

The premium steel for highest
surface requirements and
forming tolerances in die casting

CS1



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The surface quality of castings and thus also of the die casting die is becoming increasingly important in numerous applications. Consequently, the casting process requires correspondingly complex system components with the tightest forming tolerances and special process precision.

The premium steel CS1 improves the part quality, extends the service life of the tool and avoids costly rework costs through:

- Prevention of premature heat cracks due to excellent thermal shock resistance with increased hot yield strength and working hardness > 50 HRC
- Safety against overstressing in casting due to outstanding toughness even at the working hardness of > 50 HRC, which is typical for CS1
- Avoidance of wash-out and hot wear due to increased high-temperature strength and wear resistance compared to the hot-working steels commonly used in die casting
- Dimensional stability in casting. Dimensional stability due to high tempering resistance and compressive strength at working hardnesses of > 50 HRC
- Due to its high hardness it is often possible to save expensive coatings

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.

Requirements in die casting

Highly sophisticated cast products made of light metal alloys are becoming increasingly important worldwide. In addition to the demand for automotive structural components, demand is growing above all for vehicle interiors and for components in the field of electric drives and controls. For many of them, the industry expects very high dimensional accuracy, aesthetic finish and mechanical properties.

Cast parts made of aluminium and magnesium alloys for the electromechanical industry, as well as housings and components for the growing market of LED lighting require high precision in large quantities. These parts must fulfill a wide range of functions, from electrical conductivity and heat dissipation to high efficiency. The highest demands are placed on the corresponding cast products in terms of dimensional stability, surface finish and mechanical properties.

Digitalization in particular is bringing die casting as a manufacturing process increasingly into focus. With the establishment of the new mobile phone standard 5G, the demand for die cast components is increasing at an unprecedented rate. In particular, equipment for mobile phone masts such as cast aluminium housings for radio frames and covers, filters and amplifier packages in the field



of mobile communication with high frequency requirements are mechanically very demanding. For optimum performance, highest positional accuracy is expected for the part casted.

Corresponding die casting moulds, therefore, require excellent die performance with high repeatability. Especially under the aspect of cost-effective production, costly reworking steps can be saved with an already high surface quality after casting.

For these applications Kind&Co has developed the steel CS1, a premium steel with the highest resistance to thermal shock and hot wear.



Material properties CS1

CS1 is a Cr-Mo-V alloyed hot work tool steel of the highest purity and homogeneity. High toughness properties are ensured by special additives and special process diligence.

CS1 offers a particularly high resistance to the formation and propagation of thermal shock cracks due to its special combination of properties including an exceptionally high working hardness, high tempering resistance, and high toughness. The steel thus significantly extends the service life of tools for sensitive components and their quality.



CS1 enables in particular

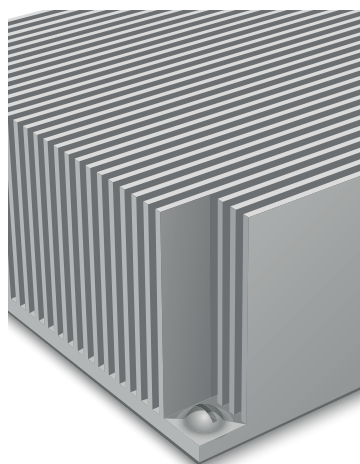
- Excellent moulding performance with high repeat accuracy
- Minimisation of rework
- Precision and economy
- High production reliability



