

## 40SiCrMnMo7-6-6\* All

### General Information

A medium carbon steel for quench and tempering steel with high hardenability. Ovako 477L has high tensile strength in combination with high toughness, and it is often used for large axles and machine parts. By using air- or gas-quenching it is possible to reduce the amount of quenching distortion. Additionally the use of quenching medias such as oil and salt may be avoided, which improves both safety and environment. The sulphur content is in a low and narrow range for consistent machinability.

Suitable for nitriding

Suitable for induction or flame hardening

Through hardenability corresponding to a bar with approx 60mm diameter (cooling in still air)

Provides low distortion

Weldable under certain conditions

*\* 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 %
477L	IC	CEV 1.15 <sub>max</sub>	Min	0.38	1.65	1.40	-	0.012	1.50	-	0.43
		Pcm 0.7 <sub>max</sub>	Max	0.42	1.80	1.55	0.020	0.020	1.60	0.30	0.47

## Transformation temperatures

	Temperature °C
AC1	721
AC3	792

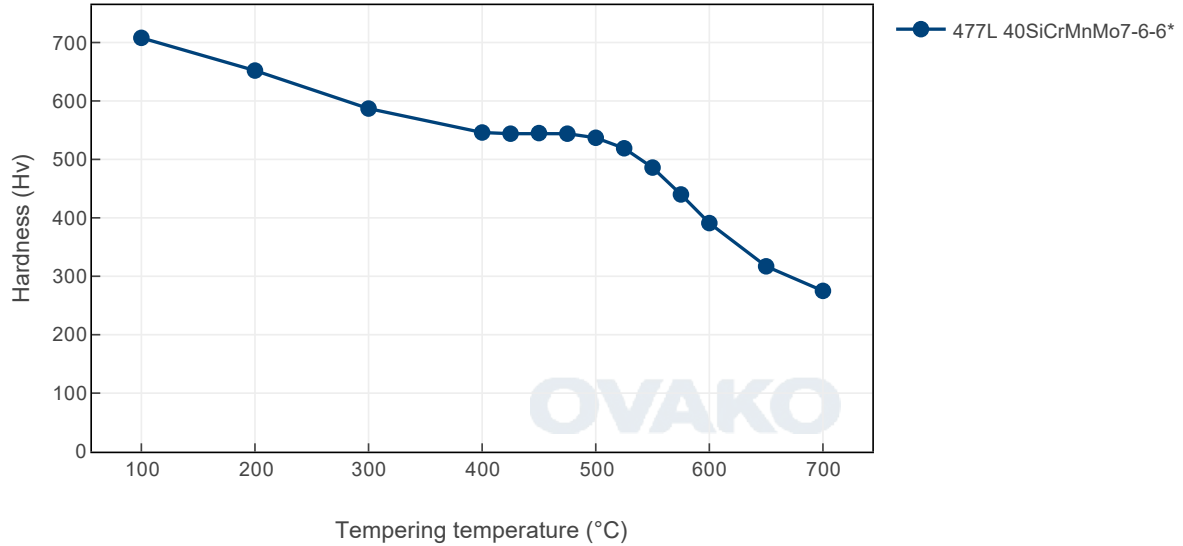
## Heat treatment recommendations

Treatment	Condition <sup>ⓘ</sup>	Temperature cycle	Cooling/quenching
Hot forging	+AR	850-1150°C	
Normalizing	+N	900-950°C	In air
Soft annealing	+A	775°C/4h	Slow cooling, 10°C/h down to 650°C 200HB
Hardening	+Q	900-950°C	In air, gas or oil
Tempering	+QT	160-700°C See tempering diagram	

