MATERIAL FACTS

With decades of experience, voestalpine is a reliable partner in the development and manufacturing of advanced high-strength steels (ahss). The ahss classic family made by voestalpine includes dual-phase and complex-phase steels with clearly differentiated property profiles.

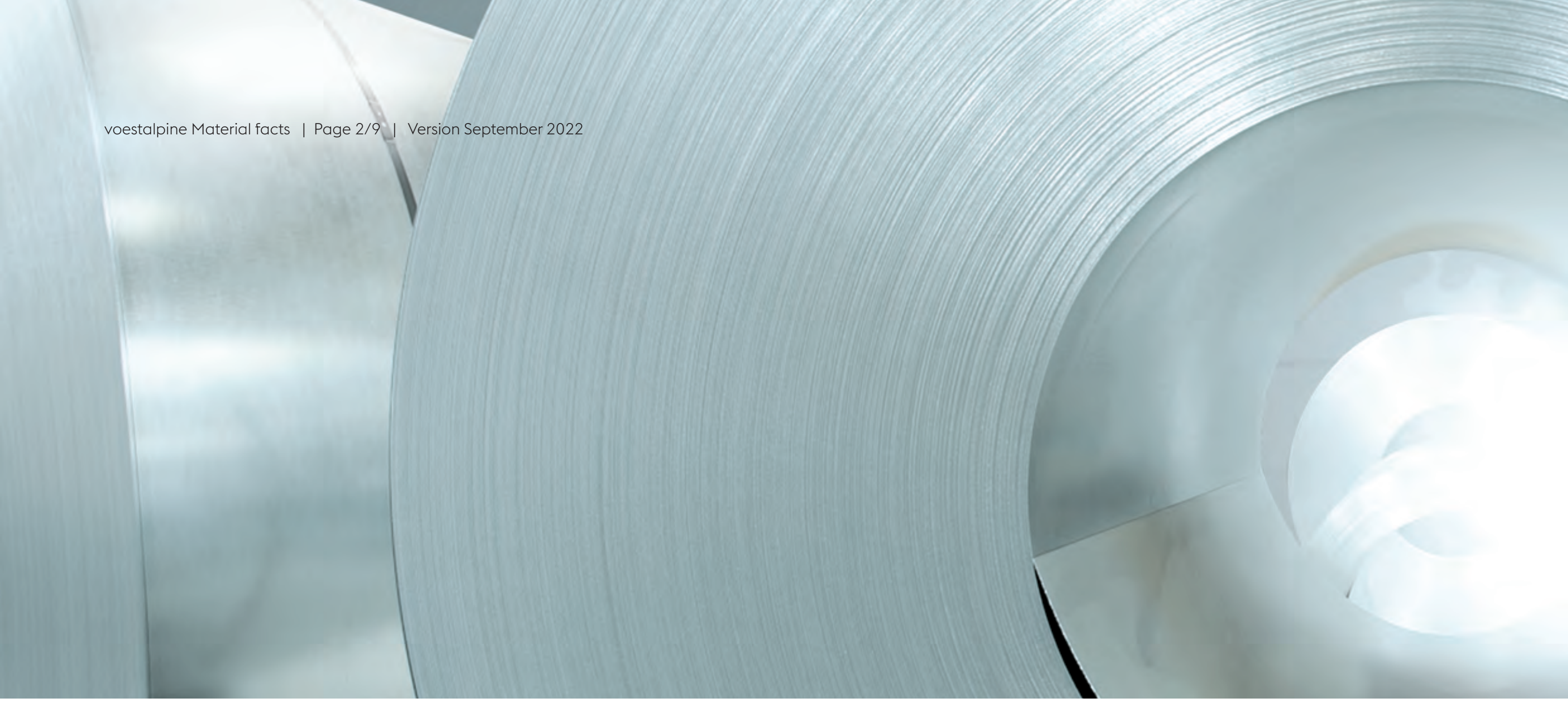
The following comparison illustrates which steel grades are recommended for which requirements and applications.

ahss classic is now also available as a greentec steel edition in proven quality with a reduced carbon footprint.

