

High-performance materials,  
premium service and heat treatment for

# Die Casting



A detailed close-up photograph of a die casting mold. The mold is made of a dark, heavy-duty metal, likely a hot-work tool steel. It features several large, rectangular cavities designed for casting parts. The surfaces of the mold are highly textured, showing signs of wear, including scratches, scuffs, and areas where the metal has been polished or ground. The lighting is dramatic, highlighting the metallic sheen and the intricate details of the mold's design.

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# Die Casting

An economical die casting process requires reliably working dies. Tool-related interruptions in the casting process or disproportionately high reworking costs for the products have a direct effect on the production costs of the cast parts.

Our tool steels, manufactured under optimized production processes, offer special and high-quality properties with regard to

- **Thermal shock resistance**
- **High-temperature strength**
- **Toughness**
- **Wear resistance**

Choosing the right hot-work tool steel extends the life of the tool and improves the quality of the final product.



## Kind&Co

For over 130 years, we have been producing high-quality tool steel exclusively at our site in Bielstein. Kind&Co is still a family owned business today. We stand for sophisticated material solutions, highest quality, reliable service and competent advice - tailored to the respective application. We have particularly strong application expertise in the areas of die casting, extrusion and die forging.

### Die casting (HPDC/LPDC)

Modern applications in the die casting industry reduce the weight and increase the efficiency of many industrial products.

- Automotive engine and transmission construction
- Structural components in automotive lightweight construction
- Solutions in e-mobility
- Electrical motor and housing construction
- Telecommunications
- Industrial applications
- Consumer goods industry

The increasing demands in the die casting industry require modern and high-quality tooling solutions. Complex geometries, large-format casting products, reduced cycle times and alloys are difficult to cast. These conditions require tool steel that is capable of avoiding premature tool failures even under the toughest production conditions and of achieving the best economic efficiency with the tools.



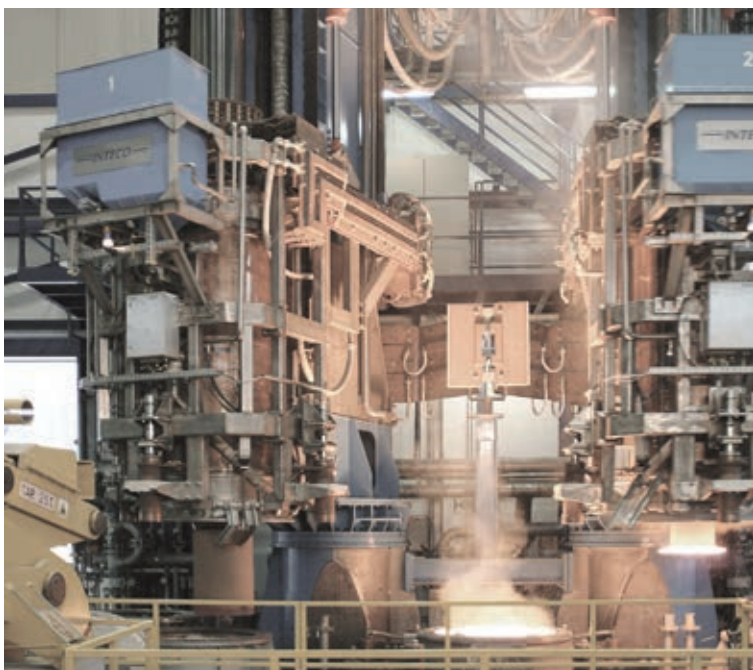
Forging of ESR blocks on the 30MN press ▲

### Trends

Electromobility is bringing about a far-reaching change in the cast parts range. The already very diverse range of die-cast structural components is constantly increasing and contributes to the weight reduction of vehicles. The complexity of such components places particularly high demands on die casters, die makers and steel manufacturers. The high mechanical and thermal stresses occurring in the die inserts must be compensated by the die insert with the highest possible toughness of the steel in order to prevent premature cracking in the heavily-loaded areas of the die inserts.

Visible and painted areas of the die-cast components place the highest demands on the thermal shock resistance of the steels used in order to avoid costly reworking of the cast parts. Higher die reliability can be achieved by using steels with improved toughness and thermal shock resistance.

With state-of-the-art technology and the many years of experience of our materials engineers, we supply first-class solutions and tailor-made hot-work tool steels that meet the high demands of the die casting industry.