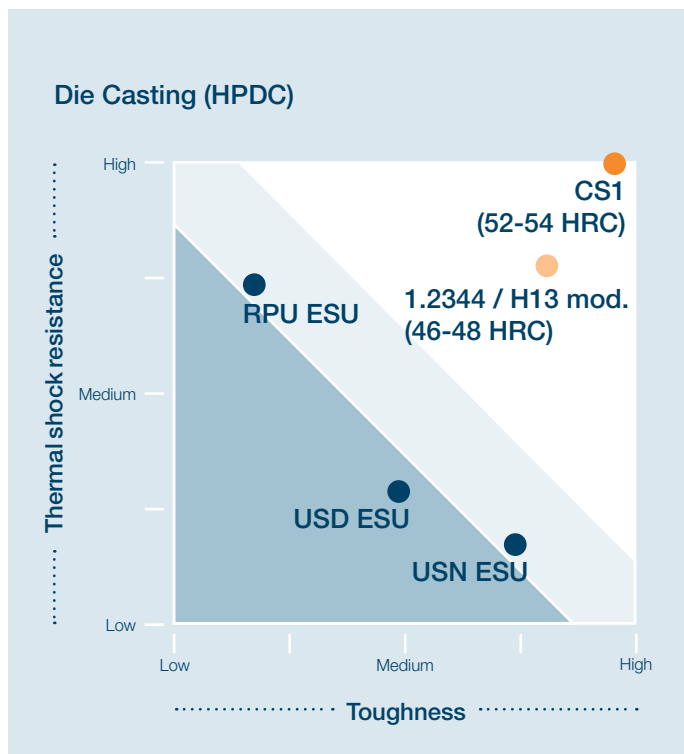
Applications

CS1 for the highest demands for moulds for the production of

- precise castings with fine and complex structures
- parts with low wall thickness
- parts with tightest shape tolerances and highest positional accuracy in the casting
- parts where mounting surfaces, fits, grooves and connecting dimensions are cast to finished size
- sophisticated surface contours and painted surfaces
- cast parts with high optical demands and high flatness
- parts with high demands on functionality
- cast parts for interlocked assemblies
- housings with highly stressed sealing areas



Comparison of material characteristics

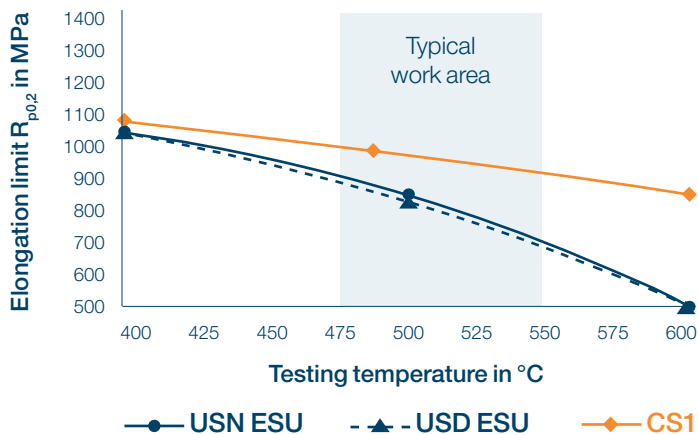


CS1 offers an excellent combination of toughness and thermal shock resistance.

