

Cryodur 1520

(C70W)

C 0.70 Si 0.25 Mn 0.25

Steel properties

Shell-hardenable steel with wear-resistant surface and high core toughness.

Applications

Trimming dies, pliers, tool bits for pneumatic and hand tools.

Heat treatment

Soft annealing °C

680 – 710

Cooling

Furnace, from 500 °C air

Hardness HB

max. 180

Stress-relief annealing °C

approx. 600 – 650

Cooling

Furnace

Hardening °C

780 – 810

Quenching

Water

Hardness after quenching HRC

64

Tempering °C

HRC

100

200

300

350

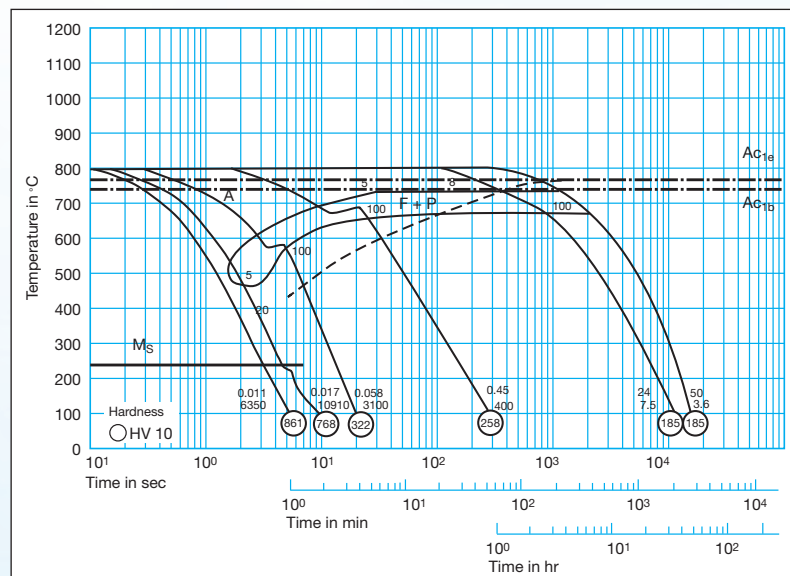
64

61

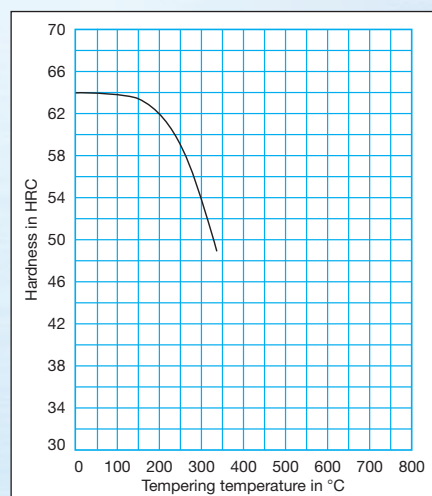
56

49

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 1730

C45U

C 0.45 Si 0.20 Mn 0.70

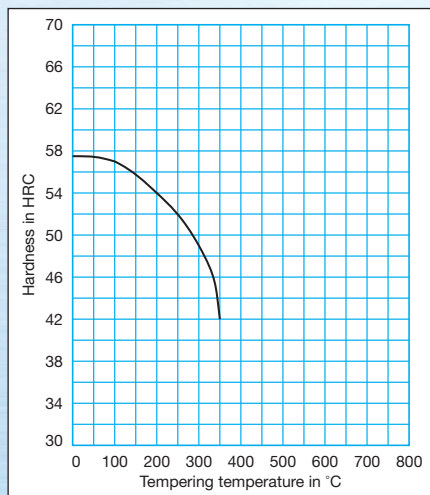
Steel properties Shell-hardenable steel featuring hard surface and tough core.

Standards AISI 1045

Applications Components for tools (e.g. base plates for plastic moulds and pressure casting moulds). Also suitable for hand tools, pliers and agricultural tools of all kinds.

Heat treatment	Soft annealing °C 680 – 710	Cooling Furnace	Hardness HB max. 207		
	Stress-relief annealing °C approx. 600 – 650	Cooling Furnace			
	Hardening °C 800 – 830	Quenching Water	Hardness after quenching HRC 57		
Tempering °C HRC		100 57	200 54	300 49	350 42

Tempering diagram



Cryodur 2002

(125Cr1)

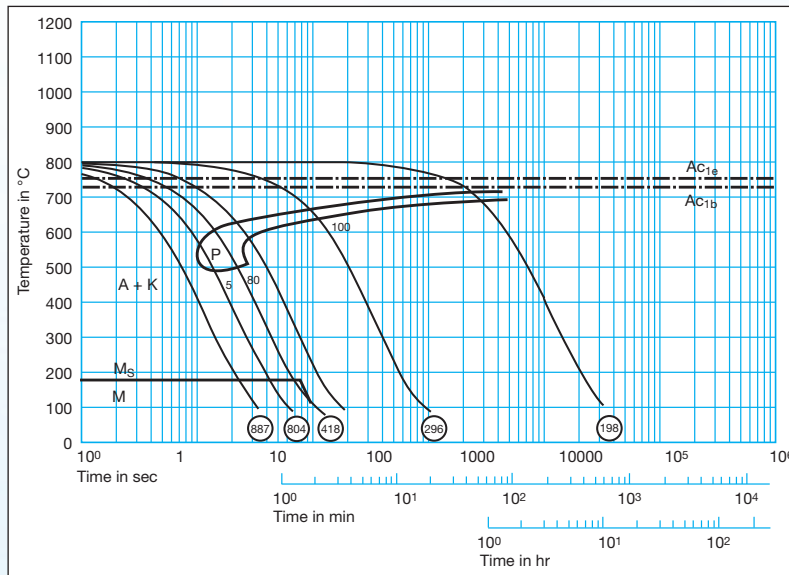
C 1.30 Cr 0.25 Si 0.25 Mn 0.30

Steel properties Tool steel with high surface hardness.

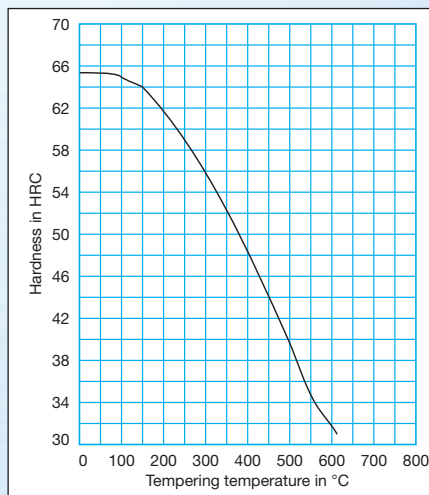
Applications Cutting tools, drawing dies, files and mandrels.

Heat treatment	Soft annealing °C	Cooling	Hardness HB		
	700 – 720	Furnace	max. 200		
	Stress-relief annealing °C	Cooling			
	approx. 650 – 680	Furnace			
	Hardening °C	Quenching	Hardness after quenching HRC		
	770 – 800	Oil: < 10 mm Ø	65		
	Tempering °C	100	200	300	400
	HRC	64	62	56	49

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2008

(140Cr3)

C 1.50 Si 0.25 Mn 0.25 Cr 0.85 V 0.20

Steel properties Water-hardening special steel.

Applications Files.

Heat treatment

Soft annealing °C
730 – 760

Cooling
Furnace

Hardness HB
max. 220

Stress-relief annealing °C
approx. 650 – 680

Cooling
Furnace

Hardening °C
780 – 820

Quenching
Water

Hardness after quenching HRC
68

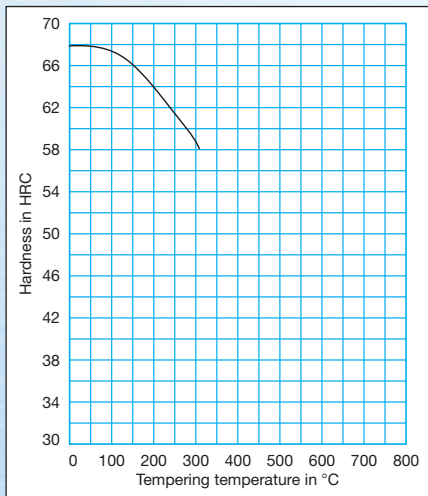
Tempering °C
HRC

100
63

200
62

300
59

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2067

100Cr6

C 1.00 Si 0.20 Mn 0.35 Cr 1.50

Steel properties Oil-hardenable grade with low hardening depth, wear-resistant.

Standards AISI L1 / L3 AFNOR Y100C6

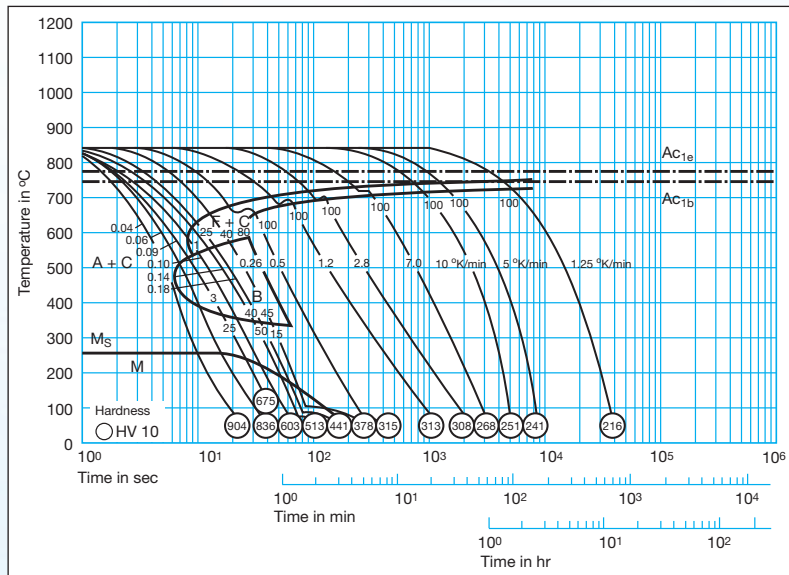
Physical properties

Thermal conductivity at °C	20	350	700
W/(m · K)	33.0	32.2	31.4

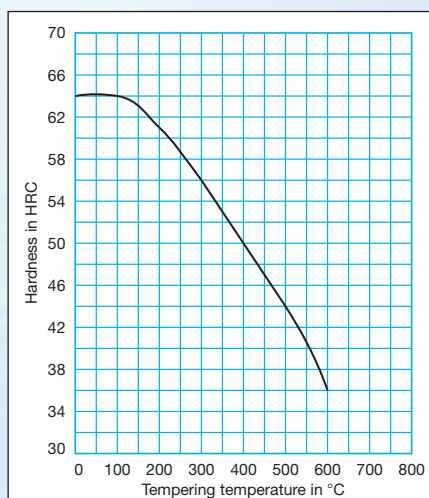
Applications Cold pilger rolls and jaws, thread cutting tools, gauges, mandrels, wood and paper processing tools, cold extrusion and spinning tools, flanging rolls, shear and rotary shear blades.

Heat treatment	Soft annealing °C	Cooling	Hardness HB				
	710 – 750	Furnace	max. 225				
	Stress-relief annealing °C	Cooling					
	approx. 650	Furnace					
	Hardening °C	Quenching	Hardness after quenching HRC				
	830 – 860	Oil or saltbath, 180 – 220 °C	64				
	Tempering °C	100	200	300	400	500	600
	HRC	64	61	56	50	44	36

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2080

X210Cr12

C 2.00 Si 0.30 Mn 0.30 Cr 12.00

Steel properties 12 % ledeburitic chromium tool steel with extreme wear resistance.

