

## 18CrMo8-5\* All

### General Information

Ovako 225 is a steel specially designed for nitriding but is also suitable for carburizing or applications requiring quenched and tempered steels.

- High nitriding rate
- Suitable for nitriding, case carburizing or quench and tempering
- Also suitable for applications require quenched and tempered steel in bars with diameter 25-160 mm.
- Weldable under certain conditions

Variant 225A - Standard quality

Variant 225C - With a reduced sulphur content for a reduced number of sulphide inclusions

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.*

### Chemical composition

Variant	Cast	Weldability		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	V %
225A	IC	CEV 0.94 <sub>max</sub>	Min	0.16	0.20	0.75	-	0.020	1.75	-	0.50	-
		Pcm 0.42 <sub>max</sub>	Max	0.19	0.40	1.00	0.020	0.030	2.00	0.30	0.60	0.100
225C	IC	CEV 0.94 <sub>max</sub>	Min	0.16	0.20	0.75	-	0.005	1.75	-	0.50	-
		Pcm 0.42 <sub>max</sub>	Max	0.19	0.40	1.00	0.020	0.014	2.00	0.30	0.60	0.100

## Mechanical Properties

Variant	Condition <sup>①</sup>	Format	Dimension [mm]	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A <sub>5</sub> [%]	Reduction of area Z <sub>min</sub> [%]	Hardness	Impact (ISO-V) strength <sub>min</sub>
225A	+QT	Round bar	80 typical	800*	> 880	12	55	275-330 HB	20 °C 80 J (long)
		Round bar	< 80	800*	> 880	12	55	275-330 HB	-20 °C 40 J (long)
		Round bar	80 < 120	760*	> 860	12	55	265-320 HB	20 °C 60 J (long)
		Round bar	80 < 120	760*	> 860	12	55	265-320 HB	-20 °C 27 J (long)
		Round bar	> 120	740*	> 840	12	55	255-320 HB	20 °C 40 J (long)
225C	+QT	Round bar	> 80	800*	> 880	12	55	275-330 HB	20 °C 80 J (long)
		Round bar	> 80	800*	> 880	12	55	275-330 HB	-20 °C 40 J (long)
		Round bar	80 < 120	760*	> 860	12	55	265-320 HB	20 °C 60 J (long)
		Round bar	80 < 120	760*	> 860	12	55	265-320 HB	-20 °C 27 J (long)
		Round bar	> 120	740*	> 840	12	55	255-320 HB	20 °C 40 J (long)

