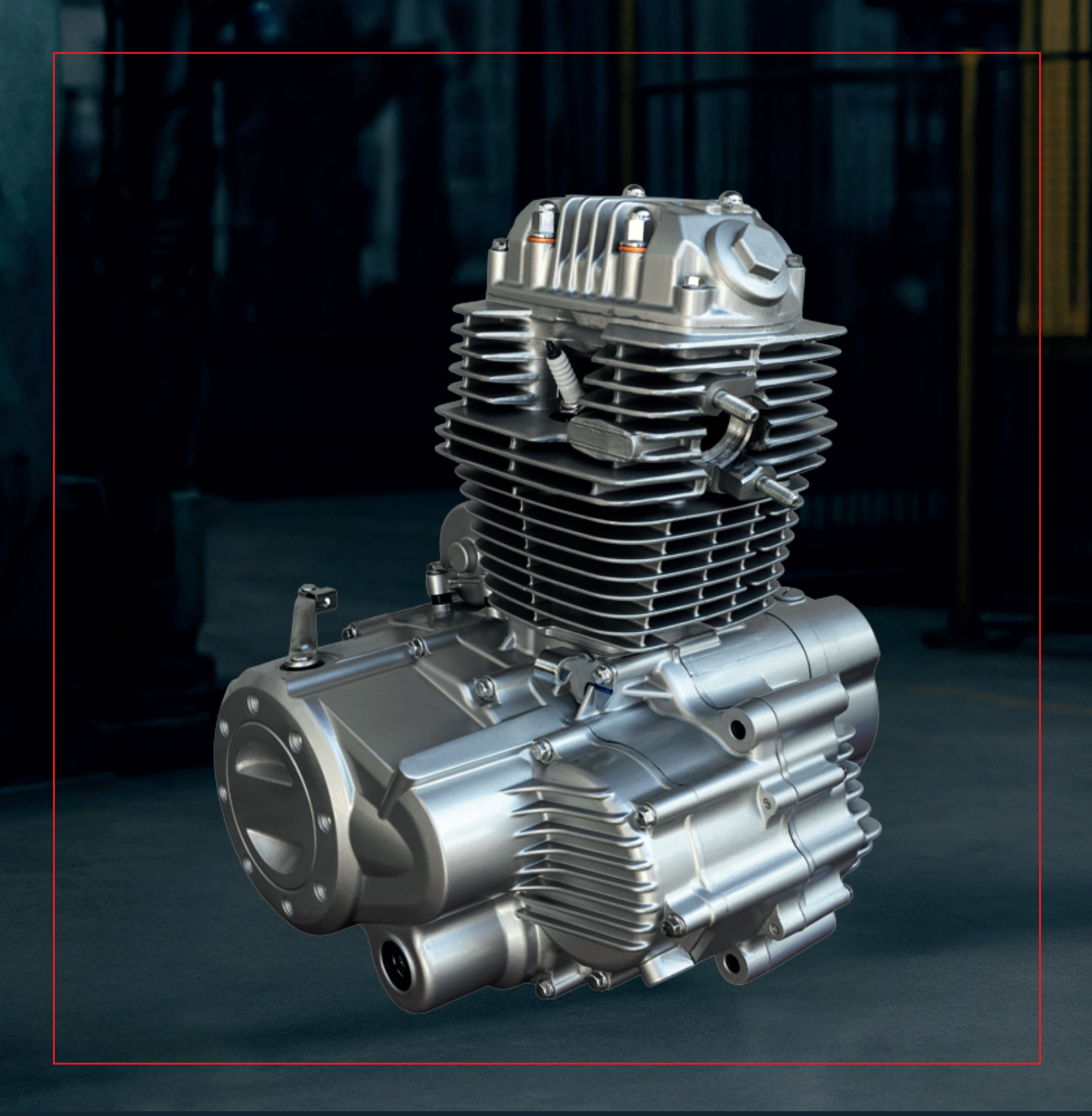

The premium steel for highest surface requirements and forming tolerances in die casting

CS1

Edelstahlwerk Kind & Co.
GMH GRUPPE
Pure Performance

WHEN YOUR CASTINGS DEMAND FLAWLESS SURFACES, TIGHT TOLERANCES AND RELIABLE REPEATABILITY, YOUR DIE STEEL CANNOT COMPROMISE.