Standards AISI D3 AFNOR Z200C12

Physical properties

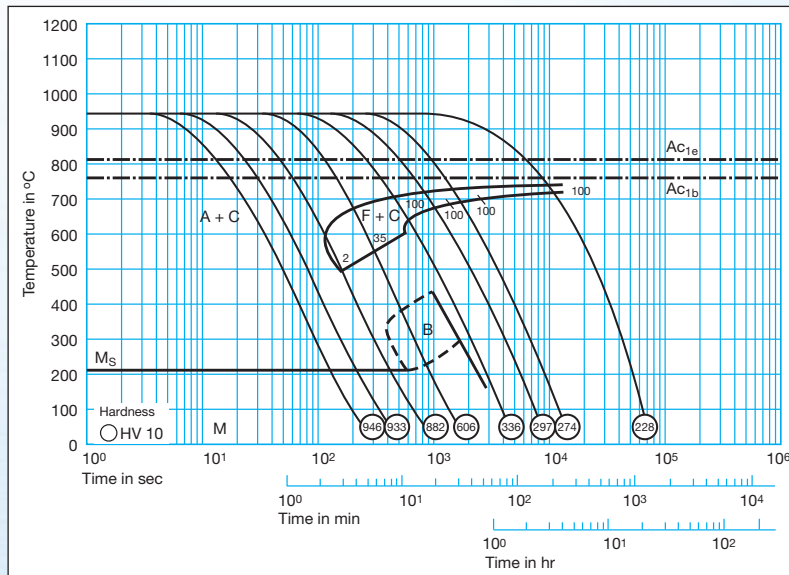
Coefficient of thermal expansion							
at °C	20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600	20 – 700
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	10.8	11.7	12.2	12.6	12.8	13.1	13.3

Thermal conductivity			
at °C	20	350	700
$\text{W}/(\text{m} \cdot \text{K})$	16.7	20.5	24.2

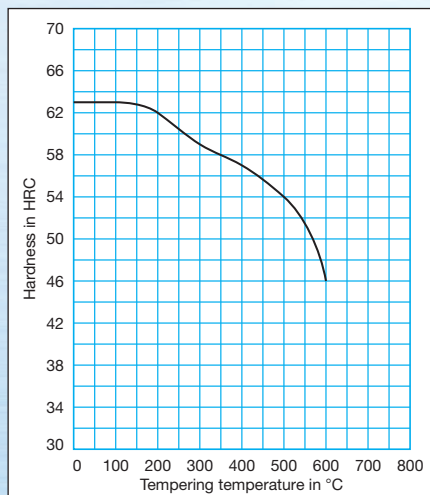
Applications Cutting tools for sheets up to 4 mm thickness, trimming dies, blanking dies for paper and plastics, shear blades and rotary shear blades for sheet thicknesses up to 2 mm, drawing and deep-drawing tools. Woodworking tools, stone pressing tools, pressure pads and highly wear-resistant plastic moulds, profile rolls.

Heat treatment	Soft annealing °C	Cooling	Hardness HB				
	800 – 840	Furnace	max. 250				
	Stress-relief annealing °C	Cooling					
	approx. 650 – 700	Furnace					
	Hardening °C	Quenching	Hardness after quenching HRC				
	930 – 960	Oil	64				
	950 – 980	Air (up to 30 mm thickness)	64				
	Tempering °C						
	100	200	300	400	500	600	
	HRC	63	62	59	57	54	46

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2101

(62SiMnCr4)

C 0.65 Si 1.10 Mn 1.10 Cr 0.70

Steel properties

Good toughness and wear resistance.

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 200
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	11.8	12.5

Thermal conductivity

at °C	20	350	700
$\text{W}/(\text{m} \cdot \text{K})$	31.0	31.5	31.9

Applications

Spring collets, shear blades, guide rails and punching tools.

Heat treatment

Soft annealing °C
700 – 750

Cooling
Furnace

Hardness HB
max. 225

Stress-relief annealing °C
approx. 650 – 680

Cooling
Furnace

Hardening °C
830 – 860

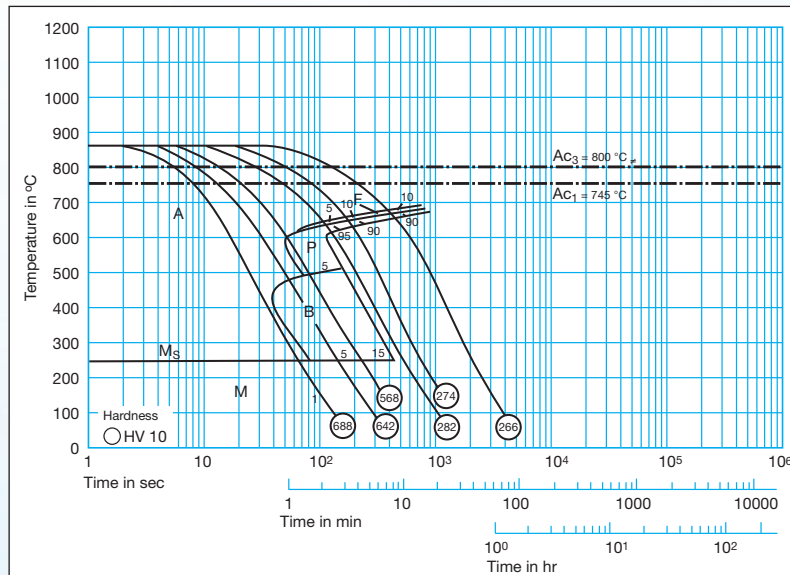
Quenching
Oil or
saltbath, 180 – 220 °C

Hardness after quenching HRC
61

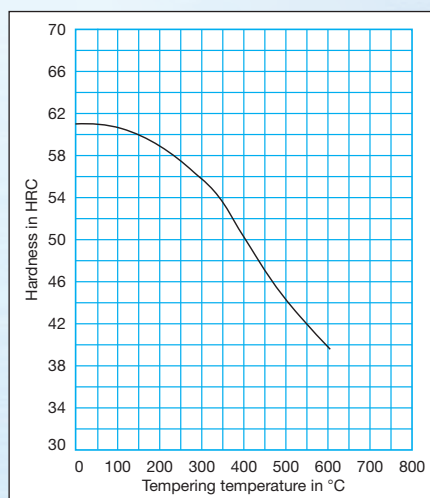
Tempering °C
HRC

100	200	300	400	500	600
61	59	56	50	45	40

Time-temperature-transformation diagram



Tempering diagram



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Cryodur 2201

(X165CrV12)

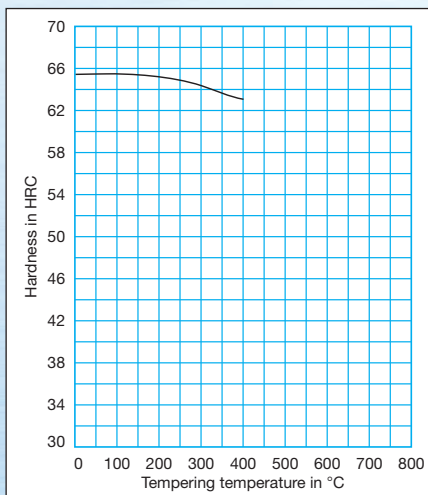
C 1.60 Cr 12.00 V 0.10

Steel properties Dimensionally stable, oil-hardenable grade featuring extreme wear resistance combined with sufficient toughness.

Applications High-performance steel for cutting, hobbers, thread rolls, metal saws, wood milling machines and similar items.

Heat treatment	Soft annealing °C 800 – 830	Cooling Furnace	Hardness HB max. 231		
	Stress-relief annealing °C approx. 650 – 680	Cooling Furnace			
	Hardening °C 960 – 1000	Quenching Oil or saltbath, 350 – 400 °C	Hardness after quenching HRC 64		
	Tempering °C HRC	100 64	200 63	300 61	400 58

Tempering diagram



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Cryodur 2210

(115CrV3)

C 1.20 Cr 0.70 V 0.10

Steel properties Wear resistant chromium-vanadium alloyed cold-work steel.

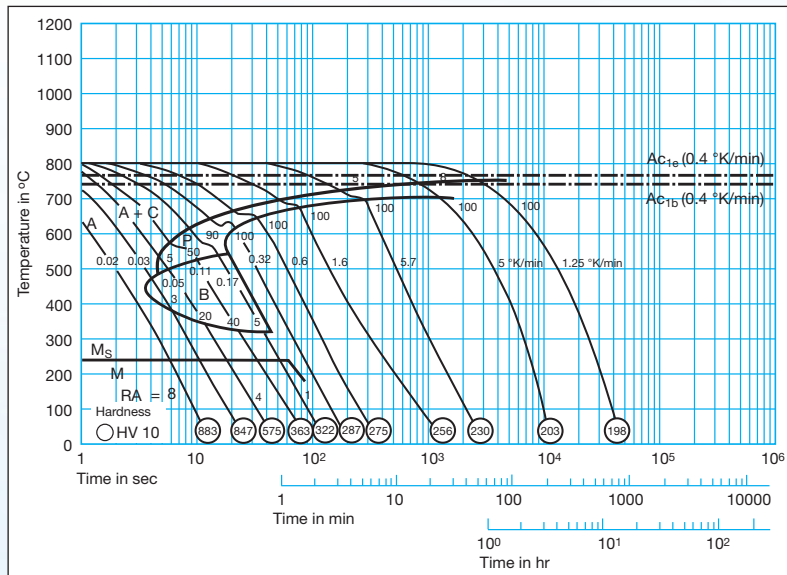
Standards AISI L2

Physical properties	Coefficient of thermal expansion							
	at °C	20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600	20 – 700
	$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	10.0	12.7	13.7	14.2	14.9	15.8	16.8
	Thermal conductivity							
	at °C	20		350			700	
	$\text{W}/(\text{m} \cdot \text{K})$	34.2		32.6			31.0	

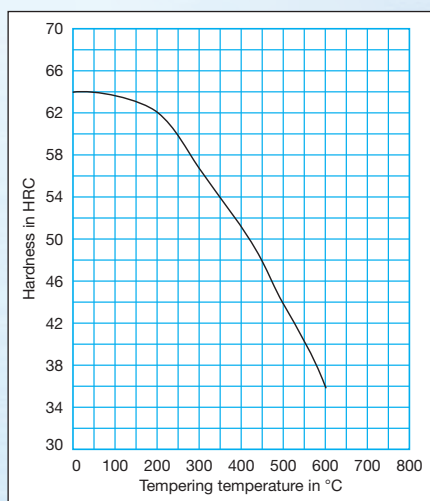
Applications Piercing dies, guide rods, twist drills, ejector pins and wood chisels.

Heat treatment	Soft annealing °C	Cooling	Hardness HB				
		710 – 750	Furnace	max. 220			
	Stress-relief annealing °C	Cooling					
	approx. 650 – 680	Furnace					
	Hardening °C	Quenching	Hardness after quenching HRC				
	810 – 840 780 – 810	Oil: < 15 mm Ø Water: > 15 mm Ø	64 64				
	Tempering °C	100	200	300	400	500	600
	HRC	64	62	57	51	44	36

Time-temperature-transformation diagram



Tempering diagram



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Cryodur 2242

(59CrV4)

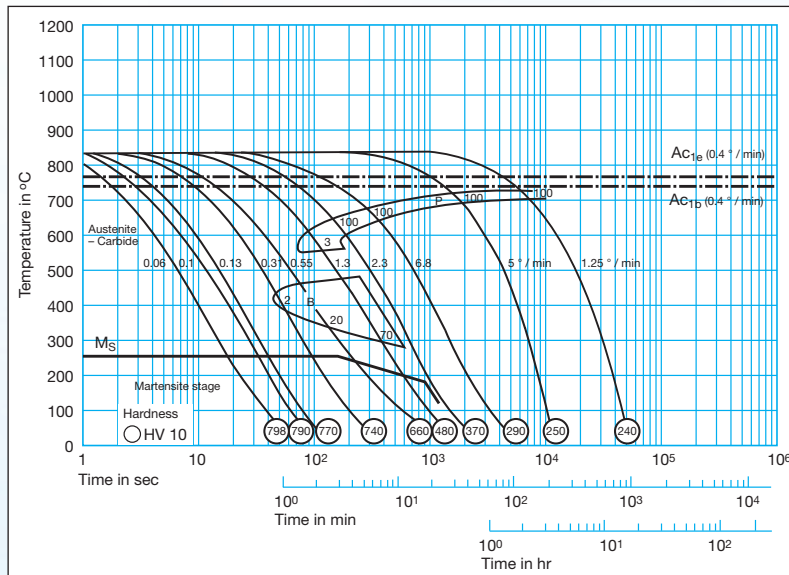
C 0.59 Mn 0.90 Cr 1.00 V 0.10

Steel properties Wear resistant, high toughness.

