

HSX® STEELS FROM STEELTEC

FURTHER PROGRESS MADE IN HIGHER-STRENGTH STEEL SOLUTIONS

With their new higher-strength HSX® steels, Steeltec AG, part of the Schmolz + Bickenbach Group, has managed to balance high strength and good machining properties. While sulphur content typically improves machinability, the latest developments have allowed Steeltec to significantly reduce the sulphur content of HSX® steels, while at the same time maintaining good machinability. Components that are highly-stressed are more stable as a result.

Furthermore, the extensive characterisation of the HSX® series' physical properties is a further new development. This enables magnetic characteristic values to be combined with mechanical material properties for example. This sets a precedent for complex components to be designed in a completely new and exceptionally economical way in the future.



The drive shaft is an increasingly loaded component, which has to withstand a growing changing load when the input power increases.

Based in Switzerland, Steeltec AG is one of Europe's leading bright steel manufacturers. By focussing on high-strength and higher-strength special steels as well as special free-cutting steels, it has established itself as an important partner for the automobile, hydraulics and machine manufacturing industries. Steeltec collaborates with customers, suppliers and research institutes to further develop steel and steel production methods.

Higher-strength special steels: HSX®

The HSX® series stands out even in delivery condition thanks to its higher strength and good machinability. It comprises four higher-strength steels, which differ in terms of strength, toughness and structure. Steeltec has made it possible for customers to modify materials and make them even stronger according to application requirements. The company offers variations in sulphur content for each HSX® steel. This means that the optimal balance between strength

Presentation



In chain production plants, HSX® steels can be drawn, stripped and ground in line with requirements.



Thanks to higher strengths, ETG® 100 and HSX® 130 also withstand greater loads at a smaller shaft diameter when compared to standard quenched and tempered steels.



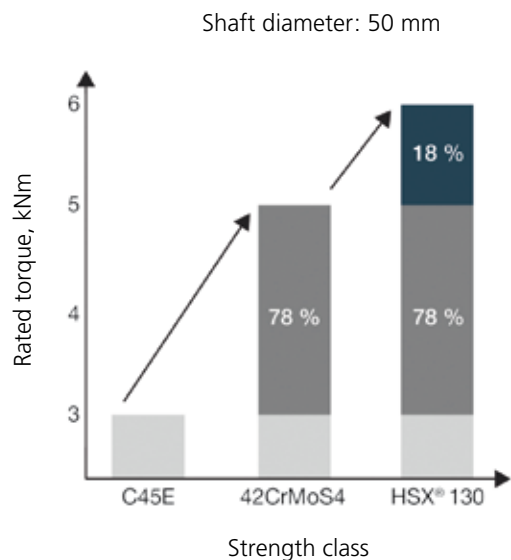
Thanks to their outstanding properties, the four HSX® steels can replace 20 normal steels and, as a result, optimise production processes and reduce storage costs.

and machinability can be defined for each application. Depending the requirement, sulphur content can be almost completely reduced. This significantly lowers the risk of cracking in thin-walled components, such as the pump cylinder in anti-locking systems. *“Despite the reduction in the sulphur content, our HSX® steels are considerably more machinable than traditional quenched and tempered steels,”* assures Dirk Ochmann, Head of Sales at Steeltec. *“We are happy to advise machinists and design engineers on how to achieve the best results in machining and applications.”*

One improvement is the extensive characterisation of the HSX® series in terms of physical properties, such as the magnetic characteristic values. Design engineers use this knowledge to make more efficient models: The higher-strength HSX® steels can be joined to a component, which nowadays comprises a combination of magnetic materials and standard materials. When it comes to the production of solenoid valves, for example, the steels prove their worth – in the past, a complex design process would have been required to fulfil these requirements. Here, the HSX® steels present another benefit and further differentiate themselves: As opposed to with the standard quenched and tempered steels, certain production stages, such as a downstream heat treatment, are no longer needed. This also precludes the necessity for related add-on operations, such as reshaping, grinding and deburring the components. This leads to shorter processes and significantly reduced logistics applications.

