

# Tool Steel

Special steel solutions for every application



# Plastic mould steel

Classification	Brand	Chemical composition in weight-%									Designations		
		C	Si	Mn	S	Cr	Mo	V	Ni	Additions	DIN	AISI	
Non-sulphurised	Formadur 2311	0.40	-	1.50	-	1.90	0.20	-	-	-	40CrMnMo7	P20	
	Formadur 2738	0.40	-	1.50	-	1.90	0.20	-	1.00	-	40CrMnNiMo8-6-4	P20+Ni	
	Formadur 320	0.34	-	0.80	-	1.70	0.40	-	0.50	-	-	-	
	Formadur 400	0.36	-	0.90	-	1.90	0.50	-	0.50	+	-	-	
	Formadur 400 Superclean	0.36	-	0.90	-	1.90	0.50	-	0.50	+	-	-	
	Formadur PH 42 Superclean	0.15	-	1.50	-	-	-	-	3.00	1.00 Al + 1.00 Cu	-	-	
Sulphurised	Formadur 2312	0.40	-	1.50	0.05	1.90	0.20	-	-	-	40CrMnMoS8-6	P20+S	
Corrosion resistant, non-sulphurised	Formadur 2083	0.40	-	-	-	13.00	-	-	-	-	X40Cr14	420	
	Formadur 2083 Superclean	0.40	-	-	-	13.00	-	-	-	-	X40Cr14	420	
	Formadur 2190 Superclean	0.37	0.90	0.50	-	13.60	-	0.30	-	-	(X37Cr13)	-	
	Formadur 2316	0.36	-	-	-	16.00	1.20	-	-	-	X38CrMo16	420mod	
	Formadur 2316 Superclean	0.36	-	-	-	16.00	1.20	-	-	-	X38CrMo16	420mod	
	Formadur PH X Superclean	0.05	-	-	-	15.00	-	-	4.50	3.50 Cu + Nb	-	-	
Corrosion resistant, sulphurised	Formadur 2085	0.33	-	-	0.05	16.00	-	-	0.50	-	X33CrS16	420FM	
	Corroplast	0.05	-	1.30	0.15	12.50	-	-	-	+	-	-	
	Corroplast FM	0.22	-	1.60	0.12	12.80	-	-	-	+	-	-	

This is an excerpt from our portfolio. Other grades may be available in remelted condition.  
Reference numbers/designations in brackets are not standardised in EN ISO 4957.

Superclean = ESR

	<b>Hardness</b>	<b>Properties</b>	<b>Applications</b>
	280 - 325 HB*	Good polishability, suitable for texturing, good machinability, through-hardenability up to 400 mm	Plastic moulds, mould frames for plastic moulds and die casting moulds
	280 - 325 HB*	Good polishability, suitable for texturing, good machinability, improved through-hardenability compared to Formadur 2311	Large plastic moulds, mould frames for plastic moulds and die casting moulds
	310 - 355 HB*	Good polishability, improved texturing properties, good machinability, homogeneous hardness and microstructure compared to Formadur 2311/ 2738	Large-format plastic injection and extrusion moulds with deep engraving and high demands on core strength, large mould frames
	365 - 410 HB*	Excellent polishability, improved texturing properties, improved wear resistance and core hardness, homogeneous hardness and microstructure compared to Formadur 2311/ 2738	Plastic injection and extrusion moulds for all dimensions and deep engraving with high demands on polishability, wear resistance and core hardness
	365 - 410 HB*	Best polishability, improved texturing properties, improved wear resistance and core hardness, best homogeneity of hardness and microstructure	As Formadur 400 with highest demands on polishability
	36 - 40 HRC*	Best polishability, good texturing properties, good machinability, precipitation hardened, good dimensional stability, improved compressive strength	Suitable for all kinds of tools in plastic processing with high demands on strength, such as highly stressed plastic injection moulds, compression moulds, hot-runner
	280 - 325 HB*	Best machinability, through-hardenability up to 400 mm	Mould frames for plastic and die casting moulds, press brake dies, plastic moulds without special requirements on surface quality
	48 - 52 HRC	Good corrosion resistance, good polishability	Moulds and inserts for processing plastics with corrosive plastics
	48 - 52 HRC	Good corrosion resistance, excellent polishability	Moulds and inserts for processing plastics with corrosive plastics
	48 - 52 HRC	Good corrosion resistance, excellent polishability, improved through-hardenability compared to Formadur 2083	Moulds and inserts for processing plastics with corrosive plastics
	265 - 310 HB*	Excellent corrosion resistance, good polishability	Moulds for processing plastics with higher demands on corrosion resistance, tools for plastic extrusion
	265 - 310 HB*	Excellent corrosion resistance, very good polishability, improved homogeneity	As Formadur 2316 with highest demands on polishability, tools for plastic extrusion
	38 - 42 HRC*	Best corrosion resistance, outstanding polishability, best homogeneity of hardness and microstructure, precipitation hardened, good dimensional stability	High polished tools and moulds for processing of high corrosive plastics, tools for plastic extrusion
	280 - 325 HB*	Corrosion-resistant, improved machinability compared to Formadur 2316	Mould frames, plastic moulds without special demands on surface quality
	280 - 325 HB*	Corrosion-resistant, excellent machinability, improved weldability compared to Formadur 2085	Base plates, mould bases and plastic moulds without special requirements on polishability, as well as being resistant to condensation and cooling water (All-Stainless-Concept)
	270 - 315 HB*	Corrosion-resistant, best machinability, best homogeneity of hardness and microstructure, good dimensional stability	Complex base plates and mould frames with highest demands on machinability and resistance to condensation and cooling water (All-Stainless-Concept), plastic moulds without special requirements on polishability