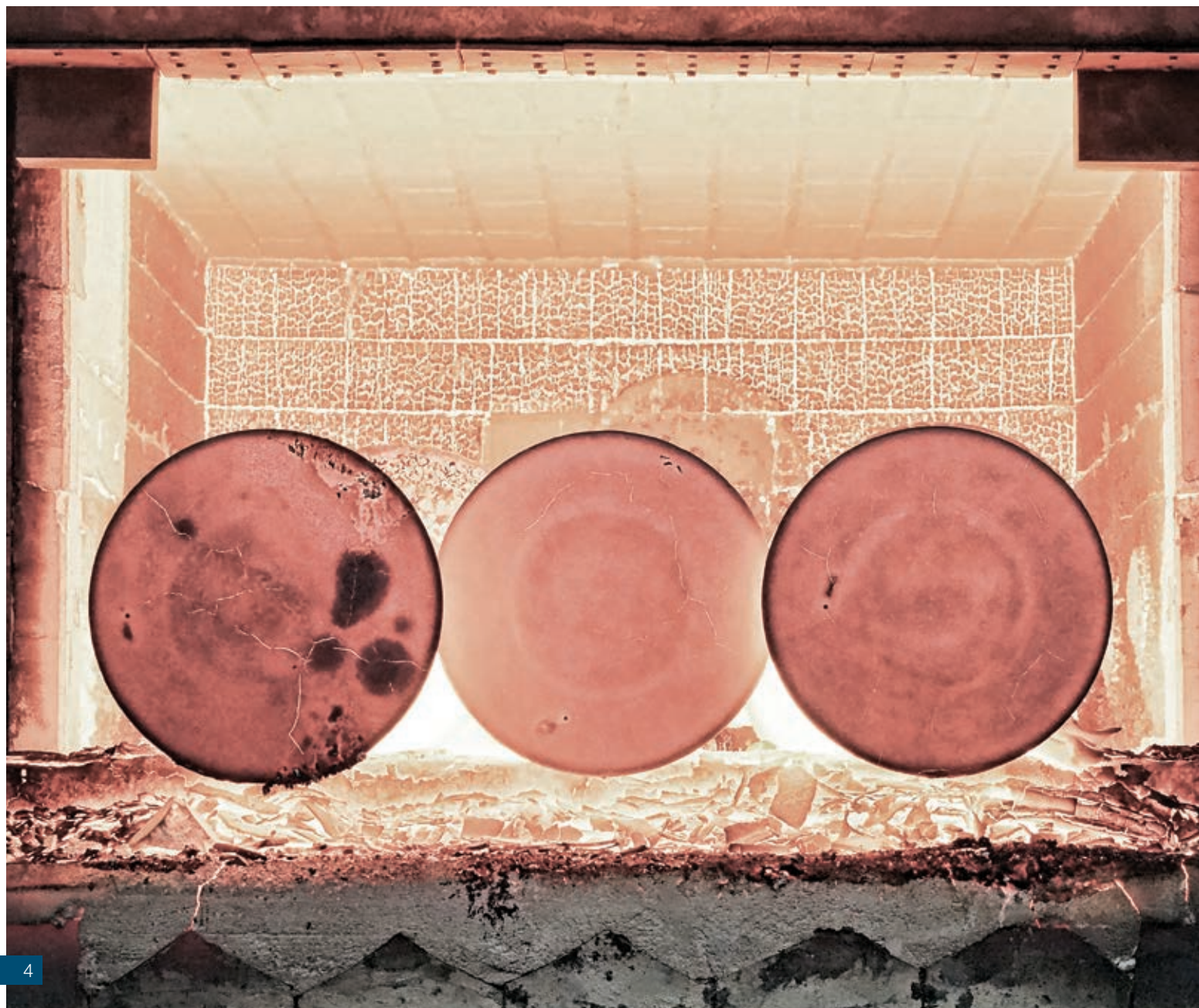


◀ Electro-slag remelting process (ESR)



Our range covers the entire spectrum from die steel to hardened die inserts

		Rod, black	3D piece	Rod, bright	Machined part (drawing)	Hardening	Service/repair
Die casting (HPDC)	Die insert, slider, Sprue bush	x	x	x	x	x	(x)
	Accessories • Shot sleeve • Casting piston • ...	x	x	x	x	x	(x)
Low-pressure die casting (LPDC)	Die insert	x	x	x	x	x	(x)

