Material data sheet
Steel grade

Last revised: Thu, 23 Feb 2023 16:19:31 GMT

OVAKO

19MnV6* All

General Information

19MnV6* is a micro alloyed steel with high tensile strength, good machinability and weldability.

- Suitable for case carburizing or nitriding
- Good dimensional stability
- Fine-grain treated
- Delivered in as-rolled, normalized or quenched and tempered condition
- Weldable if preheated

Ovako 280T is our premium variant.

Ovako 280X is used in the Ovako hollow bar program according to EN10294-1.

Ovako 281P is an additional variant of 281, which possess slightly different mechanical properties.

Ovako 281T is a micro alloyed steel that is suitable for quench and tempering and possess a high tensile strength.

For additional Heat Treatment Data, please visit the Heat Treatment Guide.

** Designation followed by "*" is not an official EN standard grade but named according to the rules in EN 10027.*

Similar designations

19MnVS6, E470, 20MnV6, 20 MV 6, SS 2142, 1.1301, 19MnV6, 1.0536

Chemical composition

Variant	Cast	Weldability		C%	Si%	Mn%	P%	S%	Cr%	Ni%	Mo%	V%	N%	Dl%
280T	IC	CEV 0.6_{max}	Min	0.17	0.30	1.45	-	0.020	0.20	-	-	0.080	-	1.60
		Pcm 0.35_{max}	Max	0.20	0.45	1.60	0.025	0.035	0.28	0.20	0.10	0.120	-	1.90
280X	CC	CEV 0.58_{max}	Min	0.16	0.20	1.40	-	0.020	-	-	-	0.080	-	-
		Pcm 0.32_{max}	Max	0.20	0.50	1.70	0.020	0.040	0.30	0.30	0.08	0.130	-	-
281P	IC	CEV 0.64_{max}	Min	0.17	0.15	1.30	-	0.020	0.10	-	-	0.100	-	1.55
		Pcm 0.37_{max}	Max	0.22	0.30	1.70	0.035	0.035	0.20	0.20	0.10	0.140	-	1.80
281T	IC	CEV 0.64_{max}	Min	0.17	0.15	1.55	-	-	0.15	0.15	-	0.100	-	-
		Pcm 0.37_{max}	Max	0.22	0.50	1.70	0.030	0.003	0.25	0.30	0.06	0.140	-	1.90
EN10294-1:2005	Std	CEV $_{max}$	Min	0.16	0.10	1.30	-	0.015	-	-	-	0.080	-	-
		Pcm $_{max}$	Max	0.22	0.50	1.70	0.030	0.050	-	-	-	0.150	0.0200	-

Mechanical Properties

Variant	Condition	Format	Dimension [mm]	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A_5 [%]	Hardness	Impact (ISO-V) $strength_{min}$
280T	+AR	Tube,wall	< 25	500*	670 typical	20	225 HB typical	-
		Tube,wall	> 25	470*	640 typical	20	220 HB typical	-
		Round bar	24 < 80	450*	620 typical	20	200 HB typical	20 °C 27 J (long)
		Round bar	80 < 190	410*	550 typical	19	200 HB typical	20 °C 27 J (long)
	+N	Round bar	24 < 190	410*	550 typical	19	200 HB typical	20 °C 27 J (long)
		Round bar	24 < 190	410*	550 typical	19	200 HB typical	-40 °C 27 J (long)
		Tube,wall	< 15	430*	600 typical	25	190 HB typical	-40 °C 27 J (long)
		Tube,wall	15 < 25	400*	580 typical	25	185 HB typical	-40 °C 27 J (long)
		Tube,wall	> 25	380*	560 typical	25	180 HB typical	-40 °C 27 J (long)
	+QT	Tube,wall	< 30	600*	700 typical	18	260 HB typical	-40 °C 27 J (long)
280X	+AR	Tube,wall	< 25	500	> 670	17	225 HB typical	-
		Tube,wall	> 25	470	> 650	17	220 HB typical	-
	+N	Tube,wall	< 16	440	> 600	23	190 HB typical	-40 °C 27 J (long)
		Tube,wall	16 < 25	420	> 580	20	185 HB typical	-40 °C 27 J (long)
		Tube,wall	> 25	400	> 560	19	180 HB typical	-40 °C 27 J (long)
	+QT	Tube,wall	< 30	600	700 typical	18	260 HB typical	-40 °C 27 J (long)
281T	+AR	Tube,wall	< 20	510	700 typical	20	220 HB typical	20 °C 27 J (long)
	+N	Tube,wall	< 20	450*	650 typical	25	200 HB typical	-20 °C 50 J (long) -20 °C 27 J (transv)
	+QT	Tube,wall	< 30	590	650-800	20	-	-20 °C 27 J (long) -20 °C 20 J (transv)

