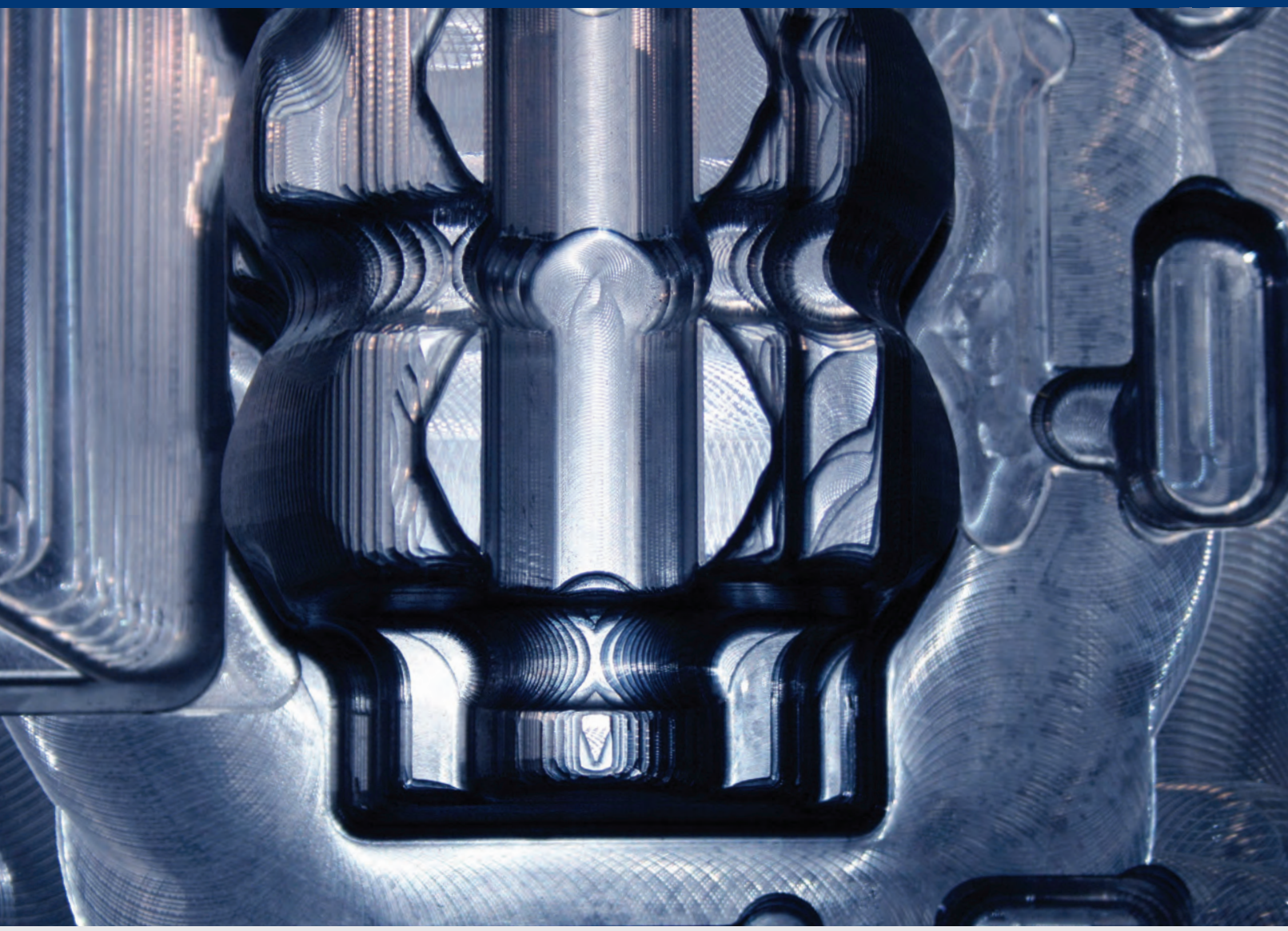
DIE CASTING



HIGH PERFORMANCE STEELS
FOR DIE CASTING

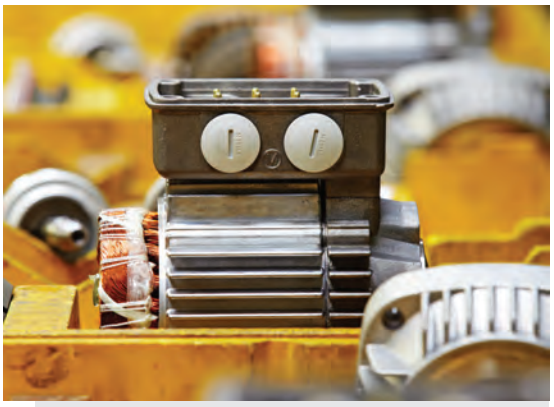
KIND&CO
EDELSTAHLWERK

YOUR AREAS OF APPLICATION FOR HIGH PRESSURE DIE CASTING

Areas of application

Die casting is a manufacturing process for producing aluminium, zinc, magnesium or copper materials. It enables production of cast components in large numbers and with high precision. Die cast components have taken over in many areas of our everyday lives: widespread products include escalator steps, bodies for electric motors, telecommunications equipment and cameras, as well as numerous vehicle parts. Die cast components are produced in short cycle times and are more or less ready to install after solidification. This makes pressure die casting a cost-effective, sustainable procedure.

The automotive industry‘s efforts to cut emissions by reducing weight lends particular importance to pressure die casting. For the past few years, so-called structural components such as shock towers, cross and longitudinal beams and even door and window frames have been increasingly produced from light metals by means of die casting.



Stresses

Die cast dies are subject to very complex stresses in their operational use, comprising mechanical, thermal and chemical components. With the growing size – but also the complexity – of die cast components, the demands placed on dies and die steels are increasing. Significantly tougher steels are needed to compensate for mechanical and thermal stresses.