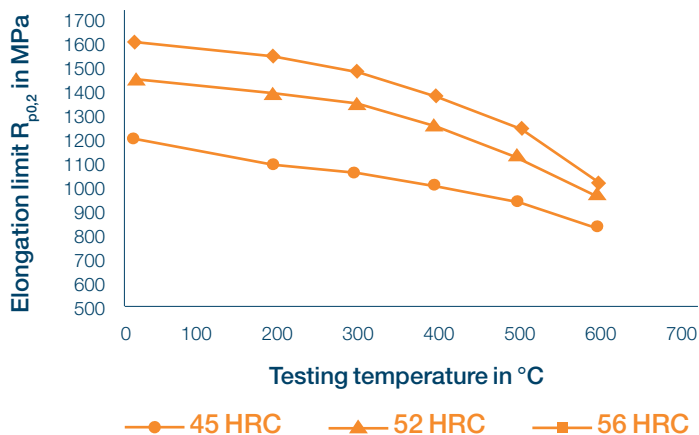


▲ Brake caliper of a motorcycle in aluminum alloy

Material comparison: Heat resistance at different working temperatures



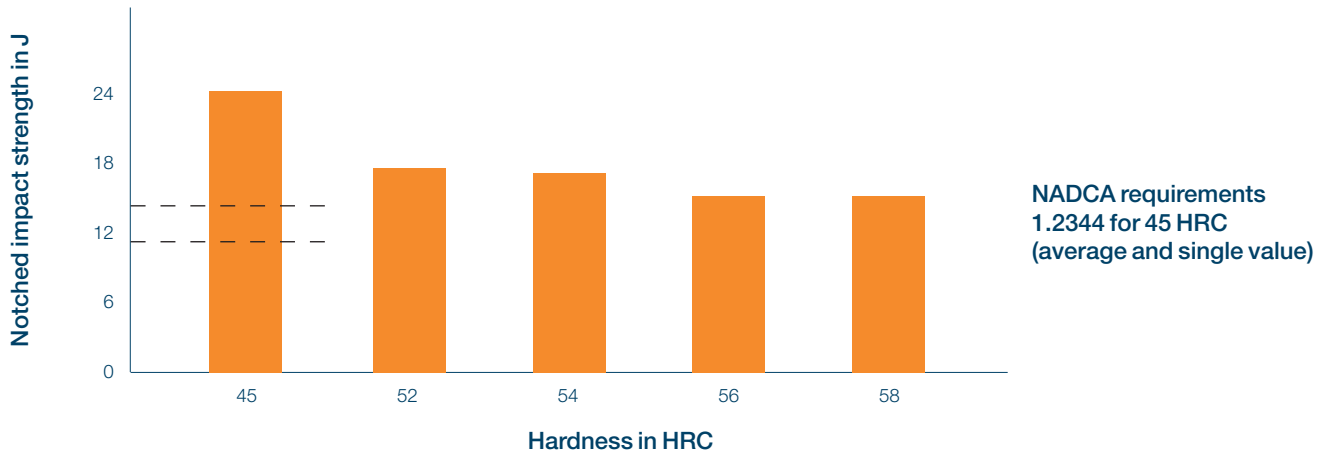
Heat resistance CS1 at different hardness levels



The high yield strength of CS1 even at elevated temperatures contributes significantly to the prevention of thermal shock cracks.

Thanks to its high toughness level, CS1 can also be used for high hardnesses of up to 56 HRC. This increases the high-temperature strength and reduces the risk of thermal shock cracks.