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

Transformation temperatures

	Temperature °C
MS	395
AC1	721
AC3	810

Steel grade 281: A1: 712, A3: 800

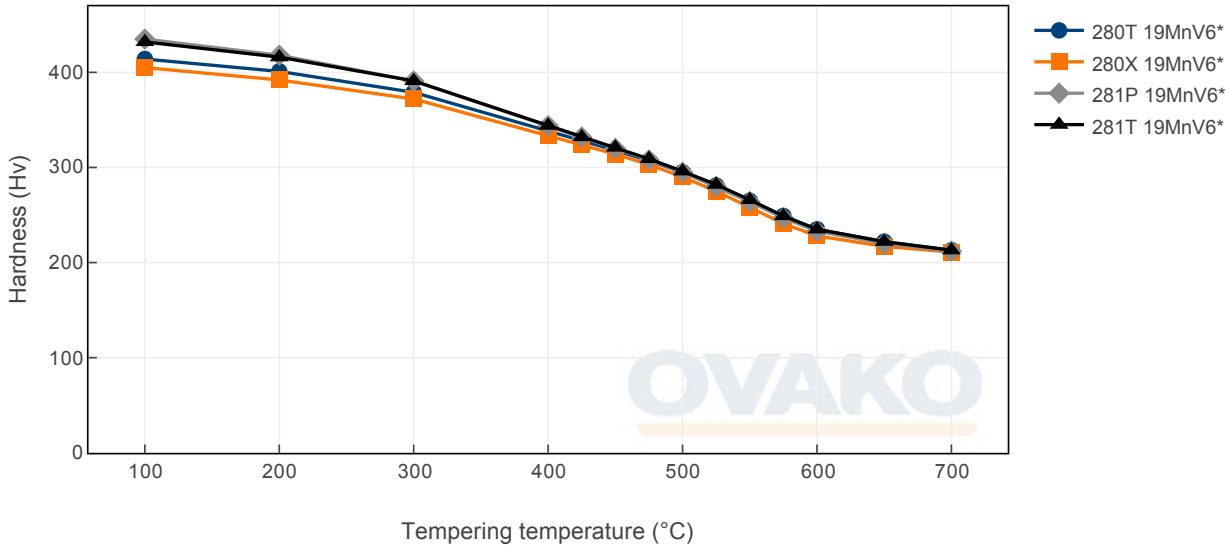
Heat treatment recommendations

Treatment	Condition	Temperature cycle	Cooling/quenching
Normalizing	+N	900-920°C	In still air
Stress relieve annealing	+SRA	550-600°C	In furnace or in still air.
Carburizing	+C	850-950°C Carbon potential see diagram	In still air or direct quench
Hardening	+QT	900-950°C	In water
Hardening	+QT	850-910°C As-carburized	In oil
Tempering	+QT	500-650°C	
Tempering	+QT	150-200°C As-carburized	

