

STEEL GRADE

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16NiCrS4

All

General Information

16NiCrS4 is an case hardening steel with good dimension stability, high toughness and improved machinability.

Ovako 146S is an ingot cast steel. The chemical composition is well controlled to give the steel a controlled hardenability towards the high end (HH). It has reduced silicon content for reduced propensity for internal oxidation during carburizing. Regulated sulphur content ensures good machinability properties.

4730 is an contious cast steel. The chemical composition is well controlled to give the steel a controlled hardenability towards the low end (HL). For improved machinability this steel is processed according to our M-Steel concept.

Similar designations

SS 2511, 16NCD5 (AFNOR), 637 A 16 (BS), 16NC6 (AFNOR), BS 637M17 M

Chemical composition

Variant	Cast	Weldability		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Cu %
EN ISO 683-3 16NiCrS4	Std	CEV 0.67 _{max}	Min	0.13	0.15	0.70	-	0.020	0.60	0.80	-
		Pcm 0.33 _{max}	Max	0.19	0.40	1.00	0.025	0.040	1.00	1.10	0.40

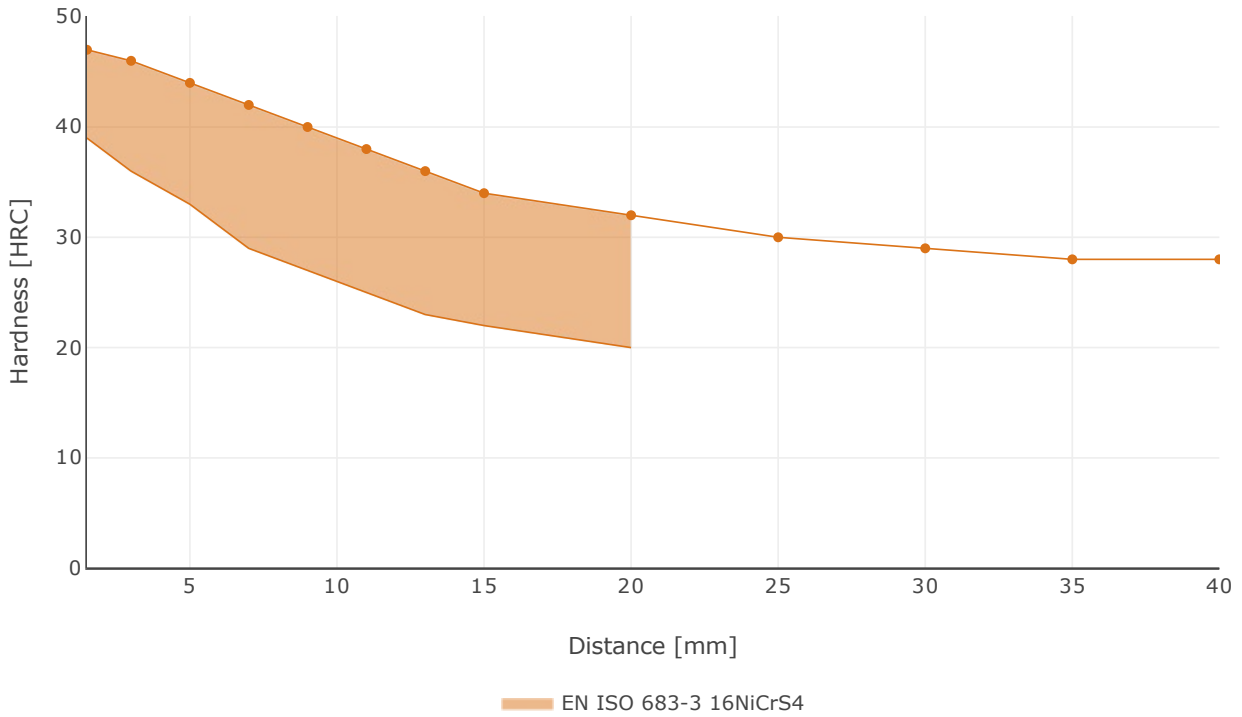
Transformation temperatures

	Temperature °C
AC1	714
AC3	799

Heat treatment recommendations

Treatment	Condition ¹	Temperature cycle	Cooling/quenching
Hot forging	+AR	Soaking at 800 - 1200°C	In air
Normalizing	+N	860 - 890°C	In air
Soft annealing	+A	600 - 670°C / 2h	In air
Quenching	+Q	Hardening temperature 840 - 890°C	In oil
Carburizing	+Q	Hardening as carburized soaking 780 - 830°C	In oil
Tempering	+QT	Soaking at 160 - 250°C 1hr	In air

