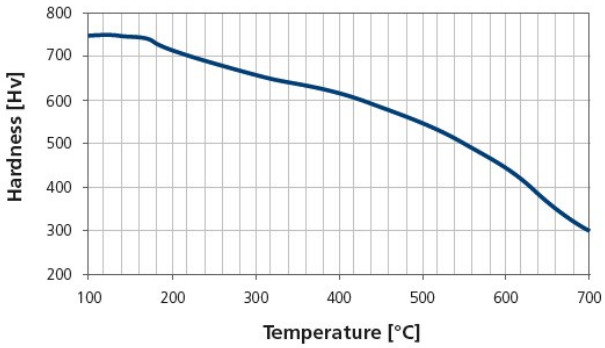
Micro inclusions - BQ										Macro inclusions - BQ	
Applied standard	ASTM 45									Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295									Sampling	Statistical testing on billets
Maximum average limits	A		B		C		D			Limits	< 2,5 mm/dm^2
	Th	He	Th	He	Th	He	Th	He			
	2.0	1.5	0.8	0.1	0	0	0.5	0.3			

Micro inclusions - IQ			Macro inclusions - IQ		
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^2	<18 defects /dm^3 > 0.2 mm FBH

IQ

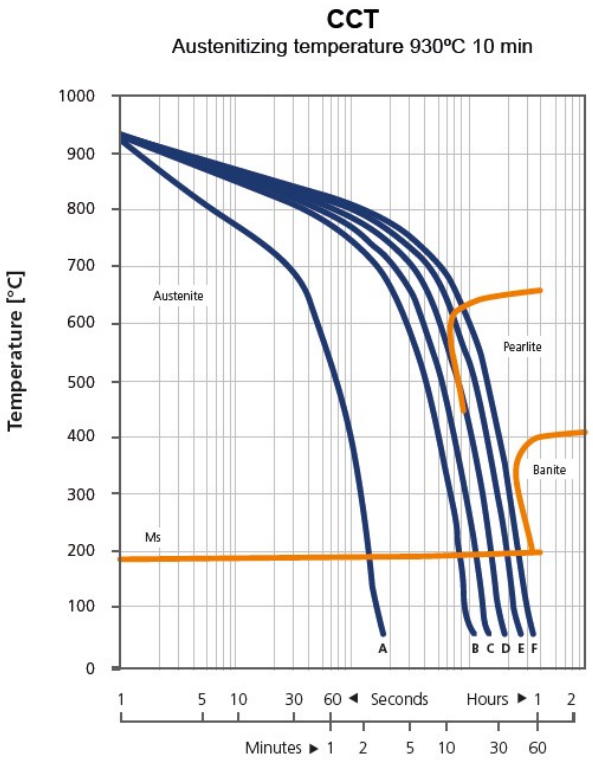


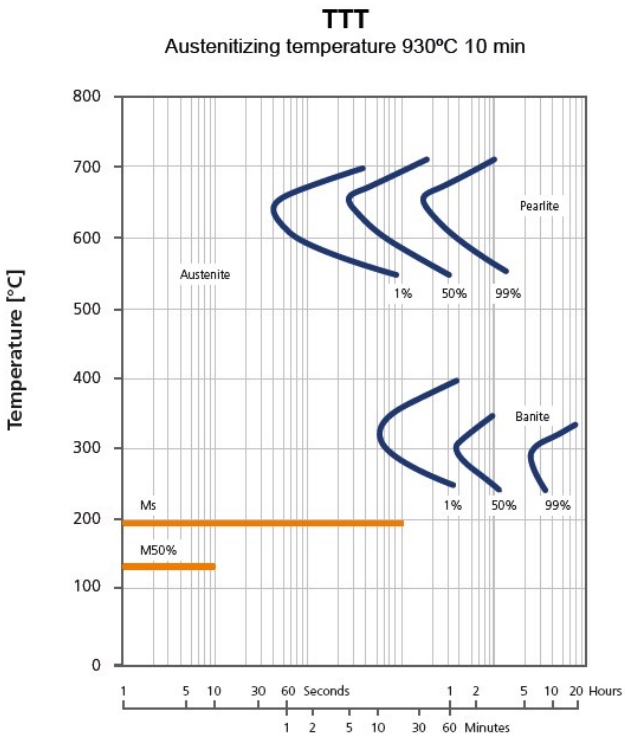
Tempering response Ovako 677



Tempering response for Ovatec 677. Austenitized at 900°C for 30 min and hardened in air. Tempered one hour at each tested temperature level.

Transformation diagrams

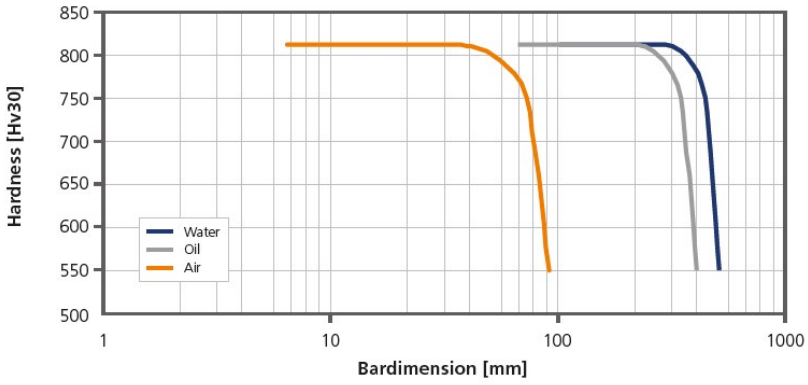




	A	B	C	D	E	F
t_{8-5} [s]:	66	395	536	750	1000	1304
Hv_{30}:	812	812	811	794	827	505

Hardenability

The hardenability describes the steel's ability to form the hard martensite during cooling. It is measured as the steel hardness versus cooling rate or dimension.



Hardenability of Ovatec 677 calculated from CCT measurements and two-dimensional quenching of a bar. Each curve corresponds to different cooling medias.

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_2 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)	Climate compensated Net emission = Scope 3 (CO2e kg /1000 kg steel) Scope 1 - 2 = 0 (compensated)
677	Round bar	+AR	653	254
677	Tube,wall	+AR	680	280

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 resistivityAmbient 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/