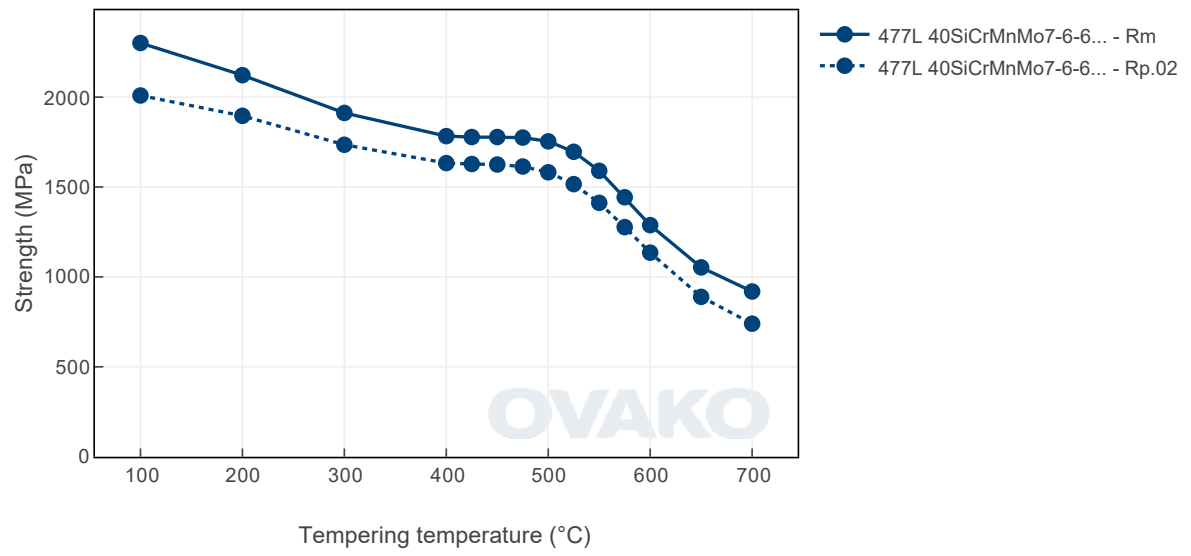
## Heat Treatment Guide generated Graphs

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.

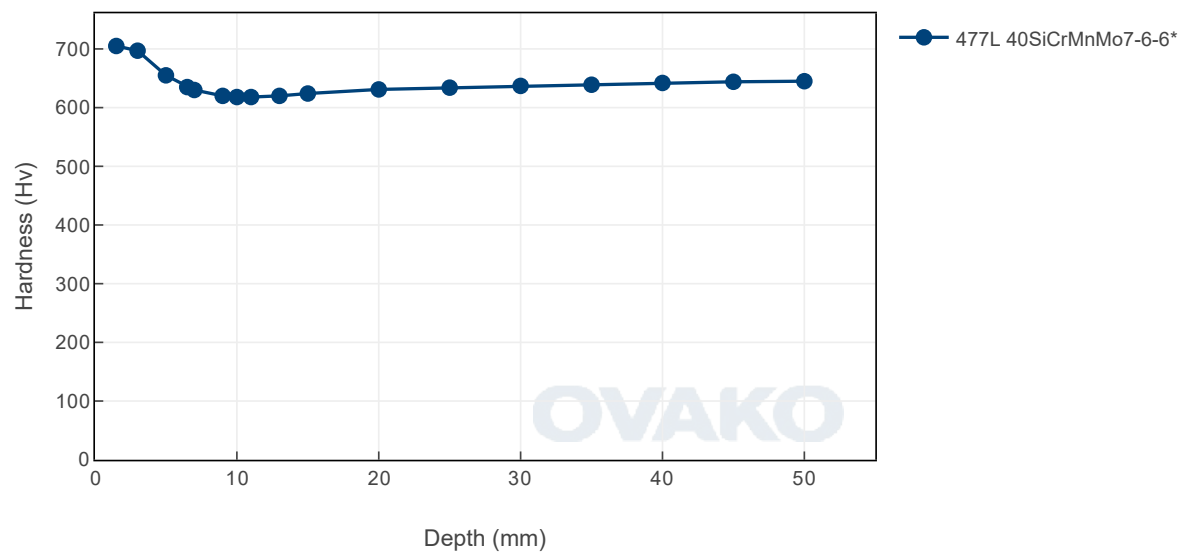
Tempering Diagram (hardness)



