MATERIAL DATA SHEET

STEEL GRADE

Last revised: Thu, 16 Jan 2025 15:50:39 GMT

OVAKO

20MnCr5 All

General Information

20MnCr5 is a case-hardening steel with low carbon content but good hardenability reaching good wear resistance due to high surface hardness after hardening. The small grain size benefits in good ductility and fatigue strength. Suitable for gearboxes and axle gears.

Ovako 236F is a standard variant with controlled sulphur content for consistent machining properties.

Ovako 236Q 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

20MnCrS5, 1.7147, 20MnCr4, 1.7149

Chemical composition

Variant	Cast	Di	Weldability		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	Cu %	Al %
236Q	IC		CEV 0.73_{max}	Min	0.17	0.10	1.10	-	-	1.00	0.10	-	-	0.050
			Pcm 0.38_{max}	Max	0.22	0.25	1.30	0.025	0.002	1.20	0.25	0.08	0.25	0.200
236F	IC		CEV 0.79_{max}	Min	0.17	0.20	1.10	-	0.015	1.10	-	-	-	0.020
			Pcm 0.4_{max}	Max	0.22	0.35	1.40	0.025	0.025	1.30	0.25	0.08	0.30	0.040
MC212	CC	3.11	CEV $_{max}$	Min	0.17	0.15	1.10	-	-	1.00	-	-	-	0.020
			Pcm $_{max}$	Max	0.22	0.40	1.40	0.025	0.035	1.30	-	-	0.30	0.040
20MnCr5 +H EN ISO 683-3	Std		CEV $_{max}$	Min	0.17	0.15	1.10	-	-	1.00	-	-	-	-
			Pcm $_{max}$	Max	0.22	0.40	1.40	0.025	0.035	1.30	-	-	0.40	-