CS1

Edelstahlwerk Kind & Co.
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Pure Performance

CS1 is the premium hot-work tool steel for demanding die casting applications where surface quality, dimensional accuracy and process stability directly impact productivity and cost efficiency.

THE MARKET REALITY

Your castings are getting harder to make. Your die steel should not limit performance.

From 5G antenna housings to EV control housings and premium consumer electronics, today's die-cast components require:

- tighter tolerances
- thinner walls
- higher surface quality
- stable high-volume production

Every rework step, premature tool failure or surface defect increases manufacturing cost and reduces process efficiency.

THE SOLUTION

CS1: Engineered for demanding HPDC applications.

CS1 is a Cr-Mo-V alloyed premium hot-work tool steel of exceptional purity and homogeneity, developed by Kind & Co. for die-casting applications where surface quality and dimensional precision are critical.

Its combination of:
- working hardness
- excellent tempering resistance
- superior toughness
- high thermal shock resistance

helps prevent crack formation and significantly extends tool service life under demanding thermal and mechanical load.

Thermal shock cracks
Repeated thermal cycling causes conventional die steels to crack prematurely, resulting in unstable tool life and increased maintenance.

Surface rework
Early surface degradation can require costly finishing operations and reduce the efficiency of near-net-shape production.

Dimensional instability
Sealing surfaces, assembly fits and mounting points cast to finished size require consistent dimensional repeatability across long production cycles.

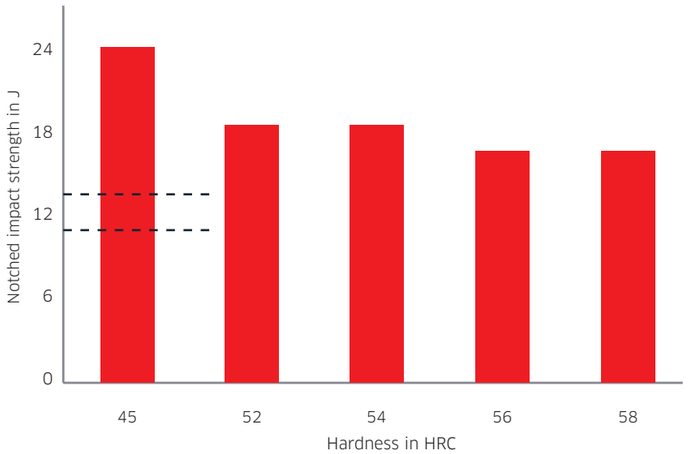
50+ HRC Working Hardness
CS1 maintains outstanding toughness at working hardnesses above 50 HRC – where conventional steels often reach their limits. This combination improves process reliability and reduces the risk of overstressing cracks.

Wear Resistance
High-temperature strength and wear resistance help prevent wash-out and erosion in critical tool areas, preserving surface quality and dimensional stability.

Thermal Shock Resistance
The combination of high hardness, tempering resistance and toughness provides exceptional resistance to thermal shock crack formation and propagation – supporting stable production over long operating cycles.

Documented Tool Cost Reduction
In a throttle body die application, CS1 at 52 HRC exceeded 90,000 shots without significant rework, reducing total tool cost to only 37% of the benchmark steel solution.