*R<sub>p0,2</sub> \* R<sub>eh</sub>, \*\* R<sub>el</sub>*

## Transformation temperatures

	Temperature °C
MS	416
AC1	751
AC3	853

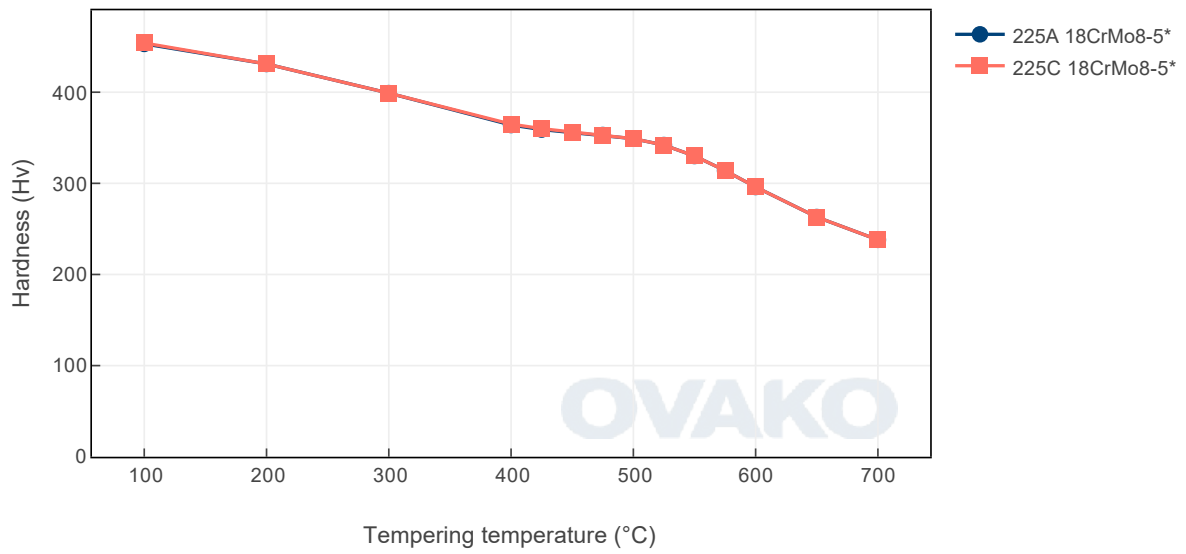
## Heat treatment recommendations

Treatment	Condition <sup>①</sup>	Temperature cycle	Cooling/quenching
Hot forging	+U	850-1050°C	In air
Normalizing	+N	860-950°C	In air
Soft annealing	+A	680-740°C	In air
Nitriding	+Nt	480-550°C	
Carburizing	+C	860-950°C Carbon potential see diagram	In oil
Hardening	+QT	900-950°C	In oil or water
Hardening	+QT	850-910°C Hardening of as-carburized components	In oil or water
Tempering	+T	160-650°C	In air

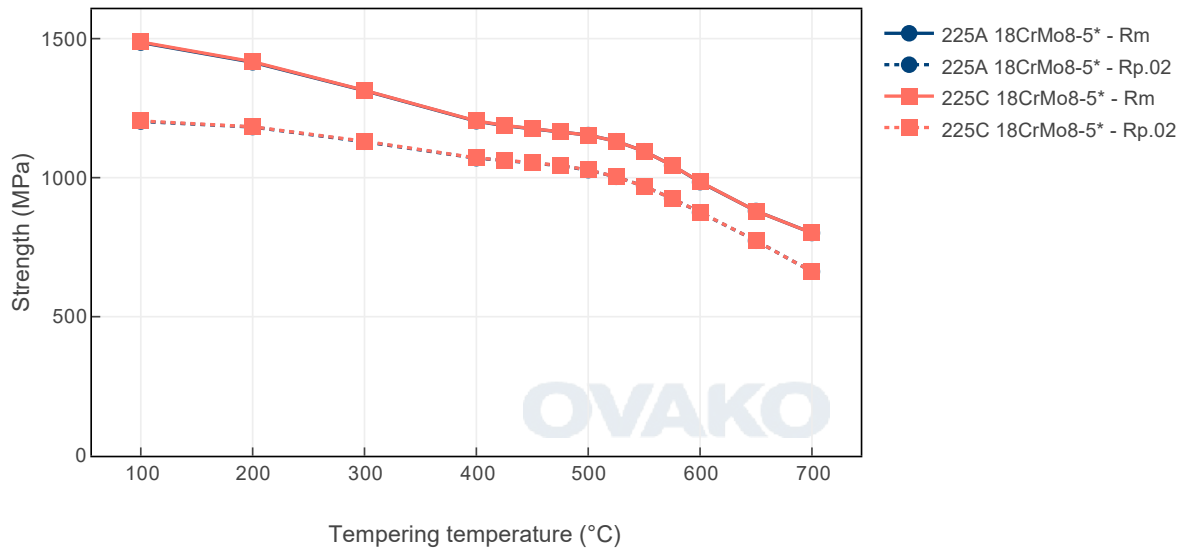
## Heat Treatment Guide generated Graphs

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.

