

## 28NiCrMnMo14-6-4\* All

### General Information

Ovako 455 is a high strength quench and tempering steel with good toughness and good dimension stability. Ovako 455 is used in the mining and construction industry.

\* 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%
455A	IC	CEV 1.21 <sub>max</sub>	Min	0.24	0.20	0.85	-	-	1.35	3.40	0.30
		Pcm 0.56 <sub>max</sub>	Max	0.29	0.35	1.05	0.015	0.010	1.75	3.90	0.45

## Transformation temperatures

	Temperature °C
AC1	686
AC3	767

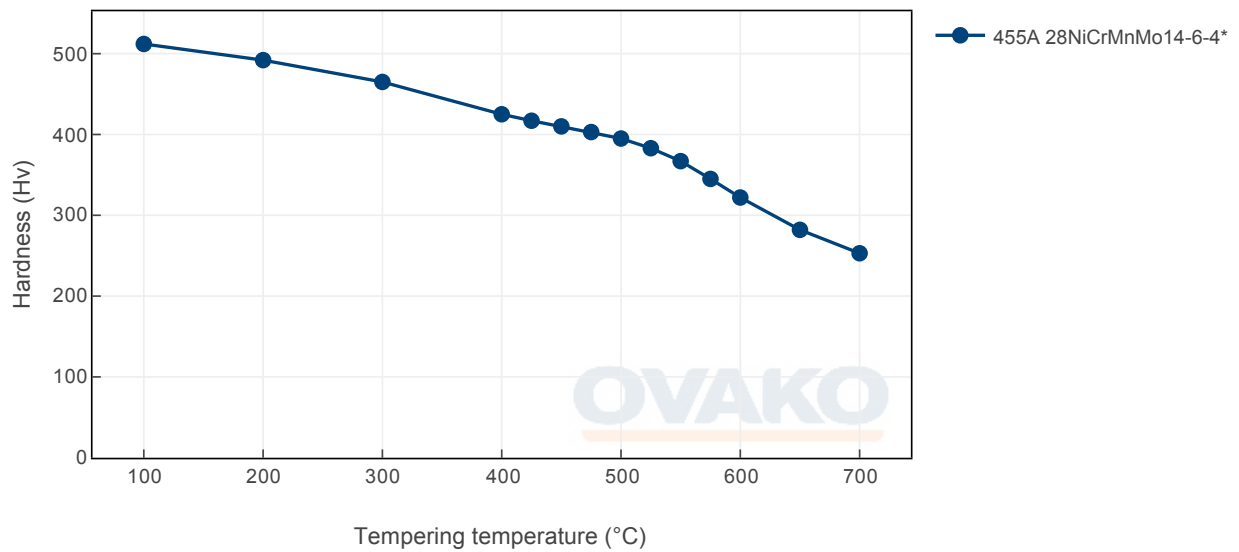
## Heat treatment recommendations

Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging	+AR	850-1100°C	In air
Normalizing	+N	900-950°C	In air
Annealing	+A	650-730°C	In air
Hardening	+Q	840-890°C	In oil
Tempering	+T	160-700°C See tempering diagram	In air

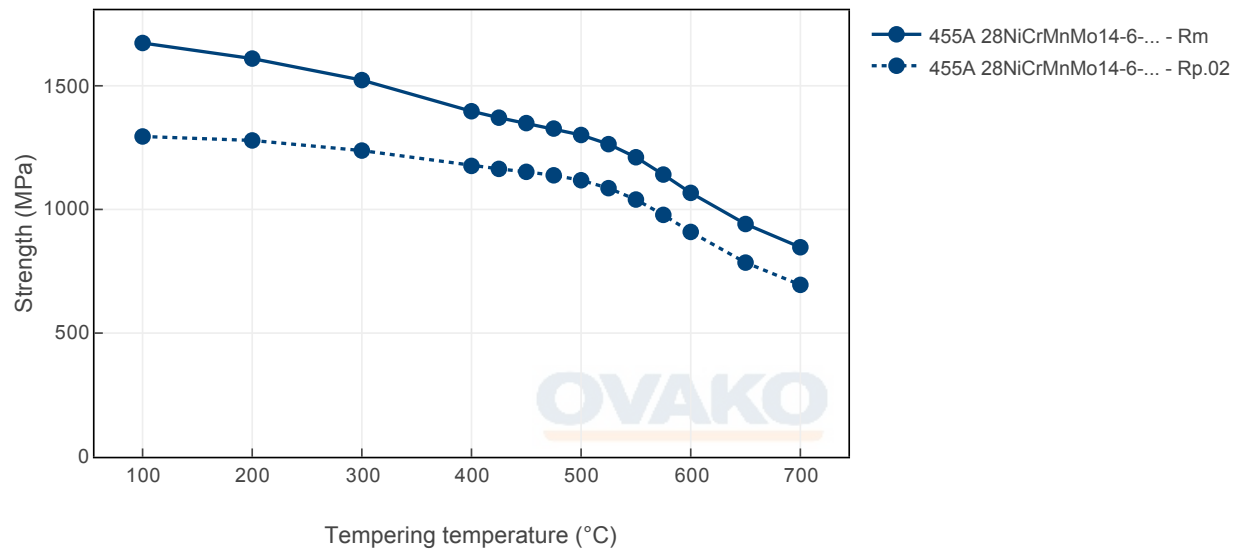
## Heat Treatment Guide generated Graphs

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.