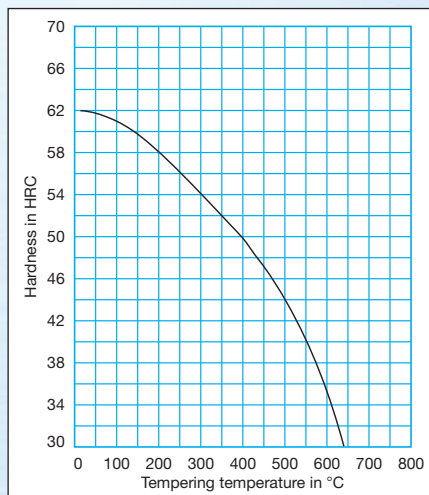
Applications Special steel for hand chisels of all types, including flat, cross-cut and pointed chisels for the treatment of hard materials. Also for screwdrivers and other hand tools.

Heat treatment	Soft annealing °C	Cooling	Hardness HB			
	710 – 740	Furnace	max. 230			
	Stress-relief annealing °C	Cooling				
	approx. 650 – 680	Furnace				
	Hardening °C	Quenching	Hardness after quenching HRC			
	810 – 850	Oil	62			
	Tempering °C	100	200	300	400	
	HRC	61	58	55	50	

Time-temperature-transformation diagram



Tempering diagram



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Cryodur 2243

(61CrSiV5)

C 0.60 Si 0.90 Mn 0.80 Cr 1.10 V 0.10

Steel properties Wear resistant, high toughness.

Physical properties

Thermal conductivity at °C	20	350	700
W/(m · K)	33.5	32.0	31.0

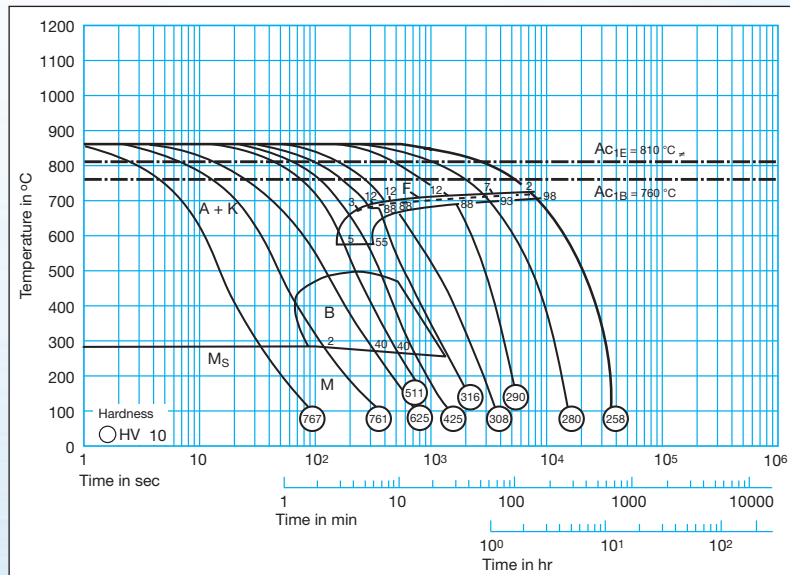
Applications

Cold heading dies, shear blades, section-cutting shear blades and trimming dies, punching tools and bolting tools.

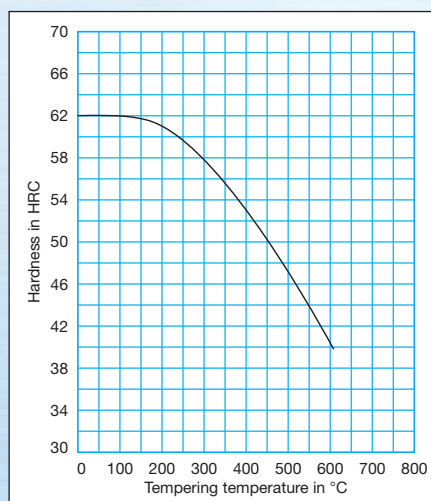
Heat treatment

Soft annealing °C	Cooling	Hardness HB
700 – 740	Furnace	max. 220
Stress-relief annealing °C	Cooling	
approx. 650 – 680	Furnace	
Hardening °C	Quenching	Hardness after quenching HRC
850 – 880	Oil or saltbath, 180 – 220 °C	62
Tempering °C		
HRC	100 200 300 400 500 600	62 61 57 52 47 40

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2249

(45SiCrV6)

C 0.45 Si 1.35 V 0.10 Cr 1.35

Steel properties

Tough, impact-resistant tool steel.

Applications

Pneumatic chipping hammers, punching tools, riveting hammers, punches and woodworking tools.

Heat treatment

Soft annealing °C
710 – 750

Cooling
Furnace

Hardness HB
max. 219

Stress-relief annealing °C
approx. 650 – 680

Cooling
Furnace

Hardening °C
860 – 890

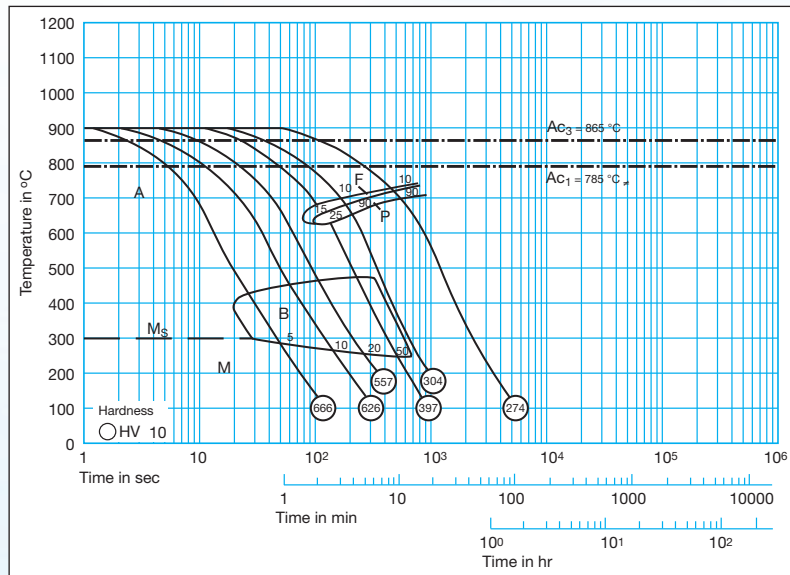
Quenching
Oil

Hardness after quenching HRC
58

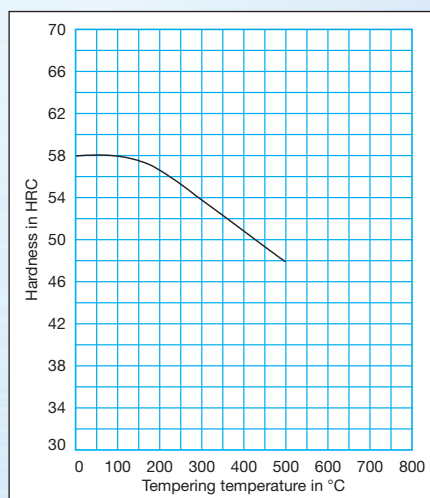
Tempering °C
HRC

100	200	300	400	500
58	57	53	51	49

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2327

(~86CrMoV7)

C 0.83 **Si** 0.45 **Mn** 0.40 **Cr** 1.90 **Mo** 0.30

Steel properties

Cr-Mo alloyed shell-hardenable grade with high wear resistance.

Applications

Standard cold-roll steel for rolls of all sizes, backup rolls and work rolls.

Heat treatment

Soft annealing °C
710 – 750

Cooling
Furnace

Hardness HB
max. 250

Hardening °C
830 – 850

Quenching
Water

Hardness after quenching HRC
64 – 65

Tempering °C
HRC

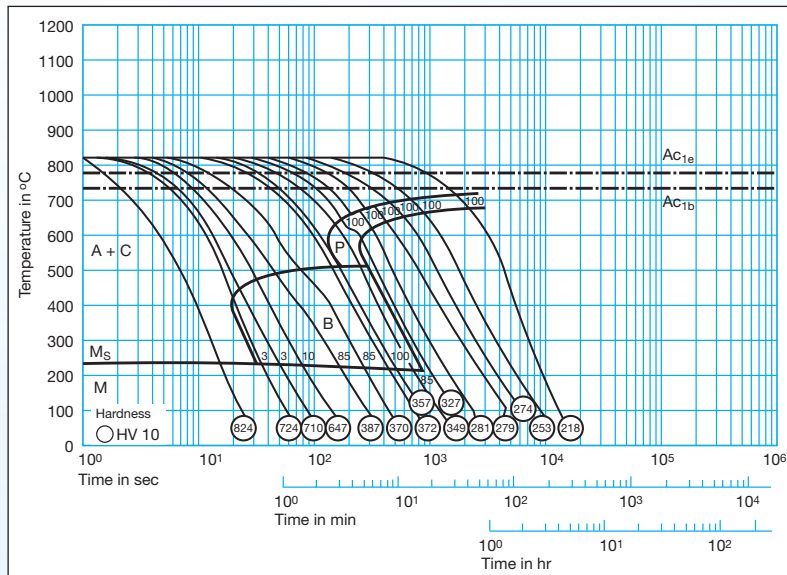
100
64

200
60

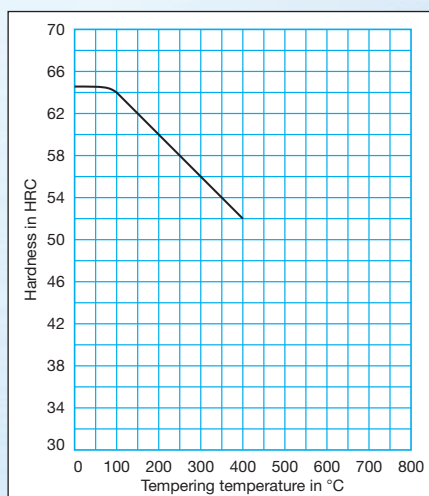
300
56

400
52

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2328

(45CrMoV7)

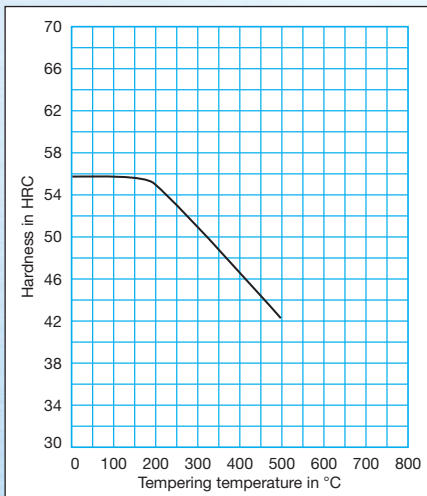
C 0.45 Mn 0.90 Cr 1.80 Mo 0.30 V 0.05

Steel properties Air-hardening steel of great hardness and toughness.

Applications Special steel for chisels.

Heat treatment	Soft annealing °C 690 – 730	Cooling Furnace	Hardness HB max. 248				
	Stress-relief annealing °C approx. 650	Cooling Furnace					
	Hardening °C 840 – 860	Quenching Air	Hardness after quenching HRC 55				
Tempering °C HRC		100	200	300	400	500	600
		55	55	52	49	45	38

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2357

(50CrMoV13-15)

C 0.50 Si 0.30 Mn 0.70 Cr 3.35 Mo 1.60 V 0.25

Steel properties High toughness and wear resistance, high compression strength combined with dimensional stability and good polishability.