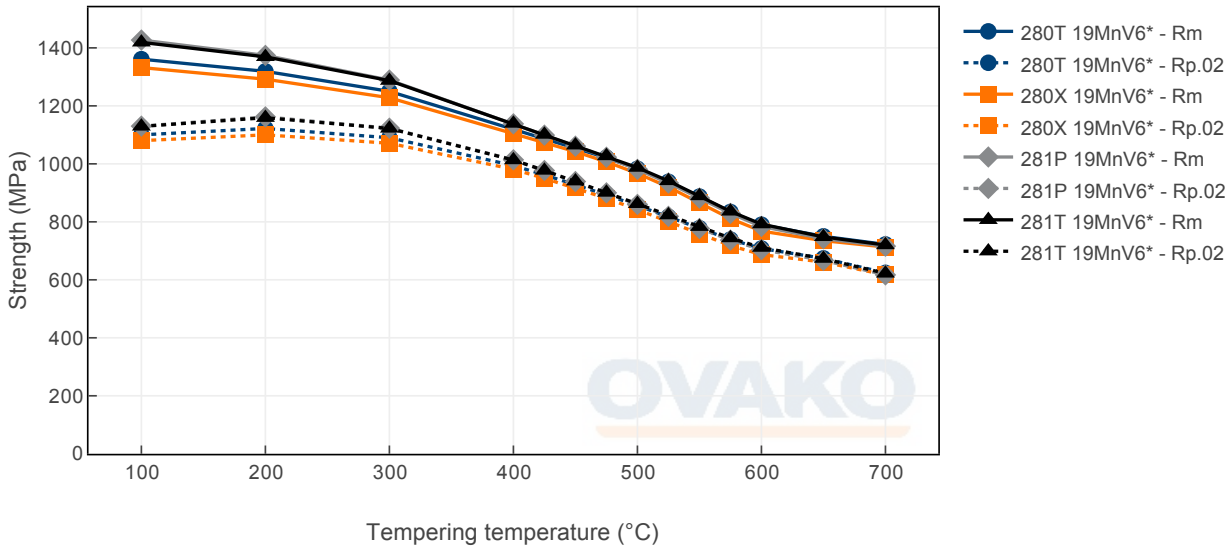
Heat Treatment Guide generated Graphs

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.

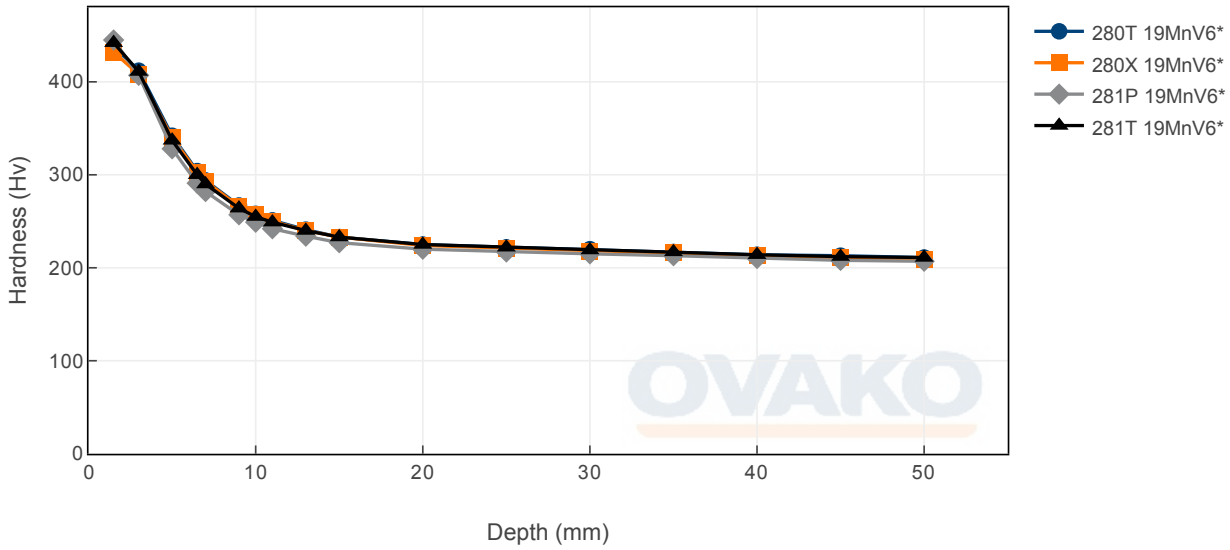
Tempering Diagram (hardness)



Tempering Diagram (strength)