\*pre-hardened

# Hot work tool steel

Brand	Chemical composition in weight-%									Designations		
	C	Si	Mn	S	Cr	Mo	V	Ni	Additions	DIN	AISI	
<b>Thermodur 2329</b>	0.45	0.70	0.80	-	1.80	0.30	0.20	0.60	-	46CrSiMoV7	-	
<b>Thermodur 2714</b>	0.56	-	-	-	1.10	0.50	0.10	1.70	-	55NiCrMoV7	-	
<b>Thermodur 2343 EFS</b>	0.38	1.00	-	-	5.30	1.30	0.40	-	-	X37CrMoV5-1	H11	
<b>Thermodur 2343 EFS Superclean</b>	0.38	1.00	-	-	5.30	1.30	0.40	-	-	X37CrMoV5-1	H11	
<b>Thermodur 2344 EFS</b>	0.40	1.00	-	-	5.30	1.40	1.00	-	-	X40CrMoV5-1	H13	
<b>Thermodur 2344 EFS Superclean</b>	0.40	1.00	-	-	5.30	1.40	1.00	-	-	X40CrMoV5-1	H13	
<b>Thermodur 2365 EFS</b>	0.32	-	-	-	3.00	2.80	0.50	-	-	32CrMoV12-28	H10	
<b>Thermodur 2367 EFS</b>	0.37	-	-	-	5.00	3.00	0.60	-	-	X38CrMoV5-3	-	
<b>Thermodur 2367 EFS Superclean</b>	0.37	-	-	-	5.00	3.00	0.60	-	-	X38CrMoV5-3	-	
<b>Thermodur 2999 EFS Superclean</b>	0.45	0.30	0.30	-	3.00	5.00	1.00	-	-	-	-	
<b>Thermodur E 38 K Superclean</b>	0.35	0.30	0.30	< 0.003	5.00	1.35	0.45	-	-	-	-	
<b>Thermodur E 40 K Superclean</b>	0.35	0.30	0.30	< 0.003	5.00	1.75	0.80	-	+	-	-	
<b>Thermodur 2383 Superclean</b>	0.45	-	0.90	-	-	1.50	1.50	0.90	-	-	-	

This is an excerpt from our portfolio. Other grades may be available in remelted condition.

Superclean = ESR

Reference numbers/designations in brackets are not standardised in EN ISO 4957.

