



The use of CS1 in die casting

Bielstein, November 12, 2019

Premium hot-work steel CS1 for high surface requirements and high working hardness

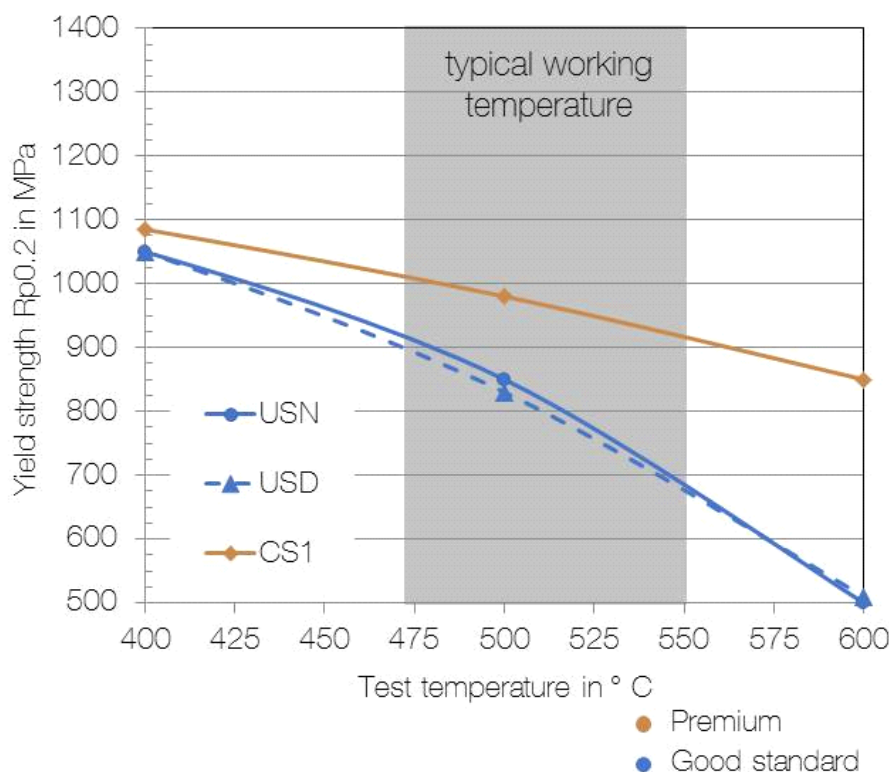


- In particular, thermal shock cracks are responsible for 80 % of die casting moulds failures. The demands on the surface quality, especially with visible surfaces or mounting surfaces, are already high and will continue to increase.
- With a significantly higher working hardness, as can be achieved with CS1, the hot yield strength and thermal shock resistance are significantly improved. Likewise, the high attainable hardness can make any possible nitration of the mould redundant.
- In addition, a very good long-term tempering resistance significantly reduces a hardening decrease in the applied areas.

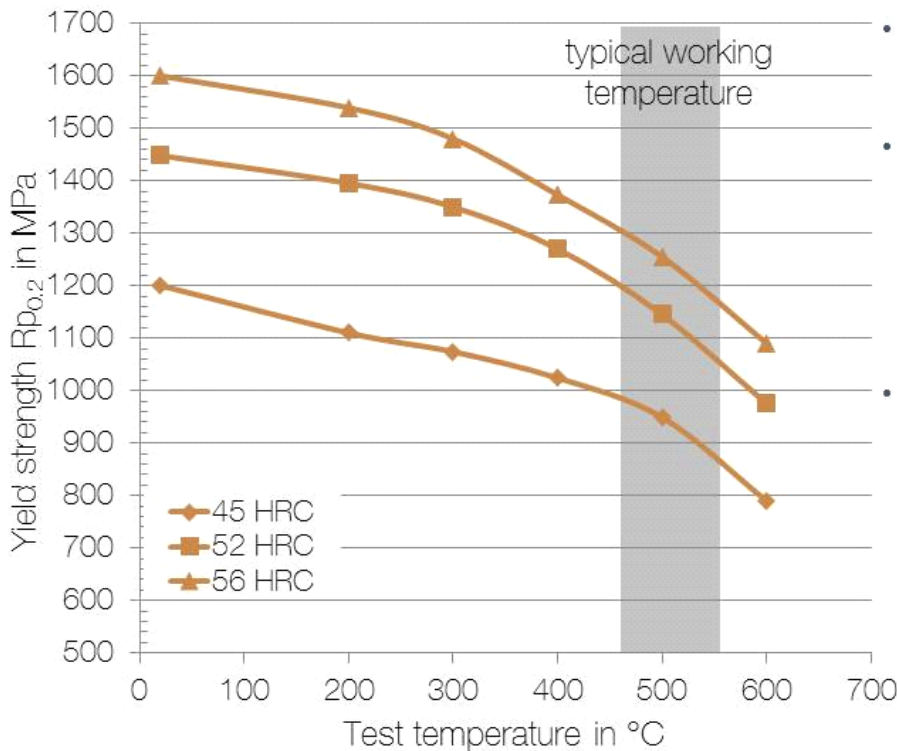
- The material CS1 is a chrome-molybdenum-vanadium hot-work steel, which was specially designed for mechanically stressed tools.
- By combining a tailor-made alloy concept, manufacturing processes with the highest level of purity and optimum heat treatment, the CS1 offers the possibility of high hardness combined with a very high level of toughness.
- CS1 has excellent wear resistance and excellent polishability and thus meets the highest demands on surface quality.
- The hot-working steel CS1 has a good dimensional stability during heat treatment and in use.