Transformation temperatures

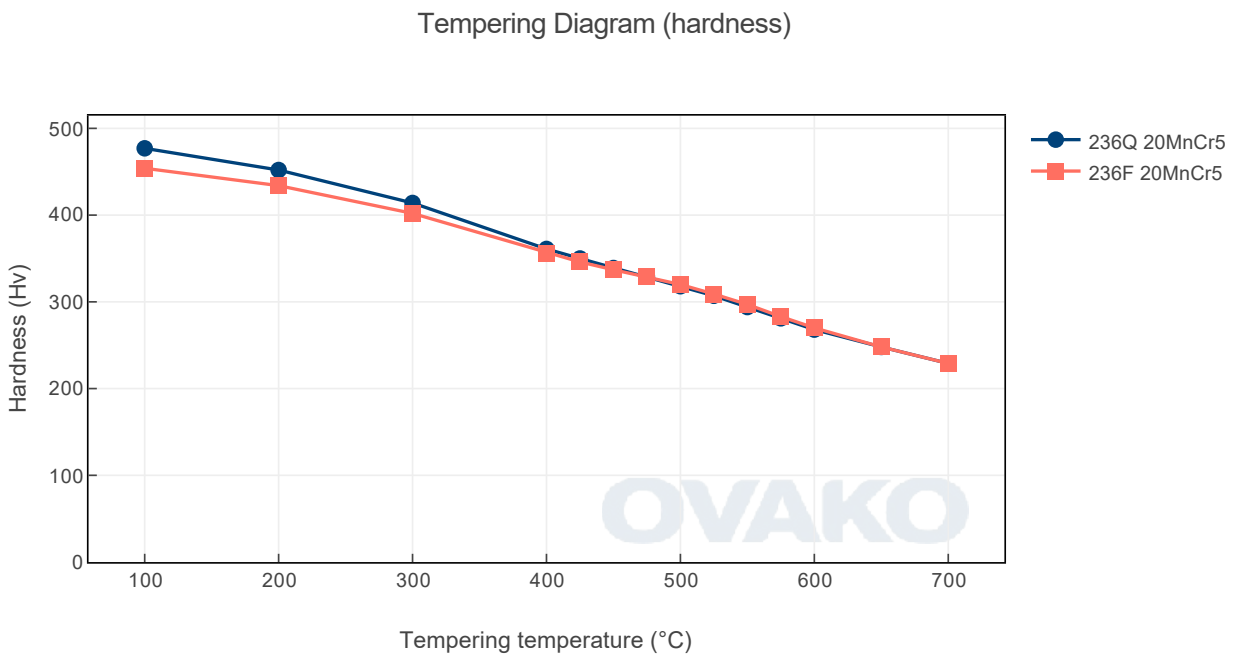
	Temperature °C
MS	385
AC1	731
AC3	831

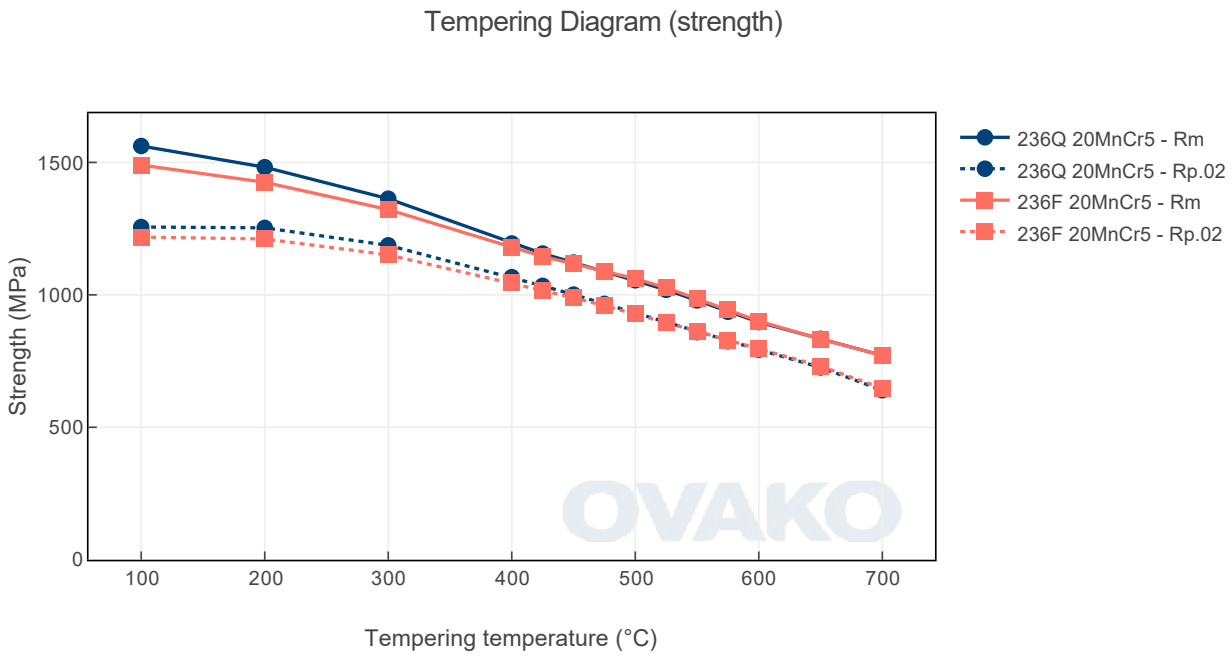
Heat treatment recommendations

Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging		850 - 1 200	Slowly or in air
Annealing	+A	670 - 710	Slowly (15°C/h) until 600°C
	+FP	950 - 1 000	Quickly to following stage
	+FP	630 - 650	Keeping about 3 hours, after that: in air
Normalizing		860 - 890	In air
Stress relieve annealing		650 - 680	In air
Carburizing		860 - 900	In air
Hardening		830 - 870	Quenching in oil or water