Standards AISI S7

Physical properties

Coefficient of thermal expansion
at °C 20 – 200 20 – 400
10⁻⁶ m/(m · K) 12.2 12.5

Thermal conductivity
at °C 20 200 400
W/(m · K) 28.9 30.0 31.0

Applications Cold-work tool steel for punching tools, moulds, scrap shears, piercing dies, hobbers, coining dies, deburring tools, plastic moulds and pelleters.

Heat treatment

Soft annealing °C
610 – 650

Cooling
Furnace

Hardness HB
approx. 220

Stress-relief annealing °C
approx. 600

Cooling
Furnace

Hardening °C
920 – 970

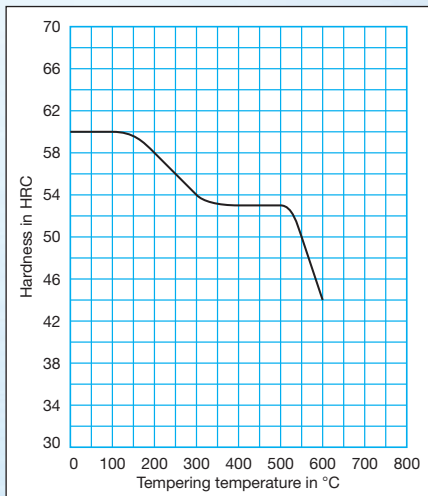
Quenching
Air or oil

Hardness after quenching HRC
60 – 62

Tempering °C
HRC

100	200	300	400	500	550	600
60	58	54	53	53	50	44

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2360

(~X48CrMoV8-1-1)

C 0.50 Si 1.20 Mn 0.35 Cr 7.30 Mo 1.50 V 0.50

Steel properties

Cryodur 2360 is a 7 % chromium steel that derives its high wear resistance from a balanced combination of the alloying elements. The medium V concentration of 0.5 % generates a sufficiently high hardenability combined with high toughness, even at comparatively low operating temperatures below RT.

Applications

This grade is especially suitable for use with chipper knives, blade holders, veneer slicing blades, blade inserts, billet-shear blades and reinforcements. All require a combination of high hardness and toughness as do large cold extrusion tools of complex geometry.

Heat treatment

Soft annealing °C

830 – 860

Cooling

Furnace

Hardness HB

Max. 240

Stress-relief annealing °C

approx. 650

Cooling

Furnace

Hardening °C

1030 – 1070

Quenching

Air, oil or saltbath, 550 °C

Hardness after quenching HRC

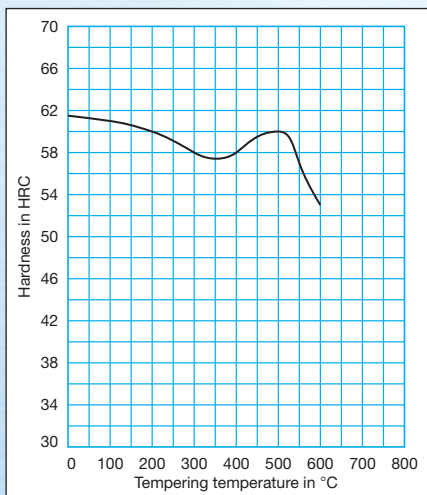
60 – 61

Tempering °C

HRC

100	200	300	400	500	550	600
61	60	58	58	60	57	53

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2362

(~X63CrMoV5-1)

C 0.65 Si 1.10 Mn 0.40 Cr 5.20 Mo 1.40 V 0.50

Steel properties

Cr-Mo alloyed through-hardening grade with high tempering resistance.

Applications

Intermediate rolls for cluster mills.

Heat treatment

Soft annealing °C
800 – 840

Cooling
Furnace

Hardness HB
max. 250

Hardening °C
980 – 1020

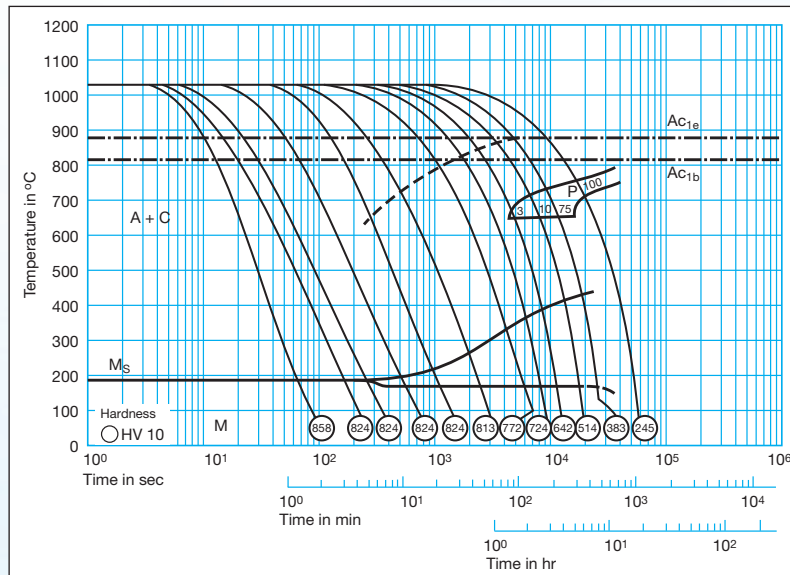
Quenching
Oil or saltbath

Hardness after quenching HRC
61 – 63

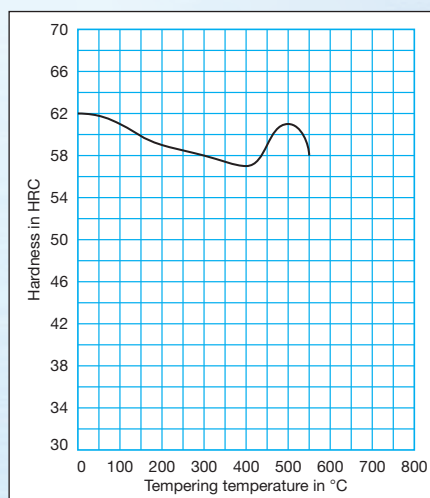
Tempering °C
HRC

100	200	300	400	500	550
61	59	58	57	61	58

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2363

X100CrMoV5

C 1.00 Si 0.30 Mn 0.50 Cr 5.00 Mo 0.95 V 0.20

Steel properties High dimensional stability during heat treatment. High wear resistance and toughness.

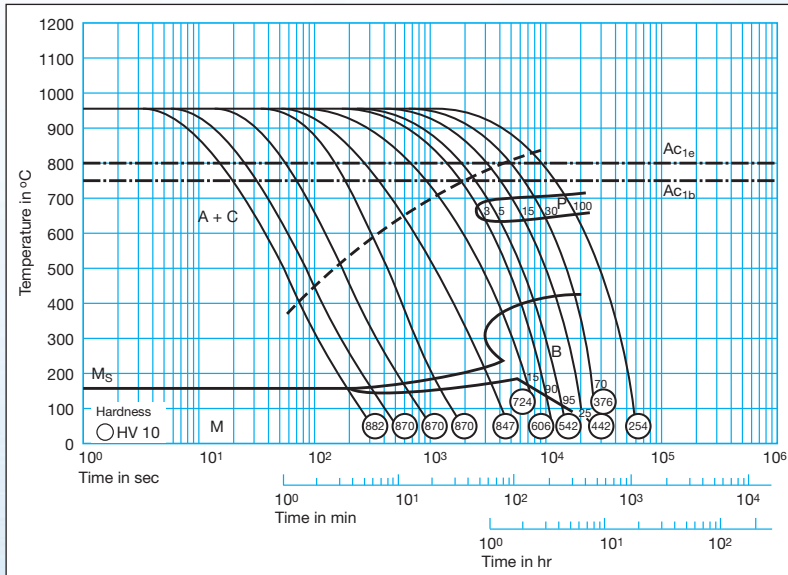
Standards AISI A2 AFNOR Z100CDV5

Physical properties
Thermal conductivity
 at °C 20 350 700
 W/(m · K) 15.8 26.7 29.1

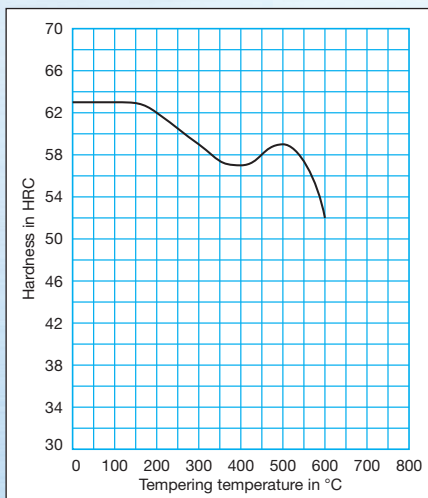
Applications Cutting tools, rolls, shear blades, cold pilger mandrels, cold stamping tools, moulds for plastics processing.

Heat treatment	Soft annealing °C 800 – 840	Cooling Furnace	Hardness HB max. 231			
	Stress-relief annealing °C approx. 650	Cooling Furnace				
	Hardening °C 930 – 970	Quenching Air, oil or saltbath, 500 – 550 °C	Hardness after quenching HRC 63			
Tempering °C HRC	100	200	300	400	500	600
	63	62	59	57	59	52

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2379

X153CrMoV12

C 1.55 Si 0.30 Mn 0.35 Cr 12.00 Mo 0.75 V 0.90

Steel properties

12 % ledeburitic chromium steel. Combines maximum wear resistance, good toughness, outstanding cutting edge retention and tempering resistance. It can be nitrided after special heat treatment.

Standards

AISI D2

AFNOR Z160CDV12

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 200	20 – 300	20 – 400
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	10.5	11.5	11.9	12.2

Thermal conductivity

at °C	20	350	700
$\text{W}/(\text{m} \cdot \text{K})$	16.7	20.5	24.2

Applications

Threading rolls and dies, cold extrusion tools, trimming, cutting and stamping tools for sheet thicknesses up to 6 mm, precision cutting tools for sheet thicknesses up to 12 mm, cold pilger mandrels, circular-shear blades, deep-drawing tools, pressure pads and highly wear-resistant plastic moulds.