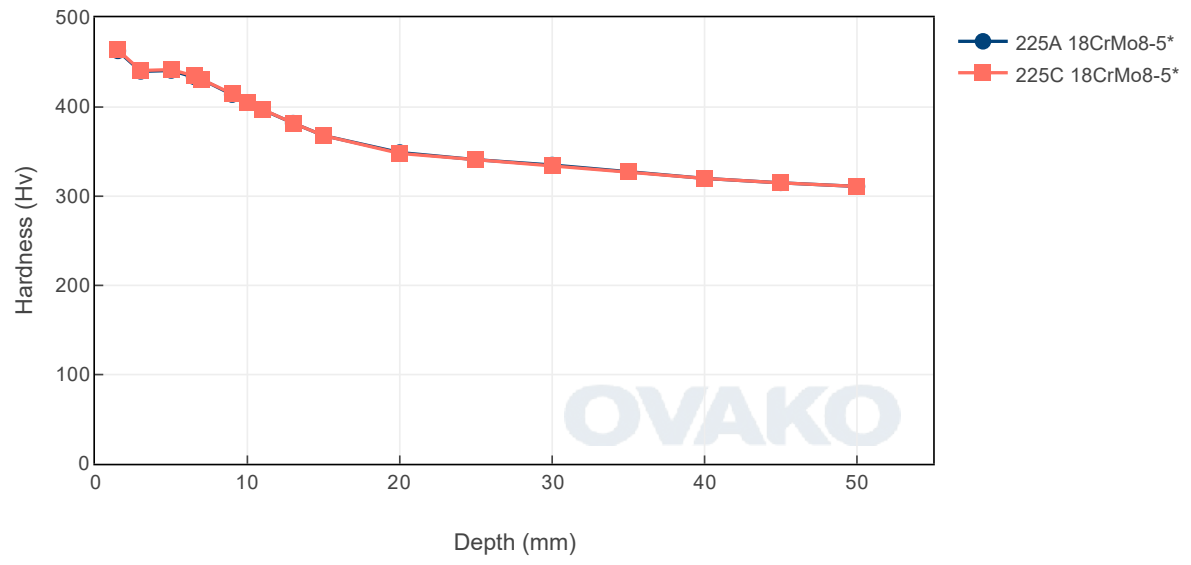
Tempering Diagram (hardness)



Tempering Diagram (strength)