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



NADCA requirements
1.2344 for 45 HRC
(average and single value)

Test conditions
Sample material: 230 mm Ø
Specimen position : cross / transition

HT carried out in vacuum hardening on Charpy-V specimens

CS1 is included in NADCA #207 since 2024

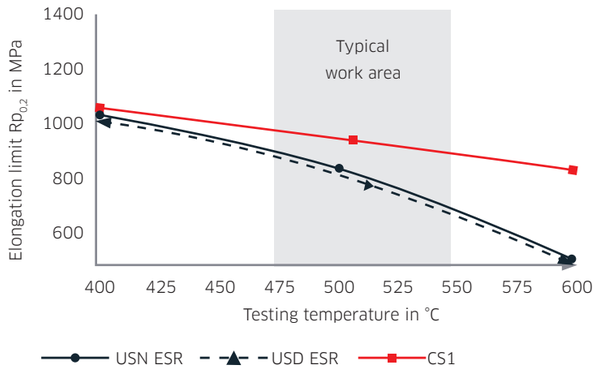
METALLURGICAL PERFORMANCE

Validated for Demanding HPDC Applications

CS1 combines high thermal shock resistance, toughness and high-temperature strength – properties critical for stable long-term die casting performance under extreme thermal cycling.

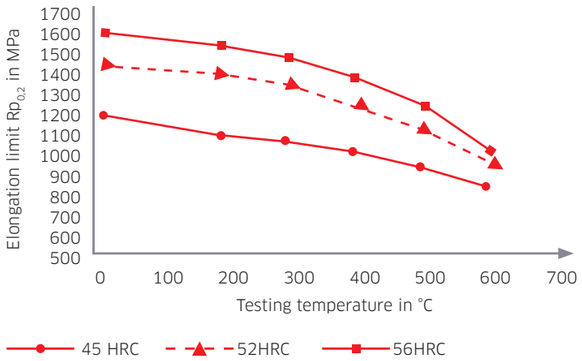
The following comparisons illustrate the metallurgical foundation behind improved tool life and dimensional stability in demanding HPDC applications.

Material comparison: Heat resistance at different working temperatures



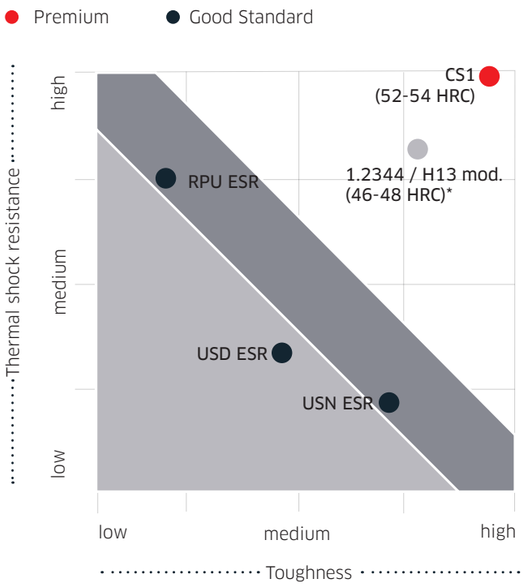
The high yield strength of CS1 even at elevated temperatures contributes significantly to the prevention of thermal shock cracks.