Heat treatment

Soft annealing °C

830 – 860

Cooling

Furnace

Hardness HB

max. 250

Stress-relief annealing °C

650 – 700

Cooling

Furnace

Hardening °C

1000 – 1050

Quenching

Air, oil or saltbath, 500 – 550 °C

Hardness after quenching HRC

63

Tempering °C (three times)

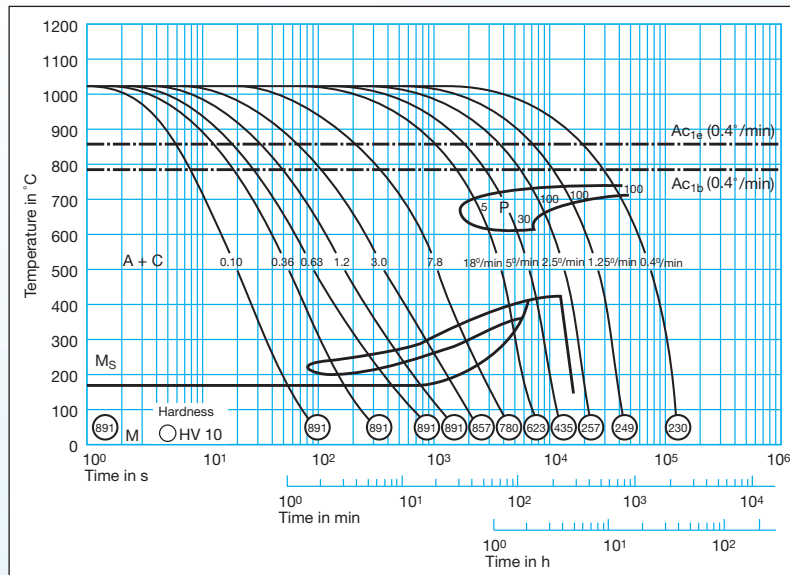
100 200 300 400 500 525 550 600

HRC

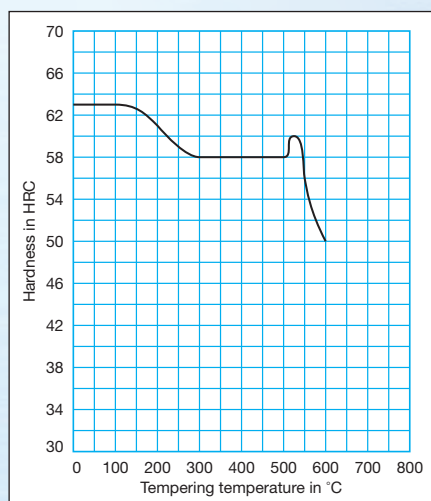
63 61 58 58 58 60 56 50

Time-temperature-transformation diagram

Hardening temperature: 1030 °C



Tempering diagram



Special heat treatment

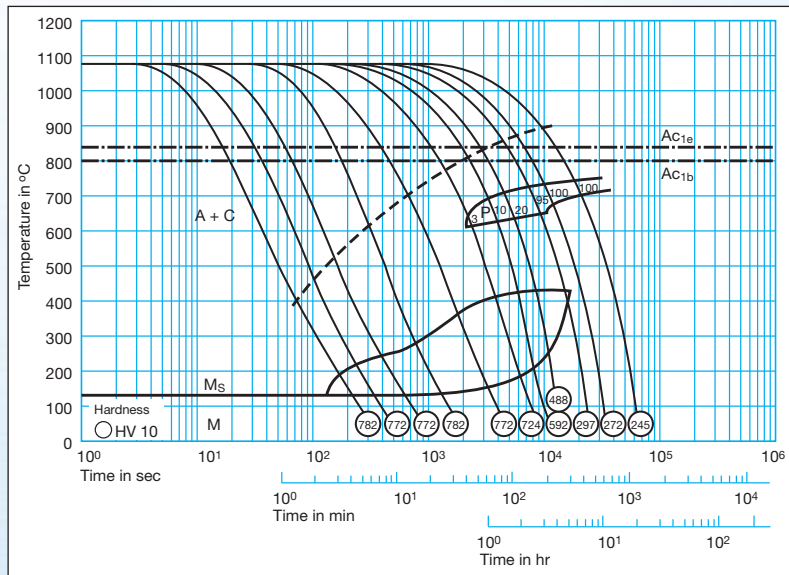
Hardening °C
1050 – 1080

Quenching
Air, oil or saltbath, 500 – 550 °C

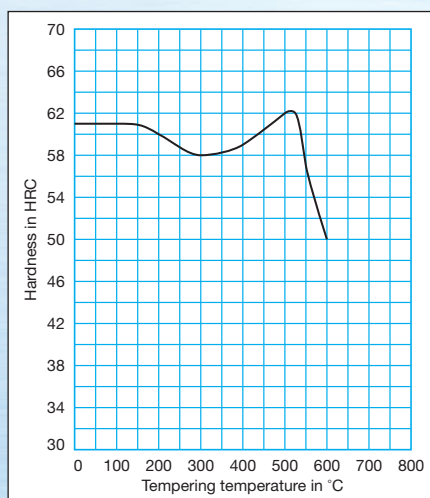
Hardness after quenching HRC
61

Tempering °C (three times)	100	200	300	400	500	525	550	600
HRC	61	60	58	59	62	62	57	50

Time-temperature-transformation diagram
Hardening temperature: 1080 °C



Tempering diagram



Cryodur 2381

(73MoV5-2)

C 0.73 Si 1.20 Mn 0.50 Mo 0.55 V 0.20

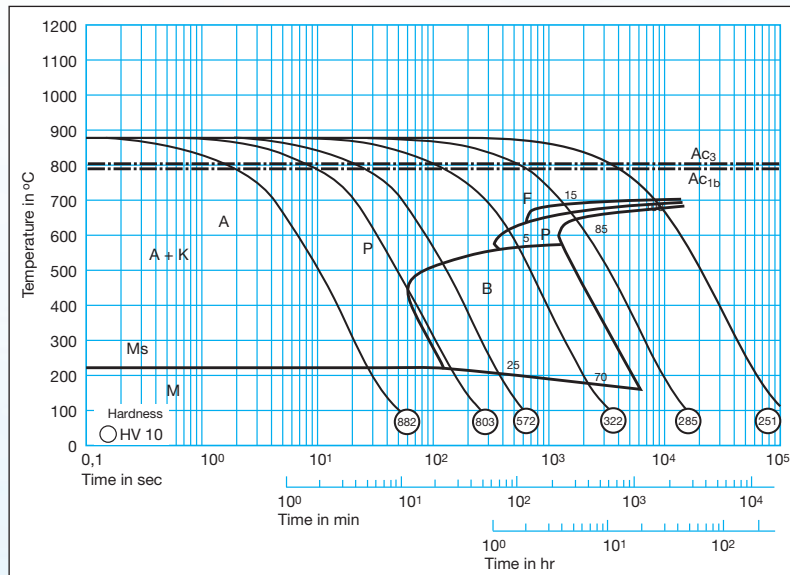
Steel properties High tensile special steel with good resistance to twisting.

Standards AISI ~S2

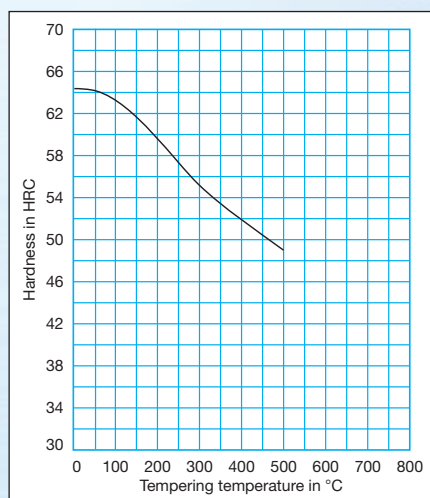
Applications Screwdrivers, bits, low-stressed tools for the cutting, punching and folding of sheet.

Heat treatment	Soft annealing °C 700 – 750	Cooling Furnace	Hardness HB max. 230			
	Stress-relief annealing °C 650 – 680	Cooling Furnace				
	Hardening °C 840 – 860	Quenching Oil	Hardness after quenching HRC 64			
Tempering °C HRC	100	200	300	400	500	600
	64	60	56	52	48	45

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2436

X210CrW12

C 2.10 Si 0.35 Mn 0.35 Cr 12.00 W 0.70

Steel properties

12 % ledeburitic chromium steel with very high wear resistance and cutting edge retention as well as improved hardenability in comparison to Cryodur 2080.

Standards

AISI ~D6 AFNOR Z210CW12-01

Physical properties

Coefficient of thermal expansion at °C							
20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600	20 – 700	
10.9	11.9	12.3	12.6	12.9	13.0	13.2	
Thermal conductivity at °C							
20			350			700	
16.7			20.5			24.2	

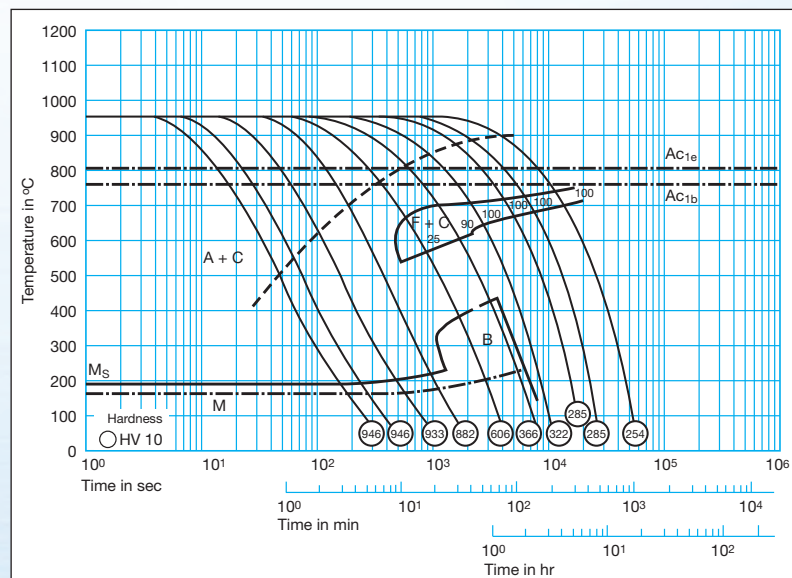
Applications

Heavy-duty blanking dies for cutting transformer and dynamo sheets up to 2 mm thickness as well as for paper and plastics, deep-drawing tools, drawing dies and mandrels, shear blades, stone pressing tools.

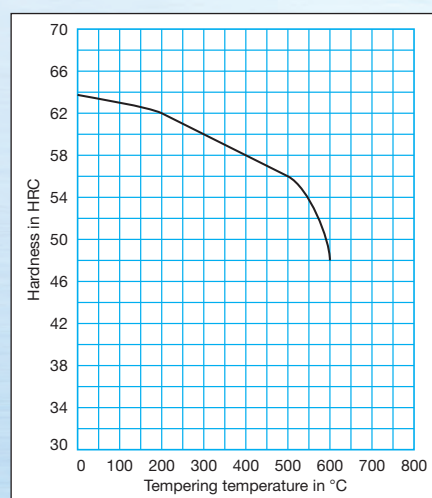
Heat treatment

Soft annealing °C	Cooling	Hardness HB				
800 – 840	Furnace	max. 250				
Stress-relief annealing °C	Cooling					
650 – 700	Furnace					
Hardening °C	Quenching	Hardness after quenching HRC				
950 – 980	Air, oil or saltbath, 500 – 550 °C	64				
Tempering °C						
	100	200	300	400	500	600
HRC	63	62	60	58	56	48

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2510

(100MnCrW4)

C 0.95 Si 0.20 Mn 1.10 Cr 0.60 V 0.10 W 0.60

Steel properties

Good cutting edge retention, high hardenability and dimensional stability during heat treatment.

Standards

AISI O1 AFNOR 90MnWCV5

Physical properties

Thermal conductivity at °C	20	350	700
W/(m · K)	33.5	32.0	30.9

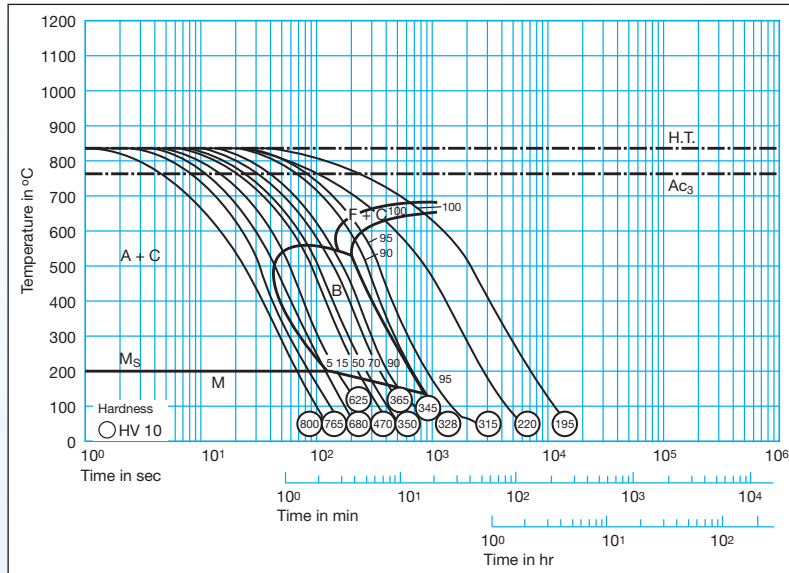
Applications

Blanking and stamping dies for cutting sheets up to 6 mm thickness, threading tools, drills, broaches, gauges, measuring tools, plastic moulds, shear blades, guide rails.