Hardness	Properties	Applications
46 - 52 HRC	High tempering resistance, high-temperature strength, good hardenability, good weldability, nitridable, PVD and CVD coatable, good machinability	Forging dies, extrusion press tools, compression moulding dies
355 - 410 HB*	High toughness, high tempering resistance and through-hardenability	Standard steel for forging dies, press dies, auxiliary tools for extrusion, die holders, armored trim dies, hot shear blades
42 - 52 HRC	High high-temperature strength, excellent toughness, very good thermal shock resistance, good temperature wear resistance and very good polishability	Universally usable e.g. die casting dies and moulds for light metal processing, mandrel bars, forging dies and inserts, shrink rings, hot shear blades, ejector pins and tools for plastic processing
42 - 52 HRC	High high-temperature strength, excellent toughness, very good thermal shock resistance, good temperature wear resistance and outstanding polishability	As Thermodur 2343 EFS for your most challenging requirements
42 - 52 HRC	Very high high-temperature strength, very high toughness, very good thermal shock resistance, very good temperature wear resistance and very good polishability	Universally usable e.g. die casting dies and moulds for light metal processing, mandrel bars, forging dies and inserts, hot shear blades, ejector pins and extrusion tools
42 - 52 HRC	Very high high-temperature strength, very high toughness, very good thermal shock resistance, very good temperature wear resistance and outstanding polishability	As Thermodur 2344 EFS for your most challenging requirements
40 - 50 HRC	Very high high-temperature strength, high toughness, excellent thermal shock resistance, very good temperature wear resistance, may be water cooled, best cold hobbing properties	High speed forging machines, dies and inserts, extrusion dies for steel and heavy metal processing, heavy metal die casting tools, piercer plugs, steel for high alternating thermal stress
42 - 52 HRC	Excellent high-temperature strength, best tempering resistance, outstanding thermal shock resistance, very high toughness	Die casting dies and extrusion dies for light and heavy metal processing, dies and inserts, high speed forging machines
42 - 52 HRC	Excellent high-temperature strength, best tempering resistance, outstanding thermal shock resistance, highest toughness	As Thermodur 2367 EFS for your most challenging requirements
42 - 52 HRC	Excellent high-temperature strength, high toughness, very good high-temperature wear resistance, best thermal shock resistance, may be water-cooled	For use at highest temperatures, high wear-exposed die inserts, high speed forging machines, die casting dies for heavy metal processing
42 - 52 HRC	Highest toughness, outstanding thermal shock resistance, outstanding high-temperature strength, good thermal wear resistance, excellent duration tempering resistance, excellent homogeneity, outstanding isotropy	Universally usable for highly stressed tools and highest temperatures, die casting dies for light metal processing (especially for complex tools), extrusion dies for light and heavy metal processing (especially for difficulty shaped profiles), dies and inserts, plastic moulds
42 - 52 HRC	Outstanding high-temperature strength, excellent toughness, very good thermal wear resistance, best thermal shock resistance, excellent duration tempering resistance, excellent homogeneity, outstanding isotropy	Universally usable for highly stressed tools and highest temperatures, die casting dies for light metal processing (especially for complex tools), extrusion dies for light and heavy metal processing (especially for difficulty shaped profiles), dies and inserts
40 - 54 HRC	Outstanding thermal conductivity, good wear resistance, good through-hardenability, best long-time tempering resistance, good high-temperature strength	Special steel for press hardening

\*pre-hardened

# Cold work tool steel

Brand	Chemical composition in weight-%									Designations	
	C	Si	Mn	S	Cr	Mo	V	Ni	Additions	DIN	AISI
<b>Cryodur 2210</b>	1.20	-	-	-	0.70	-	0.10	-	-	(115CrV3)	L2
<b>Cryodur 2357</b>	0.50	0.30	0.70	-	3.35	1.60	0.25	-	-	(50CrMoV13-15)	S7
<b>Cryodur 2363</b>	1.00	0.30	0.50	-	5.00	0.95	0.20	-	-	X100CrMoV5	A2
<b>Cryodur 2379</b>	1.55	0.30	0.35	-	12.00	0.75	0.90	-	-	X153CrMoV12	D2
<b>Cryodur 2436</b>	2.10	0.35	0.35	-	12.00	-	-	-	0.70 W	X210CrW12	D6
<b>Cryodur 2510</b>	0.95	0.20	1.10	-	0.60	-	0.10	-	0.60 W	(100MnCrW4)	O1
<b>Cryodur 2550</b>	0.60	0.60	0.35	-	1.10	-	0.20	-	2.00 W	60WCrV8	S1
<b>Cryodur 2709</b>	< 0,02	-	-	-	-	5.00	-	18.00	10.00 Co + 1.00 Ti	(X3NiCoMoTi18-9-5)	-
<b>Cryodur 2746</b>	0.45	0.25	0.70	-	1.50	0.80	0.50	4.00	-	(45NiCrMoV16-6)	-
<b>Cryodur 2767</b>	0.45	0.25	0.35	-	1.40	0.20	-	4.00	-	45NiCrMo16	6F3
<b>Cryodur 2826</b>	0.63	0.80	1.10	-	0.30	-	-	-	-	(60MnSiCr4)	S4
<b>Cryodur 2842</b>	0.90	0.20	2.00	-	0.40	-	0.10	-	-	90MnCrV8	O2
<b>Cryodur 2990</b>	1.00	0.90	-	-	8.00	1.10	1.60	-	-	-	-

