MATERIAL DATA SHEET

STEEL GRADE

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OVAKO

25CrMo4 All

General Information

25CrMo4 is a Cr and Mo alloyed quench and tempering steel with low carbon content. The steel combine high strength with high toughness.

322A - is an ingot cast variant .
6014 and 6016 are both M-steel
Delivered as rolled, soft annealed, normalized or quench and tempered. Weldable under certain conditions.

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

SS2225, 4130, 1.7218

Chemical composition

Variant	Cast	Di	Weldability		C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %
9224	CC		CEV 0.65_{max}	Min	0.22	-	0.60	-	-	0.90	-	0.15
			Pcm 0.38_{max}	Max	0.29	0.40	0.90	0.035	0.035	1.20	-	0.30
322A	IC		CEV 0.78_{max}	Min	0.22	0.10	0.60	-	0.020	0.90	-	0.15
			Pcm 0.45_{max}	Max	0.28	0.40	0.90	0.025	0.035	1.15	0.25	0.30
6014, 6016, MoC 210 M	CC	4.1	CEV 0.68_{max}	Min	0.22	0.05	0.60	0.000	0.015	0.90	-	0.15
			Pcm 0.4_{max}	Max	0.29	0.40	0.90	0.025	0.035	1.20	-	0.30
25CrMo4 EN ISO 683-2	Std		CEV $_{max}$	Min	0.22	0.10	0.60	0.000	0.000	0.90	-	0.15
			Pcm $_{max}$	Max	0.29	0.40	0.90	0.025	0.035	1.20	-	0.30

Mechanical Properties

Variant	Condition	Format	Dimension [mm]	Yield strength min [MPa]	Tensile strength [MPa]	Elongation A_5 [%]	Reduction of area Z_{min} [%]	Hardness	Impact (ISO-V) $strength_{min}$
9224	+QT	Flat bar	-	1150**	1350-1700	6	0	410-515 HV	20 °C 20 J (long)
322A	+A	Tube,wall	-	420	590 typical	25	67	185 HB typical	-
		Round bar	-	420	590 typical	25	67	185 HB typical	-
	+QT	Tube,wall	< 15	680	800 typical	15	65	250 HB typical	-
		Tube,wall	> 15	600	730 typical	15	60	230 HB typical	-
		Round bar	< 40	680	800 typical	15	65	250 HB typical	-
		Round bar	40 < 100	600	730 typical	15	60	230 HB typical	-
		Round bar	> 100	490	620 typical	15	50	200 HB typical	-
6014, 6016, MoC 210 M	+AR	Round bar	25 < 160	-	-	-	-	< 280 HB	-
	+A	Round bar	25 < 160	-	-	-	-	< 220 HB	-
	+QT	Round bar	25 < 40	600*	800-950	14	-	240-280 HB	-20 °C 27 J (long)
		Round bar	40 < 100	450*	700-850	15	-	200-250 HB	-20 °C 27 J (long)
		Round bar	100 < 160	400*	650-800	16	-	190-240 HB	-20 °C 27 J (long)

