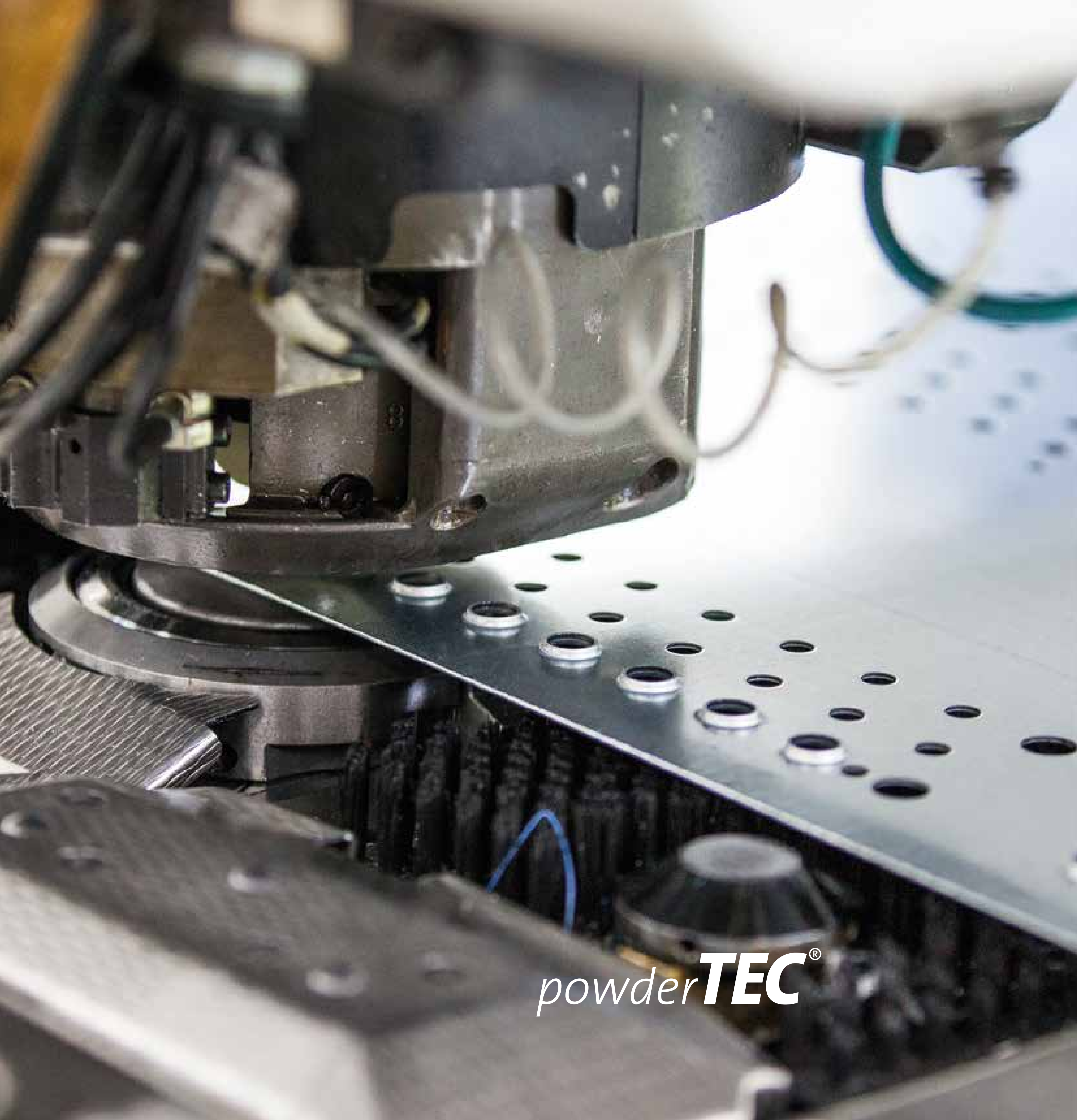