In many cases, a high degree of thermal conductivity is becoming increasingly important. This property is not only important in terms of reducing cycle times, but also contributes heavily to reducing thermally induced stress in dies.

YOUR NEEDS - OUR RANGE

Steel range

Selecting suitable hot-work tool steel for high pressure die casting dies depends on factors such as the size, geometry and complexity of the die cast component, casting material and die casting procedure (high pressure die casting, low pressure die casting...).

In addition to the familiar hot-work tool steels e.g. 1.2343, 1.2344 and 1.2367, Kind & Co. offers the specially developed hot-work tool steels TQ1, HP1 and HTR, which have been created to adhere to the particular needs of the die casting industry.

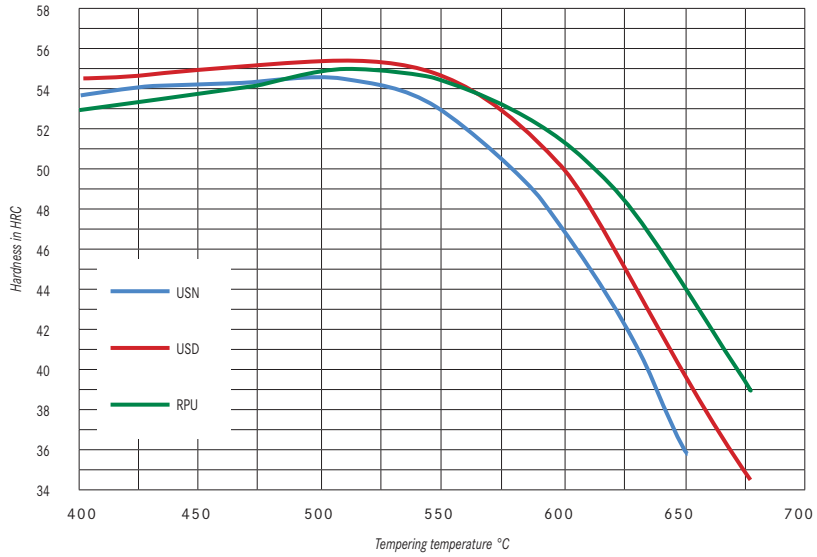
The permanent competitive pressure in the die casting industry is forcing the foundries to constantly optimise their processes. The large numbers to be yielded by the die casting dies require short cycle times, which in turn significantly increases the stresses on the dies. Ever increasing emphasis is being placed on timely co-ordination between the die designer, steel manufacturer, die maker, heat treater and die caster, in order to lend the dies the necessary performance characteristics.

