COLD WORK TOOL STEELS

High carbon high chromium steel (HCHCR D3)

Din - material - no. : 1.2080

Code : X210Cr12

Comparable Standards : A ISI D3

Equivalent Brands :

Bohler	German No. Tew (DEW	Japan	Poldi	Metal Ravne	(EWK)Thyssen Edelstahlwerke
K100	2080	SKDI	2002	OCR 12	Thyrodur2080

Chemical composition (Typical analysis %) :

C	Si	Mn	Cr
2,05	0,25	0,30	11,50

Steel Properties : Ledeburitic Cr-steel for cold work. High resistance to wear and softening. Dimensional and shape stability at heat treatment. Good cutting capability

Physical Properties :

Thermal conductivity W/ (m . K)

20°C
20,0

Density g/cm^3

20°C
7,67

Coefficient of Linear thermal expansion

10^{-6} °C^{-1}	20-100	20-200	20-300	20-400	20-500	20-600	20-700
	11,7	12,0	12,4	12,9	13,3	13,6	14,0

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
800-840	furnance	max 248

Hardening from °C	in	Hardness after quenching HRC
940 - 980	Oil, Thermal Bath Ca.400°C	64-66
960-1000	Air, Compressed Air For Thickness to 30mm	63-65

Tempering °C	100	200	300	400	500	600
HRC	64	62	60	57	53	42

APPLICATION : High performance cutting tools, stamping, woodworking drawing, deep drawing and pressing tools, rolls, guages. Shear blades for cutting thin materials, thread rolling dies, cold rolls for multiple roller stands.

COLD WORK TOOL STEELS

High carbon high chromium steel (HCHCR D2)

Din - material - no. : 1.2379

Code : X165QV12

Comparable Standards : A ISI D2

Equivalent Brands :

Bohler	German No. Tew (DEW	Japan	Poldi	Metal Ravne	(EWK)Thyssen Edelstahlwerke
K105	2601	SKD11	2002R	C4750	Thyrodur2379

Chemical composition (Typical analysis %) :

C	Si	Mn	Cr	Mo	V
1,55	0,25	0,30	11,50	0,70	1,00

Steel Properties : Ledeb. Cr-steel for cold work. High wear resistance. Very good toughness, compression strength and dimensional stability. Possibility of nitriding.

Physical Properties :

Thermal conductivity W/ (m . K) $\frac{20^0C}{20}$

Density g/cm^3 $\frac{20^0C}{7,69}$

Coefficient of Linear thermal expansion

$10^{-6}\ ^0C^{-1}$	20-100	20-200	20-300	20-400	20-500	20-600	20-700	20-800
	9,8	11,7	12,1	12,8	12,9	13,0	13,2	13,5

Heat Treatment :

Soft annealing ^0C	Cooling	Hardness HB
840-880	furnance	max 250

Hardening from ^0C	in	Hardness after quenching HRC
1020-1050	Oil, Thermal Bath 500 - 550 °C	62-64

Tempering ^0C	100	200	300	400	500	525	550	600	700
HRC	63	61	58	58	59	58	56	51	35

APPLICATION : High performance cutting tools, stamping.Thread rolling rolls and thread rolling dies, cold extrusion tools, trimming, cutting and stamping tools for sheet thicknesses up to 6 mm, presision cutting tools up to 12 mm. Cold pilger mandrels, circular-shear blades, deepdrawing tools, pressure pads and highly wear-resistant plastic moulds.

COLD WORK TOOL STEELS

Oil hardening Non Shrinking Steel (OHNS)

Din - material - no. : 1.2510

Code : 100MnCrW4

Comparable Standards : A ISI : 01

Equivalent Brands :

Bohler	German No. Tew (DEW	Japan	Poldi	Metal Ravne	(EWK)Thyssen Edelstahlwerke
K460	2510	SKS3	StabilK	OW4, Merilo EX	Thyrodur2510

Chemical composition (Typical analysis %) :

C	Si	Mn	Cr	V	W
0,95	0,25	1,10	0,60	0,10	0,60

Steel Properties : Cold work tool steel. Very high resistance to cracking High machinability, medium toughness and resisstance to wear. Dimensional stability at heat treatment.