CS1 exceeds the toughness requirements of NADCA even at high working hardnesses



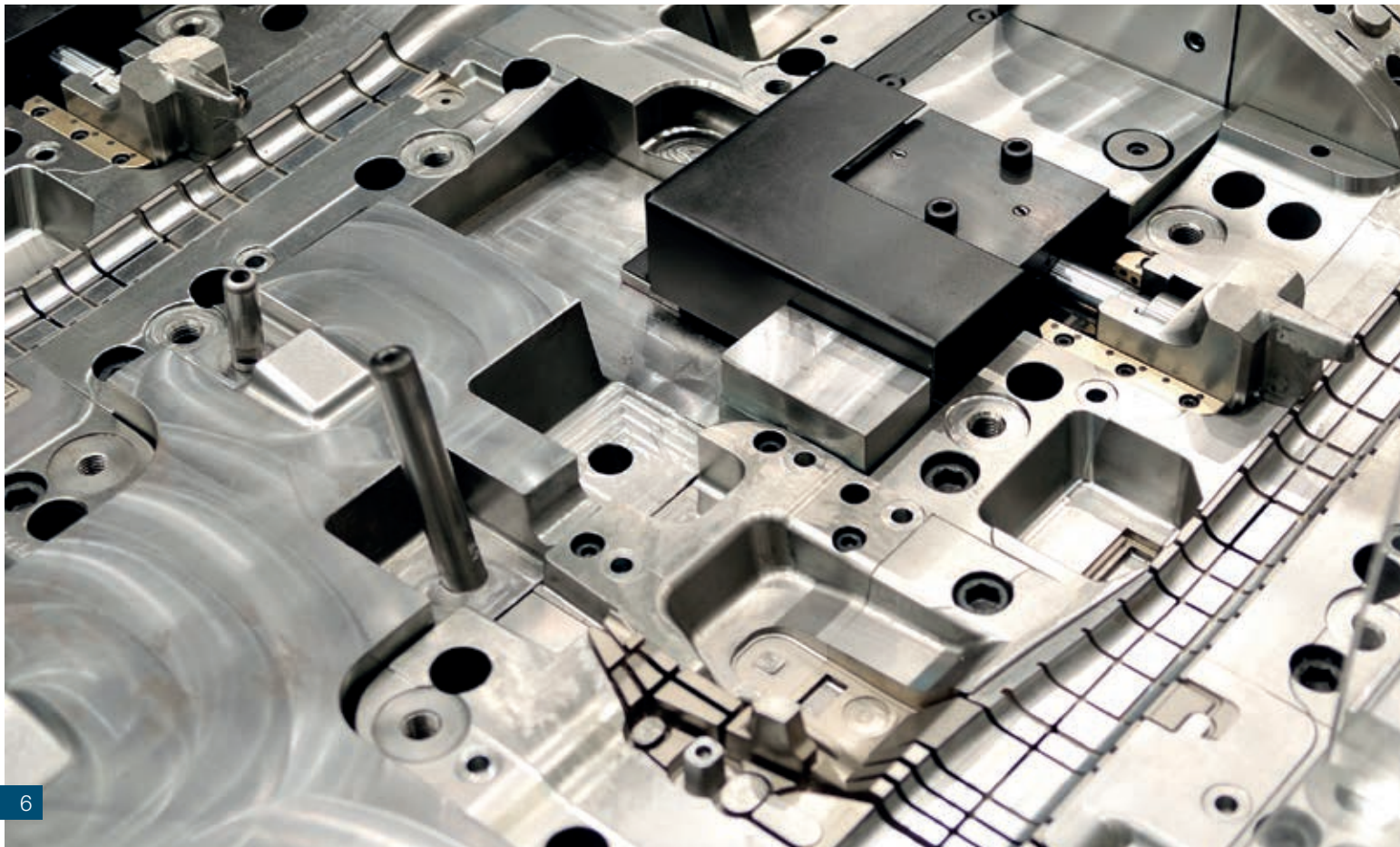
Test conditions

Sample material 230 mm Ø

Specimen position cross / transition

HT carried out in vacuum hardening on Charpy-V specimens

CS1 meets all NADCA requirements for premium steels



CS1 - Premium hot work tool steel for complex system components in die casting

Throttle body

High demands on the surface quality, as the seal is not mechanically processed after casting. With 1.2343 ESR frequent reworking with a maximum service life of 90,000 shots.

Use with CS1 at 52 HRC is > 90,000 shots without significant reworking and results in a much lower total tool cost of only 37% of the cost with the previously used steel.