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	<b>Hardness</b>	<b>Properties</b>	<b>Applications</b>
	58 - 62 HRC	Cr-V alloyed, high wear resistance, good machinability	Piercing dies, guide rods, twist drills, ejector pins and wood chisels
	54 - 58 HRC	High toughness, high wear resistance, high compression strength and dimensional stability, good polishability	Punching tools, moulds, scrap shears, piercing dies, hobs, coining dies, plastic moulds, tableting tools
	56 - 62 HRC	High dimensional stability during heat treatment, high wear resistance, good toughness	Cutting tools, rolls, shear blades, cold pilger mandrels, cold stamping tools, plastic moulds
	56 - 62 HRC	Ledeburitic 12 % Cr alloyed cold work tool steel, very high wear resistance and cutting edge retention, good tempering resistance, nitridable after special heat treatment	Threading rolls and dies, cold extrusion tools, trimming, cutting and stamping tools, precision cutting tools, cold pilger mandrels, rotary shear blades, deep-drawing tools, highly wear-resistant plastic moulds
	58 - 62 HRC	Ledeburitic 12 % Cr alloyed cold work tool steel, outstanding wear resistance and cutting edge retention	Blanking dies for cutting transformer sheets, dynamo sheets, paper and plastics, deep-drawing tools, drawing dies and mandrels, shear blades
	54 - 61 HRC	Good cutting edge retention, high hardenability, dimensional stability during heat treatment	Blanking and stamping dies for cutting sheets, threading tools, drills, broaches, gauges, measuring tools, plastic moulds, shear blades, guide rails
	54 - 58 HRC	Impact-resistant, oil-hardenable, very good toughness in combination with high hardenability	Blanking dies for cutting sheets, trimming and splitting dies, cold piercing punches, tableting tools, shear blades, chipping knives, pneumatic chisels, coining tools, cold shear blades, ejectors
	51 - 55 HRC	Precipitation-hardened, low distortion, high hardness combined with very good toughness	Casings for cold extrusion tools, die casting dies, plastic moulds
	50 - 54 HRC	Air or oil-hardenable, high toughness combined with good cutting edge retention	Special steel for cold-shear blades, particularly for cutting scrap, drawing jaws, coining and bending tools
	48 - 54 HRC	High hardenability and toughness, highly suitable for polishing and texturing	Cutlery dies, cutting tools for thick materials, billet-shear blades, drawing jaws, massive embossing and bending tools, plastic moulds, reinforcements
	51 - 59 HRC	High toughness, good elasticity in tempered condition	Special steel for spring collets
	56 - 60 HRC	Good cutting edge retention, high hardenability, dimensional stability during heat treatment	Universally usable, cutting and stamping tools, thread-cutting tools, reamers, gauges, measuring tools, plastic moulds, shear blades, guide rails, ejector pins
	57 - 63 HRC	Ledeburitic 8 % Cr alloyed special steel, high hardness and high wear resistance combined with good toughness, high tempering resistance	Cutting and punching tools including precision cutting tools, threading dies and rolls, rotary shear blades, cold pilger mandrels, strike plates, plastic moulds, cold-forming and deep-drawing dies, woodworking tools, cold rolls