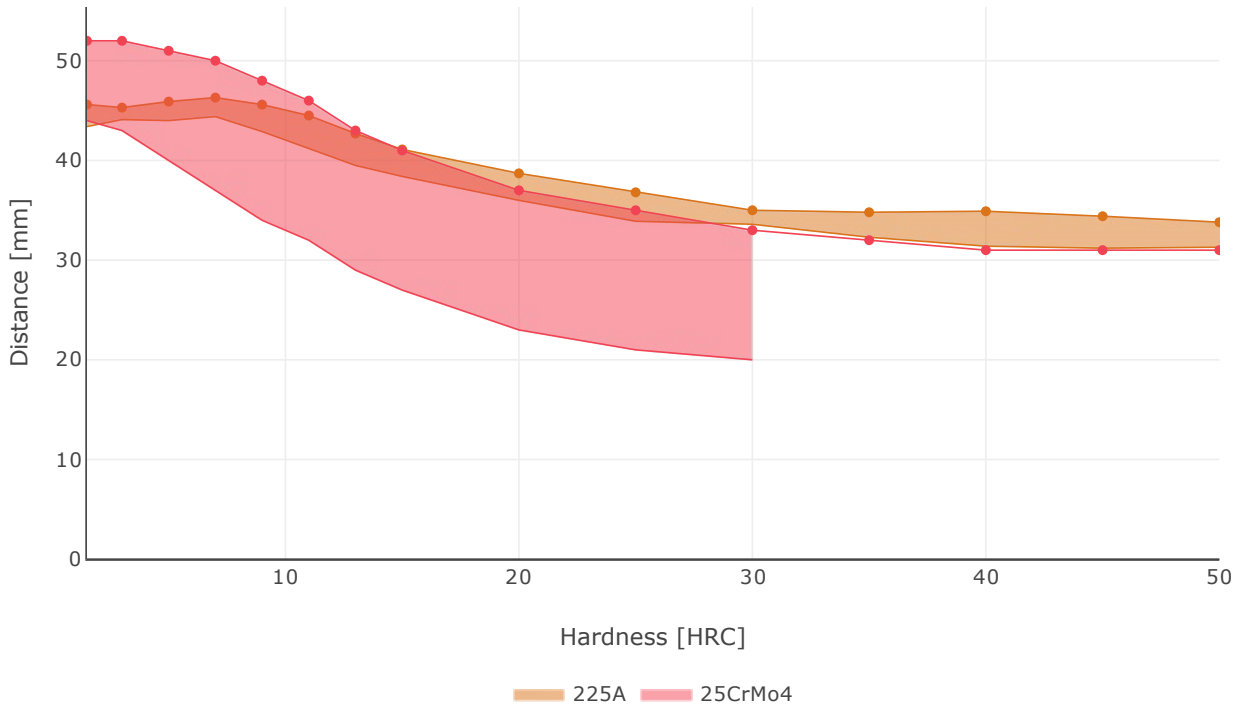


# Jominy



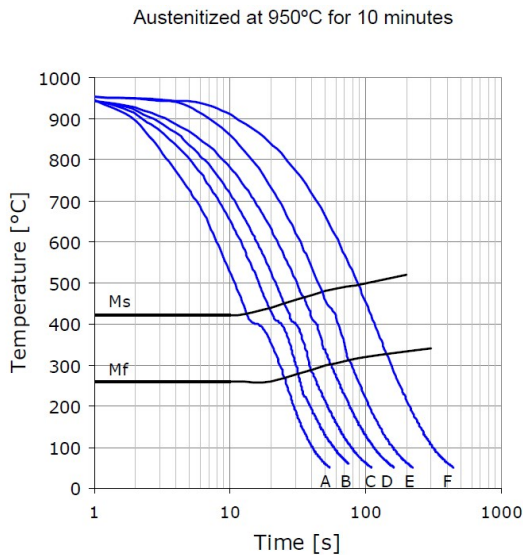


## Hardenability



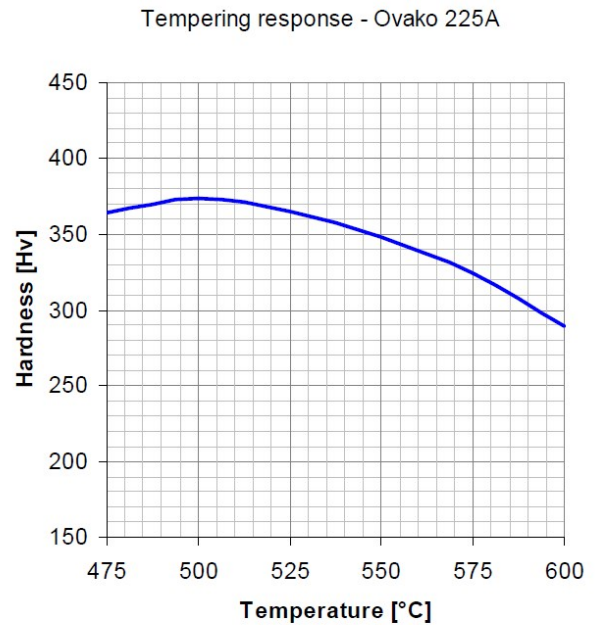
Jominy hardenability according to ASTM A255. The graph shows the average values and standard deviation for 225A and range for 25CrMo4 according to EN 10083:2006. Same graph also valid for 225C.

## CCT



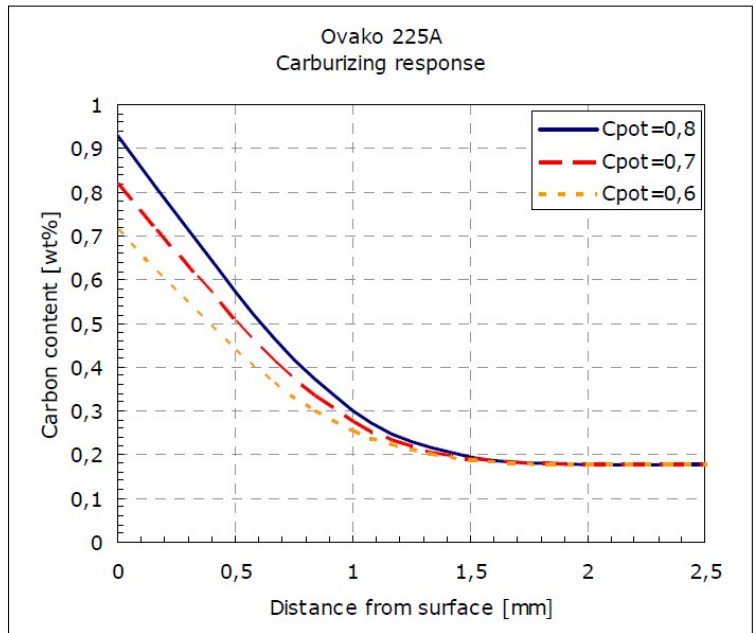
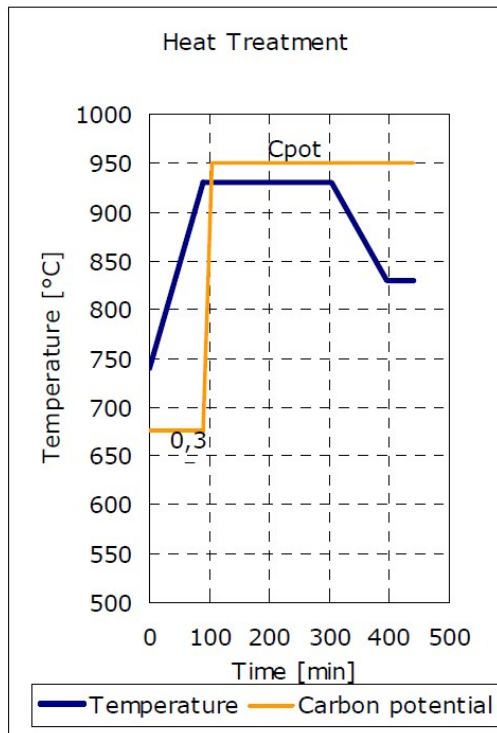
	A	B	C	D	E	F
$t_{8-5}$ [s]	7	11	15	22	30	60
Hv <sub>30</sub>	440	435	430	420	390	370

