

# 34CrNiMo6 All

## General Information

34CrNiMo6 is a quenching and tempering steel with high strength, high toughness and good hardenability. Used for large axles, machine components, tools and high strength fasteners.

The steel can be induction hardened and it is weldable under certain conditions. Through hardenability to appr. 100 mm diameter bar with oil quenching.

356D - Standard steel variant

356Q - IQ (isotropic quality) variant.

6499 - low sulphur variant of 34CrNiMo6 Suitable for fasteners according to ISO 898 Grade 10.9 up to 90 mm bar diameter

6498 - A variant of the old swedish standard SS 2541

6502 - M-steel variant of 34CrNiMo6

SB9205 - A variant of 34CrNiMo6

### **IQ-Steel®**

IQ-Steel® is an isotropic quality ultra clean steel optimized for high fatigue strength under multi axial loading.

### **M-Steel®**

The basis for the concept is that non-metallic inclusions are modified and controlled with calcium treatment in a way to minimize tool wear and to maximize chip control in machining operations. Our M-Steel treatment can be applied to any steel grade.

## Similar designations

34CrNiMo6M, SS2541, MoCN315, MoCN315M, 1.6582, 35NCD6, 816M40, 817M40, 35NiCrMo6, SNCM447, 30Ch2N2MA, F.1272, 40NiCrMo7, 4337, 4340, 92541, VSQT34CrNiMo6, VSQT34CrNiMo6/700, VSQT34CrNiMo6/800, VSQT34CrNiMo6/900, SS2541, EN24, 1.6582, EN 10083-3, SS142541

## Chemical composition

Variant	Cast	DI		C %	SI %	Mn %	P %	S %	Cr %	NI %	Mo %	V %	Al %
356D	IC		Min	0.32	0.20	0.70	-	0.020	1.35	1.30	0.20	-	-
			Max	0.38	0.35	0.80	0.025	0.030	1.60	1.60	0.30	0.100	-
356Q	IC		Min	0.32	0.15	0.65	-	-	1.50	1.50	0.20	-	-
			Max	0.38	0.35	0.80	0.025	0.002	1.60	1.60	0.30	0.100	-
6499	CC	8.81	Min	0.30	0.15	0.50	-	-	1.40	1.40	0.15	-	-
			Max	0.38	0.40	0.80	0.015	0.015	1.70	1.70	0.30	-	-
6502, MoCN 315 M	CC		Min	0.30	-	0.50	-	0.015	1.30	1.30	0.15	-	-
			Max	0.38	0.40	0.80	0.025	0.035	1.70	1.70	0.30	-	-
6498	CC	7.91	Min	0.32	0.10	0.50	-	0.020	1.30	1.30	0.15	-	-
			Max	0.39	0.40	0.80	0.035	0.035	1.70	1.70	0.30	-	-
SB4205	CC		Min	0.36	0.15	0.50	-	-	1.30	1.30	0.20	-	0.015
			Max	0.38	0.40	0.70	0.025	0.012	1.40	1.70	0.30	-	0.040
34CrNiMo6 EN ISO 683-2	Std		Min	0.30	0.10	0.50	0.000	0.000	1.30	1.30	0.15	-	-
			Max	0.38	0.40	0.80	0.025	0.035	1.70	1.70	0.30	-	-