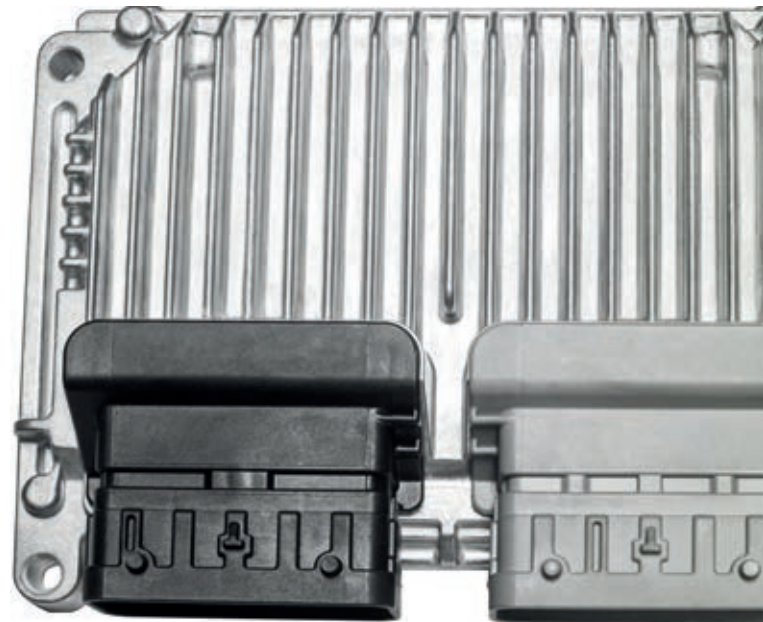


Cast cover - storage unit

Very high tightness requirements of the component led to first defects of the inserts made of 1.2343 ESR after about 5,000 shots.

The mould made of CS1 with 53 HRC produced 7,100 shots without any conspicuities.

Finally, the mould produced 50% more parts than the mould made of 1.2343 ESR.



Motorbike brake lever holder

Large visible surface, which led to the rejection of the mould from 1.2343 ESR after already about 3,500 shots. In use, the CS1 mould achieved 24,000 shots at 56 HRC.



Die casting of 5G components in telecommunications with moulds made of CS1

The 5G communications infrastructure that will drive the performance of international mobile telecommunications in the coming years requires high quality and cost effective die cast components. The mobile 5G data traffic leads to a high demand for devices in signal reception systems, local servers and terminals and thus for filters, heat sinks and heat dissipating housings. „Larger, thinner, lighter“ is driving die casting in telecommunications.

Base stations with appropriate components require not only a fast and intensive introduction with 5G devices, but also more sophisticated designs for faster performance and higher cooling rates. Precision and cost effectiveness are the demands that foundries are increasingly facing to meet the changes in light metal casting and to take advantage of the new business opportunities that the introduction of the new mobile phone standard will bring.

Cast heatsinks cover even the most demanding requirements and are often used without additional finishing. Cooling fins, mounting holes and fasteners are produced simultaneously. Cast pin fin designs provide greater surface area in certain areas of the product and better alignment flexibility.

Compared to the previous requirements for 3G and 4G devices, the cooling fins are more complicated because they are much higher and thinner. As the base station and units are larger and much more complicated, new demands are placed on foundries and die makers.





The tools must produce larger castings with

- better surface quality
- better mechanical properties
- thinner walls and lower weight

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

With our premium steel CS1 Kind&Co accompanies the entire network of die makers, heat treatment service providers and foundries for die casting in the field of 5G technology and offers a product with all the properties to ensure precision and economy.

