

# 18CrNiMo7-6 All

## General Information

Ovako 159 is a case hardening steel with high toughness of the type 18CrNiMo7-6. There are four different versions of the grade with high cleanliness requirements. All variants has tighter composition ranges compared to the standard. One variant 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 high oxidic cleanliness will enable the steel to meet the same high cleanliness demands as for re-melted qualities.

Grade 159A - Variant with low sulphur content and high cleanliness demands

Grade 159B - Variant with controlled sulphur content for consistent machinability and +H hardenability

Grade 159Q - Isotropic properties (IQ) and better fatigue strength due to higher cleanliness levels, and a finer size and distribution of non-metallic inclusions

Grade 159X - Variant with controlled sulphur content for consistent machinability and +H hardenability

Grade 159S - Variant with increased sulphur content.

## IQ-Steel®

(Isotropic Quality) is an isotropic quality ultra clean steel. IQ-Steel is optimized for fatigue strength by a strict control of steel cleanliness. IQ-Steel, a further development of BQ-Steel, is an isotropic and ultra clean steel with properties that match re-melted steels. Based on thousands of examinations by Ovako into the effects of defects on fatigue performance, the metallurgy of IQ-Steel is purer and far more consistent than conventional grades, and designed specifically to perform well in multi axial loading. This enables the manufacturing of lighter, slimmed down components like gears, bearings and other critical parts. The steels are helping our customers to achieve new design solutions and implement higher standards of finished product performance. Key to these practical advantages are Ovako's own unique, clean and consistent modern steelmaking processes that remove harmful inclusions and impurities from within the steel. IQ-Steels contain smaller and more fragmented inclusions and can handle much higher mechanical forces in all directions than conventional steels. IQ-Steels are newer, but already now well established in high pressure automotive applications. Modern diesel engines, with high and cyclic injection pressures, have proven to be an ideal application. Transmission components are another emerging area of strong interest.

## Similar designations

1.6587, AISI4820, DIN17CrNiMo6, 18CND6

## Chemical composition

Variant	Cast		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %
18CrNiMo7-6 ref	Std	Mn	0.15	-	0.50	-	-	1.50	1.40	0.25
		Max	0.21	0.40	0.90	0.025	0.015	1.80	1.70	0.35