Tempering Diagram (strength)

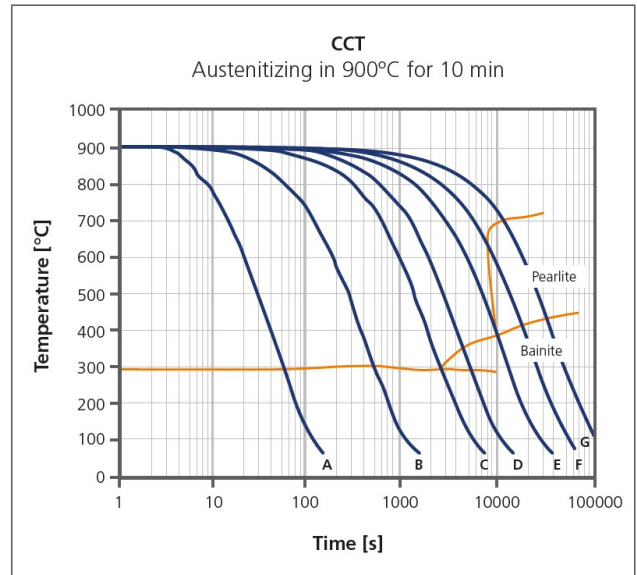
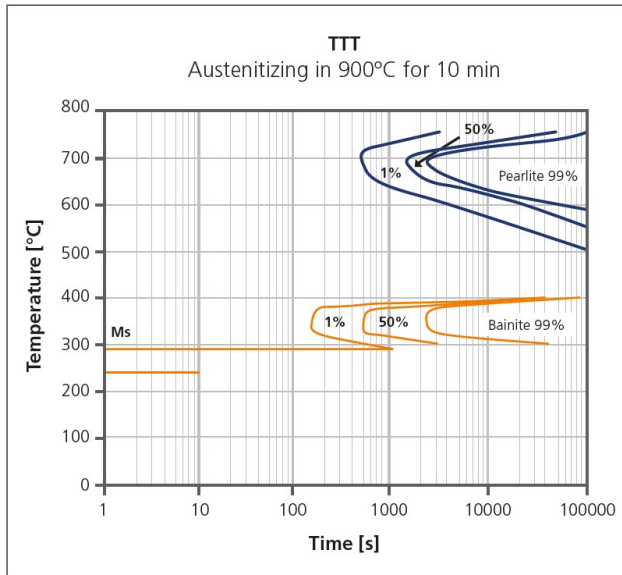


# Jominy





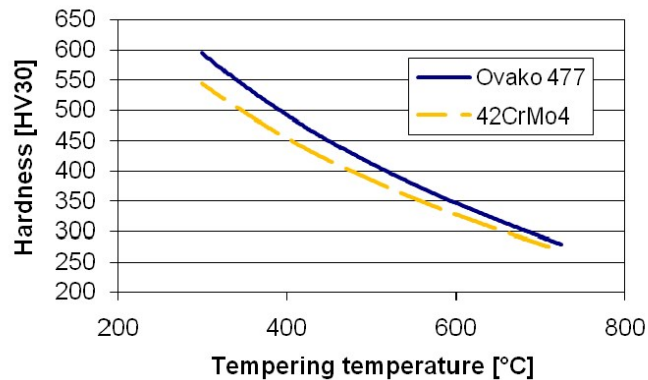
## TTT CCT - Ovako 477L



	A	B	C	D	E	F	G
$t_{8-5}$ [s]:	20	200	1000	2000	5000	10000	20000
Hv <sub>30</sub> :	670	627	609	550	434	401	278