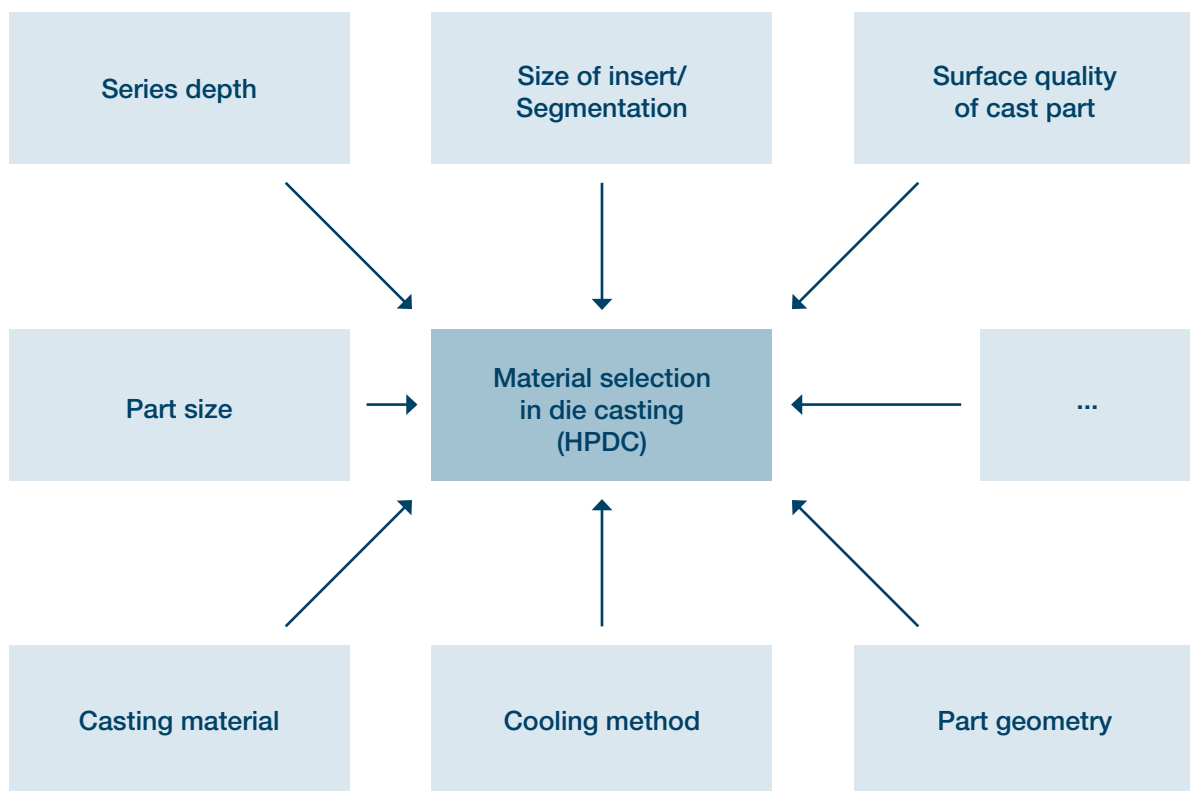


# Die casting (HPDC)

## Tool steel selection for die casting (HPDC)

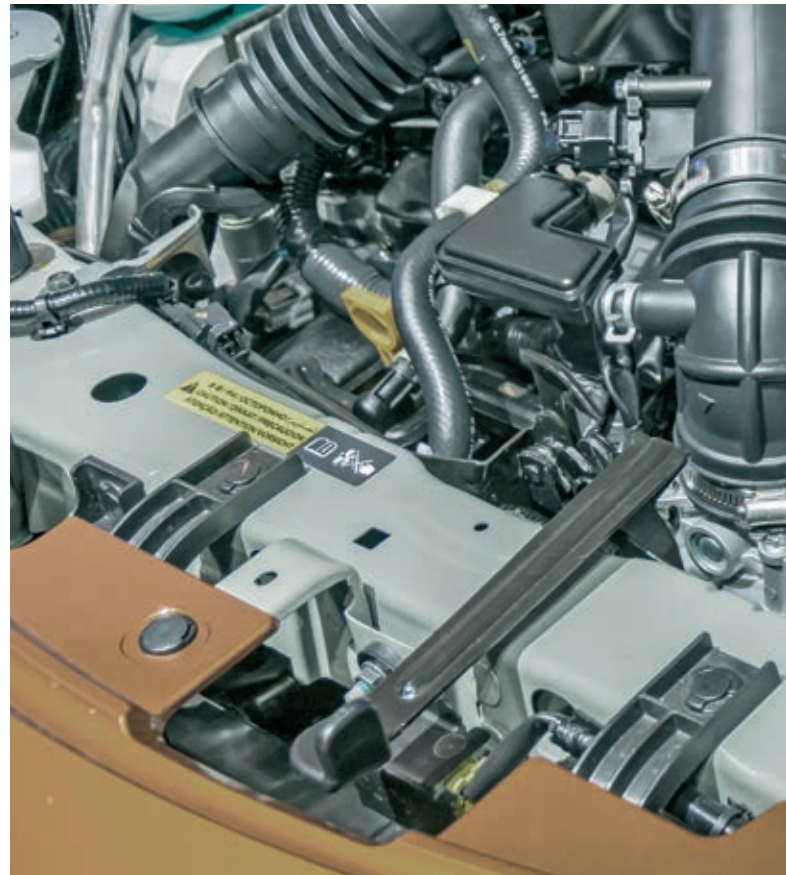
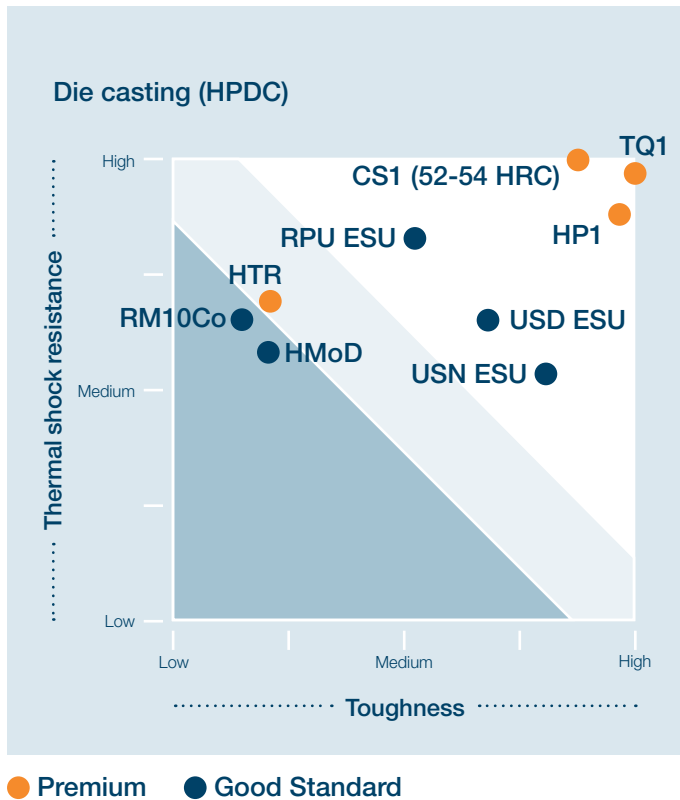
The die casting process requires a differentiated tool steel selection for different challenges.