Heat resistance CS1 at different hardness levels

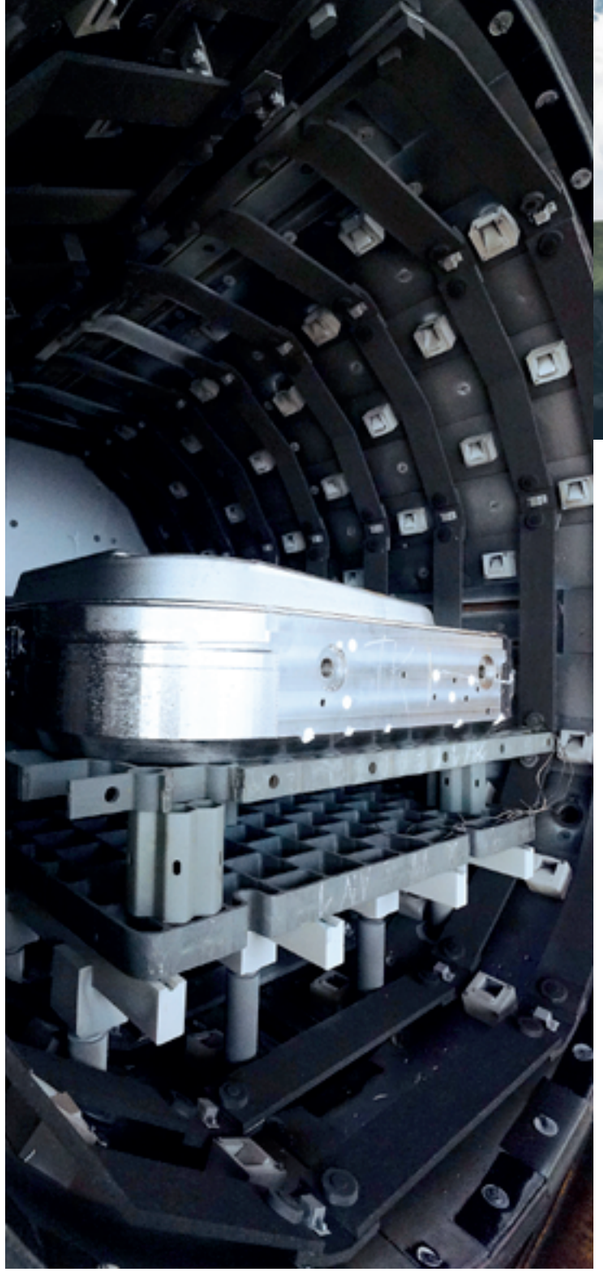


Thanks to its high toughness level, CS1 can also be used for high hardnesses of up to 56 HRC. This increases the high-temperature strength and reduces the risk of thermal shock cracks.

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



* Comparative positioning based on publicly available data for competing die steel alloys.



THROTTLE BODY | SEALING APPLICATION

High surface quality requirements without mechanical post-processing after casting.

With standard 1.2343 ESR:
- frequent rework
- maximum service life of approx. 90,000 shots

With CS1 at 52 HRC:
- 90,000 shots without significant rework
- significantly lower total tool cost

CAST COVER | STORAGE UNIT | TIGHTNESS-CRITICAL

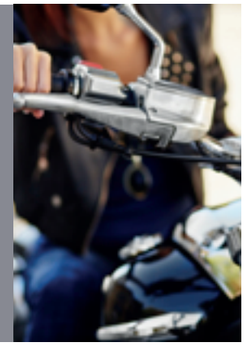
Very high tightness requirements under demanding production conditions.

Compared to 1.2343 ESR:
- 50% longer service life
- stable production without early defects during initial production cycles

MOTORBIKE BRAKE LEVER | LARGE VISIBLE SURFACE

Large painted surfaces with high demands on surface quality and mould durability.

Compared to 1.2343 ESR:
- 24,000 shots at 56 HRC
- benchmark steel rejected after approx. 3,500 shots



APPLICATIONS

CS1 is designed for demanding die-casting applications requiring:
- precise castings with complex structures
- mounting surfaces and fits cast to finished size
- highly stressed sealing areas
- thin-wall components
- demanding surface quality for painting or visible parts
- tight shape tolerances and positional accuracy
- reliable production of high-value components

Typical applications include:
- EV motor and control housings
- 5G and telecommunications components
- LED lighting components
- premium consumer electronics
- interlocked assemblies with fit-to-function requirements

CASE STUDIES | CS1

Measurable improvements in tool life, surface quality and process stability

Throttle Body | Sealing Application

Application	Previous grade	Main challenge	Result with CS1	Operational benefit
Throttle body die casting with high surface quality requirements and no mechanical post-processing after casting.	1.2343 ESR	Frequent rework and unstable tool life caused by thermal cracking and surface degradation.	More than 90,000 shots at 52 HRC without significant rework.	Significantly lower total tool cost and improved process stability.