OVERVIEW OF OUR RANGE

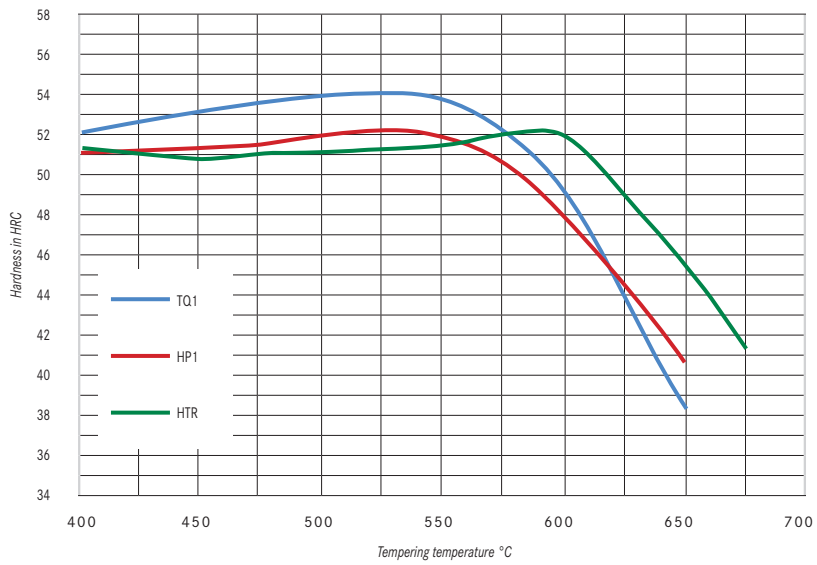
Steel name			Alloy content in mass-%								
Mat. no.	Short name	Brand name	C	Si	Mn	Cr	Mo	V	Nb	W	Co
1.2343	X37CrMoV5-1	USN	0,37	1,00	0,40	5,20	1,30	0,40	—	—	—
1.2344	X40CrMoV5-1	USD	0,40	1,00	0,40	5,20	1,30	1,00	—	—	—
1.2367	X38CrMoV5-3	RPU	0,38	0,40	0,40	5,00	2,80	0,60	—	—	—
—	—	TQ1	0,36	0,25	0,40	5,20	1,90	0,55	—	—	—
—	—	HP1	0,35	0,20	0,30	5,20	1,40	0,55	+	—	—
—	—	HTR	0,32	0,20	0,30	2,20	1,20	0,50	—	3,80	—
1.2678	X45CoCrWV5-5-5	HWD	0,40	0,30	0,40	4,50	0,50	2,10	—	4,50	4,50
1.2888	X20CoCrWMo10-9	RM10Co	0,20	0,20	0,50	9,50	2,00	—	—	5,50	10,0
1.2889	X45CoCrMoV5-5-3	HMoD	0,45	0,30	0,40	4,50	3,00	2,00	—	—	4,50