Steel		Alloy content in mass%							
Brand	M.-No.	C	Si	Mn	Cr	Mo	V	W	Nb
CS 1	---	0,50	0,30	0,40	5,00	1,90	0,55		+

CS1 has significantly higher strength at typical working temperatures

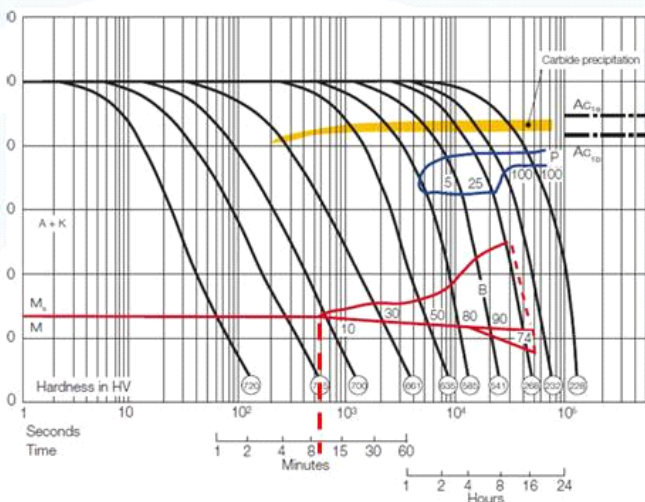


- The premium hot-working steels CS1 has a higher strength even with increasing test temperatures in the range of typical working temperatures.
- As a result, an even higher hot-strength limit can be achieved.
- In addition, the CS1 has excellent resistance to the formation of thermal fatigue cracks (heat cracking).
- CS1 is therefore very well suited for tools with the highest surface requirements.



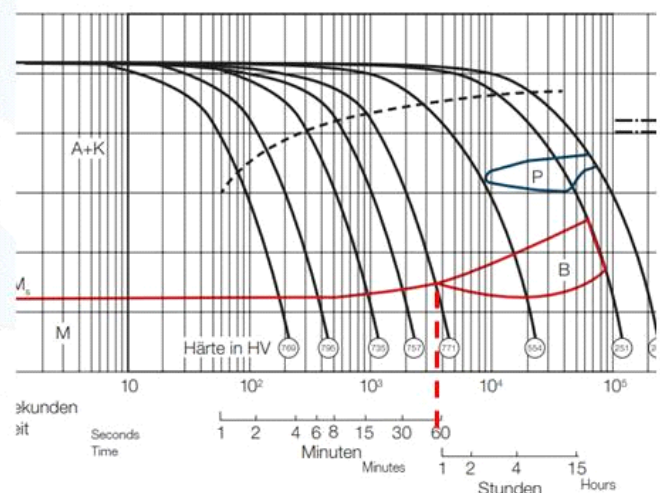
- The alloy of CS1 allows hardness values up to 56 HRC.
- In addition to the improved heat crack resistance, a higher working hardness also allows the flexible adjustment of the material with regard to wear resistance.
- The CS1 hardness window available for optimization is well above the hardness window of standard materials.

The delayed bainitic transformation of CS1 enables the hardening of large parts with greater safety



Time-temperature diagram USN

- Occurrence of the unwanted bainitic phase after approx. 10 minutes.
- Despite high quench pressure and strong circulation, it is difficult to reliably hit this narrow process window with large pieces.



Time-temperature diagram CS1

- Manifestation of the unwelcomed bainite phase only after about 60 minutes.
- This means that mould inserts can also be hardened martensitically with greater safety in the core.
- With 1030 °C and 60 minutes hold time, the CS1 has usual hardness parameters.



Motorcycle brake lever holder

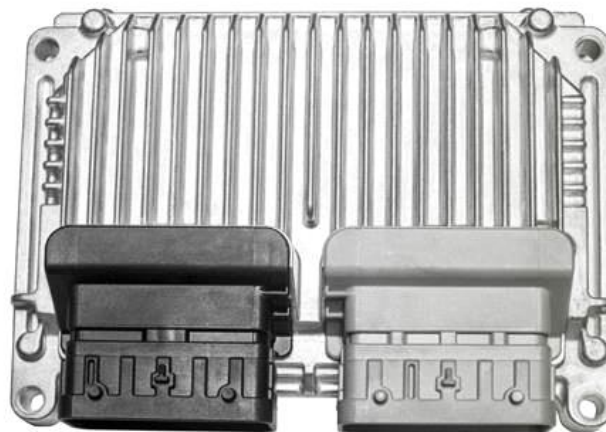
- Large visible surface, which led to the rejection of the die after about 3,500 shots.
- In a recent attempt, the CS1 die reached up to 13,000 produced pieces at 53 HRC.



Throttle body

- High surface finish requirements demanded frequent reworking in the 1.2343 ESU mould, resulting in a maximum life of 90,000 shots.
- A current attempt at a CS1 die with 52 HRC is without significant reworking at 80,000 shots. The result is still pending.

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Cast cover – memory unit

- Very high sealing requirements of the component led to first defects of the inserts from 1.2343 ESU after about 5000 shots.
- In a recent experiment, the CS1 mold with 53 HRC has so far achieved 7100 rounds without any abnormalities.
- The trial is still ongoing.

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