Cast Cover | Tightness-Critical Component

Application	Previous grade	Main challenge	Result with CS1	Operational benefit
Storage unit casting with high sealing and dimensional accuracy requirements.	1.2343 ESR	Early defects in highly stressed insert areas during production startup.	First defects occurred in the benchmark 1.2343 ESR inserts after approximately 5,000 shots. CS1 at 53 HRC achieved 7,100 shots without defects and ultimately delivered 50% longer service life.	Stable production without early defect formation during critical production phases

Motorbike Brake Lever Holder

Application	Previous grade	Main challenge	Result with CS1	Benchmark comparison
Large visible surface component with high surface quality requirements.	1.2343 ESR	Premature mould rejection caused by surface degradation.	24,000 shots at 56 HRC. Benchmark: 1.2343 ESR rejected after approximately 3,500 shots	Benchmark steel rejected after approximately 3,500 shots.

5G Telecommunications Components

Application	Main challenge	CS1 contribution	Operational benefit
Die casting moulds for 5G infrastructure components including heat sinks and electronic housings.	Complex thin-wall geometries requiring: ▪ high dimensional accuracy, ▪ excellent surface quality, ▪ and stable repeatability.	High thermal shock resistance and dimensional stability support reliable production of complex lightweight components.	Improved casting precision and reduced rework requirements in high-volume production.

Application	Verified Result
Throttle Body	90,000 shots, tool cost reduced to 37%
Cast Cover	7,100 shots without defects, 50% longer service life
Brake Lever Holder	24,000 shots vs 3,500 shots benchmark

Machining recommendations

	Roughing	Finishing
Cutting speed vc (m/min)	175	200
Feed zf (mm/tooth)	1	0.3
Cutting depth ap (mm)	1.2	0.7

Face milling in soft annealed condition (hardness max. 230 HB)
- Milling with coated carbide
- High feed milling cutter Ø 80 mm (Inserts: Ingersoll SDXS1305MPR IN4005)
- CNC machining centre from YCM (DCV-2012B)

	Roughing	Finishing
Cutting speed vc (m/min)	125	155
Feed zf (mm/tooth)	0.4	0.25
Cutting depth ap (mm)	0.6	0.15

Face milling in hardened and tempered condition (hardness 52-53 HRC)
- milling with coated carbide
- Rough machining with cutter head Ø 52 mm (inserts: Aura S10NA)
- finishing with ball milling cutter Ø 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.

TECHNICAL DATA

Material Properties & Heat Treatment

CS1 is a Cr-Mo-V alloyed premium hot-work tool steel manufactured to the highest standards of purity and homogeneity. It meets NADCA requirements for premium steels across the full working hardness range.

Parameter	Value/Recommendation	Notes
Alloy system	Cr-Mo-V premium hot-work steel	Highest purity and homogeneity grade
Working Hardness	52-54 HRC (up to 58 HRC possible)	Higher hardness = high-temp strength, lower thermal crack risk
Austenitisation temperature	1030 °C	Soaking time: 60 minutes
Tempering recommendation	Triple tempering	Ensures maximum toughness properties
NADCA approved	Meets all requirements for premium steels	Verified by Charpy-V testing
Coating compatibility	Coating possible but often unnecessary	High hardness frequently makes expensi-ve coating unnecessary

ABOUT KIND & CO.

136 years of tool steel expertise.

Since 1888, Kind & Co. has produced high-quality tool steel exclusively at its Bielstein site in Germany. As a family-owned business and part of the GMH Gruppe, we combine the stability of long-term partner with the investment capacity of an industrial group. Our expertise is not general – it is deep and specific. Die casting, extrusion, and die forging are not market segments we serve. They are the disciplines we have mastered.