## 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>
356D	+SA	Round bar	< 190	-	-	-	-	200 HB typical	-
	+QT	Round bar	< 50	900	1000 typical	10	45	360 HB typical	20 °C 140 J (long)
		Round bar	50 < 100	800	900 typical	10	45	330 HB typical	20 °C 115 J (long)
		Round bar	100 < 200	700	800 typical	10	45	300 HB typical	-
		Round bar	> 200	600	700 typical	10	45	270 HB typical	-
		Round bar	< 150	-	-	-	-	285 HB typical	20 °C 90 J (long)
	+Q	Round bar	< 100	1200	1500 typical	7	25	50 HRC typical	-
356Q	+SA	Round bar	< 190	-	-	-	-	200 HB typical	-
	+QT	Round bar	< 50	900	1000 typical	10	45	360 HB typical	20 °C 140 J (long)
		Round bar	50 < 100	800	900 typical	10	45	330 HB typical	20 °C 115 J (long)
		Round bar	100 < 200	700	800 typical	10	45	300 HB typical	-
		Round bar	> 200	600	700 typical	10	45	270 HB typical	-
		Round bar	< 150	-	-	-	-	285 HB typical	20 °C 90 J (long)
	+Q	Round bar	< 100	1200	1500 typical	7	25	50 HRC typical	-
6499	+AR	Round bar	25 < 160	-	-	-	-	< 380 HB	-
	+A	Round bar	25 < 160	-	-	-	-	< 248 HB	-
	+QT	Round bar	25 < 40	900*	1100-1300	10	45	320-380 HB	20 °C 45 J (long)
		Round bar	40 < 100	800*	1000-1200	11	50	300-350 HB	20 °C 45 J (long)
		Round bar	100 < 160	700*	900-1100	12	55	270-320 HB	20 °C 45 J (long)
6502, MoCN 315 M	+AR	Round bar	25 < 160	-	-	-	-	< 380 HB	-
	+A	Round bar	25 < 160	-	-	-	-	< 248 HB	-
	+QT	Round bar	25 < 40	900*	1100-1300	10	45	320-380 HB	20 °C 45 J (long)
		Round bar	40 < 100	800*	1000-1200	11	50	300-350 HB	20 °C 45 J (long)
		Round bar	100 < 160	700*	900-1100	12	55	270-320 HB	20 °C 45 J (long)
6498	+AR	Round bar	25 < 160	-	-	-	-	< 380 HB	-
	+A	Round bar	25 < 160	-	-	-	-	< 248 HB	-
	+QT	Round bar	25 < 40	900*	1100-1300	10	45	320-380 HB	20 °C 45 J (long)
		Round bar	40 < 100	800*	1000-1200	11	50	300-350 HB	20 °C 45 J (long)
		Round bar	25 < 160	700*	900-1050	12	55	270-325 HB	-20 °C 27 J (long)

RP0.2 \* ReH, \*\* ReL

## Transformation temperatures

	Temperature °C
MS	315
AC1	725
AC3	785

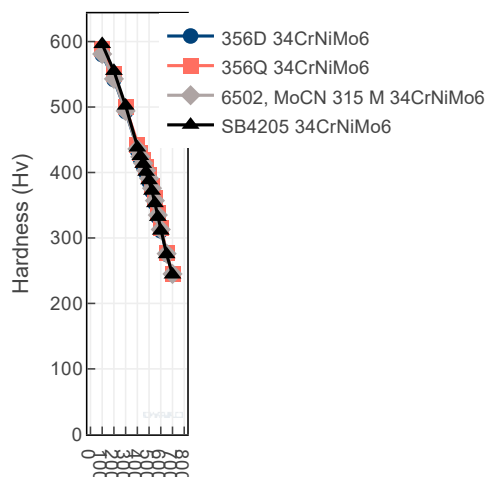
## Heat treatment recommendations

Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging	+AR	880-1050°C	In air
Soft annealing	+A	650-700°C	Slowly (15°C/h) until 600°C
Stress relieve annealing	+SRA	450-650°C (appr. 50°C under tempering temperature)	In air
Hardening	+Q	820-850°C	Quenching in oil
Tempering	+T	540-680°C	In air

## Heat Treatment Guide generated Graphs

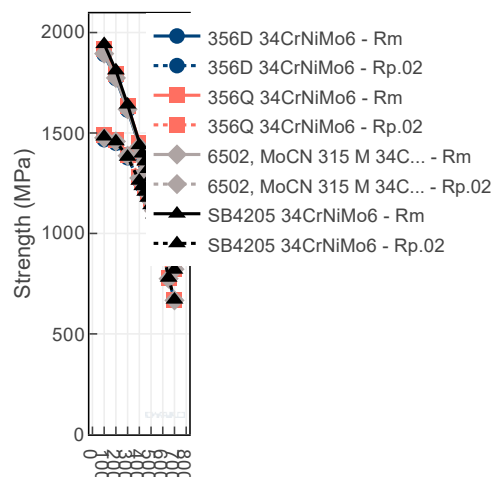
The following graphs are generated from a theoretical model. For further info see the Heat treatment guide module. Select a specific grade version for individual display.