figure 1

Greater torque at the same diameter



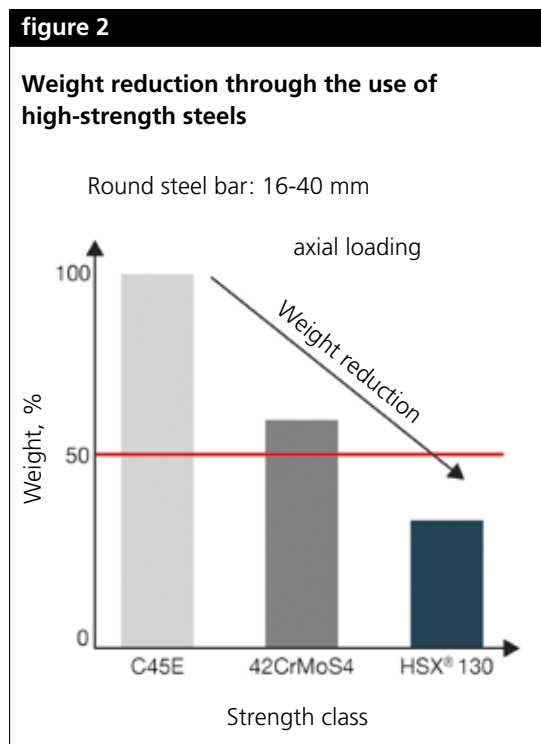
	R _{p0.2} N/mm ²	R _m N/mm ²
C45E+QT	370	630
42CrMoS4+QT	650	900
HSX® 130	1'300	1'350

In comparison to standard quenched and tempered steels with drive shafts of the same dimensions, HSX® 130 shows a significant increase in performance.

Example: Compact component designs

HSX® 90, HSX® 110, HSX® 130 and HSX® Z12 special steels are suited to manufacturing highly stressed precision components in machine, vehicle construction and hydraulics manufacturing industries. High strength and high contour accuracy, make it possible for drive shafts to be more efficient and/or smaller, for example, even in asymmetric machining. When compared with standard materials that are widely used in machine and vehicle construction, the benefits of the higher-strength HSX® 130 are significant. The unalloyed quenched and tempered C45E steel is used for less-stressed components in propulsion technology. When stress is greater, design engineers fall back on 42CrMoS4.

A comparison of the drive shaft torque and steel performance demonstrates the effect that the steels' properties have on operational capability. At a constant shaft diameter of 50 mm with changing loads, HSX® 130 can transmit 96% more force than C45E and 18% more than 42CrMoS4. Yield strength and tensile strength are important parameters for performance. When compared to widely used standard quenched and tempered steels, HSX® 130 displays between two and three times as high a yield strength at 1300 N/mm². HSX® 130 is also considerably in the lead when it comes to tensile strength at 1350 N/mm² (see Fig. 1).