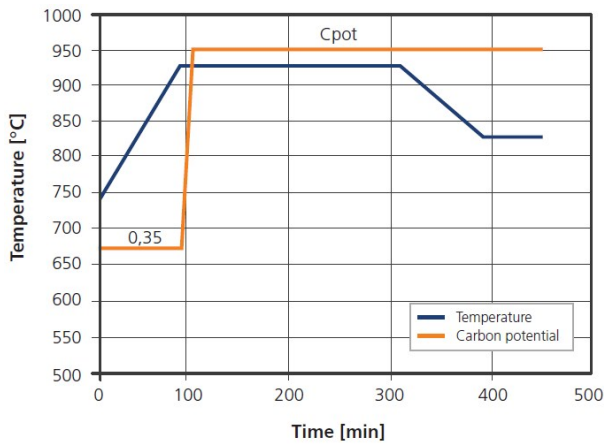
Hardenability



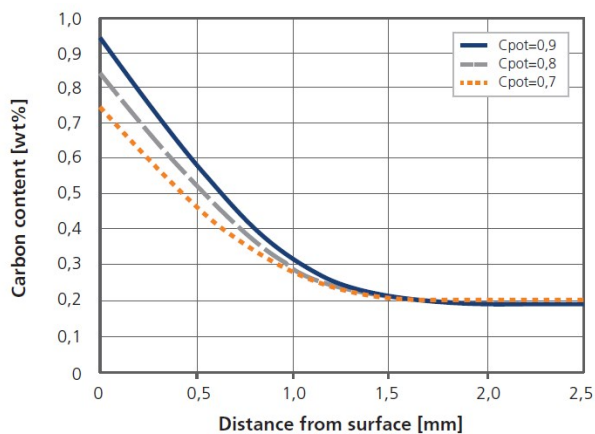
146S: Jominy hardenability according to ASTM A255. Average value with +/- standard deviation.

EN ISO 683-3 data is showing the +H version.

Heat treatment

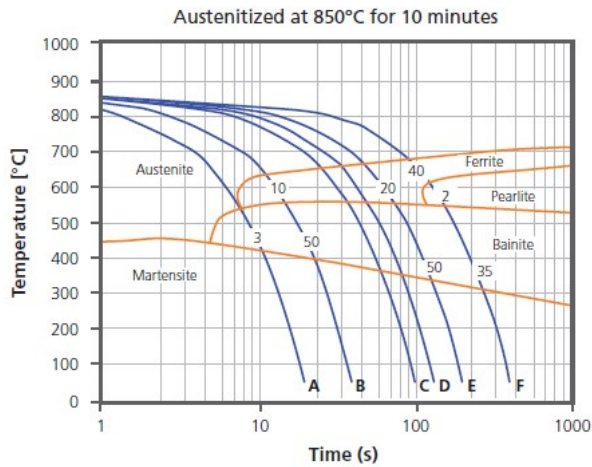


Carburizing response



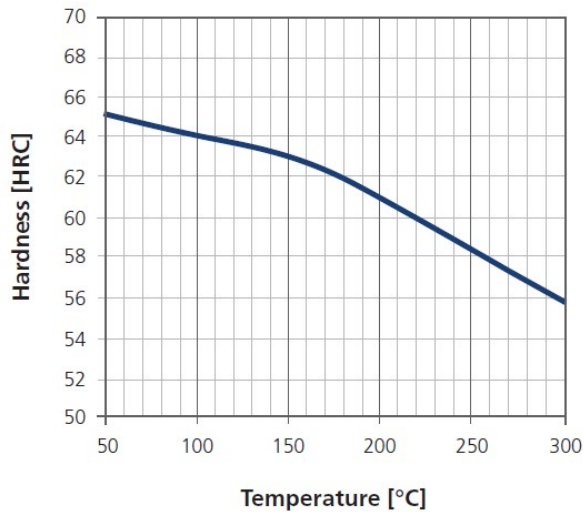
Carburization response for Ovako 146S for the cycles shown in the left figure.

CCT



	A	B	C	D	E	F
t_{8-5} [s]	7.5	15	37.5	50	75	150
Hv ₃₀	455	345	320	290	285	255

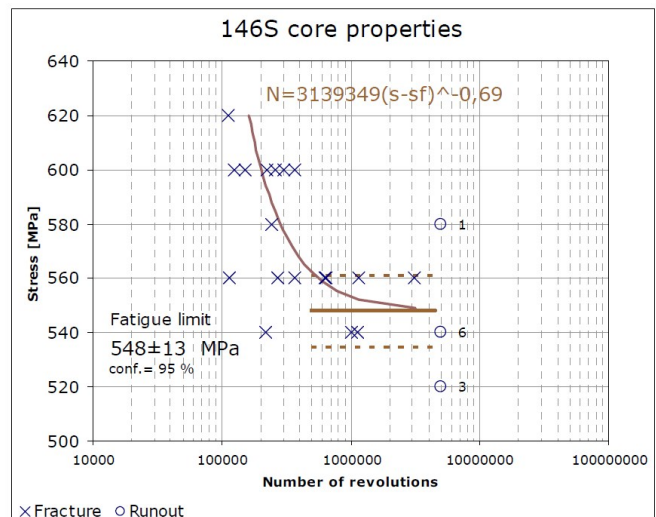
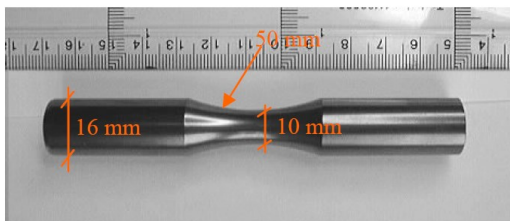
Tempering response



Tempering response for carburized surfaces of Ovako 146S after quenching and tempering one hour at different temperatures.

Fatigue properties

Test method:	Rotating beam
Test procedure:	Stair-case 20 MPa steps
Specimen:	Hourglass shape Ø 10 mm
Heat treatment:	Simulated core structure 925°C / 8h 820°C / 0.5h Oil quench 150°C / 1.5h
Hardness:	40 HRC



Steel cleanliness

Micro inclusions								Macro inclusions	
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	1,0	0,5	0	0	0,5	0,5	
Limits								Limits	< 5 mm/dm ²

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
CO ₂ e/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)
146S	Round bar	+AR	795
146S	Round bar	+FP	800
146S	Tube,wall	+AR	833
146S	Tube,wall	+FP	836
4730	Round bar	+AR	649

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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:

Via e-mail: info@ovako.com

Via telephone: +46 8 622 1300

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

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