## Mechanical Properties

Variant
Rp0.2 * Reh, ** Rel

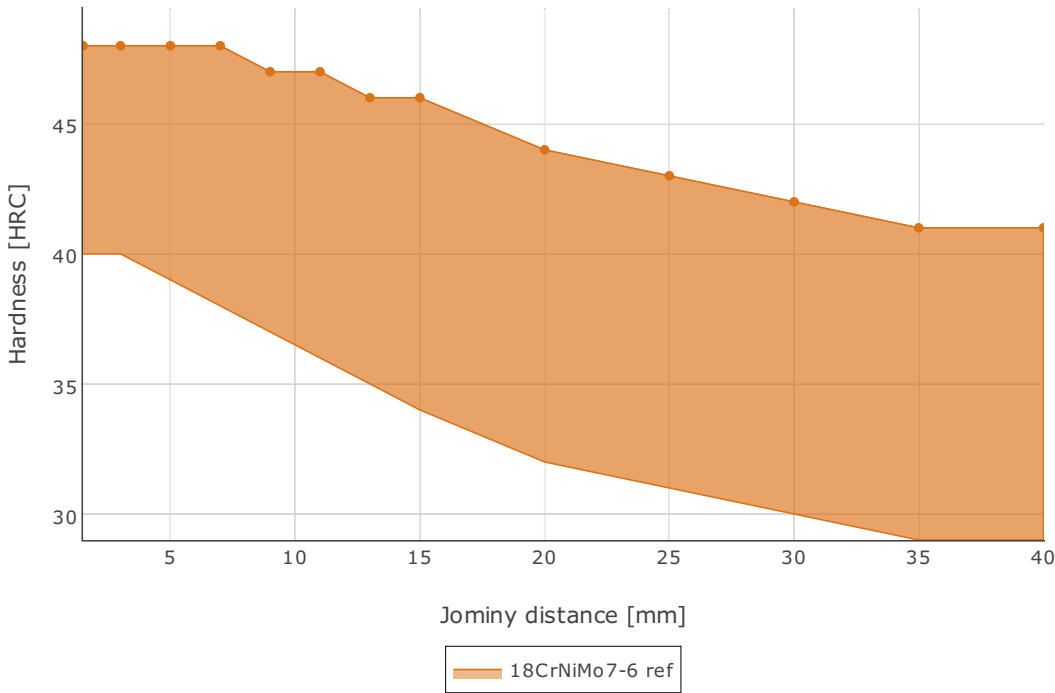
## Transformation temperatures

	Temperature °C
MS	410
AC1	726
AC3	833

Heat treatment recommendations

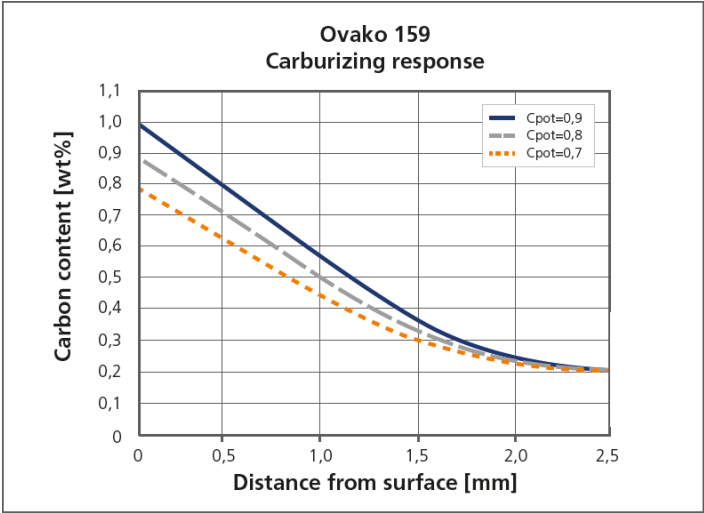
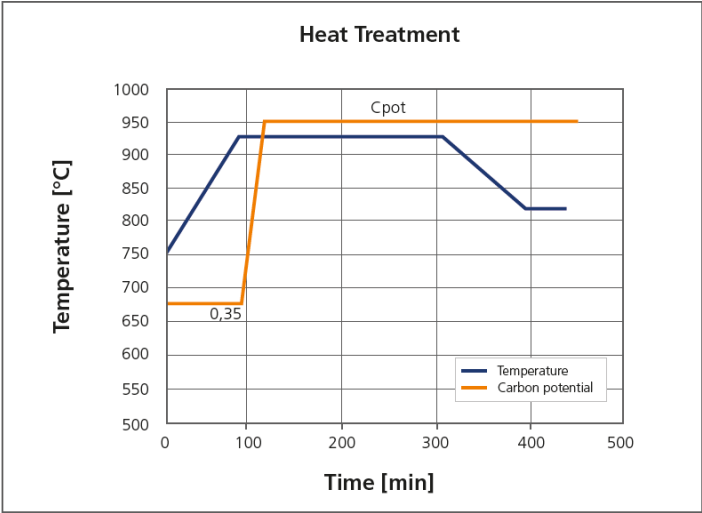
Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging	+U	800-1200°C	In air
Normalizing	+N	860-890°C	In air
Carburizing	+C	850-930°C Carbon potential see diagram	
Hardening	+QT	840-870°C	In oil
Hardening	+QT	780-830°C Hardening of as-carburized components	In oil

Hardenability



Austenitization temperature of Ovako 159X: 845°C    The reference 18CrNiMo7-6 is the "+H" variant according to SS-EN ISO 683-17 2014.

Carburizing response - Ovako 159



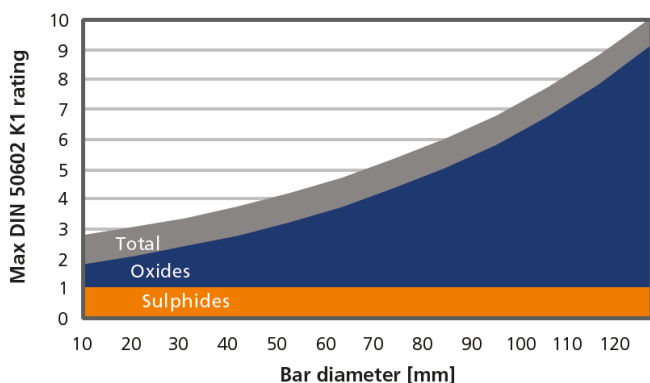
Carburization response for Ovako 159 for the cycles shown in the left figure.

## Steel cleanliness

Micro inclusions - steel grade 159X									Macro inclusions - 159X	
Applied standard	ASTM E45								Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295								Sampling	Statistical sampling on billets
Maximum average limits	A		B		C		D		Limits	<2,5 mm/dm <sup>2</sup>
	Th	He	Th	He	Th	He	Th	He		
	2.0	1.5	1.5	0.5	0.0	0.0	1.0	1.0		
Micro inclusions - IQ - steel grade 159Q									Macro inclusions - IQ - 159Q	
Applied standard	DIN 50602 K1								Applied standard	10 MHz UST (Ovako internal procedure)
Sampling	Six random sample from final product								Sampling	Statistical sampling on billets
Limits	The limits is dimension dependent. The average rating of six samples should not exceed the limits given in the graph.								Limits	<10 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/m <sup>3</sup> )
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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For more detailed information please visit <http://www.ovako.com/en/Contact-Ovako/>

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