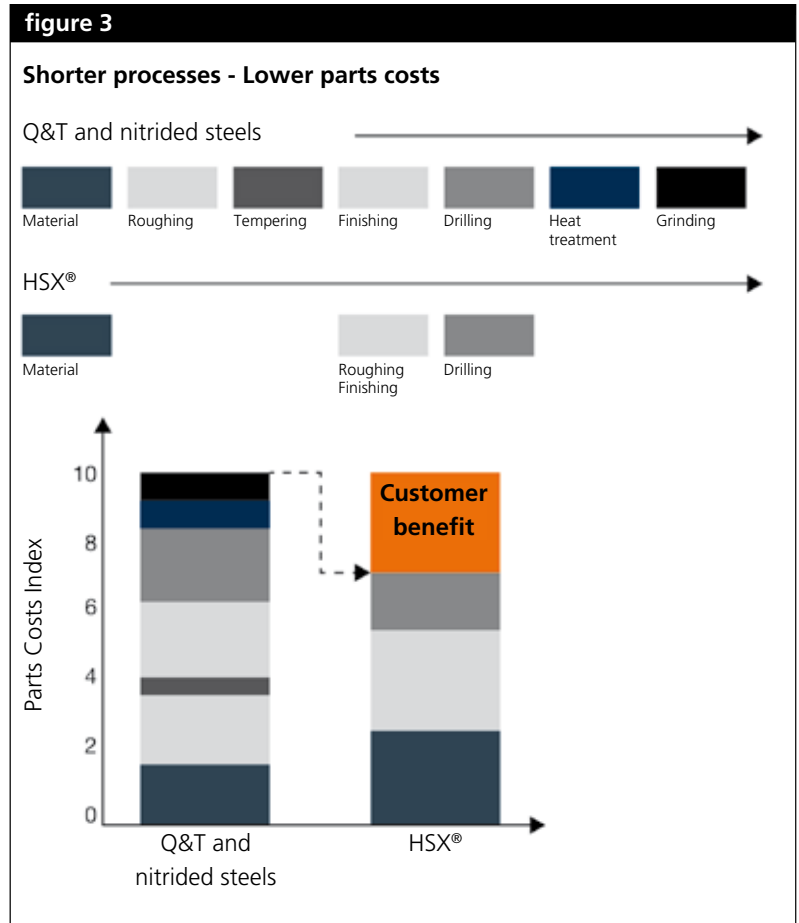


When compared to quenched and tempered steels and when requirements are constant, HSX® 130 makes it possible to design more compact components and reduce weight.

HSX® 130 also demonstrates higher strength in the demand for more compact component design methods and reduced weight. For a drive shaft made of C45E standard quenched and tempered steel, a rod diameter of 40 mm is necessary. With HSX® 130, the diameter could be practically halved with a 16.1 mm reduction, and the weight could be decreased by 64%. If 42CrMoS4 is replaced by HSX® 130 when stress levels on the drive shafts are increasing, the component weight can be reduced by 38%. Performance of 42CrMoS4 with a diameter of 30.3 mm is matched by the performance of HSX® 130 with a diameter of 24.0 mm (see Fig. 2).

Application-oriented steel solutions

In addition to HSX® 130, Steeltec manufactures three other HSX® materials to suit your mechanical properties for a variety of applications. HSX® 110 is used when high mechanical strength properties are required for improved toughness. HSX® Z12 provides increased toughness for components with higher transmission of force and additional impact load.



Thanks to higher machining performance at high strengths and a shorter manufacturing process through using HSX® steels, part costs are lower when compared with the use of standard quenched and tempered steels.

Presentation

A new arrival to the product range is the modular special material HSX® 90. This highly individualised steel solution was designed by Steeltec in development partnerships with customers according to specific component production and application requirements. The bainitic material is characterised by its high solidification properties and excellent Ra values for cold-forming, such as thread rollers, inside and outside rollers. Furthermore, this special steel displays excellent properties in terms of gas pressure density and proves excellent for laser beam welding.

The entire HSX® range benefits from uniform mechanical properties irrespective of the rod diameter across the whole cross-section and is therefore particularly suited to compact component designs.

Noteworthy cost reductions in the component manufacturing process

"The bottom line is that design engineers save by switching from standard quenched and tempered steels to our special steels," states Ochmann. "Because up to 85% of part costs arise in the component manufacturing process. Therefore, it is the process costs, rather than the price of materials, that is key to more cost-effective components. Our HSX® steels ensure short processing times. On delivery, they already have very good mechanical properties and outstanding machinability. Despite comparatively high material costs, the manufacturing process using HSX® steels is significantly more efficient and as a

result more efficient when compared to using standard quenched and tempered steels." (see Image 3). HSX® steels have special properties thanks to special methods. Depending on requirements, the rods can be drawn, stripped and ground. In a chain production plant, it automatically runs through the processes from drawing/stripping, straightening and sawing, through to the quality check and finishing. In delivery condition, the special steels already display high strength, which quenched and tempered steels can only achieve following heat treatment.

Conclusion

Steeltec AG's higher-strength HSX® steels present an cost-effective alternative to standard quenched and tempered steels both in standard applications and for highly-stressed precision components. The combination of high strength in delivery condition, outstanding machinability and shorter manufacturing processes for customers follows the trend towards higher performing and lighter components. The user is provided with a modern, efficient material while at the same time seeing total costs fall.

ABOUT STEELTEC AG

Steeltec AG is one of Europe's leading bright steel manufacturers. By focussing on high-strength and higher-strength special steels as well as special free-cutting steels, it has established itself as an important partner for the automobile, hydraulics and machine manufacturing industries. Steeltec collaborates with customers, suppliers and research institutes to further develop steel and steel production methods and to thus increase competitive strength across the entire value chain. Within these development partnerships, Steeltec develops the strongest steel solutions for the relevant application.

STEELTEC
Providing special steel solutions



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