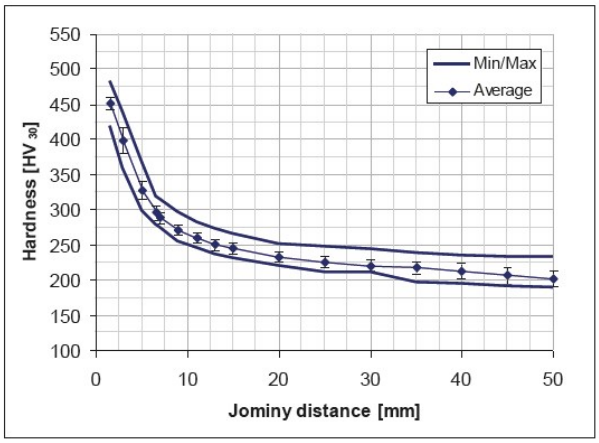


Jominy


Hardness (Hv)
400
300
200
100
0
0
10
20
30
40
50
Depth (mm)
280T 19MnV6*
280X 19MnV6*
281P 19MnV6*
281T 19MnV6*

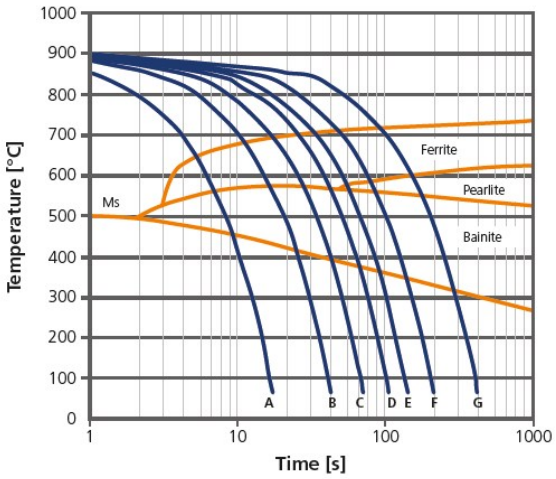
Ovako 280

Hardenability



Jominy hardenability according to ASTM A255. The graph shows the average values, standard deviation (error bars) and minimum/maximum values for Ovako 280T.

CCT – Ovako 280T

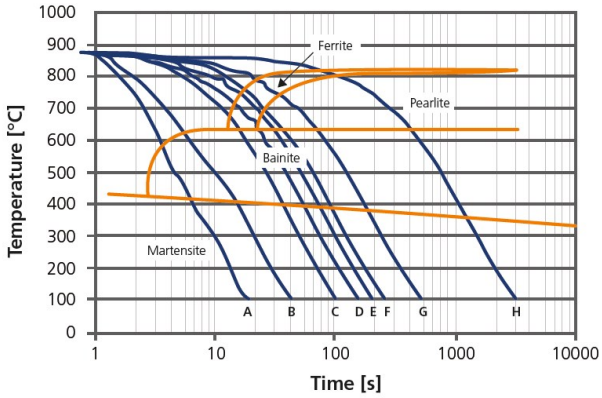


	A	B	C	D	E	F	G
t_{8-5} [s]	6	15	25	38	50	75	150
Hv_{30}	370	335	285	260	250	230	205

Ovako 281

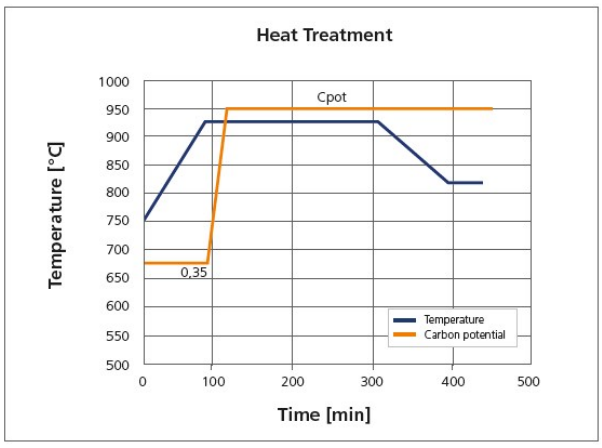
CCT

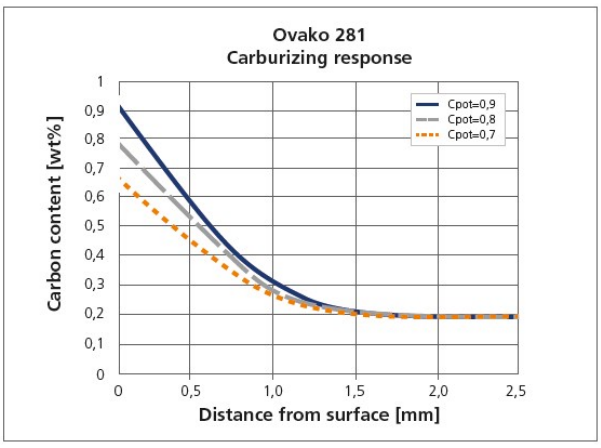
Austenitized at 860°C for 15 minutes



	A	B	C	D	E	F	G	H
t_{8-5} [s]	3	8	20	30	40	50	100	600
Hv_{30}	409	300	262	244	239	225	214	181