The selection of a suitable tool steel for a die casting die requires a fundamental analysis of the part to be cast. The following aspects in particular must be taken into account:





## Our high-quality tool steels for high-pressure die casting applications (HPDC)

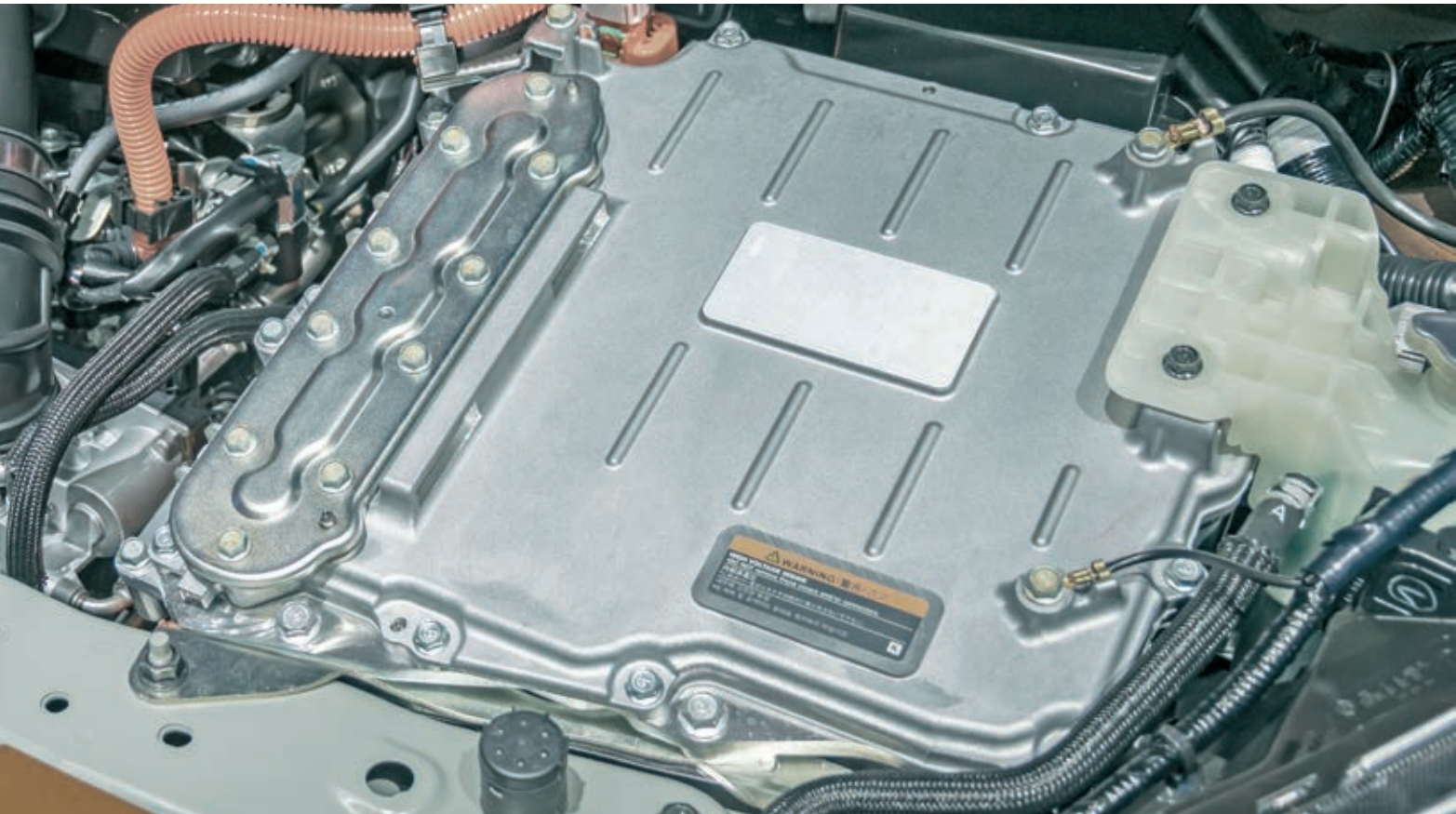


**TQ1** - The best quality for tool steel in die casting. For tools exposed to extreme conditions - large tools for structural vehicle components, tools for components in electric motor vehicles (e.g. battery housings) and dies exposed to very high flow rates. Recommended for minimal quantity spraying.

**HP1** - The premium steel for die casting that combines tailor-made properties with cost-effectiveness. For dies for highest loads and narrow tolerances (cooling fins, sealing surfaces) up to medium insert sizes. Recommended for minimal quantity spraying.

**CS1** - The solution for die casting of parts with increased demands on surface quality. A hardness of up to 54 HRC is possible. For visible parts in die casting for motorcycles, high-quality consumer products such as laptops, mobile phones and electronic components with the highest demands on surface quality. Recommended for minimal quantity spraying.

**HTR** - A remelted ESR tool steel combining very good thermal shock resistance, excellent High-temperature strengths and high thermal conductivity. For local areas and small applications that are exposed to high thermal loads, e.g. cooling blocks.



