Material data sheet
Steel grade

Ovako322
SB25CrMo4-9224
MoC210
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OVAKO

25CrMo4 All

General Information

Grade Ovako 322A and 322D are Cr and Mo alloyed quench and tempering steel with low carbon content. The steel combine high strength with high toughness.

- Variant 322A correspond to the EN grade 25CrMo4.
- Variant 322D corresponds to SAE 4130 / 30CrMo4*. Suitable for flame or induction hardening.
- Variant 6014 is EN grade 25CrMo4 M-steel

Delivered as rolled, soft annealed normalized or quench and tempered. Weldable under certain conditions.

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.*

Similar designations

9224 - 27CrMo4-2, 30CrMo4*, 30CrMo4, SS2225, 4130

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
322D	IC		CEV 0.74$_{max}$	Min	0.28	0.20	0.40	-	-	0.90	-	0.18
			Pcm 0.47$_{max}$	Max	0.33	0.35	0.60	0.025	0.010	1.10	0.25	0.25
25CrMo4 EN10083-3:2006 (ref)	Std		CEV 0.65$_{max}$	Min	0.22	-	0.60	-	-	0.90	-	0.15
			Pcm 0.38$_{max}$	Max	0.29	0.40	0.90	0.025	0.035	1.20	-	0.30
SS142225 (1986)* (ref)	Std		CEV $_{max}$	Min	0.22	0.10	0.60	-	-	0.90	-	0.15
			Pcm $_{max}$	Max	0.29	0.40	0.90	0.035	0.035	1.20	-	0.30
6014, 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

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	-
322D	+QT	Tube,wall	< 25	600	730 typical	23	70	225 HB typical	20 °C 193 J (long)
		Tube,wall	< 25	600	730 typical	23	70	225 HB typical	-20 °C 183 J (long)
		Tube,wall	< 25	600	730 typical	23	70	225 HB typical	-40 °C 176 J (long)
SS142225 (1986)* (ref)	+QT	All formats	< 160	410	640-780	16	65	185-230 HB	-
		All formats	< 100	600	800-950	15	55	235-285 HB	-
		All formats	< 40	700	900-1100	13	55	270-325 HB	-
	+A	All formats	-	-	-	-	-	< 212 HB	-
6014, 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}*

*SS142225 (1986); All formats condition +QT: Dim<160mm corresponds to SS2225-06; Dim<100mm to SS2225-03; Dim<40mm to SS2225-05; All formats condition +A corresponds to SS2225-02

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	

Hardenability

Steel cleanliness

Micro inclusions - steel grade 322A + 322D								
Applied standard	ASTM E45							
Sampling	ASTM A295							
Maximum average limits	A		B		C		D	
	Th	He	Th	He	Th	He	Th	He
	2.5	1.5	1.5	0.5	0	0	1.0	0.5

Macro inclusions - 322A + 322D	
Applied standard	ISO 3763 (Blue fracture)
Sampling	Statistical testing on billets
Limits	< 5 mm/dm^2

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

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