TECHNICAL DETAILS – TEMPERING DIAGRAM

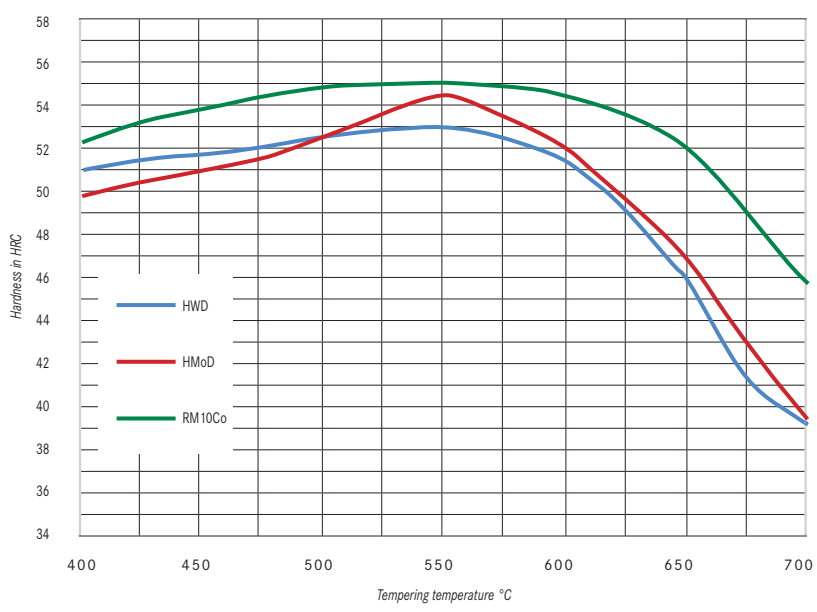
USN, USD, RPU



TQ1, HP1, HTR

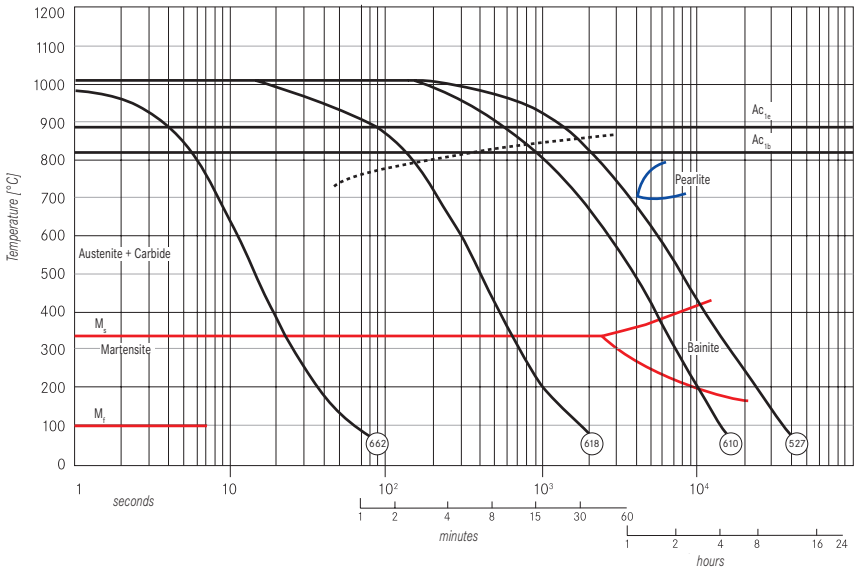


HWD, HMoD, RM10Co



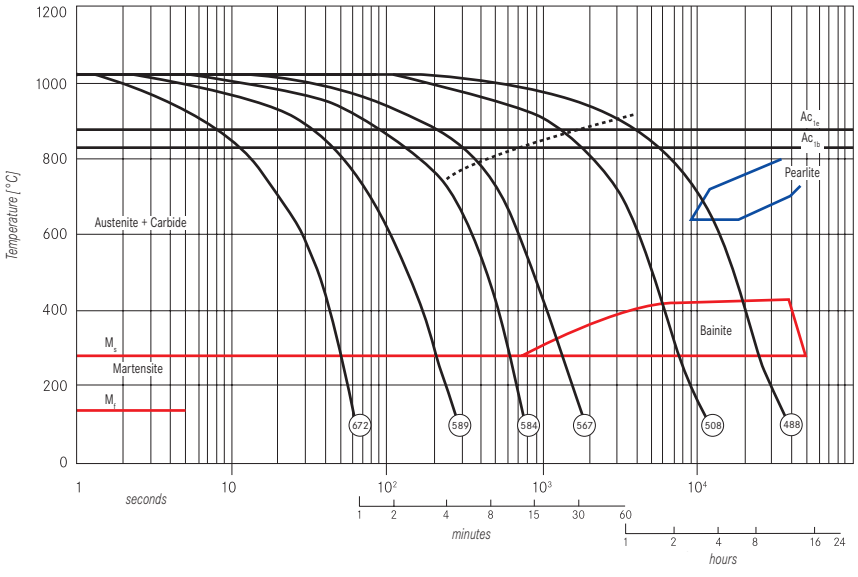
TECHNICAL DETAILS – TTT DIAGRAMS

TQ1



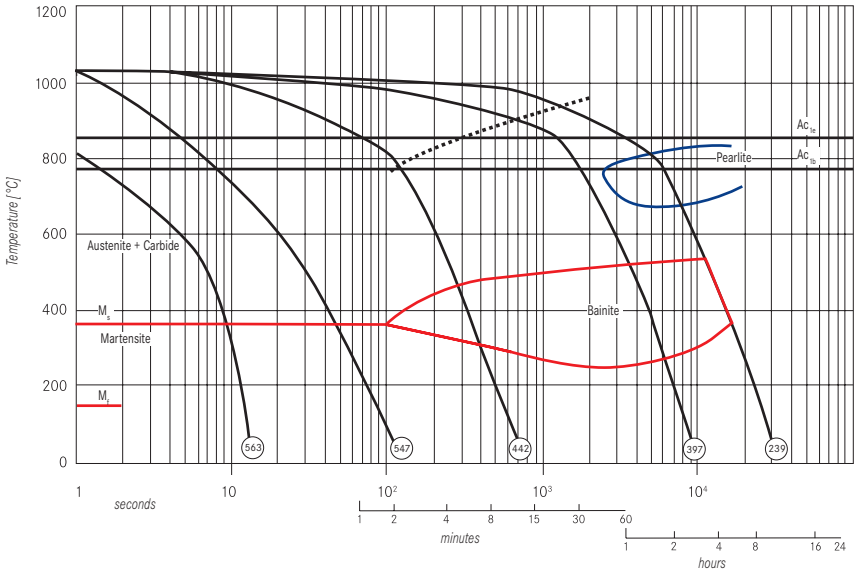
TQ1 steel was developed under the principle of the highest purity. Not only has its phosphorus and sulphur content been reduced, but also that of trace elements that diminish its toughness such as boron, copper, tin and zinc. TQ1 thus distinguishes itself through its particular combination of high-temperature strength with a very high degree of toughness, together with a high resistance to thermal shock. TQ1 is first choice in cases where the highest demands are placed on cast component surfaces.