# High-speed steel and PM-steel

Classification	Brand	Chemical composition in weight-%									
		C	Si	Mn	S	Cr	Mo	V	Ni	Additions	
High speed steel	Rapidur 3243	0.92	-	-	-	4.10	5.00	1.90	-	4.80 Co + 6.40 W	
	Rapidur 3247	1.08	-	-	-	4.10	9.50	1.20	-	8.00 Co + 1.50 W	
	Rapidur 3343	0.90	0.30	0.30	-	4.10	5.00	1.90	-	6.40 W	
	Rapidur 3344	1.22	-	-	-	4.10	5.00	2.90	-	6.40 W	
Powder metallurgical tool steel <sup>1</sup>	Cold work tool steel	Cryodur PM-V10	2.45	0.90	0.50	0.05	5.30	1.30	10.00	-	-
		Cryodur PM-V12	2.90	0.90	0.50	0.05	5.30	1.30	12.00	-	-
		Cryodur PM-V15	4.40	0.90	0.90	-	13.00	1.20	15.00	-	Ni + Co + W < 0.5
	High speed tool steel	Rapidur PM-23	1.30	-	-	-	4.20	5.00	3.00	-	6.4 W
		Rapidur PM-30	1.30	-	-	-	4.20	5.00	3.00	-	6.4 W + 8.5 Co
		Rapidur PM-52	1.60	-	-	-	5.00	2.00	5.00	-	10.5 W + 8.0 Co
		Rapidur PM-60	2.30	-	-	-	4.20	7.00	6.50	-	7.0 W + 10.5 Co
Rapidur PM-M4	1.35	-	-	-	4.10	5.00	4.10	-	6.0 W		

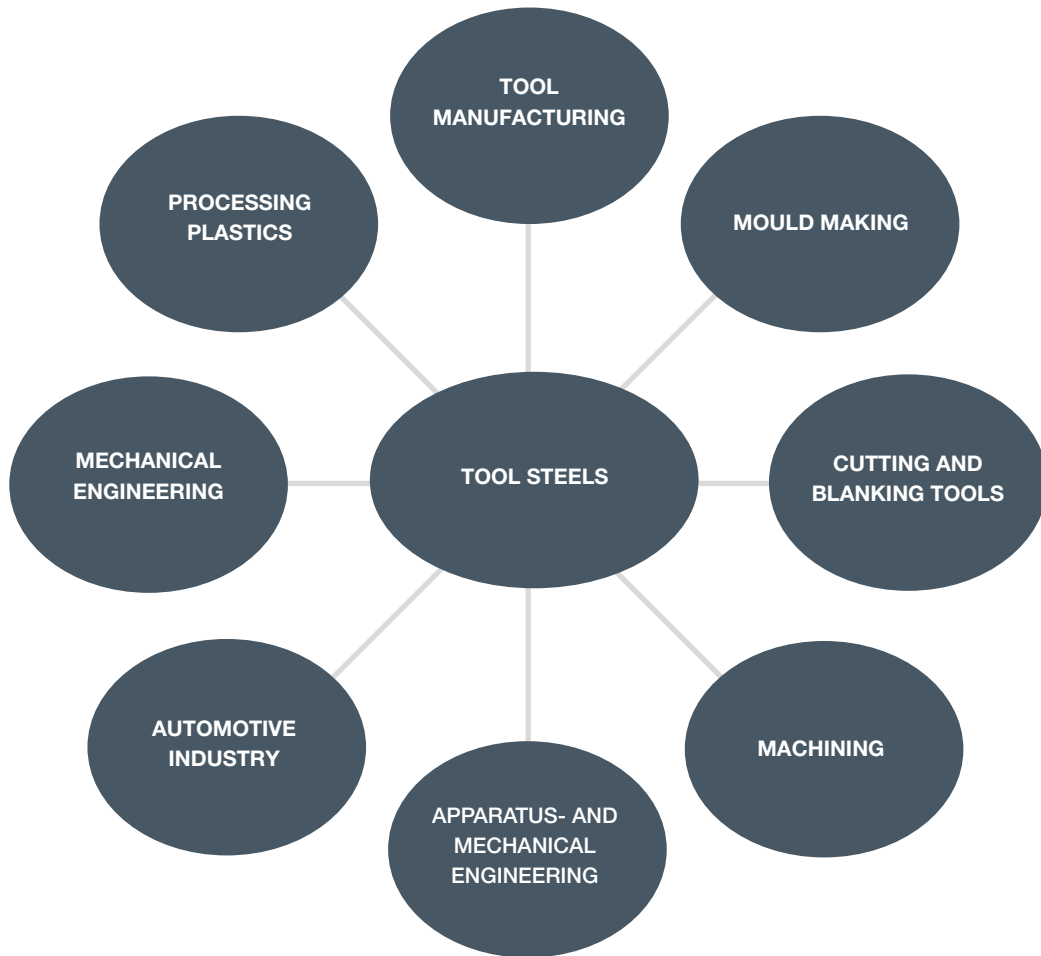
<sup>1</sup>These tool steels are available ex new production and are currently not stocked. Additional powder metallurgical tool steels available upon request.