**USN ESR** - A high-quality re-melted ESR hot-work tool steel with high toughness and good high-temperature strengths. A world-wide standard for HPDC parts in many applications where tooling economy and tooling safety must be combined. Used for inserts and die plates in many areas of die casting of Al, Al-Mg and Zn-Sn-Pb.

**USD ESR** - A high-quality, re-melted ESR tool steel for aluminium, magnesium and zinc die casting moulds. Slightly lower toughness compared to USN ESR. The standard in many non-European markets.

**RPU ESR** - A tool steel with increased thermal shock resistance and high high-temperature strengths. For small and medium-sized moulds and long production units in HPDC, e.g. die casting of electric motor housings, consumer goods and casting of brass at elevated temperatures. Also the standard for ejector pins, casting pistons and shot sleeves in die casting.

**RM10Co** - A tool steel with extremely high high-temperature strengths, suitable for special requirements regarding wear at high temperatures and resistance to molten metal: die plates for die casting of brass, casting systems for hot-chamber die casting machines, casting pistons, piston rings and local inserts in shot sleeves.

**HMoD** - Hot-work tool steel with excellent wear resistance and excellent high-temperature strengths. For local areas in the gate area or distribution system, small die inserts and die casting tools for casting brass or other heavy metals, especially for thin-walled castings.

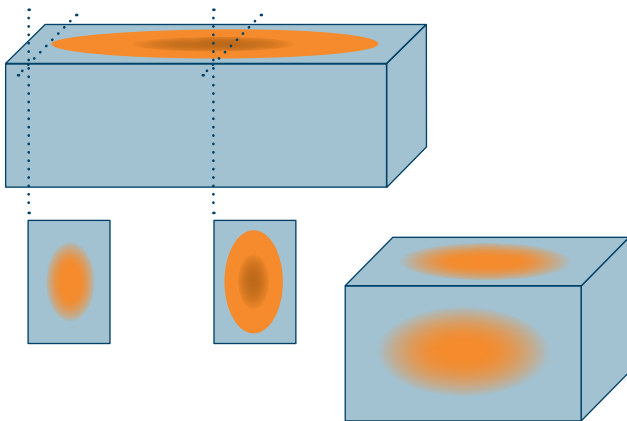


### 3D-forging

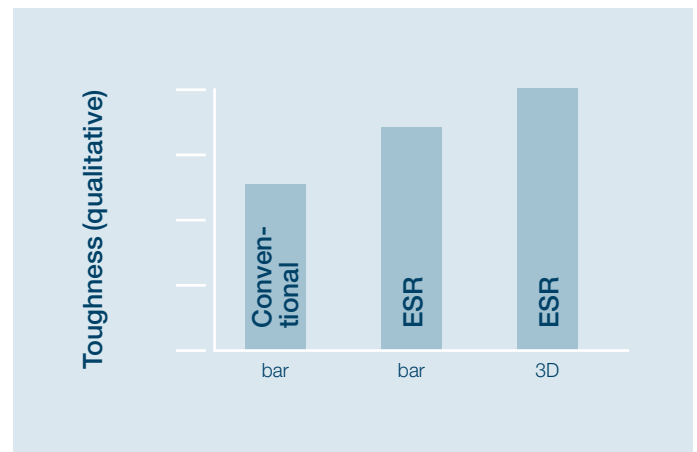
Kind&Co offers a special forging process for the forming of die-cast die steels: individual 3D forging of the die block. Selected starting material in the form of ingots and billets is forged to the customer's desired dimensions. The isotropic properties of the component are achieved by the precisely fitting deformation on our forging presses.

The fibre in the longitudinal direction is avoided and a much more homogeneous microstructure is achieved. Three-dimensional forging improves the toughness level of the steel and is, therefore, particularly recommended for larger die inserts with complex design and the highest toughness requirements.

#### 3D pieces have better quenching conditions for geometric reasons



#### 3D forging improves toughness and isotropy





## High-quality heat treatment service from a single source

For more than 40 years, Kind&Co has been known as a specialist supplier of heat treatment processes for die casting dies. With 5 vacuum furnaces and up to 6.5 tons charging weight, we are able to meet even the highest customer requirements. Due to the very high quenching performance and high cooling pressures of up to 15 bar, we can ensure excellent material properties even with large cross-sections and unit weights. Comprehensive documentation for our customers guarantees reliable and reproducible results.

Our equipment exceeds the requirements of the current NADCA, as well as Ford and GM specifications. We are known internationally by die casters and die makers as one of the leading service providers in heat treatment, even for the largest die casting dies for the production of structural parts in automotive engineering.



6.5t vacuum furnace ▲

Premium steels such as TQ1 and CS1 are characterized by a special transformation behaviour during cooling and are therefore ideally suited for large-format die inserts.

Our specialists in application technology and heat treatment will be pleased to advise you on questions concerning the determination of machining allowances and the preparation of dies for hardening and stand ready with their recommendations.

As a long-standing partner of the die casting industry, we also offer nitriding without compound layer in our Program 99. The process reduces the adhesion tendency of the melt and increases the wear resistance of the die without the usual negative influence on the formation of thermal shock cracks.

## Hardness parameters

Brand label	Hardening temperature in °C	Soaking time in minutes
TQ1	1010	60
HP1	1020	60
CS1	1030	60
HTR	1060	60
USN ESR	1000	45
USD ESR	1020	45
RPU ESR	1030	45
RM10Co	1130	45
HMoD	1130	45

We recommend 3 tempering cycles to ensure maximum toughness properties.