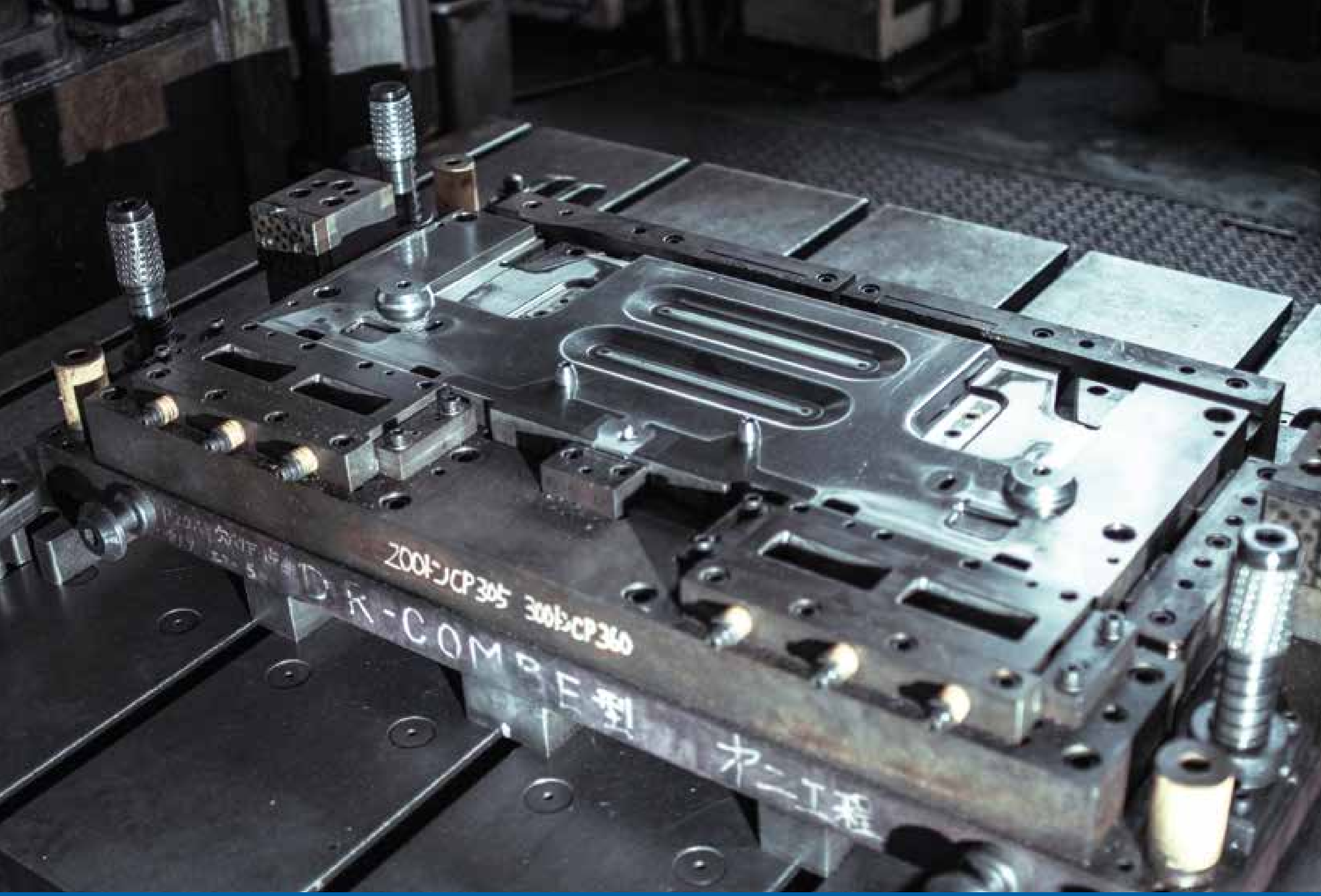


