Ferro-Titanit®

C-Spezial

Chemical composition

Carbide phase	Binder phase (main components)			
TiC	**C**	**Cr**	**Mo**	**Fe**
33	0.65	3.0	3.0	Balance

(guideline values in % by weight)

Microstructure

Titanium carbide + martensite

Characteristic properties

The binder phase consists of a cold work steel containing 3% chromium and 3% molybdenum. The relatively low alloy content brings about a low tempering resistance. The hardness decreases above approximately 200 °C. In comparison with the other grades, C-Spezial has the best machining properties.

Mechanical properties
hardened + tempered

Density	Compression strength	Bending fracture	Modulus of elasticity	Shear modulus	Service hardness	Further data on the mechanical properties upon request
g/cm³	**MPa**	**MPa**	**MPa**	**MPa**	**HRC**	
6.5	3800	1500	292000	117000	approx. 69	

Physical properties

Thermal expansion coefficient between 20 and … °C in $10^{-6} \cdot °C^{-1}$

100	200	300
9.2	9.1	9.8

Thermal conductivity at 20 °C in $W \cdot cm^{-1} \cdot °C^{-1}$

0.205

Measuring frequency (Hz)	Damping Q^{-1} (10^{-5})
2600	14
7000	22
22000	16

Electrical resistivity at 20 °C in $\Omega \cdot mm^2 \cdot m^{-1}$

0.75

Magnetic properties

Magnetic saturation polarisation	Coercive field strength	Remanence
mT	**kA · m⁻¹**	**mT**
920	5.0	315

Use

All cold work applications in cutting and forming engineering, e.g. for cutting and blanking tools, bending jaws, extrusion punches, deep-drawing dies, form and hobbing punches, clamping jaws, blanking sleeves, tools for the processing of steel, non-ferrous metals, aluminium, etc., as well as machine elements such as pulleys, rollers and guides exposed to heavy wear.

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Annealing

Annealing temperature °C	Cooling	Hardness after annealing HRC	Transformation range °C
Soft 750 (10 h)	Furnace	approx. 49	800 – 852

Stress-relieving

If extensive machining is required, it is advisable, after rough-machining, i.e. before finish-machining, to stress-relief anneal at around 600 – 650 °C, followed by cooling in the furnace.

Hardening

Hardening temperature °C	Hardening medium	Quenching
980 – 1100	Vacuum	1 bar N_2

Heating to hardening temperature is advisably performed over several preheating stages (e.g. 400 °C, 600 °C, 800 °C) in order to ensure uniform soaking of the parts that are to be hardened and to avoid any cracking induced by thermal stress. The selected soaking time at hardening temperature must be longer than for steel tools (roughly twice to three times). Because of the rigid titanium carbide skeleton, deleterious grain growth as found in tool steel and high-speed steel cannot occur during the heat treatment. It is hence possible to accept slightly higher hardening temperatures and longer soaking times rather than insufficient hardening.

Tempering

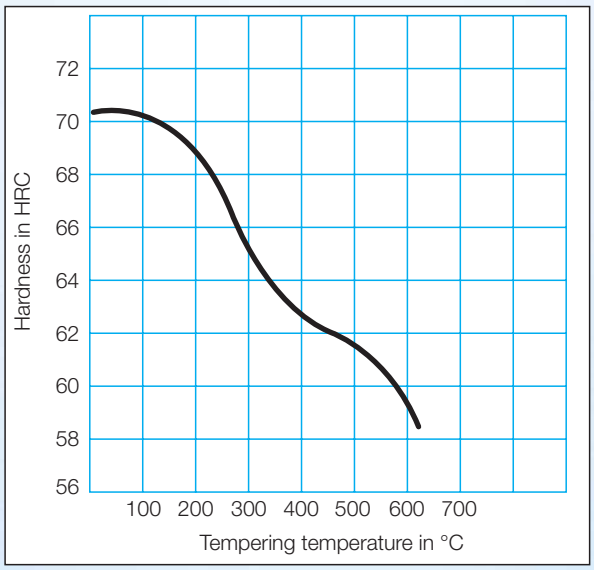
Tempering temperature °C	Service hardness HRC
150	approx. 69

In order to avoid cracking induced by hardening stresses, parts that have been hardened must be tempered immediately after quenching or cooling to around 50 °C and held at tempering temperature for at least 2 hours, followed by cooling in air.

Dimensional changes

Due to the hardening and tempering of C-Spezial, the original dimensions increase. The change in dimensions is less than 0.1%.

Tempering curve



Note:
No tempering temperature other than the one indicated should be selected, as the strong, negative influence on the resistance to wear and pick-up does not justify the minor benefit of toughness improvement.