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

Transformation temperatures

	Temperature °C
MS	391
AC1	746
AC3	826

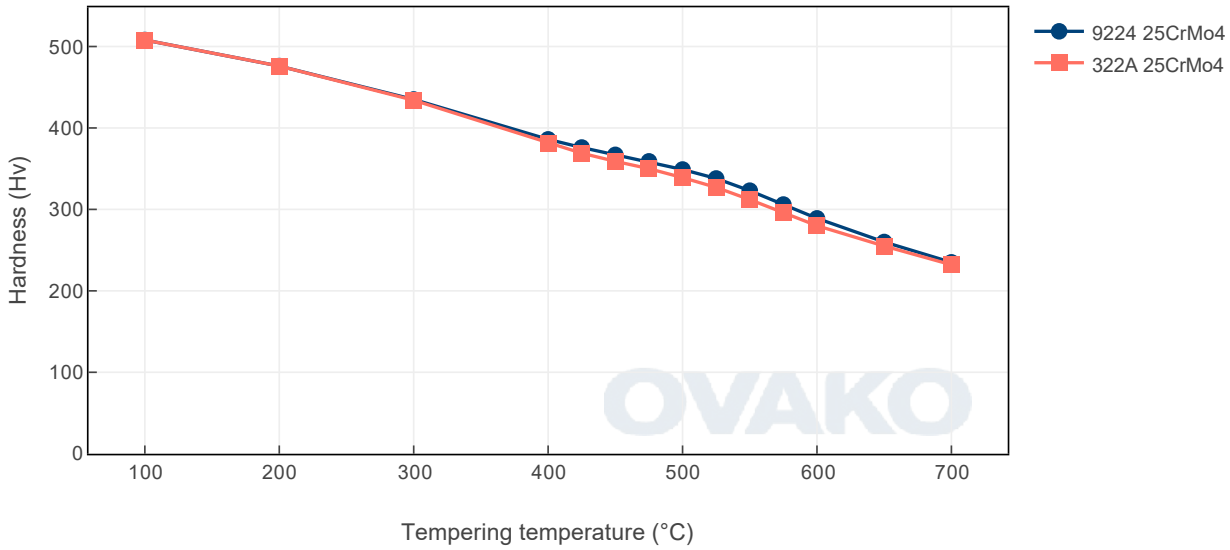
Heat treatment recommendations

Treatment	Condition	Temperature cycle	Cooling/quenching
Hot forging	+AR	850-1100°C	In still air
Normalizing	+N	840-880°C	In still air
Soft annealing	+A	700-730°C / 3h	In still air
Stress relieve annealing	+SRA	525-620°C	In still air
Hardening	+QT	840-870°C	In oil Temper immediately
Hardening	+QT	820-850°C	In water Temper immediately
Induction or Flame hardening	I-F	850-900°C	Water spray Temper immediately
Tempering	+T	550-675°C	

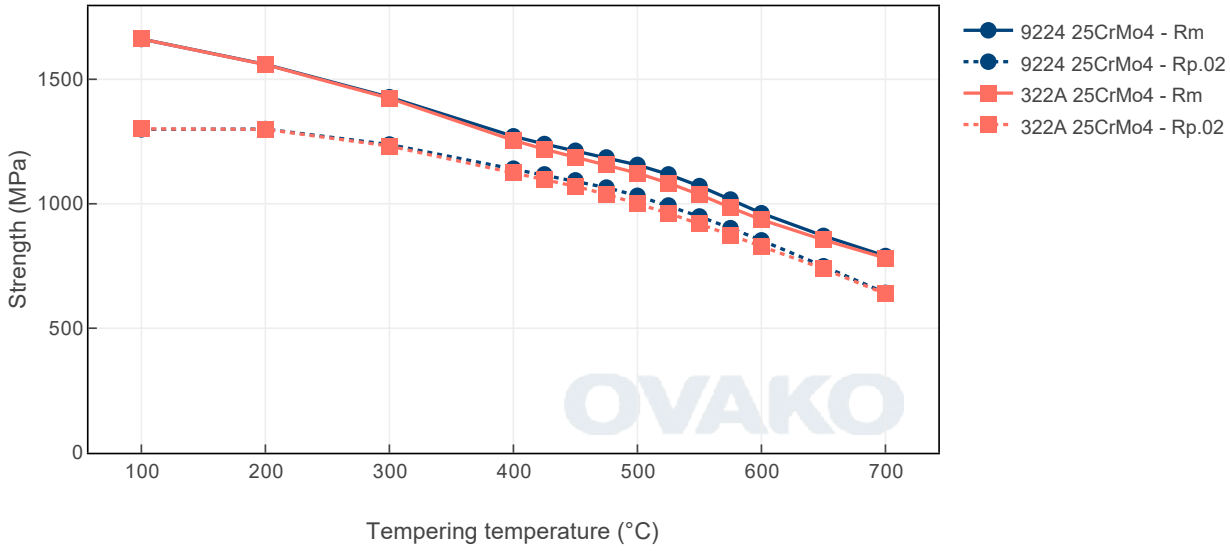
Heat Treatment Guide generated Graphs

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.

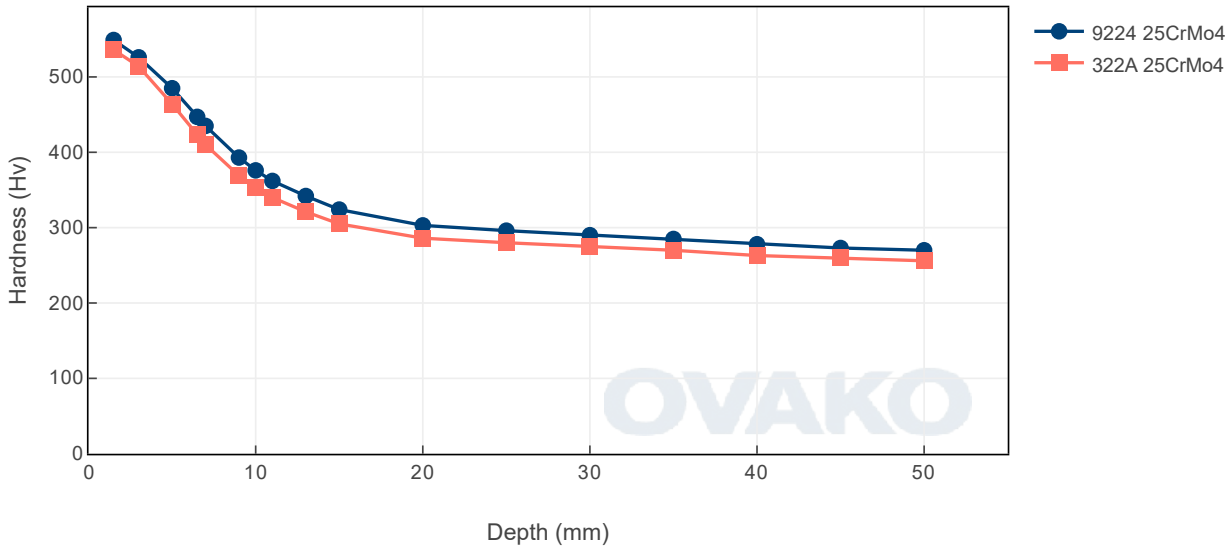
Tempering Diagram (hardness)