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Designations		Hardness	Properties	Applications
DIN	AISI			
HS6-5-2-5	M35	63 - 67 HRC	Co alloyed, high red hardness and tempering resistance, particularly suitable for conditions involving thermal stresses and discontinuous cutting	Heavy-duty milling cutters, highly stressed twist drills and taps, profile knives, machining of high-strength materials, broaches
HS2-9-1-8	M42	64 - 68 HRC	Mo based and high-carbon alloyed high speed steel, high wear resistance and red hardness, good grindability	For tools subject to severe mechanical wear, particularly suitable for die-sinking cutters, milling cutters and engraving machines, suitable for non-cutting shaping
HS6-5-2C	M2	61 - 65 HRC	Standard high-speed steel grade, high toughness and good cutting edge retention	Metal-cutting tools for roughing or finishing, shaping tools, woodworking tools, suitable for cold-forming tools
HS6-5-3	M3 Typ 2	62 - 66 HRC	Higher V and C content than Rapidur 3343, maximum wear resistance and cutting edge retention with sufficient toughness	Taps, reamers, heavy-duty milling cutters, rotary gear shaping and shaving cutters for processing of hard materials, hexagon socket punches and piercing dies for the nut production
-	-	59 - 62 HRC	Exhibits a high hardness and wear resistance with an adequate toughness, microstructure consists of fine and homogeneous distributed vanadium rich monocarbides without segregations due to the powder metallurgical processing	Various applications for cold work: punches, bending dies, cold forming presses, cutting knives; screw conveyors
-	-	60 - 63 HRC	Higher C and V content compared to Cryodur PM-V10 for higher hardness and wear resistance	Various application for cold work: punches, bending dies, cold forming presses, cutting knives; screw conveyors
-	-	62 - 65 HRC	Higher C and V content compared to Cryodur PM-V10 and Cryodur PM-V12 for higher hardness and wear resistance, increased Cr for further improvement regarding hardness and wear resistance combined with medium corrosion resistance	Various application for cold work: punches, bending dies, cold forming presses, cutting knives; screw conveyors; knives for the food industry
1.3344 / 1.3395 HS 6-5-3	M3-2	58 - 65 HRC	Good red hardness, high bending and compressive strength, high wear resistance, better toughness and machinability properties compared to conventional produced high speed tool steels	Thread-cutting tools, reamers, heavy-duty milling cutters, drills, punching tools
1.3294 / 1.3244 HS 6-5-3-8	M36	60 - 68 HRC	Co alloyed, higher red hardness and tempering resistance compared to Rapidur PM-23	Thread-cutting tools, reamers, heavy-duty milling cutters, drills, punching tools
1.3253 HS 10-2-5-8	-	62 - 68 HRC	High W and Co contents, improved hot strength and wear resistance	Thread-cutting tools, heavy-duty milling cutters, drills for difficult to machine materials
(1.3241 / 1.3292) HS 6-7-6-10	-	63 - 69 HRC	W and Co alloyed, increased volume fraction of carbides for highest wear resistance also at elevated temperatures	Heavy-duty cutting tools with very high requirements on red hardness and wear resistance
(1.3351) HS 6-5-4	M4	59 - 65 HRC	Rapidur PM-23 with increased C, V and carbide volume fraction for higher wear resistance	Thread-cutting tools, reamers, heavy-duty milling cutters, drills, punching tools



## THE TOOL STEEL EXPERTS

The solutions realised by Deutsche Edelstahlwerke are as diverse as the customer requirements impose on the right steel grade.

The wide range of tool steels offered by Deutsche Edelstahlwerke displays properties tailored precisely to the respective application, such as economical machinability, high wear resistance, good thermal conductivity and good hardenability, as well as good polishing and texturing properties.

### Delivery Programme

You can find our complete delivery programme in the brochure „High-tech Steel Solutions for tomorrow’s World (Products and Services)“ on [www.dew-stahl.com](http://www.dew-stahl.com).