HP1



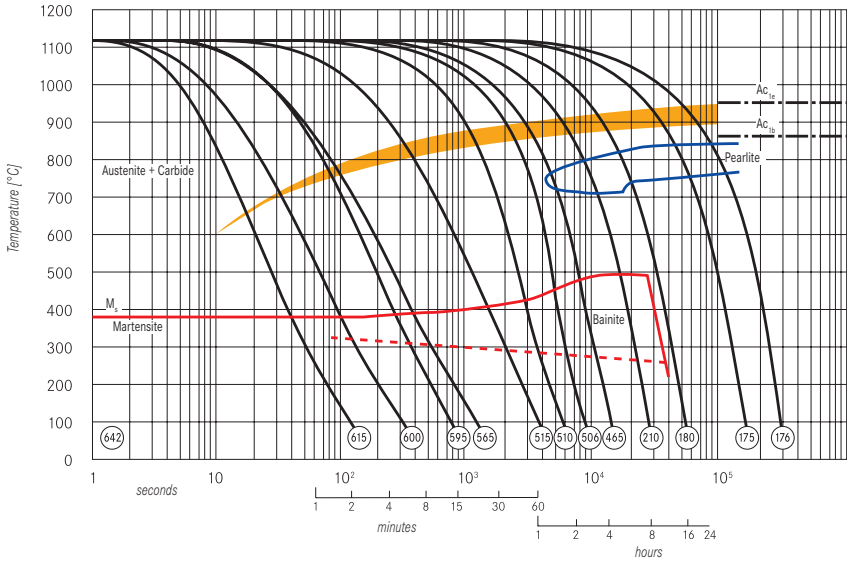
HP1 was developed under the same principle of the highest purity. It has been developed specifically for smaller die casting dies with the highest demands on surface quality. It achieves almost the same characteristics as TQ1.

HTR



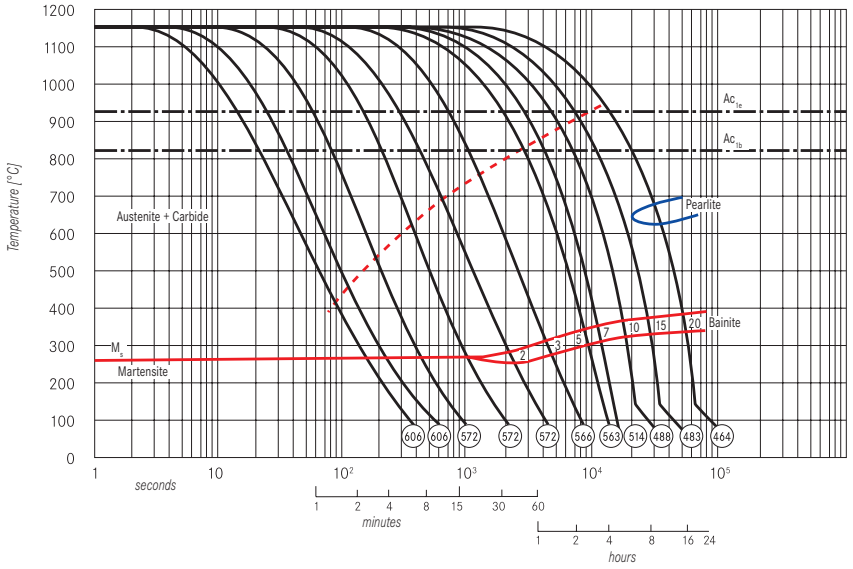
HTR stands out due to its extraordinarily high thermal conductivity and high-temperature strength. It is particularly recommended for small die inserts subject to high thermal stress. Partial inserts made of HTR can conduct heat away from areas subject to particularly high thermal stresses due to its high thermal conductivity.