## Tempering response



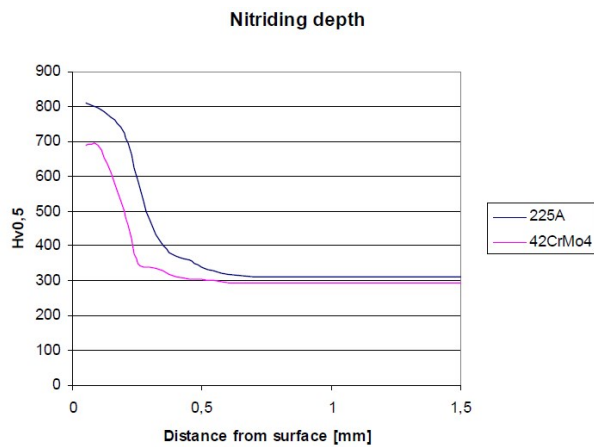
Austenitized at 920°C water quenched. Same graph also valid for 225C.

## Carburizing response

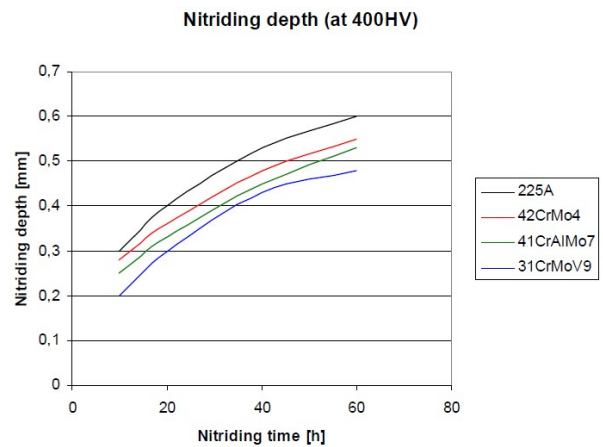


Carburization response for Ovako 225 for the cycles shown in the left figure. Same graph also valid for 225C.

## Nitriding response



Comparison of achieved hardness gradient with Ovako 225A and 42CrMo4. Gas nitrided at 510°C for 30 hours. Same graph also valid for 225C.



Nitriding depth, defined at 400HV versus process time for different nitriding steel grades. Plasma nitriding at 510°C. Same graph also valid for 225C.

## Steel cleanliness

Micro inclusions - Ovako 225C									Macro inclusions - Ovako 225C	
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		Limits	< 5.0 mm/dm <sup>2</sup>
	Th	He	Th	He	Th	He	Th	He		
	2.0	1.5	1.0	0.5	0	0	0.5	0.5		

## 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<sub>2</sub> 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
CO <sub>2</sub> e/kg	120	62	76

To get the full picture of our products environmental impact we have to look at all of our CO<sub>2</sub> 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 <sub>2</sub> e kg /1000 kg steel)	Climate compensated Net emission = Scope 3 (CO <sub>2</sub> e kg /1000 kg steel) Scope 1 - 2 = 0 (compensated)
225	Round bar	+AR	669	272
255	Round bar	+QT	679	274

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/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

Would you like to know more about our offers? Don´t hesitate to contact us:

Via e-mail: [info@ovako.com](mailto: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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