Physical Properties :

Thermal conductivity W/ (m . K) $\frac{20^{0}C}{30}$

Density g/cm^3 $\frac{20^{0}C}{7,85}$

Coefficient of Linear thermal expansion

$10^{-6}\ ^{0}C^{-1}$	20-100	20-200	20-300	20-400	20-500	20-600	20-700
	12,1	12,9	13,3	14,0	14,4	14,8	14,9

Heat Treatment :

Soft annealing ^{0}C	Cooling	Hardness HB
740-770	furnance	max 250

Hardening from ^{0}C	in	Hardness after quenching HRC
780 - 820	Oil, Thermal Bath 180 -220 ^{0}C	64

Tempering ^{0}C	100	200	300	400	500	600	650
HRC	64	61	56	51	44	37	34

APPLICATION : Working tools, sizing and stamping tools. Machine knives for cellulose, paper and pulp, and metal working industries, guages, plastic moulds, thread rooling tool, blanking tools.

Installed Hardness for various application using D2 grade.

Cutting	Material Thickness	Material Hardness (HB)	
		<180HRC	>180HRC
Tools for Blanking, Fine-Blanking, Punching, Cropping Shearing, Trimming, Clipping	<3 mm (1/8") 3-6 mm (1/8"-1/4")	60-62 58-60	58-60 54-56

Forming	HRC
Tools for	
Bending, forming, deep-drawing, rim-rolling, spinning and flow-forming	56-62
Coining dies,	56-60
Cold extrusion dies, .	58-60
Punches	56-60
Tube and section forming rol s; plain rolls .	58-62
Dies for moulding of Ceramics, bricks, tiles, grinding wheels, tablets, abrasive plastics	58-62
Thread - rolling dies	58-62
Cold-healing tools	56-60
Crushing hammers	56-60
Swaging tools	56-60
Gauge, measuring tools, guide rails, bushes, sleeves, knurling tools, Sandblast nozzles	58-62

Installed Hardness for various application using D3 grade.

Cutting	Material Thickness	Material Hardness (HB)	
		<180HRC	>180HRC
Tools for Blanking, Punching, Cropping Shearing, Trimming, Clipping	<3	60-62	56-58

Forming	HRC
Tools for	
Bending, Raising, Deep-Drawing, Rim-Rolling, Spinning and Flow-Forming	56-62
Tube and section forming rolls	58-62
Cold drawing/sizing dies	58-62
Compacting dies for metal powder parts	58-62
Master hobs for cold hobbing	56-60
Dies for Moulding of Ceramics, bricks, tiles, Grinding wheels, Tablets, Abrasive plastics	58-62
Guages, measuring tools. Guide rails, bushes, sleeves, Knurling tools Sandblast nozzles	58-62
Crushing hammers	56-60
Swaging blocks	56-60

Installed Hardness for various application using AISI: 01 grade.

Cutting	Material Thickness (mm)	Material Hardness (HB)
Tools for Blanking, Punching, Plercing, Cropping Shearing, Trimming, Clipping	 up to 3 mm (1/8") 3-6 mm (1/8-1/4") 6-10mm (1/4-13/32")	 60-62 56-60 54-56
Short Cold shears, Rotary shear blades for plastic waste		56-60
Clipping, trimming tools for forgings	Hot	58-60
	Cold	56-58

Forming	HRC
Tools for	
Bending, Raising, Deep-Drawing, Rim-Rolling, Spinning and Flow-Turning	56-62
Coining dies	56-60
Tube and section forming rolls	58-62
Master hobs for cold hobbing	58-60
Swaging blocks	56-60
Guages, Measuring Tools, Guide Rails, Bushes, Sleeves	58-62
Dies and Inserts for moulding Tablets, Abrasive Plastics	58-62