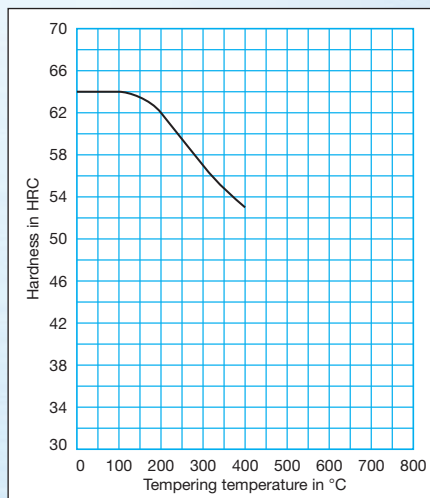
Heat treatment

Soft annealing °C 740 – 770	Cooling Furnace	Hardness HB max. 230		
Stress-relief annealing °C approx. 650	Cooling Furnace			
Hardening °C 780 – 820	Quenching Oil or saltbath, 180 – 220 °C	Hardness after quenching HRC 64		
Tempering °C HRC	100 64	200 62	300 57	400 53

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2516

(120WV4)

C 1.20 Cr 0.20 V 0.10 W 1.00

Steel properties

Water-hardening steel featuring good cutting edge retention and high hardenability.

Applications

Thread cutting tools, twist drills, dentist's drills and metal saws.

Heat treatment

Soft annealing °C

700 – 720

Cooling

Furnace

Hardness HB

max. 230

Stress-relief annealing °C

650 – 680

Cooling

Furnace

Hardening °C

780 – 820

Quenching

Oil or water

Hardness after quenching HRC

66

Tempering °C

HRC

100

200

300

400

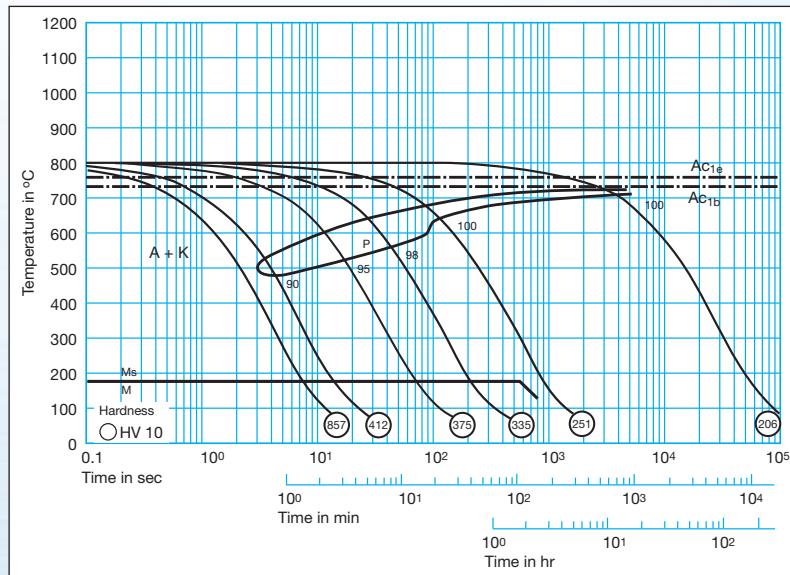
65

62

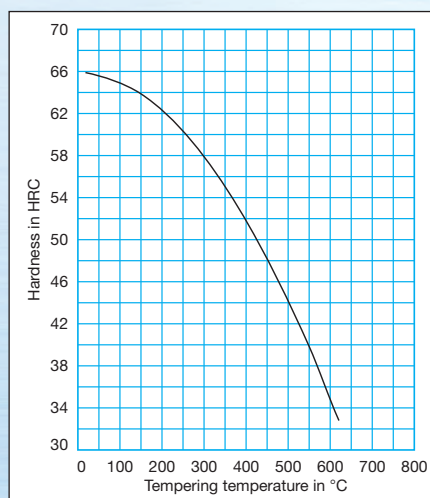
57

51

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2550

60WCrV8

C 0.60 Si 0.60 Mn 0.35 Cr 1.10 V 0.20 W 2.00

Steel properties Impact-resistant oil-hardenable steel, characterized by very good toughness in combination with high hardenability.

Standards AISI ~S1 AFNOR 55WC20

Physical properties **Coefficient of thermal expansion at °C**
 $10^{-6} \text{ m}/(\text{m} \cdot \text{K})$

20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600	20 – 700
11.8	12.7	13.1	13.5	14.0	14.3	14.5

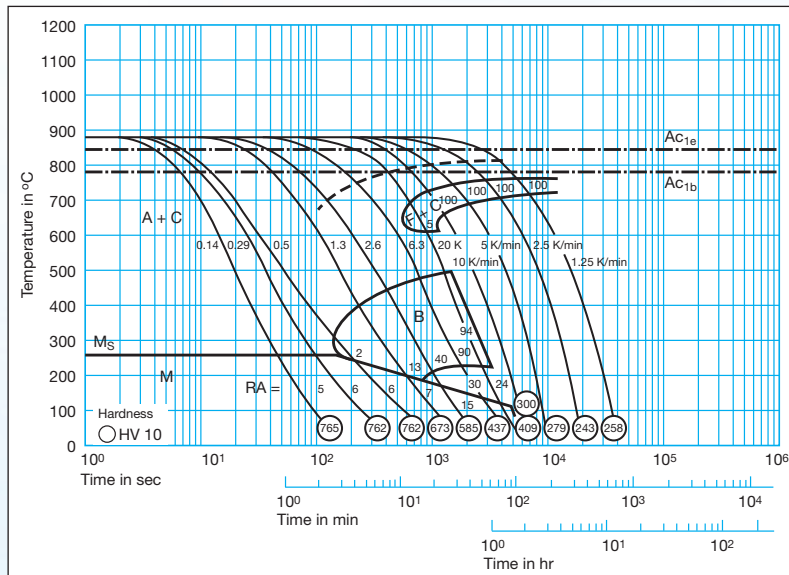
Thermal conductivity at °C
 $\text{W}/(\text{m} \cdot \text{K})$

20	350	700
34.2	32.6	30.9

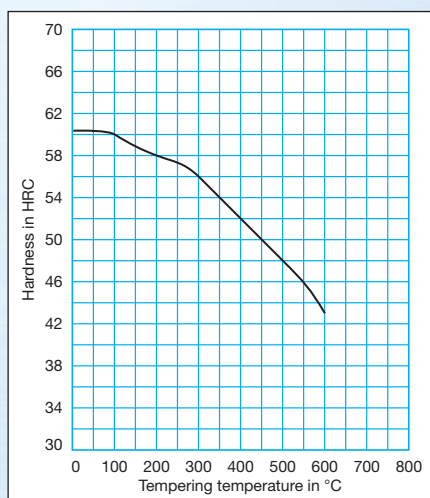
Applications Blanking dies for cutting sheets up to 12 mm thickness, trimming and splitting dies, cold piercing punches, preforming punches, shear blades, chipping knives, pneumatic chisels, coining tools, cold shear blades, ejectors.

Heat treatment	Soft annealing °C 710 – 750	Cooling Furnace	Hardness HB max. 225				
	Stress-relief annealing °C approx. 650	Cooling Furnace					
	Hardening °C 870 – 900	Quenching Oil or saltbath, 180 – 220 °C	Hardness after quenching HRC 60				
	Tempering °C HRC	100	200	300	400	500	600
		60	58	56	52	48	43

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2709

(X3NiCoMoTi18-9-5)

C < 0.02 Mo 5.00 Ni 18.00 Co 10.00 Ti 1.00

Steel properties

Precipitation-hardenable grade with high yield point and tensile strength combined with good toughness.

Standards

AISI 18MAR300

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	10.3	11.0	11.2	11.5	11.8	11.6

Thermal conductivity

at °C	20	350	700
$\text{W}/(\text{m} \cdot \text{K})$	14.2	18.5	22.5

Applications

Casings for cold extrusion tools, cutting and punching tools.

Heat treatment

Soft annealing °C

820 – 850

Cooling

Water

Hardness HB

max. 340

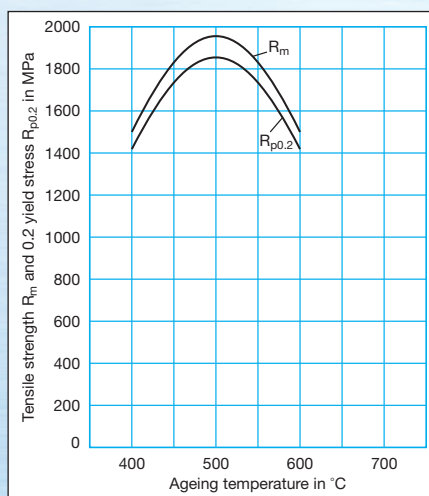
Precipitation temperature °C

490 / 6 h / (Air)

Attainable hardness HRC

approx. 55

Precipitation diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2721

(50NiCr13)

C 0.55 Si 0.25 Mn 0.45 Cr 1.00 Ni 3.10

Steel properties

Air or oil-hardenable steel with good machinability and high toughness.

Physical properties

Thermal conductivity

at °C	20	350	700
W/(m · K)	31.0	31.2	31.8

Applications

Cold heading dies, hobbors, cutlery dies, reinforcements and pelleters.

Heat treatment

Soft annealing °C

610 – 650

Cooling

Furnace

Hardness HB

max. 250

Stress-relief annealing °C

approx. 600

Cooling

Furnace

Hardening °C

840 – 870

Quenching

Oil or saltbath, 180 – 220 °C

Hardness after quenching HRC

59

Tempering °C

HRC

100

200

300

400

500

600

59

56

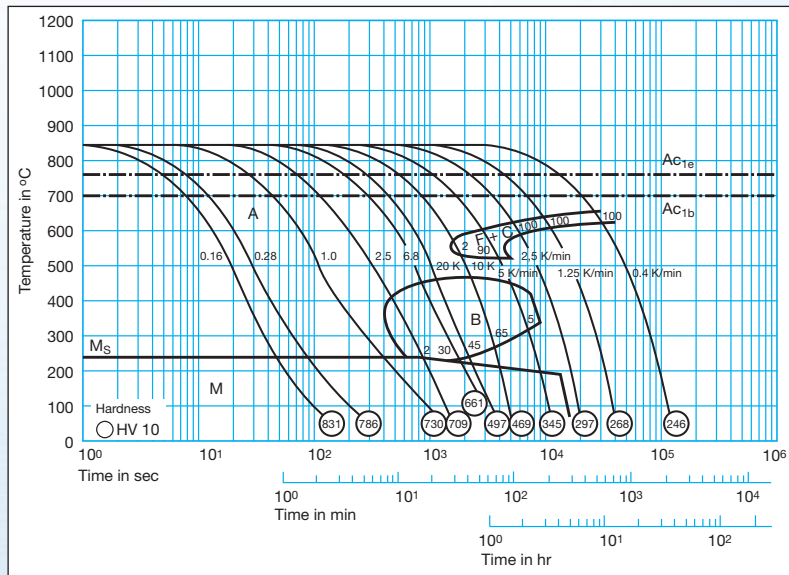
52

48

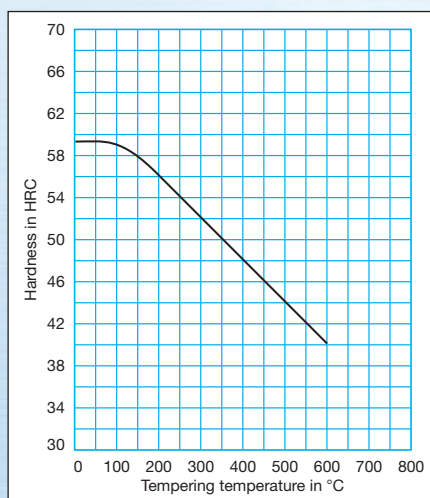
44

40

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2743

(60NiCrMoV12-4)

C 0.58 Si 0.40 Mn 0.65 Cr 1.15 Mo 0.35 Ni 2.85 V 0.10

Steel properties

Nickel-alloyed cold-work steel with a good combination of wear resistance and toughness.