Tempering Diagram (hardness)



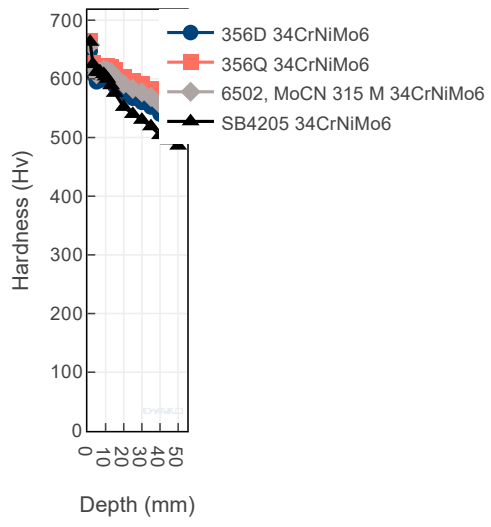
Tempering temperature (°C)

Tempering Diagram (strength)

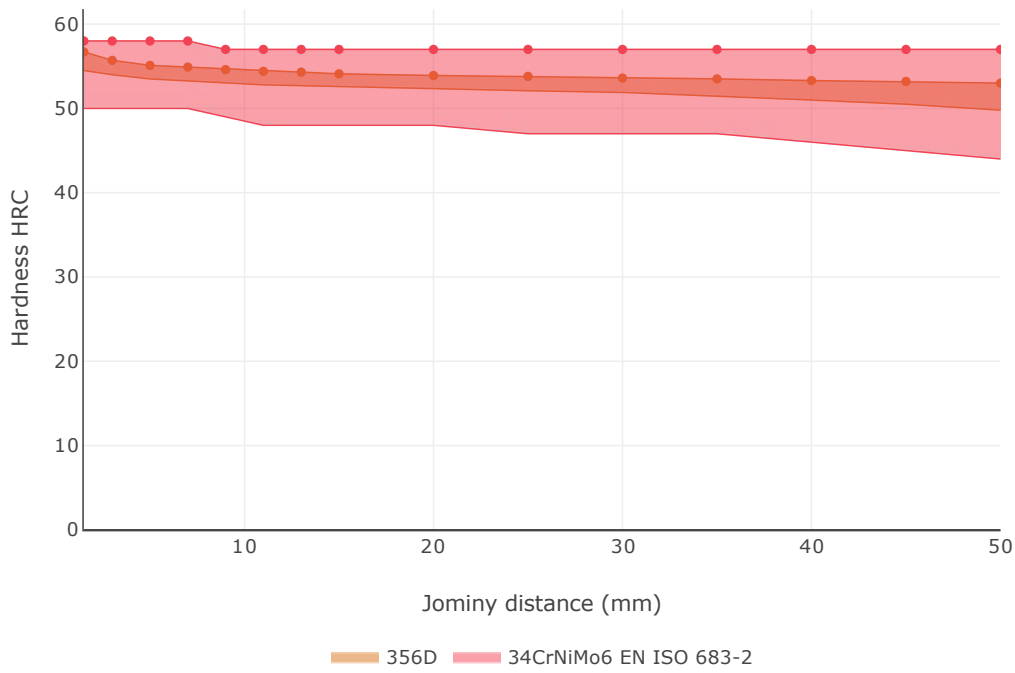


Tempering temperature (°C)

# Jominy

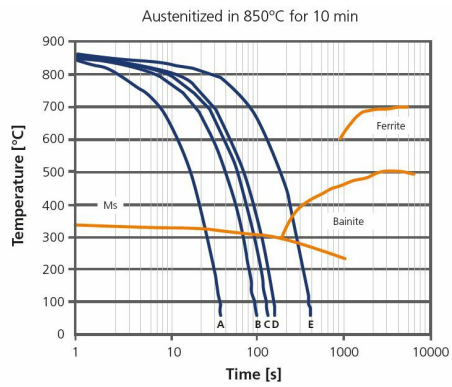


## Hardenability



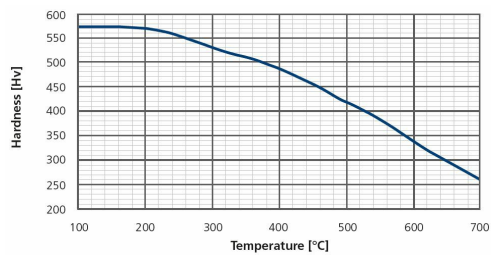
Jominy hardenability of Ovako 356D. Valid also for Ovako 356Q. Average value with +/- standard deviation.