HWD



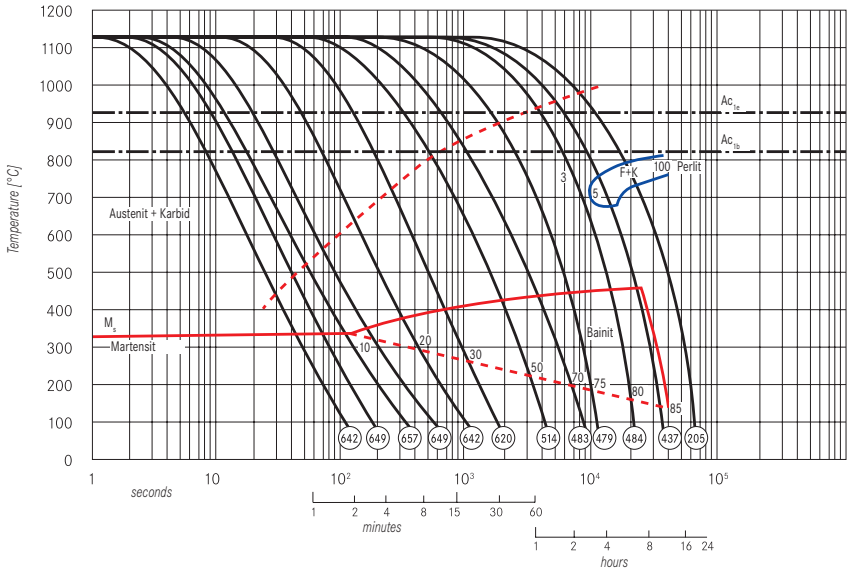
The grade HWD brings together the maximum high-temperature strength, tempering resistance and high-temperature wear resistance. That is why it is used in heavy metal pressure die casting, where it is favoured for thin-walled cast parts or directly washed cores.

RM10Co



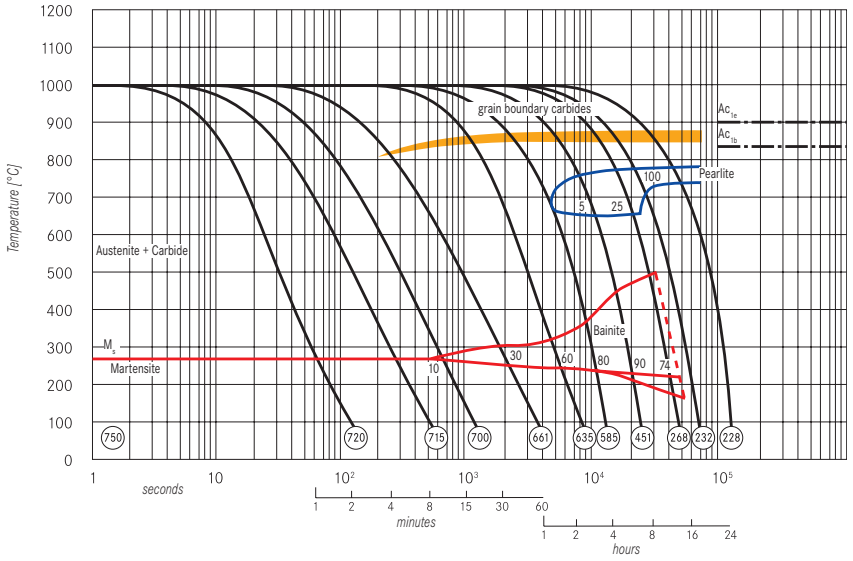
RM10Co also has extraordinary tempering resistance and high-temperature strength. Because it is extremely resistant to molten metals, it is suited amongst other things to filling systems in magnesium hot chamber die casting machines. It can also be used successfully in brass die casting for slides, cores and filling systems.

HMoD



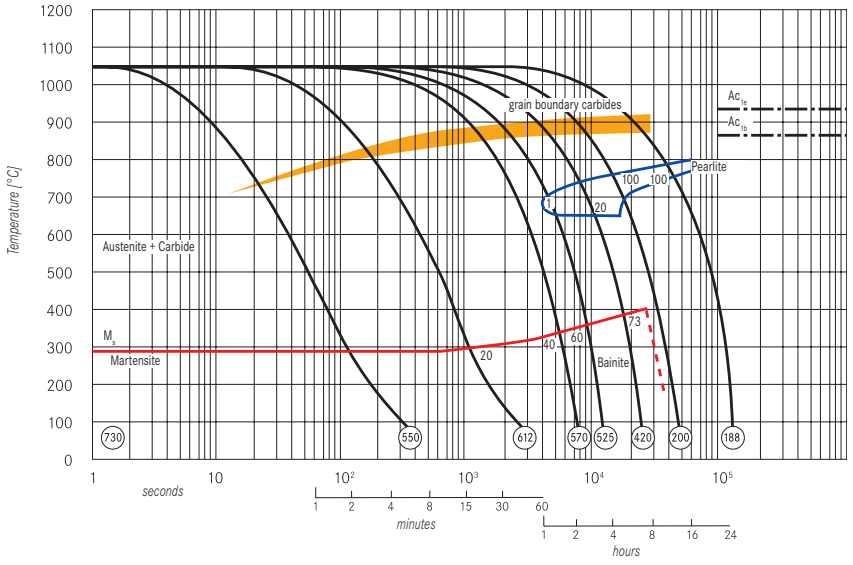
HMoD steel is similar to HWD steel. It is a variant of HWD steel alloyed with molybdenum. It is suited to the same areas of use as HWD, but is somewhat tougher. HMoD is suitable for die casting dies in the area of heavy metal, and also in light metal casting for highly stressed cores in casting streams.