Physical properties

Coefficient of thermal expansion

at °C	20 – 200	20 – 400
10 ⁻⁶ m/(m · K)	12.2	12.5

Thermal conductivity

at °C	20	200	400
W/(m · K)	28.9	30.0	31.0

Applications

Scrap-shear blades, dies and coining tools, piercing punches.

Heat treatment

Soft annealing °C

690 – 700

Cooling

Furnace

Hardness HB

approx. 235

Stress-relief annealing °C

600 – 650

Cooling

Furnace

Hardening °C

840 – 870

Quenching

Oil

Hardness after quenching HRC

61

Tempering °C

HRC

100

61

200

59

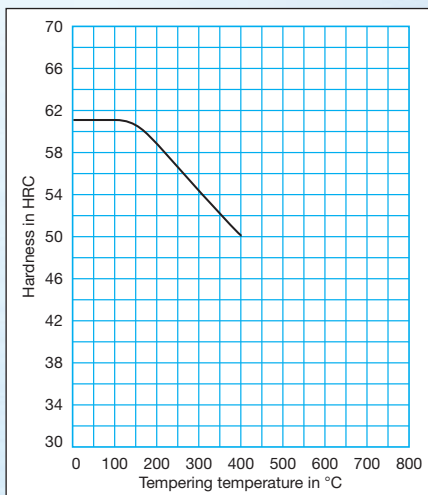
300

54

400

50

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2746

(45NiCrMoV16-6)

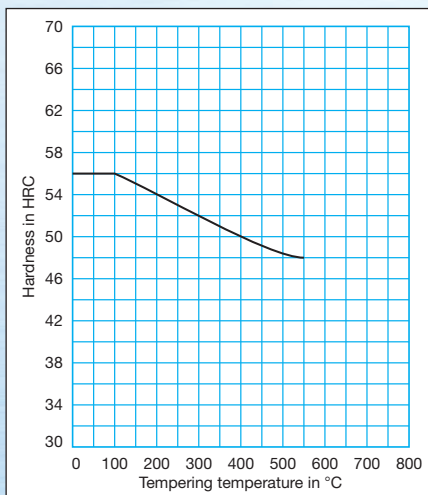
C 0.45 Si 0.25 Mn 0.70 Cr 1.50 Mo 0.80 Ni 4.00 V 0.50

Steel properties Air or oil-hardenable steel featuring high toughness.

Applications Special steel for cold-shear blades, particularly for cutting scrap. Drawing jaws, coining and bending tools.

Heat treatment	Soft annealing °C	Cooling	Hardness HB				
	610 – 650	Furnace	max. 295				
	Stress-relief annealing °C	Cooling	Hardness after quenching HRC				
	approx. 600	Furnace	56				
	Hardening °C	Quenching	Hardness after quenching HRC				
	880 – 910	Air, oil or saltbath, 180 – 220 °C	56				
	Tempering °C	100	200	300	400	500	550
	HRC	56	54	52	50	49	48

Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2766

(35NiCrMo16)

C 0.35 Si 0.25 Mn 0.50 Cr 1.35 Ni 4.10 Mo 0.30

Steel properties

Dimensionally stable air-hardening steel featuring maximum toughness, polishable. Also supplied with lower carbon and higher chromium content.

Applications

Moulds, dies with deep engravings, plastic moulds und hydraulic chisels.

Heat treatment

Soft annealing °C
590 – 610

Cooling
Furnace

Hardness HB
max. 260

Stress-relief annealing °C
600 – 650

Cooling
Furnace

Hardening °C
820 – 840

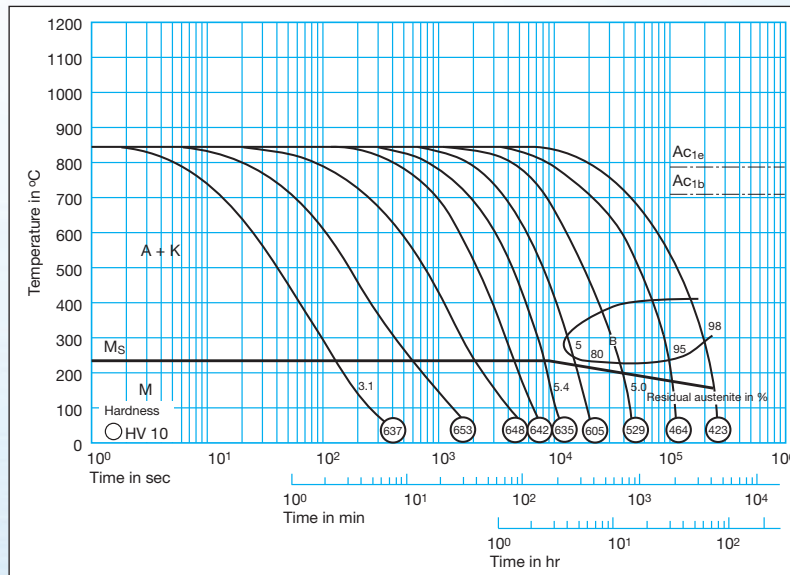
Quenching
Oil or
saltbath, 180 – 220 °C

Hardness after quenching HRC
approx. 58

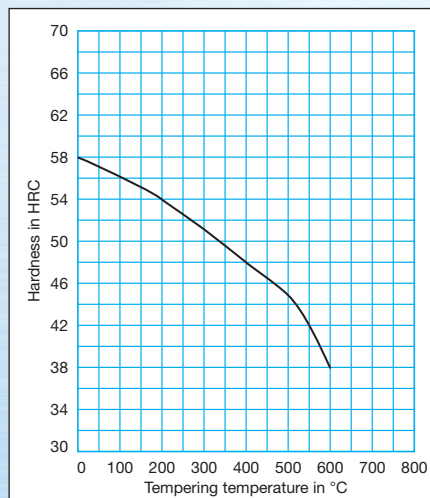
Tempering °C
HRC

100	200	300	400	500	600
56	54	51	48	45	38

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2767

45NiCrMo16

C 0.45 Si 0.25 Mn 0.35 Cr 1.40 Mo 0.20 Ni 4.00

Steel properties

High hardenability and toughness, highly suitable for polishing, texturing and EDM machining.
We recommend the use of Cryodur 2767 (ESR) for extreme demands.

Standards

AISI 6F3

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 200	20 – 300
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$ Annealed	11.7	12.6	13.1
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$ Quenched and tempered	12.0	12.5	13.0

Thermal conductivity

at °C	100	150	200	250	300
$\text{W}/(\text{m} \cdot \text{K})$ Annealed	38.2	38.6	38.9	39.1	39.6
$\text{W}/(\text{m} \cdot \text{K})$ Quenched and tempered	27.7	28.9	29.7	30.5	31.0

Applications

Cutlery dies, cutting tools for thick material, billet-shear blades, drawing jaws, massive embossing and bending tools, plastic moulds, reinforcements.

Heat treatment

Soft annealing °C

610 – 650

Cooling

Furnace

Hardness HB

max. 260

Stress-relief annealing °C

approx. 600 – 650

Cooling

Furnace

Hardening °C

840 – 870

Quenching

Air, oil or saltbath, 180 – 220 °C

Hardness after quenching HRC

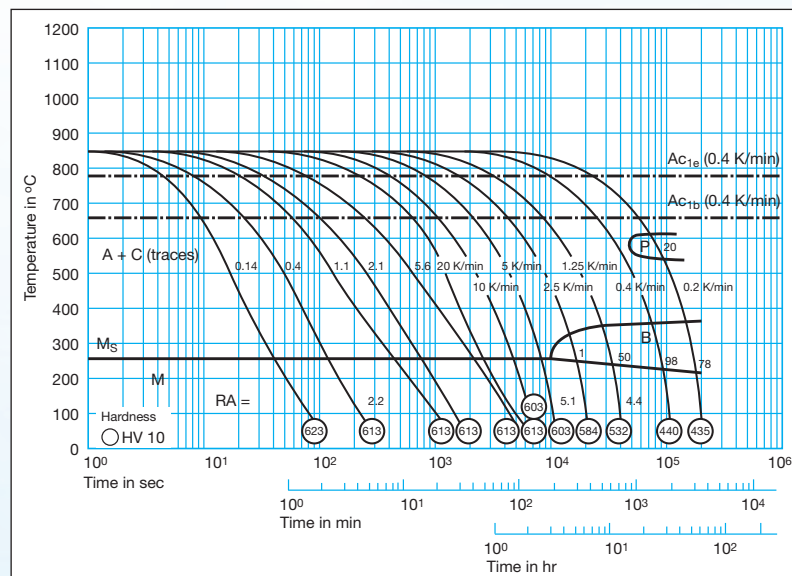
56

Tempering °C

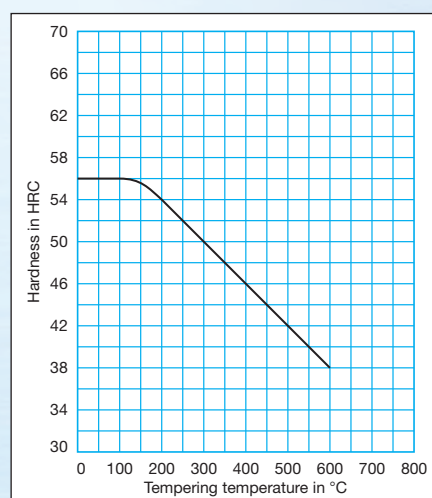
HRC

100	200	300	400	500	600
56	54	50	46	42	38

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2826

(60MnSiCr4)

C 0.63 Si 0.80 Mn 1.10 Cr 0.30

Steel properties High toughness and good resilience in tempered condition.

Standards AISI S4

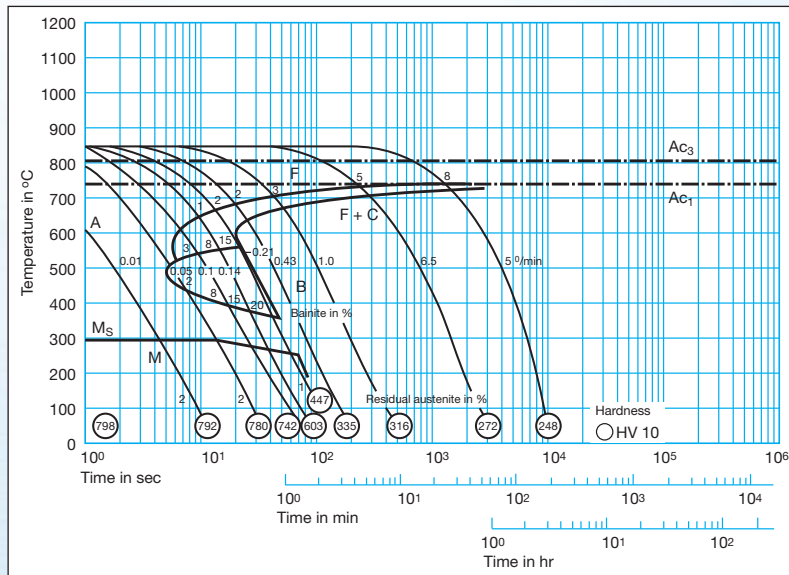
Physical properties

Thermal conductivity at °C	20	350	700
W/(m · K)	34.2	32.6	31.0

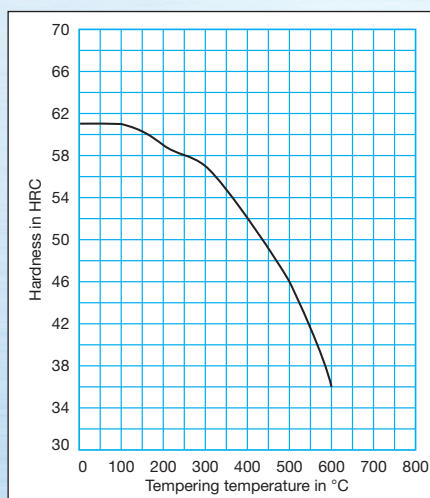
Applications Spring collets, shear blades and trimming dies.