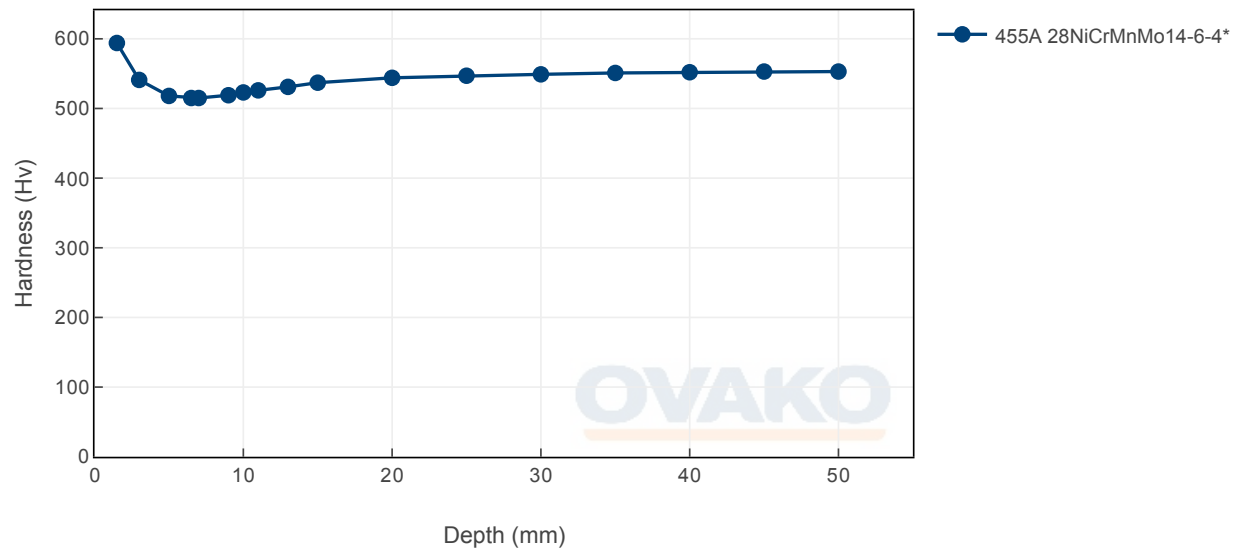
Tempering Diagram (hardness)



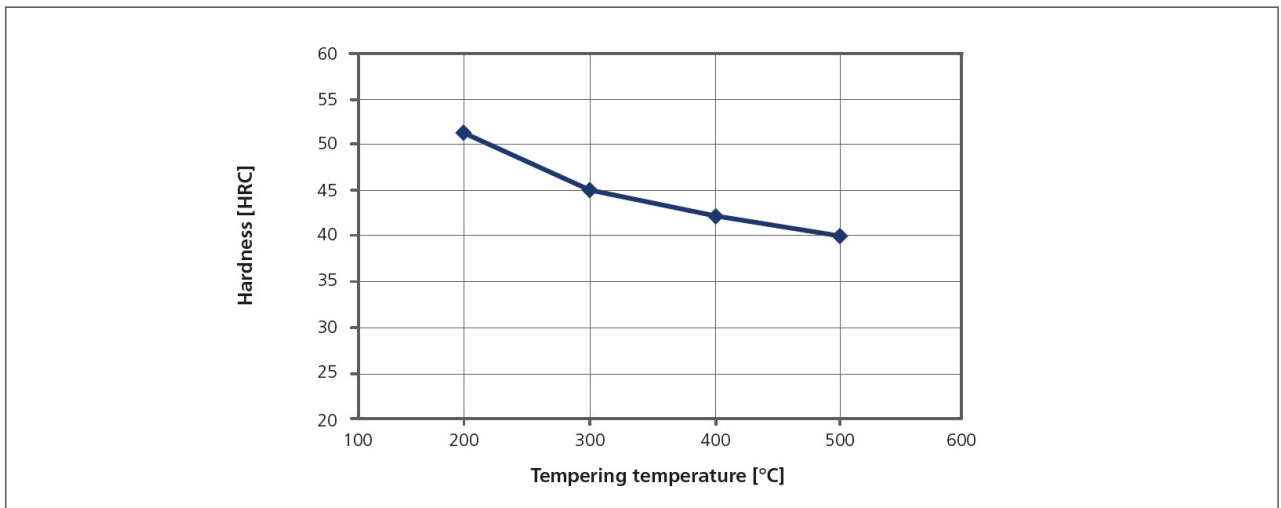
Tempering Diagram (strength)