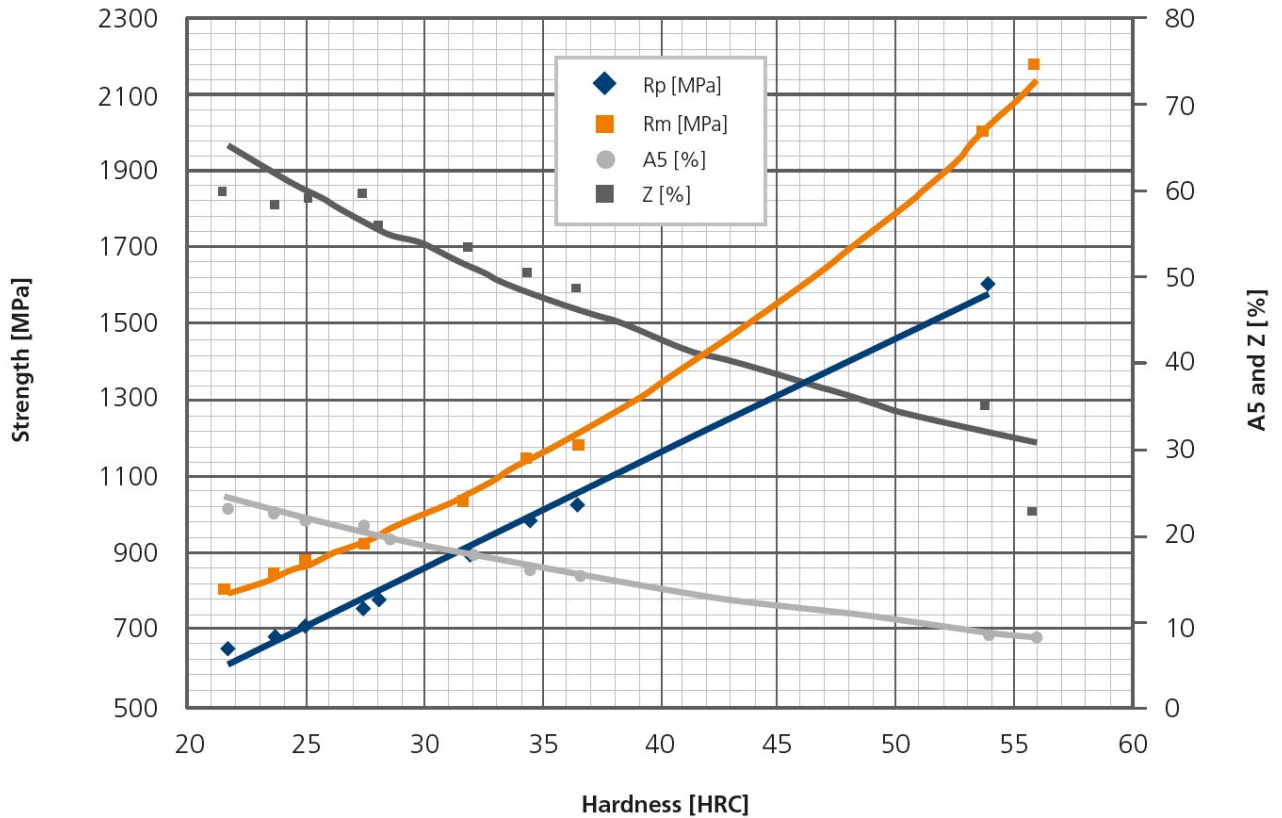
## Tempering response - Ovako 477L

### Hardened and tempered 1h



Tempering response for Ovako 477 compared to 42CrMo4. Austenitized at 900°C for 30min and hardened in air. Tempered one hour at each tested temperature level.

## Mechanical Properties - Ovako 477L



Mechanical properties for Ovako477L from tensile tests performed at different hardness of the material.

## Steel cleanliness

Micro inclusions - steel grade Ovako 477L									Macro inclusions - 477L	
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 mm/dm <sup>2</sup>
	Th	He	Th	He	Th	He	Th	He		
	2.5	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 (CO2e kg /1000 kg steel)	Climate compensated Net emission = Scope 3 (CO2e kg /1000 kg steel) Scope 1 - 2 = 0 (compensated)
477L	Round bar	+AR	686	287
477L	Round bar	+T	691	290
477L	Tube,wall	+AR	715	318
477L	Tube,wall	+T	718	320

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 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/>

### Disclaimer

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