Properties of Steel:

Din	Wear Resistance	Weldability	Machinability
1.2080 - D3	++	0	+
1.2379 - D2	+++	0	+
1.25.10 - 01	++	0	++

0 to +++ Ascending

PLASTIC MOULD STEELS:

Din - material - no. : 1.2738(P20+Ni)

Code : 40 CrMnNiMo 8-6-4

Equivalent Brands :

Metal Ravne	(EWK)Thyssen Edelstahlwerke
Utopnin	Thyroplast 2738

Chemical composition (Typical analysis %) :

C	Mn	Cr	Ni	Mo
0.40	1.5	1.9	1.0	0.2

Steel Properties : Pre-hardened plastic mould steel, hardness in as-delivered condition 280to325HB. Good machinability. suitable for texturing, improved through hardenability cornpared to 1.2311

Physical Properties : Coefficient of thermal expansion 10^{-6}m(m-k)

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C	20-600°C	20-700°C
11.1	12.9	13.4	13.8	14.2	14.6	14.9

Thermal conductivity W/ (m . K)

20°C	350°C	700°C
34.5	33.5	32.0

Heat Treatment :

Soft annealing°C	Cooling	Hardness HB
710-740	furnance	max 235

Hardening °C	Quenching	Hardness after quenching HRC
840-870	Polymer or Oil	51

Tempering °C	100	200	300	400	500	600	700
HRC	51	50	48	46	42	39	28

APPLICATION : Large plastic moulds with deep engravings and intensive impacts on the core, for use in large moulds which have to display high core strength. The additional nickel content of 1 % increases the through hardenability. Suitable for use in Injection Moulds, Compression Moulds, Blow Moulds and Large Moulds.

PLASTIC MOULD STEELS:

Din - material - no. : 1.2311

Code : 40 CrMnMo7

Equivalent Brands :

Metal Ravne	(EWK)Thyssen Edelstahlwerke
UTOPNEX	THYROPLAST2311

Chemical composition (Typical analysis %) :

C	Mn	Cr	Mo
0.40	1.5	1.9	0.2

Steel Properties : Pre-hardened plastic mould steel, hardness in as - delivered condition 280 to 325HB. Good machinability, suitable for texturing

Physical Properties :

Coefficient of thermal expansion 10^{-6}m(m-k)	20-100°C	20-200°C	20-300°C
Annealed	12.8	13.2	13.8
Quenched and tempered	12.4	13.0	13.4

Thermal conductivity W (m . K)	100°C	150°C	200°C	250°C	300°C
Annealed	39.7	40.6	41.5	41.8	42.0
Quenched and tempered	34.0	34.0	33.6	32.9	31.9

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
710-740	furnance	max 235

Hardening °C	Quenching	Hardness after quenching HRC
840 - 870	Oil or Salt Bath, 180-220 °C	51

Tempering °C	100	200	300	400	500	600	700
HRC	51	50	48	46	42	36	28

APPLICATION : Plastic mould, Mould frames for plastic moulds and pressure casting moulds and recipient sleeves. Suitable for use in Injection moulds, compression moulds, blow moulds and large moulds.

PLASTIC MOULD STEELS:

Din - material - no. : 1.2312

Code : 40 CrMnMo 58-6

Equivalent Brands : (EWK)Thyssen Edelstahlwerke
THYROPLAST2311

Chemical composition (Typical analysis %) :

C	Mn	Cr	Mo	S
0.40	1.5	1.9	0.2	0.05

Steel Properties : Pre-hardened plastic mould steel, hardness in as - delivered condition 280 to 325HB. Higher sulphur content provides good machinability at higher hardness, possibility of nitriding good polishability.