Tempering		150 - 200	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)
Strength (MPa)
1500
1000
500
0
100
200
300
400
500
600
700
Tempering temperature (°C)
236Q 20MnCr5 - Rm
236Q 20MnCr5 - Rp.02
236F 20MnCr5 - Rm
236F 20MnCr5 - Rp.02
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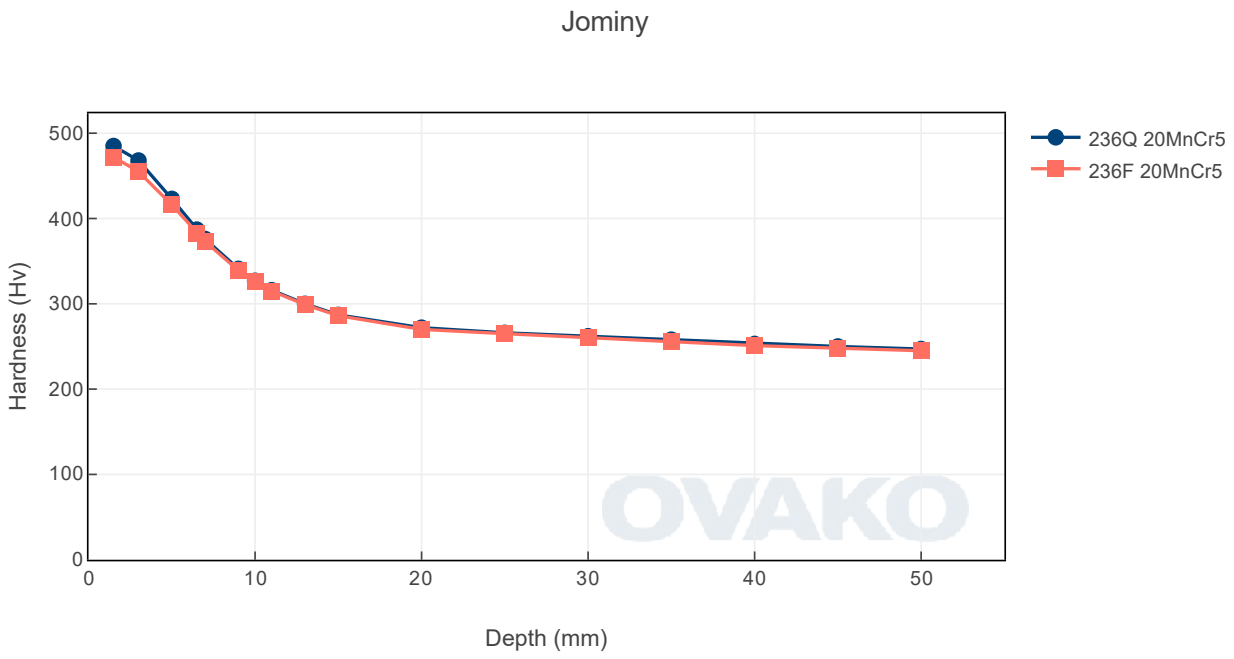
Jominy
Hardness (Hv)
500
400
300
200
100
0
0
10
20
30
40
50
Depth (mm)
236Q 20MnCr5
236F 20MnCr5
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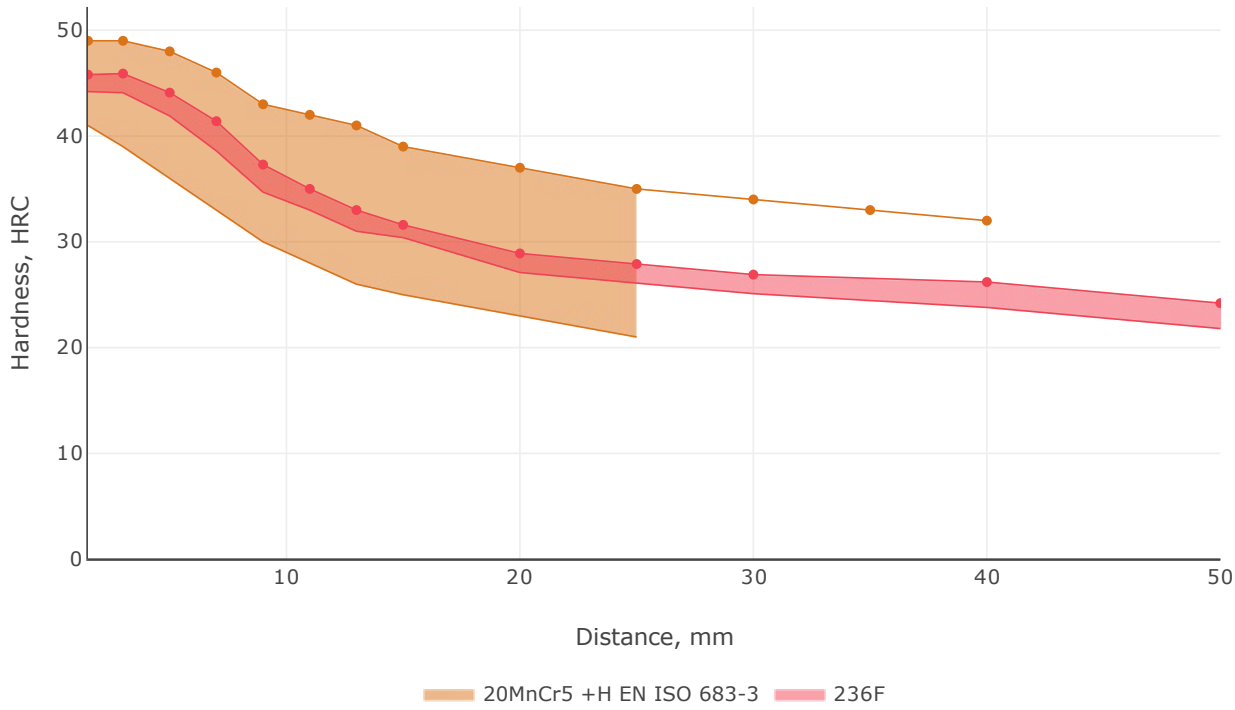
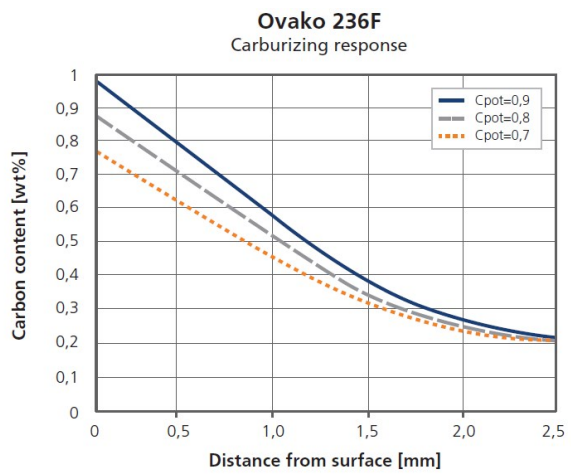
Hardenability