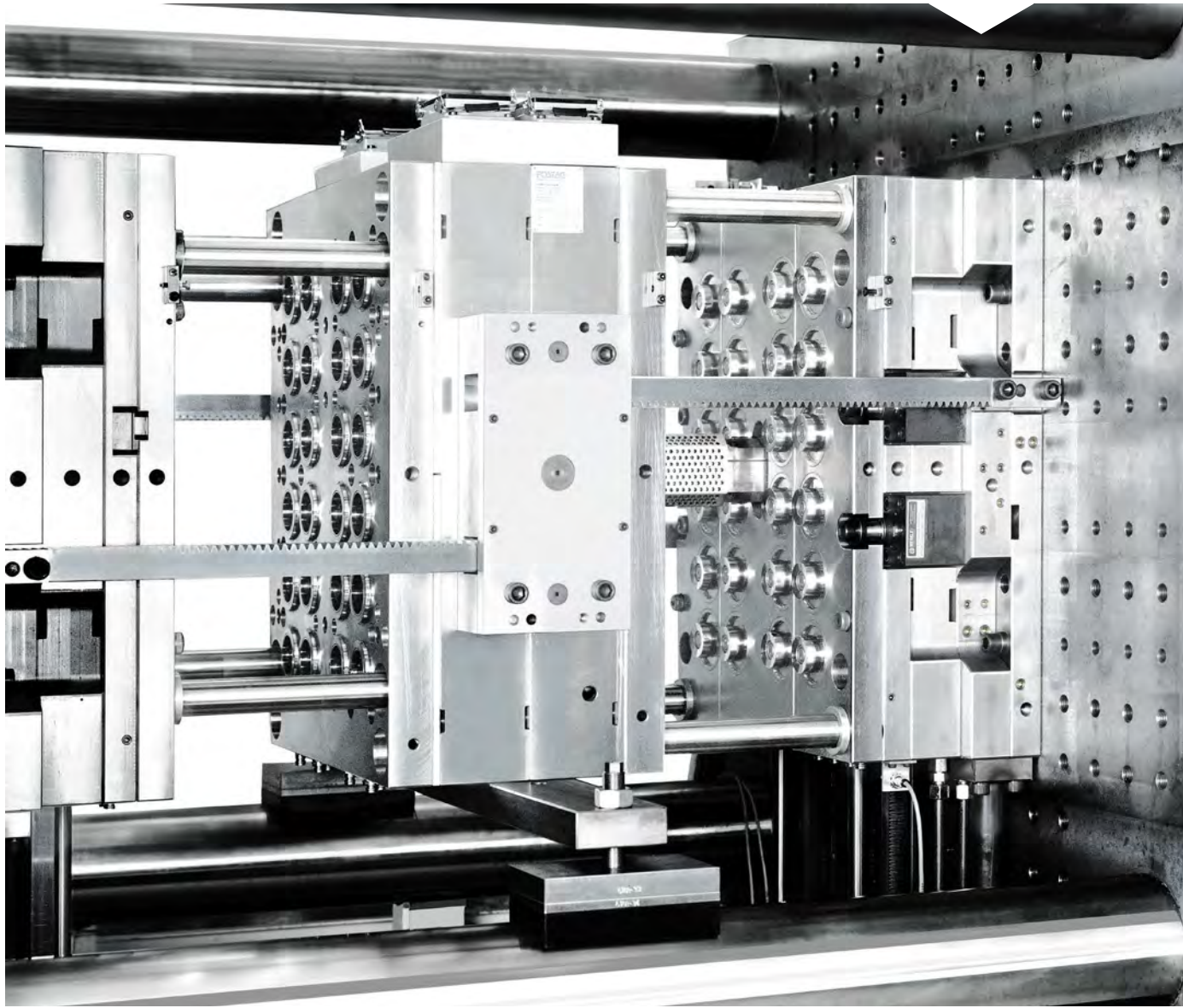
## MORE INFORMATION

Further information about processing and application possibilities you can find in our brochures:

- » Steel for plastic moulding
  - » Hot work tool steel
  - » Cold work tool steel and high speed steel
  - » The "All-Stainless-Concept"
- as well as in our technical data sheets on our homepage [www.dew-stahl.com](http://www.dew-stahl.com).

### General note (liability)

All statements regarding the properties or utilization of the materials or products mentioned are for the purpose of description only. Guarantees regarding the existence of certain properties or certain utilization are only ever valid if agreed upon in writing.



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[www.swisssteel-group.com](http://www.swisssteel-group.com)

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