OB-PM-K39
COLD-WORKING
TOOL STEEL



Top: Powder-metallurgical steel such as OB-PM-K39 provides for more flexible and reliable production of complex precision punching and blanking tools.

Bottom left: The high wear resistance of OB-PM-K39 enables a longer service life for precision tools without compromising production quality.

Bottom right: OB-PM-K39 is also ideal for precision stamping dies with a very fine level of detail.

OBERSTE-BEULMANN *powderTEC®*:
MAXIMUM PERFORMANCE. MAXIMUM PRECISION.

4TH-GENERATION POWDER-METALLURGICAL STEEL

OB-PM-K39 is a powder metallurgically produced cold work steel with a very fine, uniform, segregation-free microstructure and carbide distribution. Due to the increased vanadium content and the resulting enrichment of the microstructure with hard carbides, the abrasive wear resistance has been improved.

OB-PM-K39 is characterized by an improved wear resistance compared to OB-PM-S39, with unchanged very good toughness properties. OB-PM-K39 withstands highest pressure loads.

ADVANTAGES AND BENEFITS

- High working hardness up to 64 HRC
- High toughness
- High compressive strength
- Very good abrasive and adhesive wear resistance
- Excellent hard machinability
- Stable mechanical and technological properties
- Joint heat treatment is possible with common cold working tool steels at hardening temperatures from 1030 – 1180 °C

Product merits:
- Optimum machinability
- High flexibility with regard to heat treatment
- No substantial changes to the mechanical and technological properties

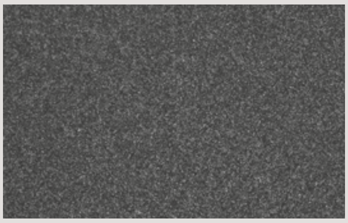
Your benefits:
- More flexible tool manufacturing with less risks

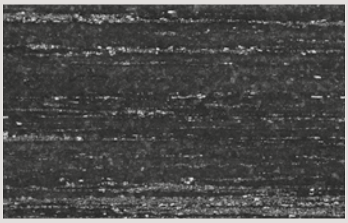
APPLICATIONS

Tools for cold and semi-hot working applications such as extrusion dies, drawing dies, embossing dies, cold rolling or pilger mandrels, sintering dies, cold extrusion dies, cold upsetting punches, fine blanking dies, plastic injection molding dies.

Knives for the recycling, paper and packaging industry, shearing knives, cylinders and screw conveyors, inserts, spray nozzles

COMPARISON OF MICROSTRUCTURE PROPERTIES





Left: Oberste-Beulmann *powderTEC®*
Right: Conventional steel

COMPOSITION

MATERIAL NO.	ABBREVIATED NAME	CHEMICAL COMPOSITION IN %										ANNEALED HARDNESS	WORKING HARDNESS
		C	Si	Mn	Cr	Mo	Ni	V	W	Co	OTHER	MAX. HB	HRC
OB-PM-K39		2.48	0.50	0.30	4.30	4.00		8.90	1.00	2.00		280	58–64*

SMELTING	SPEC. WEIGHT	STATE ON DELIVERY	TENSILE STRENGTH (N/MM²)	MICROSTRUCTURE	DEGREE OF PURITY (DIN 50602)
	7.60 g/qm³	Soft-annealed			K1 max. 15

* depending on intended use)

PHYSICAL PROPERTIES

PARAMETERS			TEMPERATURE								
			20 °C	100 °C	200 °C	300 °C	350 °C	400 °C	500 °C	600 °C	700 °C
Coefficient of thermal expansion	10^{-6} * K	(20 °C to ...)	–	10.30	10.67	11.03	–	11.38	11.70	11.97	–
Thermal conductivity (W/m * K)	Annealed		20.1	–	–	–	–	–	–	–	–

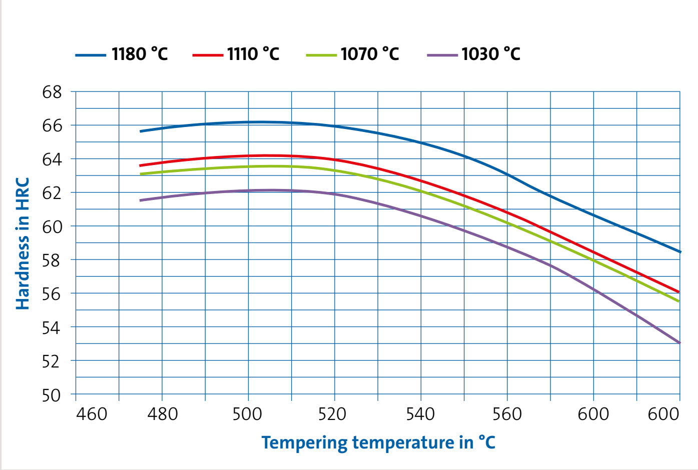
HEAT TREATMENT

HEAT TREATMENT	TEMPERATURE (°C)	COOLING	NOTES ON HEAT TREATMENT
Stress-relief annealing	approx. 650	Furnace Air	Stress relief after extensive machining and complicated tools. **Holding time:** approx. 2 h (after complete heating) - slow, controlled furnace cooling.
Hardening	1030 – 1180		
Pre-heating stage 1 Pre-heating stage 2	approx. 650 approx. 850 – 900		**Hardening temperature and holding time (after complete heating)** Toughness: 1030 - 1150 °C (20 - 30 minutes), Wear resistance: 1180 °C: (10 minutes)
Quenching	approx. 550	Hot bath Oil Vacuum	The **mildest quenching medium** is to be preferred, in order to minimise thermal stress, distortion and dimensional changes. To counter the risk of stress cracking, tempering treatment is to begin immediately after attaining a temperature of approx. 80 °C. Quench in a warm bath and equalize. Slow further air cooling. **Gas pressure**: Dependent on size of part, but min. 4 bar. Then continue cooling to room temperature in still air.