## Steel, pre-machining of the die contour and hardening from a single source

Due to the fully-integrated service of KC GS Tooling GmbH at the Wiehl location, we can offer extensive machining possibilities with a focus on deep hole drilling and 3D processes for die casting die inserts.

In addition, our services range from melting and forging to pre-machining of the cavity to hardening allowance - with simultaneous hardening service in our modern vacuum hardening shop. You get all these processes from one source and at one location, saving you time.

The machine park of KC GS Tooling comprises five machining centres with a maximum piece weight of 8t, various boring mills, a vertical milling machine and four deep-hole boring machines with traverse paths of up to 1250x1100x1600 mm for machining pieces weighing up to 7 tonnes.

Effective programming and work preparation support the fast and efficient processing of your production orders. All common file formats for the following CAD/CAM programs can be read and processed:

- IGS
- CATIA
- VDA
- PRT
- CAD
- other formats on request

The four deep hole drilling machines include a SAMAG TFZ2L-1000 with a travel of 1250x1100x1600mm.

Contact our sales department and book this service at no extra effort.





# Low pressure die casting (LPDC)

## Our high-quality tool steels for low pressure die casting (LPDC) applications

Applications in low-pressure casting are subject to mechanical, thermal and chemical stresses during operational use.

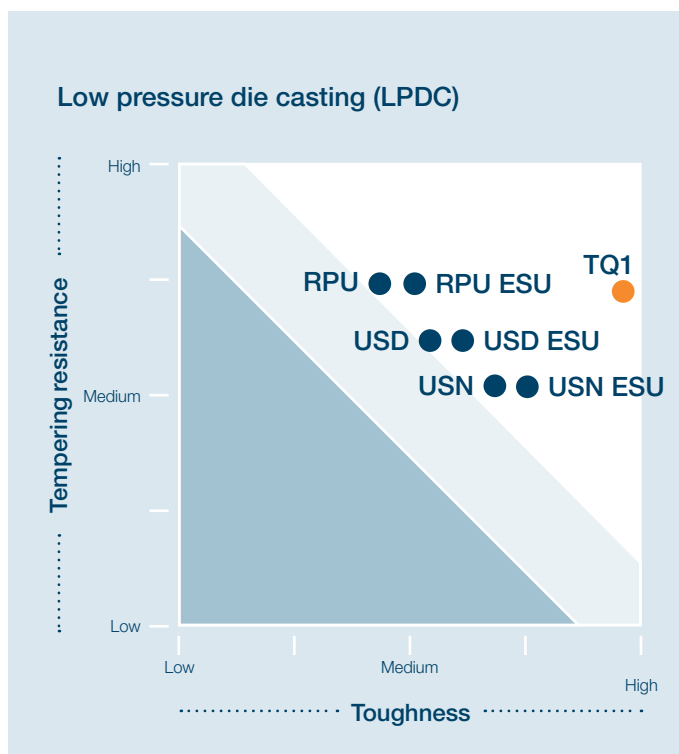
With the growing size, but also the complexity of cast components in automotive engineering - in particular a large number of structural components - the demands on dies and tool steels are increasing.

The automotive market is characterized by increasingly larger light alloy wheels on vehicles. But the rims are also becoming more and more filigree in design.

At the same time, the wheels must meet the highest safety requirements. The industrial production in casting is a special challenge for the foundryman and the die maker.