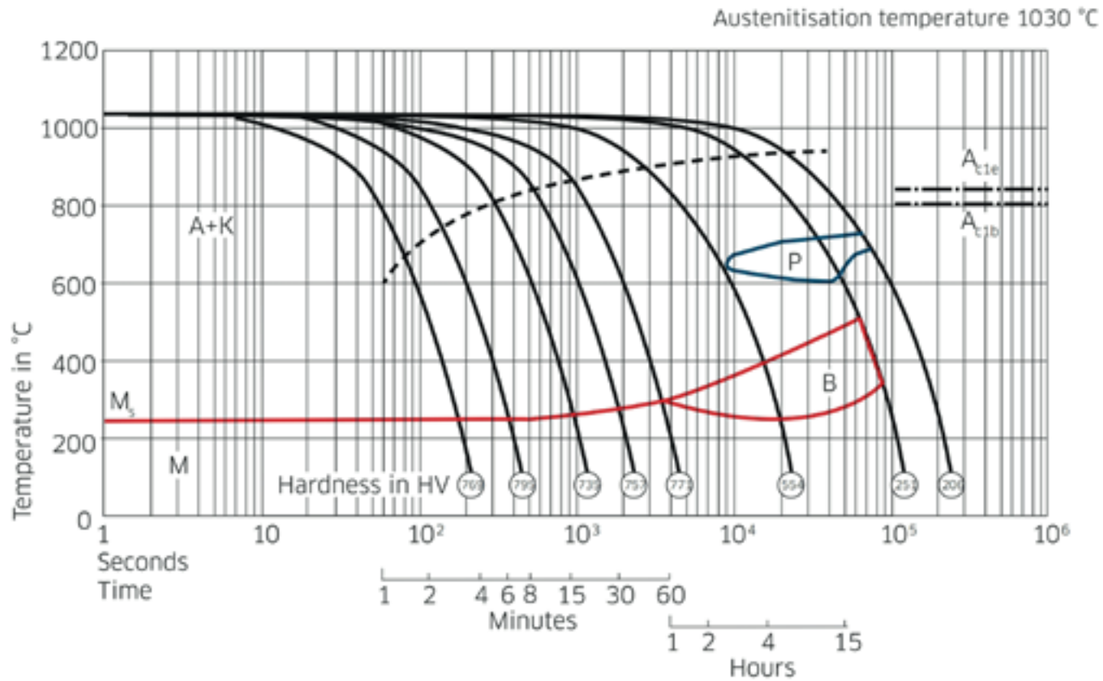
When you work with Kind & Co., you get direct access to application engineers who understand your die casting process – not just the steel. We are your technical partner from material selection though heat treatment, with all services under one roof.

Heat Treatment Guidelines for Optimal Performance

CS1 achieves its full performance potential through controlled heat treatment and tempering parameters.

The following diagrams provide recommended processing conditions for achieving the required combination of toughness, thermal shock resistance and working hardness in demanding HPDC applications.

Continuous cooling transformation diagram

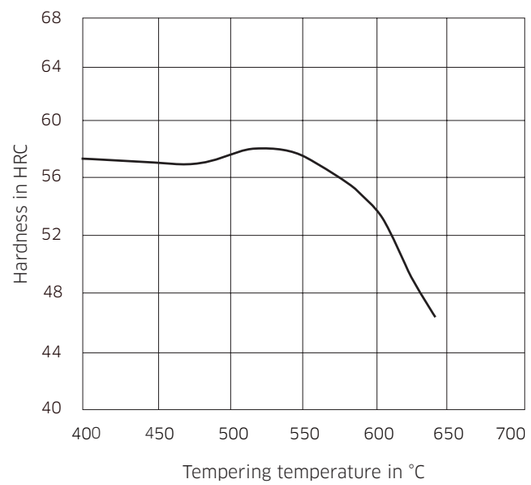


Hardness recommendation

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



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