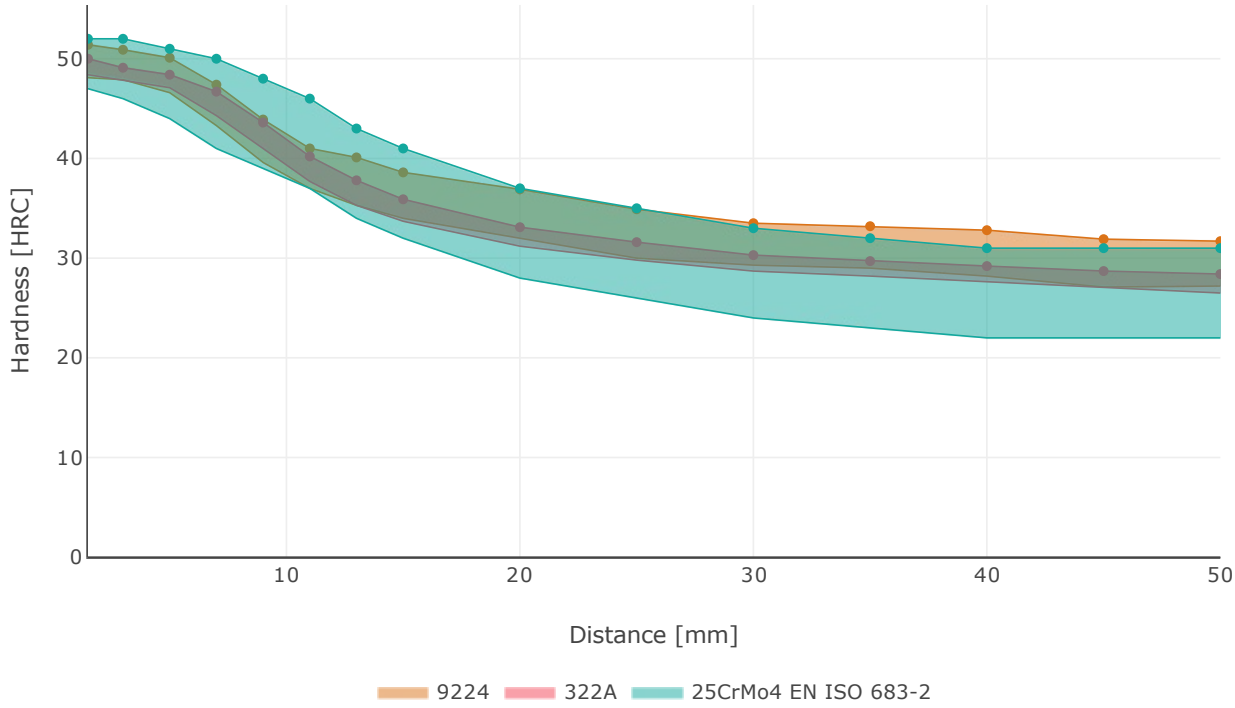
Tempering Diagram (strength)



Jominy


Hardness (Hv)
500
400
300
200
100
0
0
10
20
30
40
50
Depth (mm)
9224 25CrMo4
322A 25CrMo4
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Hardenability



The standard variant is the +HH version of 25CrMo4 EN ISO 683-2

Steel cleanliness

Micro inclusions - steel grade 322A									Macro inclusions - 322A	
Applied standard	ASTM E45								Applied standard	ISO 3763 (Blue fracture)
Sampling	ASTM A295								Sampling	Statistical testing on billets
Maximum	A		B		C		D		Limits	< 5 mm/dm^2
average	Th	He	Th	He	Th	He	Th	He		
limits	2.5	1.5	1.5	0.5	0	0	1.0	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.

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)
322A	Round bar	+AR	619
322A	Round bar	+QT	625
322A	Tube,wall	+AR	643
322A	Tube,wall	+QT	651
9224	Round bar	+AR	464
6014, MoC 210 M	Round bar	+AR	525
6014, MoC 210 M	Round bar	+QT	779

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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