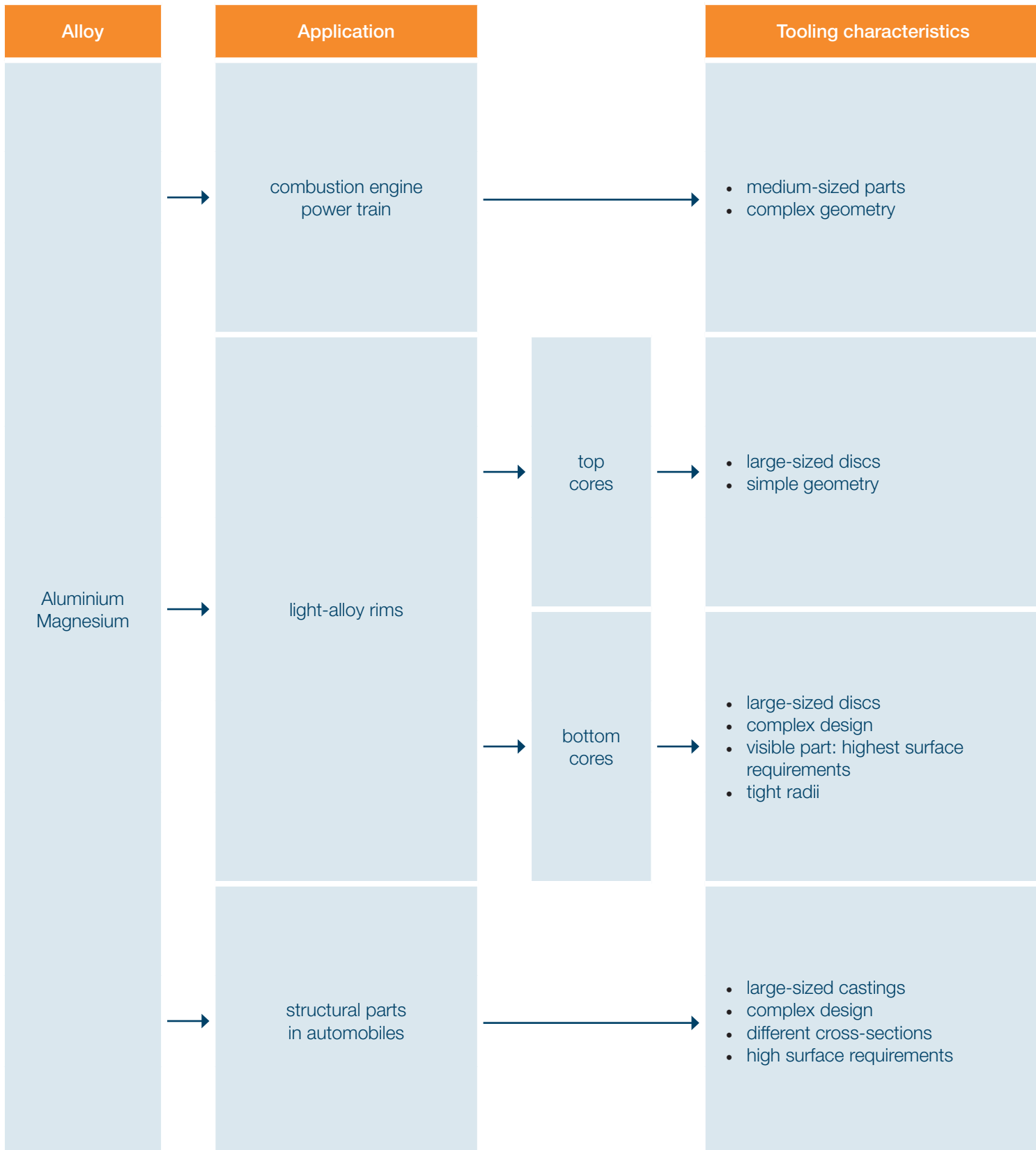
The use of steels which combine maximum toughness with very high high-temperature strength offers foundrymen new opportunities to manufacture more complex products cost-effectively. TQ1 has proved itself in this field especially for the visible side of the wheels, but also for thick-walled structural parts, e.g. in the wheel suspension.

## Modern tool steel solutions for low pressure die casting (LPDC)



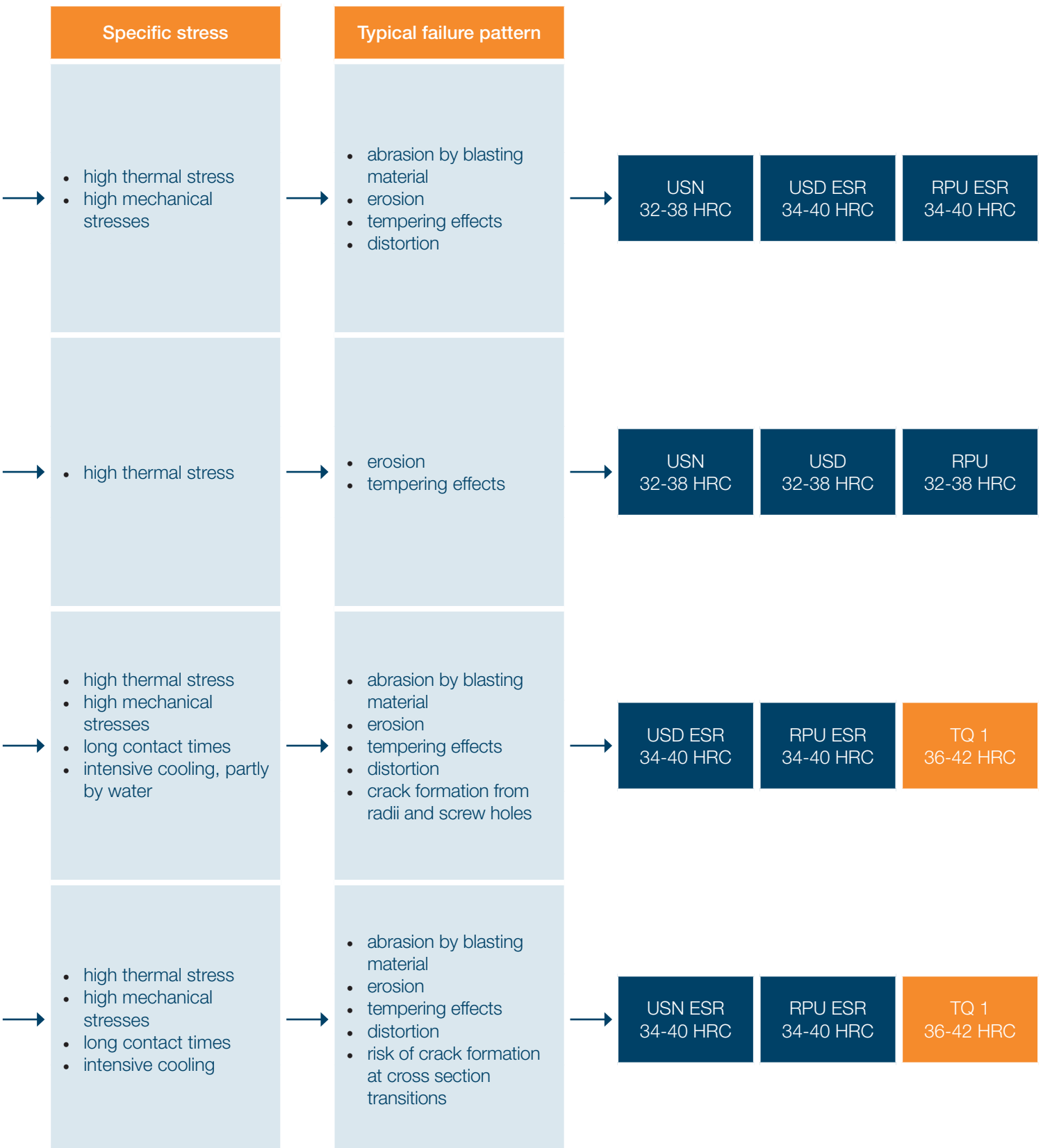
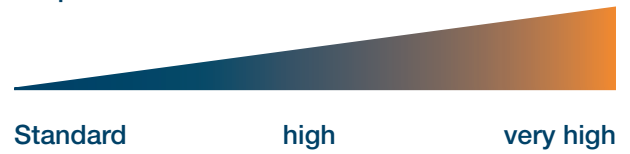
● Premium ● Good Standard