USN



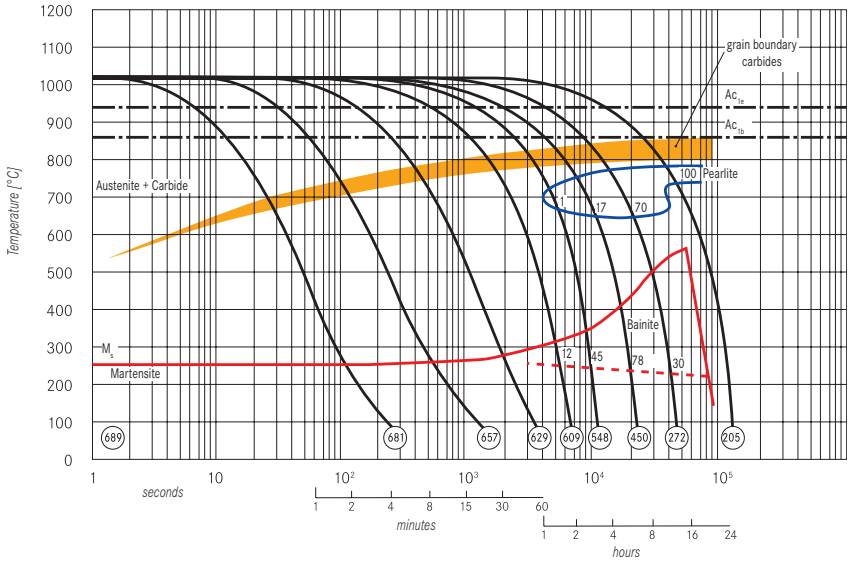
The hot-work tool steel USN combines good high-temperature strength with a high degree of toughness at high temperatures. It has good resistance to thermal shocks occurring during die casting. It is a versatile steel for light metal die casting dies, thanks to this combination of properties.

USD



USD distinguishes from USN by its high vanadium content, which lends USD greater high-temperature strength and tempering resistance. Its thermal fatigue resistance is somewhat better compared to USN. USD can be used for a large number of light metal die casting dies.

RPU



The increased molybdenum content of RPU further increases its high-temperature strength and tempering resistance compared to USN and USD. This results in a lower impact toughness, but on the other hand it also results in further improvements in thermal fatigue resistance. RPU is therefore a good choice for light metal die casting dies, which are subject to greater demands in terms of surface quality.

PHYSICAL PROPERTIES

Steel name		Coefficient of thermal expansion in 10^{-6} m / (m x K)			Thermal conductivity in W / (m x K)		
		Temperature interval in °C			Testing temperature in °C		
Mat. no.	Brand name	20-100	20-400	20-600	20	200	400
1.2343	USN	11,8	12,7	12,9	26,8	27,8	27,3
1.2344	USD	10,9	12,7	13,3	25,5	27,1	27,7
1.2367	RPU	11,9	12,8	13,3	29,9	32,1	32,4
—	TQ1	10,3	12,5	13,0	29,8	31,0	31,4
—	HP1	11,5	12,6	13,1	29,5	30,5	30,5
—	HTR	12,3	13,6	13,8	35,2	34,6	33,0
1.2678	HWD	11,6	12,5	13,0	24,0	28,5	31,7
1.2888	RM10Co	11,3	12,6	12,6	20,5	24,2	27,5
1.2889	HMoD	11,2	11,8	12,3	24,1	28,8	32,3

DESCRIPTION OF STEEL TYPES

Generally, only hot-work tool steel produced by electro-slag-remelting can be considered for use in die casting dies. This metallurgical process gives steels their required homogeneity and purity.

The three standardised hot-work tool steels USN, USD and RPU are amongst the most frequently used hot-work tool steels for die casting in the area of light metals. They possess balanced ranges of properties, making them suitable for numerous different uses.

Die cast components subject to particularly high demands in relation to surface quality, e.g. so-called structural parts from the automotive sector with visible surfaces, require steels with significantly enhanced toughness and considerably higher thermal fatigue resistance. The same applies to dies for cast parts with very sharp corners and edges.