Heat treatment	Soft annealing °C	Cooling	Hardness HB
	680 – 710	Furnace	max. 220
	Stress-relief annealing °C	Cooling	Hardness after quenching HRC
	approx. 650	Furnace	61
	Hardening °C	Quenching	Hardness after quenching HRC
	820 – 860	Oil or saltbath, 180 – 220 °C	61
	Tempering °C		
	HRC	100 200 300 400 500 600	
		61 59 57 52 46 36	

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2833

(100V1)

C 1.00 Si 0.20 Mn 0.20 V 0.10

Steel properties Wear-resistant water-hardening steel with high insusceptibility to overheating.

Standards AISI W210 AFNOR 100V2

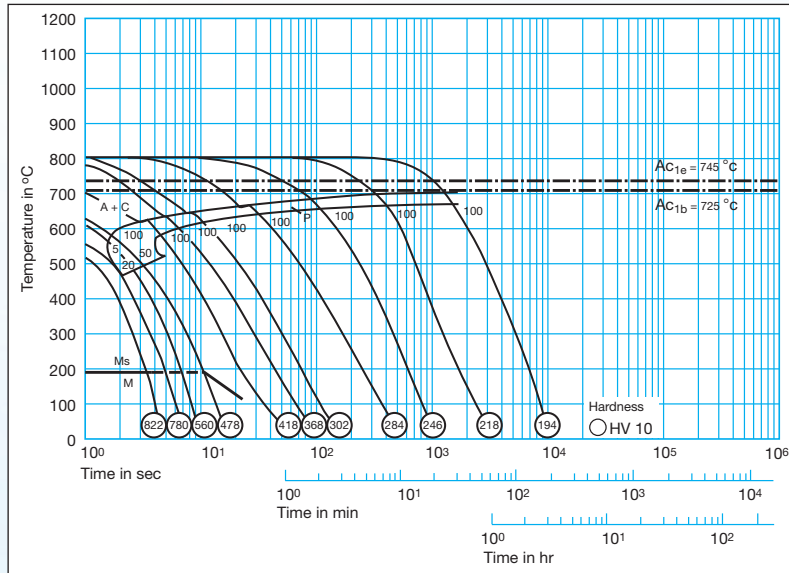
Physical properties **Thermal conductivity at °C**
W/(m · K)

20	350	700
37.6	35.2	32.6

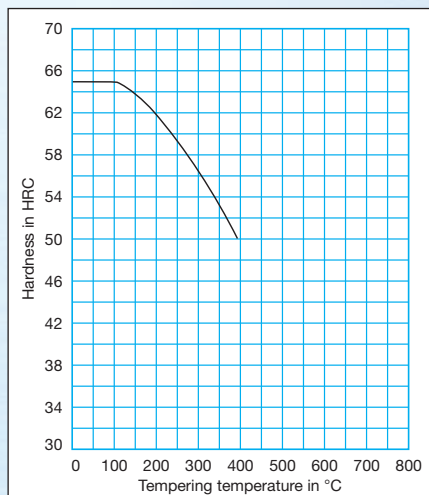
Applications Cold heading dies, first and finish upsetting punches, cold stamps and dies for the manufacturing of screws, rivets and bolts, compression pistons.

Heat treatment	Soft annealing °C 730 – 760	Cooling Furnace	Hardness HB max. 200	
	Stress-relief annealing °C 650 – 680	Cooling Furnace		
	Hardening °C 780 – 820	Quenching Water	Hardness after quenching HRC 65	
	Tempering °C	100	200	300
	HRC	65	62	57
			400	50

Time-temperature-transformation diagram



Tempering diagram



Reference numbers in brackets are not standardized in EN ISO 4957.

Cryodur 2842

90MnCrV8

C 0.90 Si 0.20 Mn 2.00 Cr 0.40 V 0.10

Steel properties

Good cutting edge retention, dimensionally stable during heat treatment.

Standards

AISI O2 AFNOR 90MV8

Physical properties

Coefficient of thermal expansion

at °C	20 – 100	20 – 200	20 – 300	20 – 400	20 – 500	20 – 600	20 – 700
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	12.2	13.2	13.8	14.3	14.7	15.0	15.3

Thermal conductivity

at °C	20	350	700
$\text{W}/(\text{m} \cdot \text{K})$	33.0	32.0	31.3

Applications

Tool steel for universal use, cutting and stamping tools for sheet up to 6 mm thickness, thread-cutting tools, reamers, gauges, measuring tools, plastic moulds, shear blades, guide strips and ejector pins.

Heat treatment

Soft annealing °C
680 – 720

Cooling
Furnace

Hardness HB
max. 220

Stress-relief annealing °C
approx. 650

Cooling
Furnace

Hardening °C
790 – 820

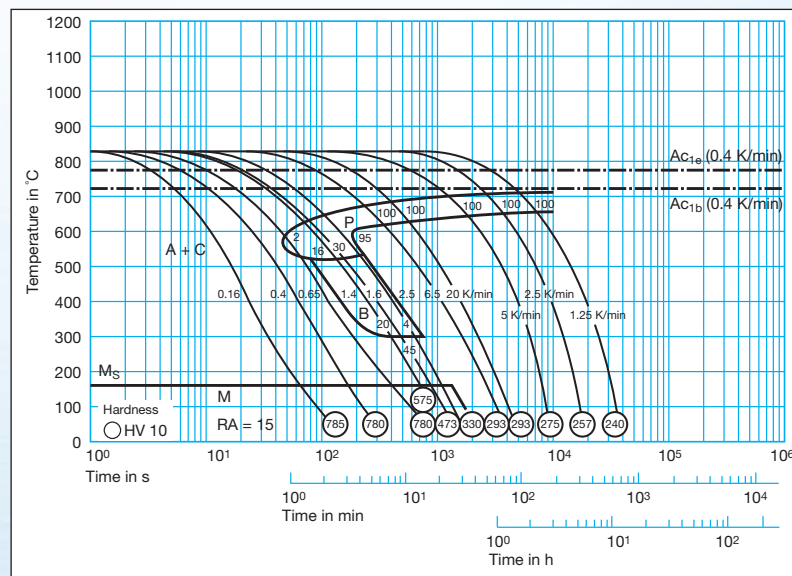
Quenching
Oil or
saltbath, 180 – 220 °C

Hardness after quenching HRC
64

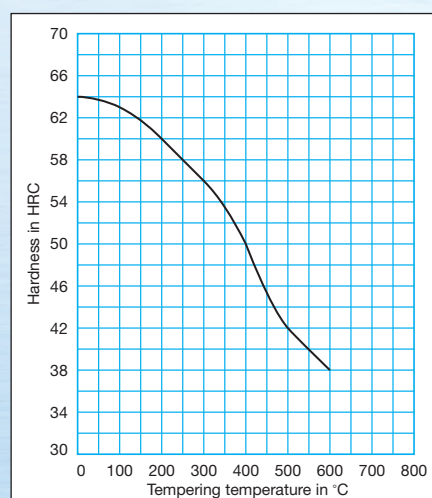
Tempering °C
HRC

100	200	300	400	500	600
63	60	56	50	42	38

Time-temperature-transformation diagram



Tempering diagram



Cryodur 2990

(~X100CrMoV8-1-1)

C 1.00 Si 0.90 Cr 8.00 Mo 1.10 V 1.60

Steel properties

Newly developed ledeburitic cold-work steel with high hardness, good toughness and high tempering resistance combined with high wear resistance.

Physical properties

Coefficient of thermal expansion

at °C	20-100	20-150	20-200	20-250	20-300	20-350	20-400	20-450	20-500
$10^{-6} \text{ m}/(\text{m} \cdot \text{K})$	11.4	11.6	11.7	11.9	12.0	12.1	12.3	12.4	12.6

Thermal conductivity

at °C	RT	100	150	200	300	400	500
$\text{W}/(\text{m} \cdot \text{K})$	24.0	25.9	26.8	27.1	27.4	27.2	26.8

Applications

Cutting and punching tools including precision cutting tools, threading dies and rolls, rotary shear blades, cold pilger mandrels, pressure pads and plastic moulds, cold-forming and deep-drawing dies, woodworking tools and cold rolls.

Heat treatment

Soft annealing °C
830 – 860

Cooling
Furnace

Hardness HB
max. 250

Stress-relief annealing °C
approx. 650

Cooling
Furnace

Hardening °C
1030¹⁾ – 1080²⁾

Quenching
Air, oil or
saltbath, 500 – 550 °C

Hardness after quenching HRC
62 – 64

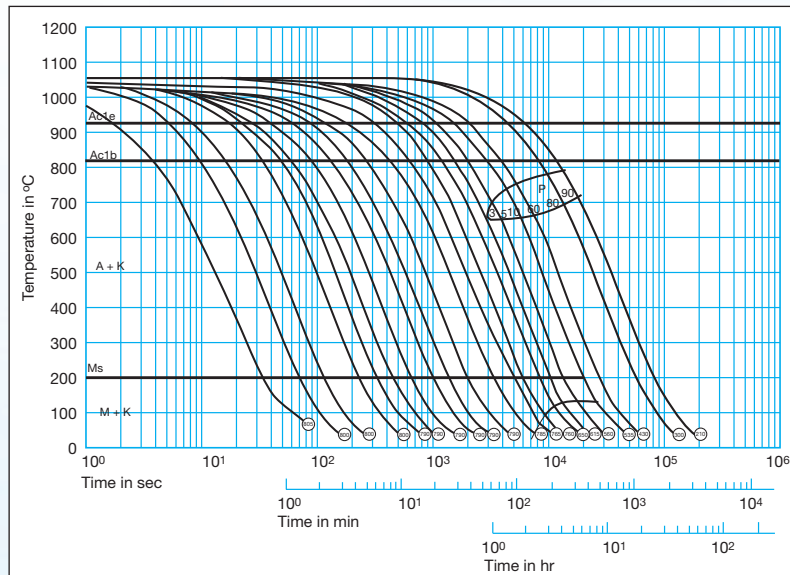
Tempering °C

¹⁾ HRC

²⁾ HRC

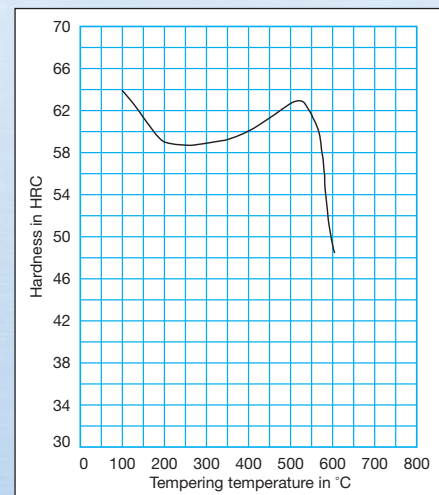
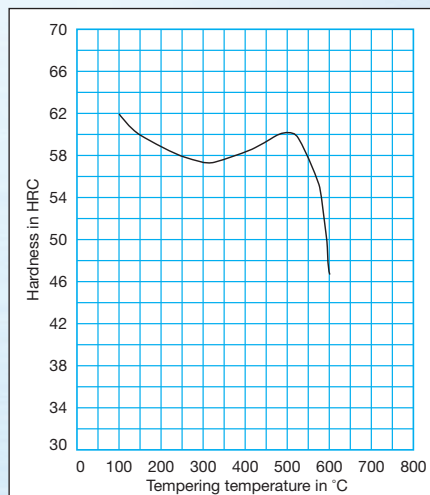
100	200	300	400	500	525	550	575	600
62	59	57	58	60	60	59	55	46
64	59	59	60	63	63	61	57	48

Time-temperature-transformation diagram



Tempering diagram

Hardening 1030 °C/
Hardening 1080 °C



Reference numbers in brackets are not standardized in EN ISO 4957.