TEMPERING

HARDNESS (HRC) AFTER TEMPERING						
	475 °C	500 °C	525 °C	550 °C	575 °C	600 °C
1180 °C	65,5	66,0	65,5	**64,0**	61,0	58,5
1110 °C	63,5	64,0	63,5	**61,5**	59,0	56,0
1070 °C	63,0	63,5	63,0	**61,0**	58,5	55,5
1030 °C	61,5	62,0	61,5	**59,5**	57,0	53,0

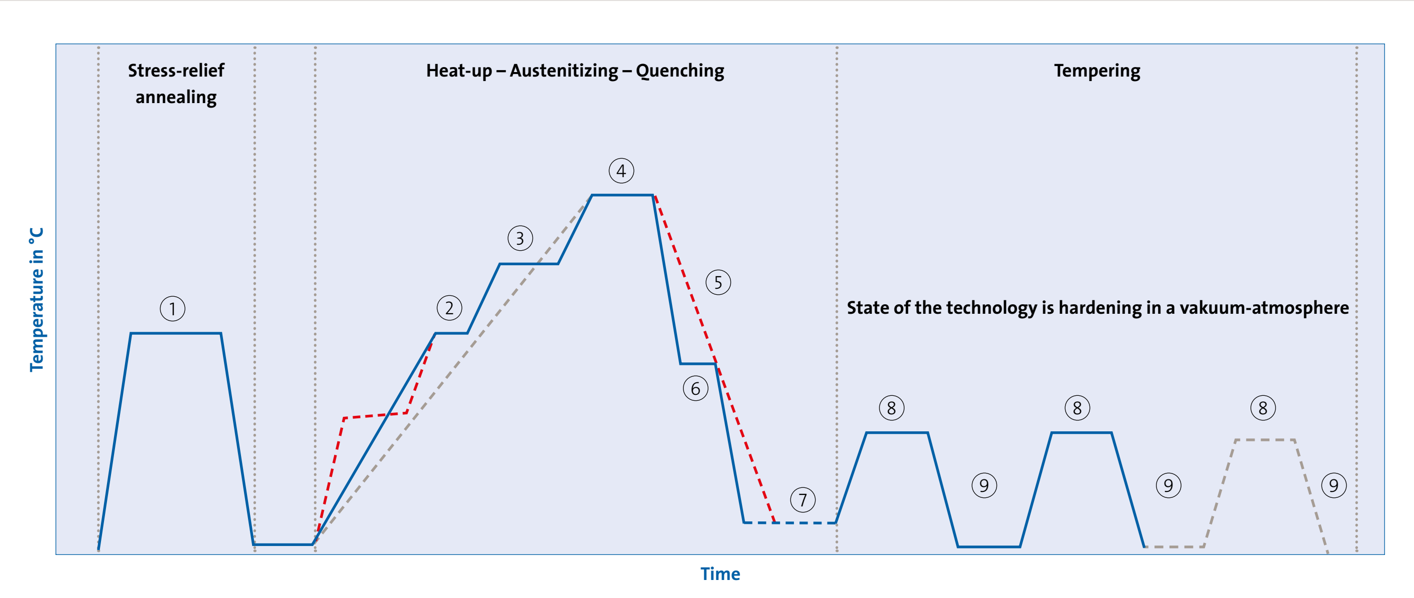
The tempering diagram shows hardness values at different austenitizing and tempering temperatures



Notes on tempering

– Slow heating to tempering temperature directly after quenching.
– A second tempering cycle is necessary, a third cycle is recommended
– The tempering process is dependent on the given requirements.
– Holding time in furnace 1 h per 20 mm of workpiece thickness, but min. 2 h

TEMPERATURE TIMELINE (HEAT TREATMENT)



Hardening under vacuum conditions represents the state of the art

1 = Annealing temperature approx. 650 °C
2 = Pre-heating stage 1 – ½ min./mm (approx. 650 °C)
3 = Pre-heating stage 2 – ½ min./mm (approx. 850–900 °C)
4 = Austenitizing temperature approx. 1030–1180 °C
(Temperature depending on required properties)

5 = Cooling medium: Pressure gas (N_2) or hot bath
6 = Hot bath approx. 550 °C (benched quenching)
7 = Equalisation temperature 80 – 100 °C (1 h/100 mm)
8 = Tempering temperature: approx. 540 – 560 °C (recommendation)
9 = Cooling medium: Air

__Note:__ The information contained in this brochure serves to describe the relevant products and processes; liability is excluded.

THE OBERSTE-BEULMANN *powderTEC®* RANGE:

powder**TEC**®

Plastic mould steel
OB-PM-M39

Cold-working tool steel
OB-PM-K39

High speed steel
OB-PM-S39
OB-PM-S59
OB-PM-S79

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