Physical Properties :

Coefficient of Linear thermal expansion 10^{-6}m(m-k)	20-100°C	20-200°C	20-300°C
Annealed	12.5	13.4	13.9
Quenched and tempered	12.3	13.0	13.7

Thermal conductivity W/ (m . K)	100°C	150°C	200°C	250°C	300°C
Annealed	40.2	40.9	40.3	40.0	39.0
Quenched and tempered	39.8	40.4	40.4	39.9	39.0

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
710-740	furnance	max 235

Hardening °C	Quenching	Hardness after quenching HRC
840 - 870	Oil or Salt Bath, 180-220 °C	51

Tempering °C	100	200	300	400	500	600	700
HRC	51	50	48	46	42	36	28

APPLICATION : Plastic mould, mould frames for plastic moulds and pressure casting moulds, recipient sleeves. Sutaible for use in Injection moulds, Blow Moulds, Large Moulds and Mould Frames.

PLASTIC MOULD STEELS:

Din - material - no. : 1.2316 (420 mod)

Code :

Equivalent Brands : (EWK)Thyssen Edelstahlwerke
THYROPLAST2316

Chemical composition : (Typical analysis %)

C	Cr	Mo
0.36	16.0	1.2

Steel Properties : Excellent corrosion resistance good polishability. Usually this steel grade is supplied in a quenched and tempered condition at a working hardness of approx. 300 HB.

Physical Properties :

Coefficient of thermal expansion 10^{-6}m(m-k)	20-100°C	20-200°C	20-300°C	20-400°C
	10.5	11.0	11.0	12.0
Thermal conductivity W/ (m . K)	20°C	350°C	700°C	
	172	210	247	

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
760 - 800	furnance	max 230

Hardening °C	Quenching	Hardness after quenching HRC
1020 - 1050	Oil or Salt Bath, 500 - 550 °C	49

Tempering °C	100	200	300	400	500	600
HRC	49	47	46	46	47	32

APPLICATION : Moulds for processing plastics with corrosive reactions. Sutaible for use in Injection moulds, Blow moulds, Compression moulds and Large moulds.

HIGH SPEED STEELS:

Din - material - no. : 1.3343

Code : S 6-5-2

Chemical composition (Typical analysis %) :

C	Cr	Mo	V	W
0,90	4,1	5,0	1,9	6,4

Steel Properties : Molybdenum high speed tool steel. Very high resistance to softening at elevated temperatures. Very high resistance to wear. Good toughness and cutting capability. Deep hardening response.

Physical Properties :

Thermal conductivity W/ (m . K)

20°C
19,0

Density g/cm³

20°C
8,12

Coefficient of Linear thermal expansion

10^{-6} °C^{-1}	20-100	20-200	20-300	20-400	20-500	20-600	20-700	20-800
	10,7	11,7	11,9	12,4	12,7	13,1	13,4	13,4

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
820 - 880	furnance	225 - 280

Heat up	Preheating 1.Step	Preheating 2. Step	Hardening from		Tempering	As tempared hardness HRC
°C	°C	°C	°C	in	°C	
450-600	850	1050	1180 -1230	Oil, Air, Thermal Bath 550°C	min.3x 540-560	min,64

Tempering °C	200	300	400	500	525	550	575	600	650	700
HRC	63	61	61	62,5	64	65	64	62,5	57	47

APPLICATION : Knives, Thread Cutting and Twist Drills, Broaching and Milling Tools, Woodworking Tools, Cold Working Tools.

HOTWORKTOOL STEELS : HOT DIE STEEL H13

Din - materi al - no. : 1.2344

Code : X40 CrMoV5-1

Comparable Standards : AISI : H13

Equivalent Brands :

Bohler	German No. Tew (DEW	Metal Ravne	(EWK)Thyssen Edelstahlwerke
W302	2344	UTOP MO 2 - EFS	Thyrotherme 2344 EFS

Chemical composition (Typical analysis %) :

C	Sl	Cr	Mo	V
0.40	1.0	5.3	1.4	1.0

Steel Properties : Highhot-wearresistance.highhot-tensile strength and toughness. Good thermal conductivity and insusceptibility to hot cracking. Can be water-cooled to a limited extent. Good tempering resistance, it maintains high hardness and strength at elevated temparature. Resistance to thermal fatigue, erosion and wear.