## Requirements

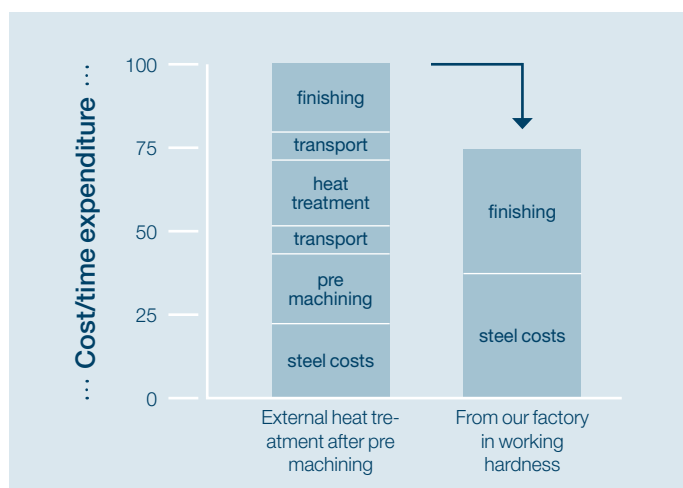


## High-quality heat treatment service from a single source

Modern bogie hearth furnaces permit economical and high-quality hardening and tempering of bars and individual pieces for low-pressure casting applications.

Water or polymer solutions are used for quenching to ensure rapid martensite transformation and a uniform, homogeneous hardening structure for our customers. A fully-automatic modern hardness testing technology ensures the high quality requirements of our customers and documents the process results.

## A heat treatment to working hardness ex works leads to cost and time savings in your company



## Highest efficiency for your application

- Save time
- Save costs
- Good machinability
- Reliable hardness
- No distortion during heat treatment
- All services from a single source

All tool steels can be supplied in the as-delivered condition in typical application hardnesses. Additional heat treatment by die maker is not necessary.

- Typical working hardness 32-42 HRC
- Other working hardness values on request
- Heat treatment with short lengths of only 1000-1300 mm ensures high homogeneity and uniform hardness of the sawn piece





## Machining recommendations

LATHE Cemented Carbide	Condition	Cutting speed Vc in m/min	Feed Fz in mm	Cutting depth ap in mm
Standard	annealed	140-200	0,40-0,90	3-10
	quenched and tempered	50-90	0,25-0,70	2-6
Premium	annealed	100-160	0,40-0,90	3-8
	quenched and tempered	30-70	0,25-0,70	2-5

FACE MILLING rounded cutter plate	Condition	Cutting speed Vc in m/min	Feed Fz in mm	Cutting depth ap in mm
Standard	annealed	120-180	0,25-0,50	2-5
	quenched and tempered	50-90	0,20-0,30	2-5
Premium	annealed	150-200	0,20-0,50	2-4
	quenched and tempered	30-70	0,20-0,30	2-4

DRILLING Solid carbide	Condition	Cutting speed Vc in m/min	Feed Fn in mm
Standard	annealed	60-100	0,15-0,30
	quenched and tempered	40-60	0,10-0,25
Premium	annealed	50-90	0,10-0,25
	quenched and tempered	40-60	0,10-0,25

DRILLING Indexable insert	Condition	Cutting speed Vc in m/min	Feed Fn in mm
Standard	annealed	180-220	0,10-0,20
	quenched and tempered	50-80	0,05-0,25
Premium	annealed	120-180	0,10-0,20
	quenched and tempered	40-60	0,05-0,25

**Standard:** USN, USD, RPU

**Premium:** TQ1, HP1, CS1

The cutting parameters are guide values. Local conditions must always be taken into account in order to choose the right values.

## Production processes

Melting

Forging

Heat treatment

Mechanical processing

Vacuum hardening

Surface treatment

## Products

Hot-work tool steels

Cold-work tool steels

Die forging steels

Plastic mould steels

## Industries

Die casting

Extrusion

Die forging

Pipe technology

Plastics technology

Hot-stamping

Special applications

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