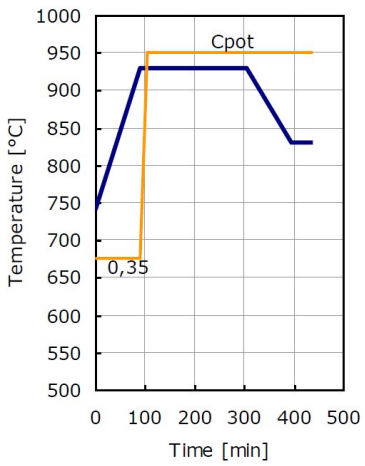


The hardenability is estimated from cast analysis. The hardenability can be verified with the end quench test if agreed on enquire and order.Jominy hardenability of Ovako 236F: Measured average value with +/-standard deviation.

Carburizing response



Heat treatment



Steel cleanliness

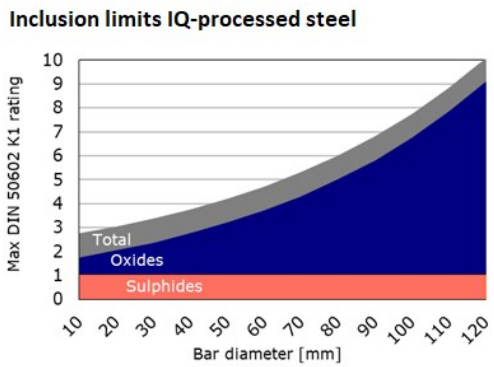
Micro inclusions - steel grade 236F								
Applied standard	ASTM E45							
Sampling	ASTM A295							
Maximum average limits	A		B		C		D	
	Th	He	Th	He	Th	He	Th	He
	2.5	1.5	1.5	0.5	0	0	0.5	0.5

Macro inclusions - 236F	
Applied standard	ISO 3763 (Blue fracture)
Sampling	Statistical testing on billets.
Limits	< 2,5 mm/dm^2

Micro inclusions - steel grade 236Q	
Applied standard	DIN 50602 K1
Sampling	Six random samples from final product dimension
Limits	The limit is dimension dependent. The average rating of six samples should not exceed the limits given in the graph.

Macro inclusions - 236Q		
Applied standard	ISO 3763 (Blue fracture)	10 M Hz UST (Ovako internal procedure)
Sampling	Statistical testing on billets	
Limits	< 1 mm/dm^2	< 10 defects/dm^3 > 0,2 mm FBH

IQ



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)
236	Round bar	+AR	608	209
236	Round bar	+FP	612	211
236	Tube,wall	+AR	630	232
236	Tube,wall	+FP	632	235

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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/

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