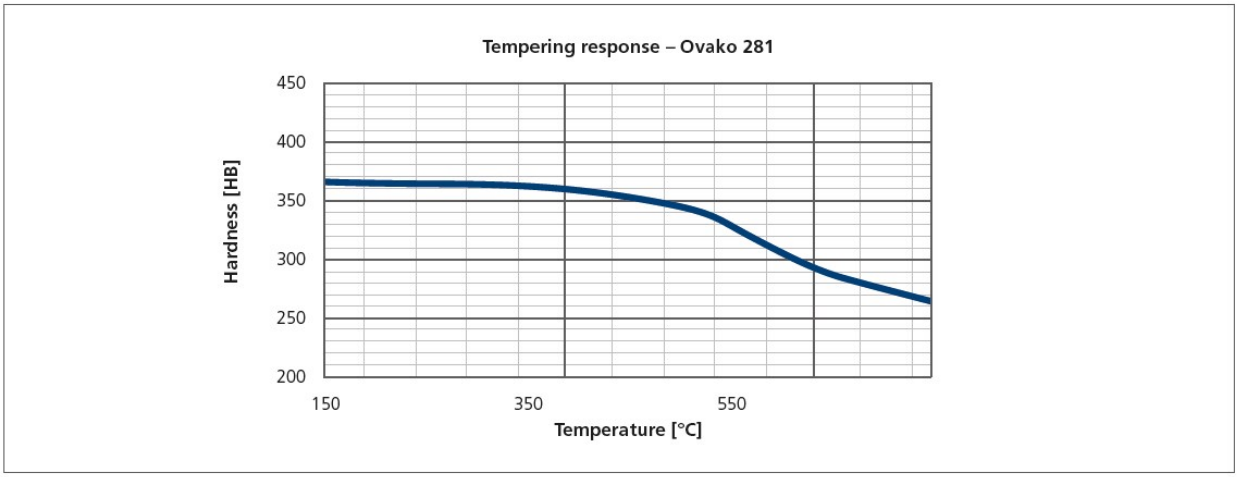
Case carburizing response - Ovako 280 and 281





Carburization response for Ovako 281 for the cycles shown in the figure above.

Tempering response - Ovako 281



Tempering response after martensitic hardening.

Welding - Ovako 280

Ovako 280T has good welding properties and can be welded with all conventional welding methods. The low carbon equivalent means that 280T can be welded without preheating up to fairly large dimensions.

- For the best results welding should be continuous, and the weld should be slowly cooled in ambient air conditions.
- If the welding is performed in a damp environment or if the temperature is below 5°C the preheating temperature should be increased by 25°C.
- To minimize the effects of a mixed zone, the chemical composition of the filler metal should be similar to that of the base material.
- Post-heating directly after welding also assists the removal of hydrogen. It should be performed at 200°C, directly after welding, holding for 5min/mm material thickness, for at least one hour.

Recommended working temperatures for welding with ferritic consumables:

Combined wall thickness [mm]							
10	20	30	40	50	60	70	80
RT	75°C		100°C		125°C		150°C