Mat. no.	Brand name	High-temperature strength	Toughness	Thermal fatigue resistance	Wear-resistance
1.2343	USN				
1.2344	USD				
1.2367	RPU				
-	TQ1				
-	HP1				
-	HTR				
1.2678	HWD				
1.2888	RM10Co				
1.2889	HMoD				

OUR RANGE – OUR HARDNESS RECOMMENDATION

Component	Aluminium, Magnesium		Zinc		Brass	
Simple die inserts, smaller to medium sized dimensions	USN USD RPU HP1 TQ1	44 – 46 HRC 43 – 45 HRC 43 – 45 HRC 44 – 46 HRC 44 – 46 HRC	USN USD	44 – 50 HRC 44 – 50 HRC	HWD RM10Co HMoD	36 – 42 HRC 42 – 46 HRC 36 – 42 HRC
Die inserts, smaller to medium sized dimensions with increased demands on surface quality	HP1 TQ1	44 – 46 HRC 44 – 46 HRC	USN USD HP1,	44 – 50 HRC 44 – 50 HRC 44 – 46 HRC	HWD RM10Co HMoD	36 – 42 HRC 42 – 46 HRC 36 – 42 HRC
Die inserts, large dimensions (wall thickness > 200 mm) with increased demands on surface quality	TQ1	43 – 45 HRC				
Die inserts for small and medium sized automotive structural components	USN HP1 TQ1	43 – 45 HRC 43 – 46 HRC 44 – 46 HRC				
Die inserts for large dimensions automotive structural components	HP1 TQ1	42 – 45 HRC 42 – 45 HRC				
Cores	USN USD HP1 TQ1	43 – 46 HRC 43 – 46 HRC 43 – 46 HRC 43 – 46 HRC	USN USD HP1	44 – 50 HRC 44 – 50 HRC 44 – 46 HRC		
Diffusor	USN USD RPU HP1 HTR	43 – 45 HRC 43 – 45 HRC 43 – 45 HRC 43 – 45 HRC 40 – 42 HRC	USN USD RPU HP1 HTR	43 – 45 HRC 43 – 45 HRC 43 – 45 HRC 43 – 45 HRC 40 – 42 HRC	HTR	40 – 42 HRC
Casting system hot-chamber machine	RM10Co	43 – 45 HRC				

HARDENING TEMPERATURES

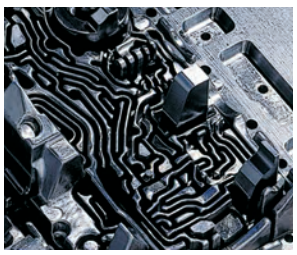
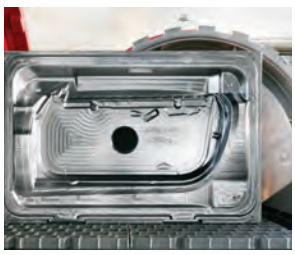
Mat. no.	Brand name	Hardening temperature in °C	Soaking time in min.
1.2343	USN	1000	45
1.2344	USD	1020	45
1.2367	RPU	1030	45
—	TQ1	1010	60
—	HP1	1020	60
—	HTR	1060	60
1.2678	HWD	1130	45
1.2888	RM10Co	1130	45
1.2889	HMoD	1130	45

In addition to the melting of steel and the subsequent forging process, the professional heat treatment of die casting dies has a great impact on the quality of steel. Maintaining process parameters and properly heat treating the die casting dies is a fundamental component for achieving the optimal material properties.

Our team of experts will assist you with the selection of suitable steel grades, heat treatment parameters and service in order to supply you with superior tool steel solutions. Our qualified application engineers will be happy to advise you at any time, in regards to your specific technical needs.

YOUR PARTNER FOR DEMANDING MATERIALS SOLUTIONS





PRODUCTS
HOT-WORK TOOL STEELS
COLD-WORK TOOL STEELS
DIE STEELS
PLASTIC MOULD STEELS

INDUSTRIES
DIE CASTING
DIE FORGING
EXTRUSION
PIPE PRODUCTION
PLASTICS TECHNOLOGY

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Tool steels and special materials

Melting

Forging

Ring rolling

Heat treatment

Machining

Surface treatment

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KIND & CO., Edelstahlwerk, KG
Bielsteiner Str. 124-130 · D-51674 Wiehl-Bielstein
Phone +49 (0) 22 62 / 84-0 · Fax +49 (0) 22 62 / 84-175
info@kind-co.de · www.kind-co.de

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