Dörrenberg Edelstahl

DE - Brand:

Special Steel

PMD M4

Chemical composition:
(Typical analysis in %)

C	Cr	Mo	W	V			
1,35	4,20	4,50	5,80	4,00			

Steel properties:

Powder-metallurgical high-speed steel, fine distributed carbide structure, high compressive strength, excellent toughness, high wear resistance, high thermal stability. The volume of carbides is a little bit higher, compared to PMD23.

Applications:

Cold work tools for punching and cutting, precision blanking tools, cold extrusion and deep drawing dies, coining tools. Also for machining tools like milling cutters, broaches etc.

Condition of delivery:

Soft annealed to max. 280 HB

Physical properties:

Thermal expansion coefficient	$\left[\frac{10^{-6}\cdot m}{m \cdot K}\right]$	20-100°C	20-200°C	20-300°C	20-400°C
		10,6	11,7	11,9	12,4
Thermal conductivity	$\left[\frac{W}{m \cdot K}\right]$	20°C	350°C	700°C	
		23,5	26,8	26,2	

Heat treatment:

Soft annealing
Annealing only in neutral atmosphere

Temperature	Cooling	Hardness
870 - 900°C	furnace	max. 280 HB

Stress relief annealing

Temperature	Cooling	
600 - 650°C	furnace	

Hardening

Temperature	Cooling	Tempering
1100 - 1200°C	oil, pressure gas (N_2), air or hot bath 500 - 550°C	see tempering diagram

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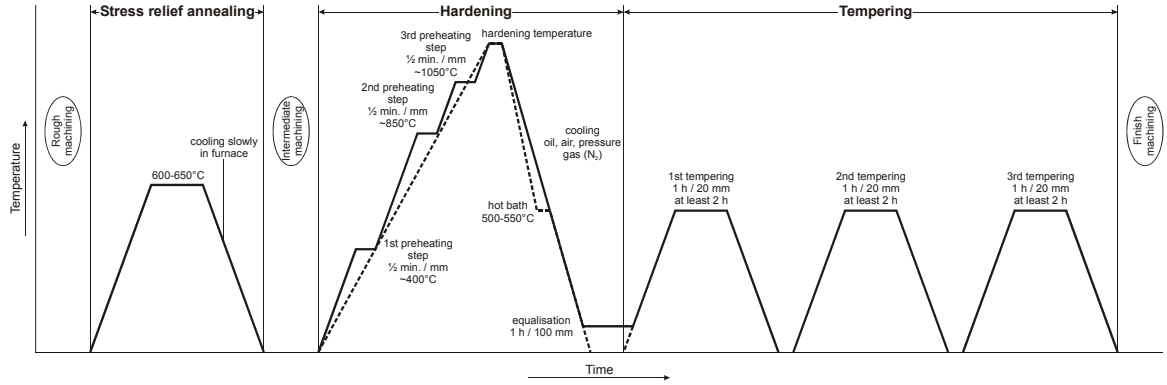
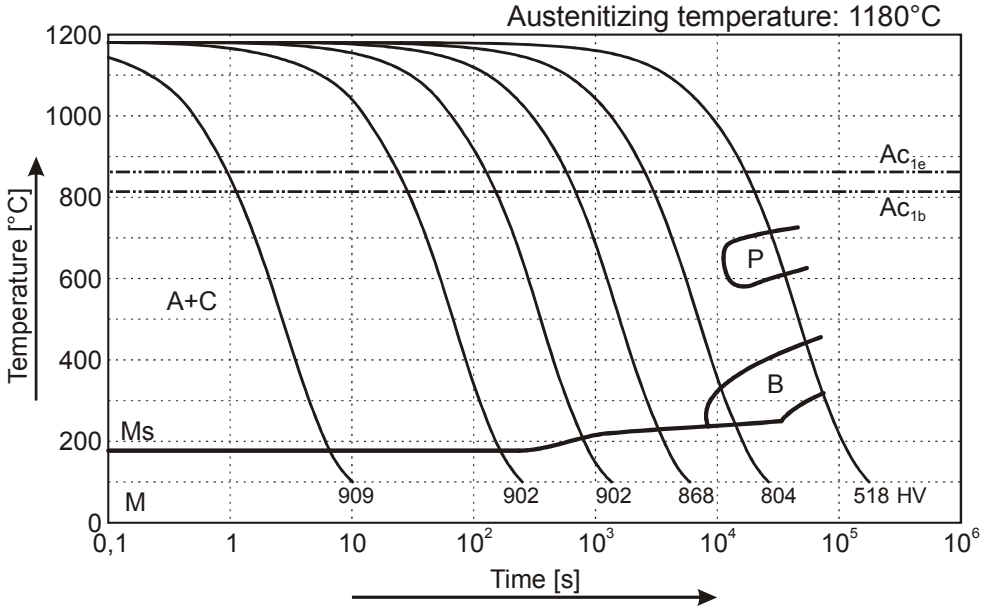
(PMD M4) Thermal Cycle Diagram



Continuous Cooling Transformation Diagram (CCT)



DE-Brand PMD M4 has to be tempered minimum three times with 540-560°C in any case.

Reference values for hardness after tempering three times, according to the austenitizing temperature (all datas ±1 HRc).

Tempering temperature	Austenitizing temperature		
	1120°C	1160°C	1200°C
Ansprunghärte	65,0 HRc	65,0 HRc	65,0 HRc
540°C	64,0 HRc	64,5 HRc	65,0 HRc
550°C	63,0 HRc	64,0 HRc	65,0 HRc
560°C	62,0 HRc	63,5 HRc	64,5 HRc
580°C	61,0 HRc	62,0 HRc	63,0 HRc
590°C	59,0 HRc	60,0 HRc	62,0 HRc

Remarks: All technical information is for reference only.