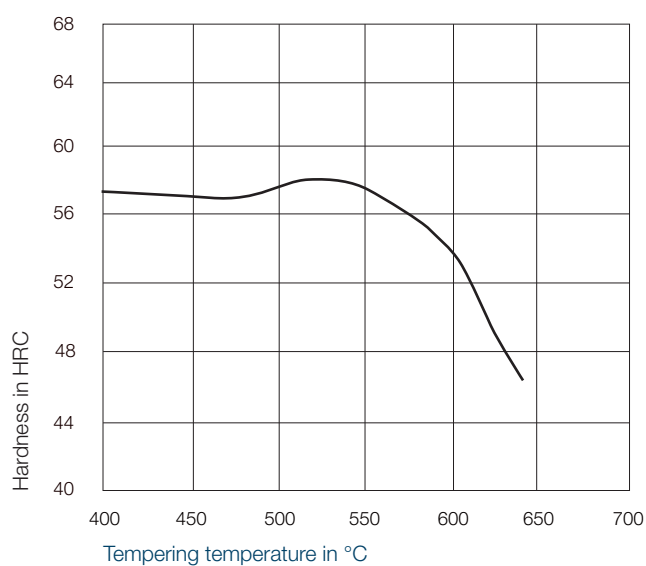


Hardness recommendation

Brand name	Austenitisation temperature in °C	Holding time in minutes
CS1	1030	60

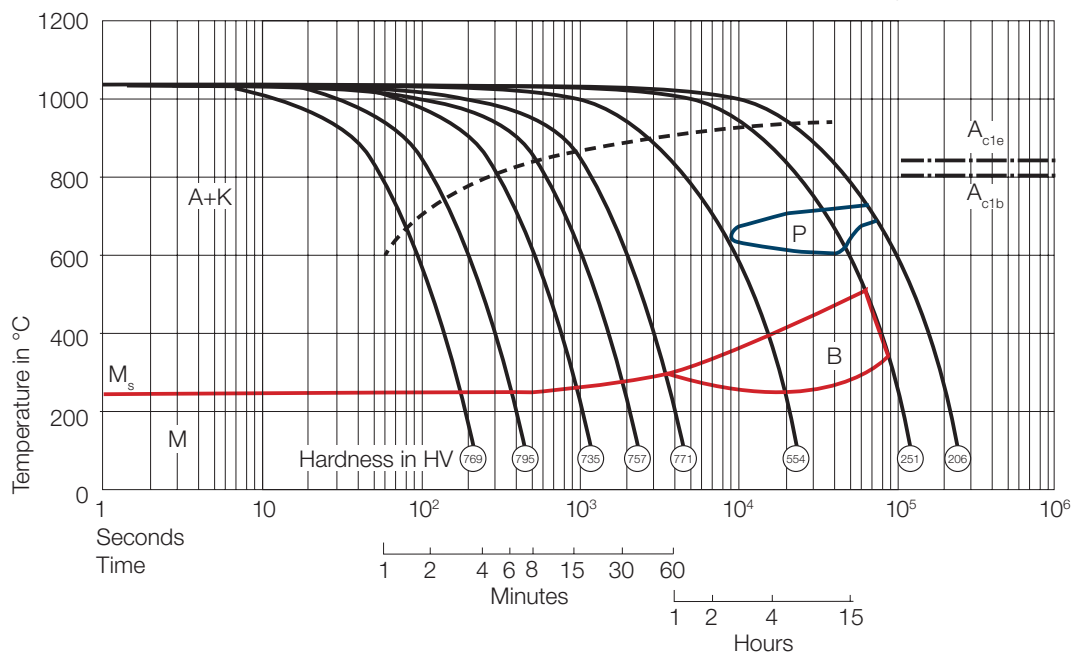
We recommend a 3 times tempering to ensure maximum toughness properties.

Tempering diagram



TTT diagram / Austenitisation: 1030°C

Austenitisation temperature 1030 °C



Machining recommendations

	Roughing	Finishing
Cutting speed v_c in m/min	175	200
Feed z_f in mm/tooth	1	0,3
Cutting depth a_p in mm	1,2	0,7

	Roughing	Finishing
Cutting speed v_c in m/min	125	155
Feed z_f in mm/tooth	0,4	0,25
Cutting depth a_p in mm	0,6	0,15

Face milling in soft annealed condition (hardness max. 230 HB)

- Milling with coated carbide
- High feed milling cutter \varnothing 80 mm (Inserts: Ingersoll SDXS1305MPR IN4005)
- CNC machining centre from YCM (DCV-2012B)

Face milling in hardened and tempered condition (hardness 52-53 HRC)

- milling with coated carbide
- Rough machining with cutter head \varnothing 52 mm (inserts: Aura S10NA)
- finishing with ball milling cutter \varnothing 12 mm (insert: Aura D12NA)
- CNC machining centre from YCM (DCV-2012B)

The cutting data mentioned above serve as an orientation. They are tested and proven parameters under the above mentioned conditions. The local conditions must always be taken into account when selecting the appropriate 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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