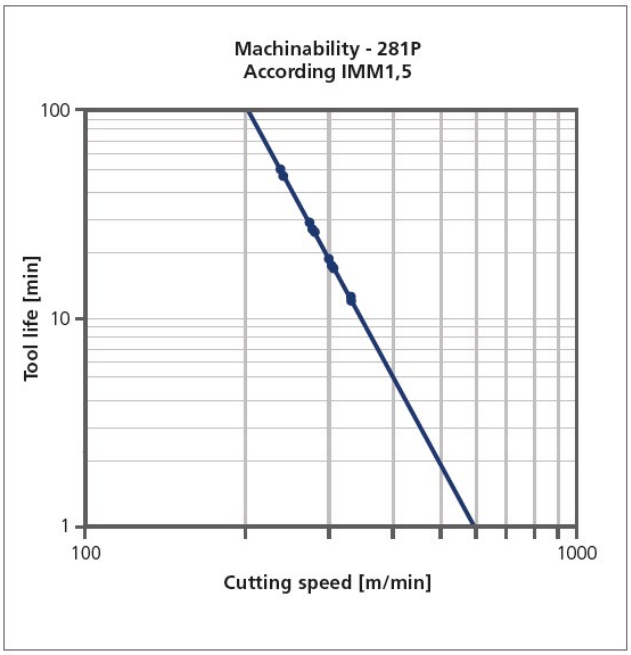
The recommended preheating temperatures are based upon a heat input around 1.7KJ/mm and that the hydrogen content does not exceed 5ml/100g weld metal.

Typical filler metals:

	ESAB	AWS	EN
MMA	OK 48.08	SFA/AWS A5.5 E8018-G	EN 499 E 46 5 1Ni B 32 HS
MIG/MAG	OK Autrod 12.64	SFA/AWS A5.18 ER70S-6	EN 440 G4Si1
SMAW	OK Tubrod 14.05	SFA/AWS A5.28 E70C-G	EN 758 T 42 4 Z M M 2 H10

Machinability - Ovako 281

281P has good free machining characteristics coupled with good mechanical properties.

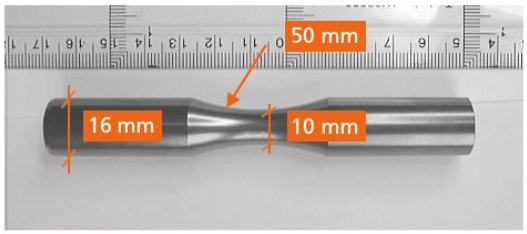


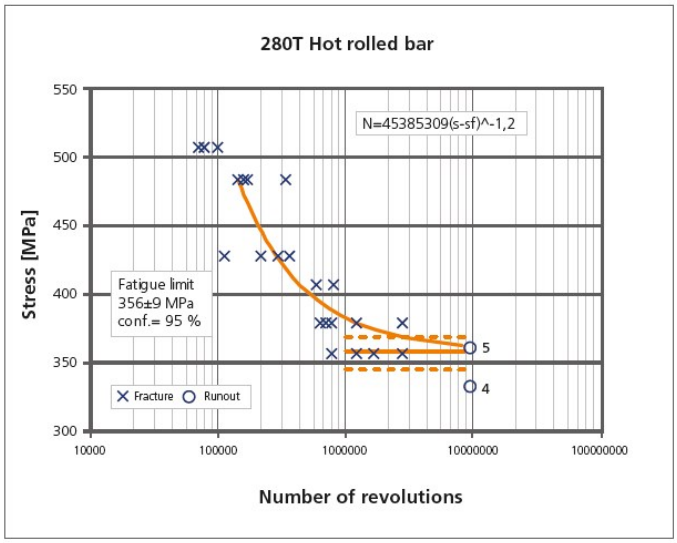
V_5	V_{10}	V_{15}	V_{30}	V_{60}	α
380	337	314	279	247	0,17

Tool-life versus cutting-speed for normalized (180Hv_{10}) Ovako 281P according to ISO 3685.

Fatigue properties - Ovako 280T

Test method:	Rotating beam
Test procedure:	Stair-case 20 MPa steps
Specimen:	Hourglass shape Ø 10 mm
Heat treatment:	Hot rolled bar Ø 80 mm
Hardness:	200 HB





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.

In many international comparisons the crude steel Scope 1-2 emission is a key parameter, ie. the CO_2 emission from the steel works itself.
As of 1 January 2022 we carbon offset all our scope 1 and 2 volume shown below.

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)
281	Round bar	+AR	606	210
281	Round bar	+N	612	211
281	Tube,wall	+AR	623	220
281	Tube,wall	+N	633	221
280T	Round bar	+AR	613	217
280T	Round bar	+N	619	218
280T	Tube,wall	+AR	630	227
280T	Tube,wall	+N	641	229

As of 1 January 2022 we use carbon offset for all our scope 1- 2 emissions, so in practice the climate compensated data is the same as the full Scope 3 level.
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/

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