Physical Properties : Coefficient of thermal expansion 10^{-6}m/(m-k)

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C	20 600°C	20-700°C
10.9	11.9	12.3	12.7	13.0	13.3	13.5

Thermal conductivity W / (m- k)	20°C	350°C	700°C
Annealed	27.2	30.5	33.4
Quenched and tempered	25.5	27.5	30.3

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
750-800	Funance	max.230

Hardening °C	Quenching	Hardness after quenching HRC
1020 -1050	Air, oil or Salt Bath, 500-550°C	54

Tempering °C	100	200	300	400	500	525	550	600	700
HRC	53	52	52	54	56	54	50	42	32

APPLICATION : Hotwork steel for universal use. Metal extursion tools for processing light metals, forging moulds, moulds, screws and barrels for plastic processing, nitrided ejectors and hot-shear blades. Pressure die casting dies.

HOTWORKTOOL STEELS : HOT DIE STEEL H11

Din - materi al - no. : 1.2343

Code : X38CrMoV5-1

Comparable Standards : AISI : H11

Chemical composition : (Typical analysis %)

C	SI	Cr	Mo	V
0.38	1.0	5.3	1.3	0.4

Steel Properties : High hot tensile strength and toughness. Good thermal conductivity and insusceptibility to hot cracking. Can be water cooled to a limited extent.

Physical Properties : Coefficient of thermal expansion 10^{-6}m/(m-k)

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C	20 600°C	20-700°C
11.8	12.4	12.6	12.7	12.8	12.9	12.9

Thermal conductivity W / (m- k)	20°C	350°C	700°C
Annealed	29.8	30.0	33.4
Quenched and tempered	26.8	27.3	30.3

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
750-800	Funance	max. 230

Hardening °C	Quenching	Hardness after quenching HRC
1000 -1030	Air, oil or Salt Bath, 500-550°C	54

Tempering °C	100	200	300	400	500	525	550	600	700
HRC	52	52	52	52	54	52	48	38	31

APPLICATION : Hot work steel for universal use. Pressure casting moulds, metal extrusion tools for processing light metals, forging dies, moulds, screws and barrels for plastic processing, shrink rings and hot-shear blades-

HOTWORKTOOL STEELS :

Din - materi al - no. : 1.2714 (Die Block)

Chemical composition (Typical analysis %) :

C	Cr	Mo	NI	V
0.56	1.1	0.5	1.7	0.1

Steel Properties : Tough die steel with high resistance to tempering and full quenching and tempering. This grade is usually supplied in -annealed condition or quenched and tempered to an installed of 370-410 HB (Round) or 355= 400 HB (square, flat)

Physical Properties : Coefficient of thermal expansion 10^{-6}m/(m-k)

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C	20 600°C
12.2	13.0	13.3	13.7	14.2	14.4

Thermal conductivity W / (m- k)	20°C	350°C	700°C
	36.0	38.0	35.0

Heat Treatment :

Soft annealing °C	Cooling	Hardness HB
650 - 700	Funance	max. 250

Hardening °C	in	Hardness after quenching HRC	N/nm²
830 - 870	oil	58	2200
860 - 900	Air	56	2050

Tempering °C	100	200	300	400	450	500	550	600	650
After que. HRC	57	54	52	49	47	46	43	38	34
in oil N/mm²	2120	1910	1790	1620	1530	1480	1360	1200	1080

Tempering °C	100	200	300	400	450	500	550	600	650
After que. HRC	55	52	50	47	45	43	40	36	32
in air N/mm²	1980	1790	1670	1530	1440	1360	1260	1140	1020

APPLICATION : Standard steel for forging dies of all kinds. Mandrels, Die Holders, Armoured Trim Dies, Hot-shear Blades.