# Jominy

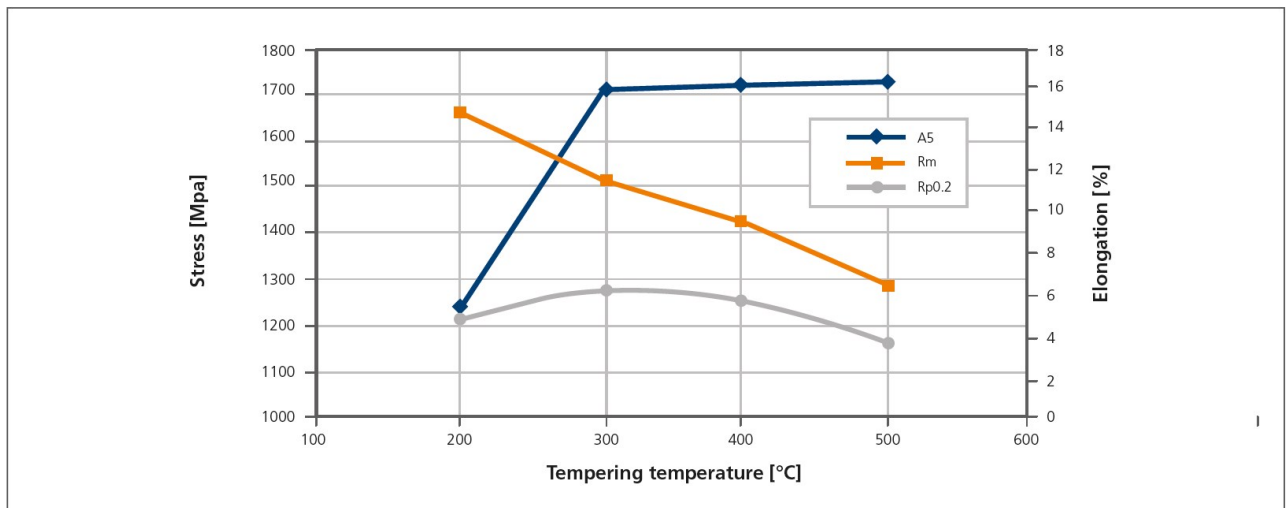


### Tempering response - Ovako 455A



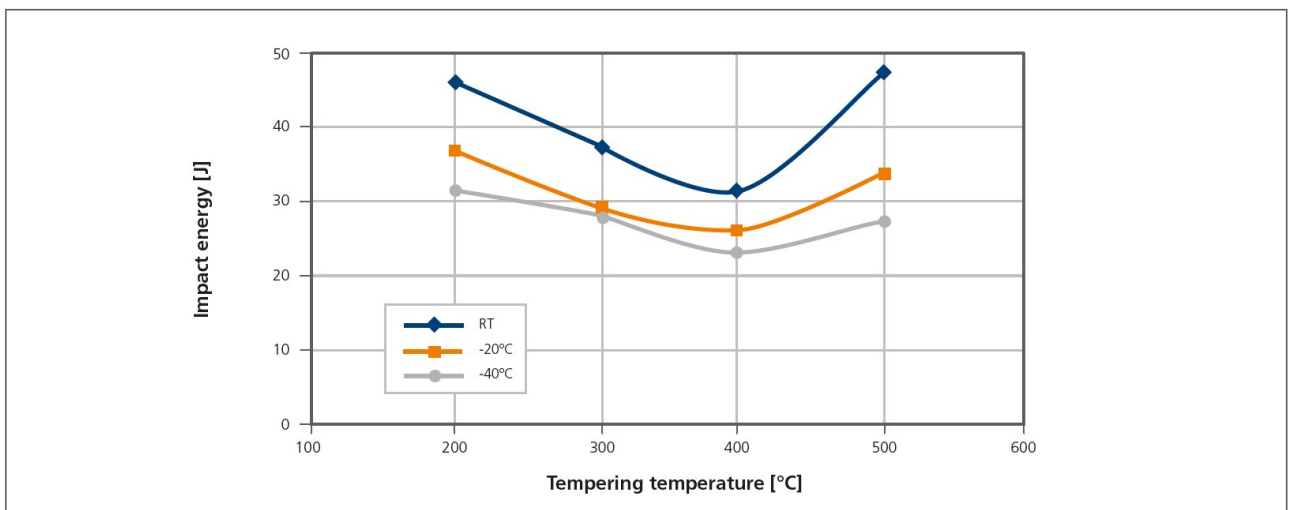
Austenitized at 860°C 30 min, quenched in oil. Tempered 1h at each temperature level.

### Mechanical properties - Ovako 455A



Austenitized at 860°C 30 min, quenched in oil. Tempered 1h at each temperature level.

### Impact toughness ( Charpy-V) - Ovako 455A



Austenitized at 860°C 30 min, quenched in oil. Tempered 1h at each temperature level.

## Steel cleanliness

Micro inclusions - steel grade Ovako 455A								Macro inclusions - 455A	
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	< 5 mm/dm <sup>2</sup>

## SUSTAINABILITY-ENVIRONMENTAL IMPACT DATA

### RUTA 1:

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)
455A	Round bar	+AR	1232	836
455A	Round bar	+QT	1239	840

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:

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Via telephone: +46 8 622 1300

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

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