## CCT - Ovako356D and Ovako356Q



	A	B	C	D	E
$t_{8-5}$ [s]	15	38	50	60	150
HV <sub>30</sub>	615	610	610	605	580

## Tempering response - Ovako356D and Ovako356Q



## Steel cleanliness

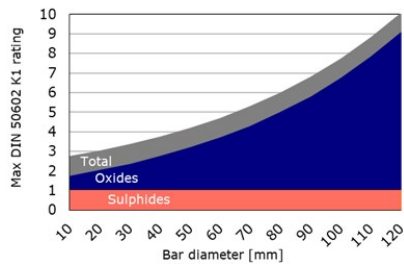
Micro inclusions - Ovako356D								Macro inclusions - Ovako356D	
Applied standard	ASTM E45							Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295							Sampling	Statistical testing on billets
Maximum average limits	A		B		C		D		
	Th	He	Th	He	Th	He	Th	He	
	2.0	1.5	0.8	0.1	0	0	0.5	0.4	
Limits								Limits	< 5 mm/dm <sup>2</sup>

## Steel cleanliness

Micro inclusions - Ovako356Q		Macro inclusions - Ovako356Q	
Applied standard	DIN 50602 K1	Applied standard	10 M Hz UST (Ovako internal standard)
Sampling	Six random samples from final product dimension	Sampling	Statistical testing on billets
Limits	The limit is dimension dependent. The average rating of six samples should not exceed the limits given in the graph	Limits	< 10 defects/dm <sup>3</sup> > 0,2 mm FBH

## IQ

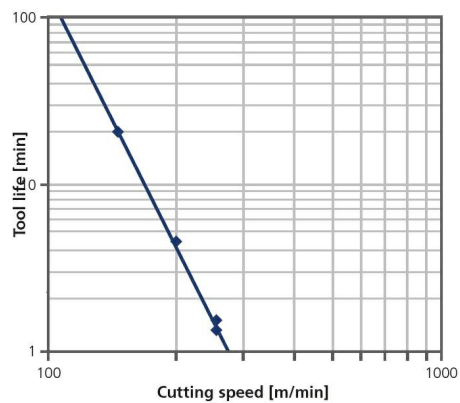
Inclusion limits IQ-processed steel



## Machinability

Test condition:	Q&T 310 HV
Test procedure:	ISO 3685
Insert:	SNMA 120408 P15
Tool holder:	CSRNL
Feed rate:	0.4 mm/r
Cutting depth:	2.5 mm
Wear criteria:	vB <sub>mean</sub> 0.3mm

Machinability - Ovako 356D  
According ISO 3685



## Tensile strength at elevated temperatures - Ovako356D

Q&T to 350 HB	RT	100°C	150°C	200°C	
R <sub>50.2</sub>	870	810	770	730	MPa
R <sub>m</sub>	970	940	920	890	MPa

## 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
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 <sup>①</sup>	Scope 1-3 (CO <sub>2</sub> e kg /1000 kg steel)
356	Round bar	+AR	860
356	Round bar	+QT	866
356	Tube, wall	+AR	904
356	Tube, wall	+QT	914
SB4205	Flat bar	+A	427
6499	Round bar	+AR	726
6499	Round bar	+QT	1019
6502, MoCN 315 M	Round bar	+AR	697
6502, MoCN 315 M	Round bar	+QT	985
SS 2541 (6498)	Round bar	+AR	710
SS 2541 (6498)	Round bar	+QT	1001
34CrNiMo6 (6499)	Round bar	+AR	726
34CrNiMo6 (6499)	Round bar	+QT	1019

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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