greentec steel

Premium quality
with reduced carbon footprint

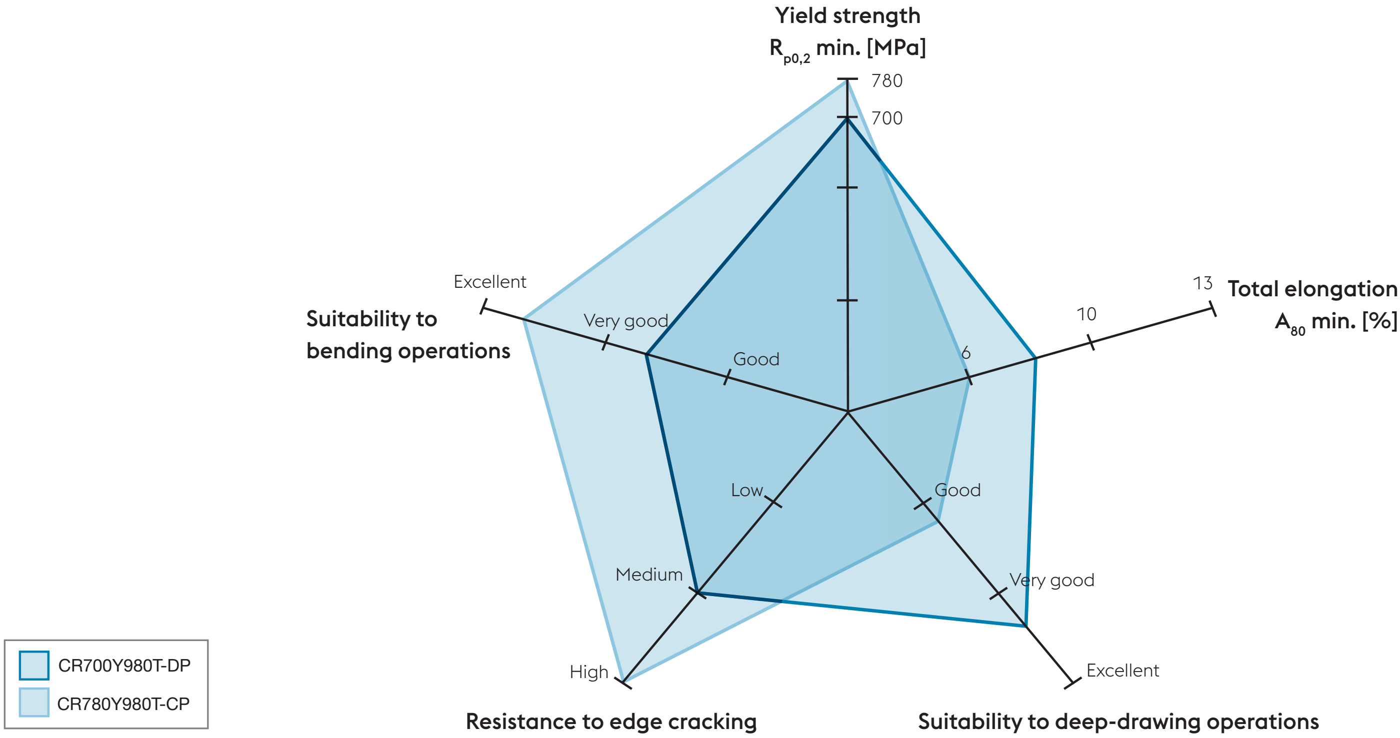
ahss classic
greentec steel



OVERVIEW OF CHARACTERISTICS

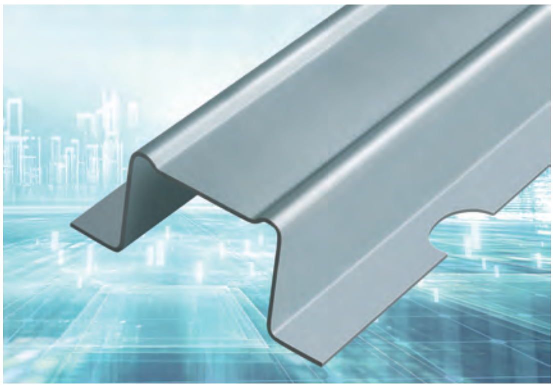
A wide range of strength classes are available in dual-phase and complex-phase steels based on EN 10346, EN 10338, VDA 239-100 and special voestalpine grades.

The following compares dual-phase steel CR700Y980T-DP and complex-phase steel CR780Y980T-CP.



DUAL-PHASE STEELS

- The mechanical properties are characterized by low yield strength, high strain hardening capacity and tensile strength as well as high uniform and total elongation.
- A balanced ratio between deep-drawing properties and stretch flanging capacity allows excellent cold formability.
- The balance between the strength and forming properties in dual-phase steels makes them highly suitable for use in complex structural components.

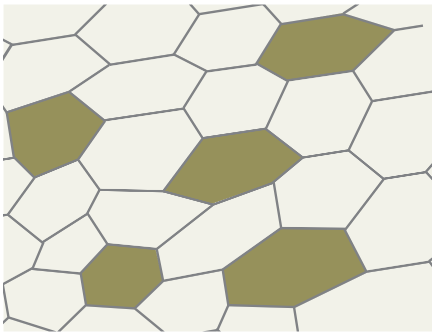


COMPLEX-PHASE STEELS

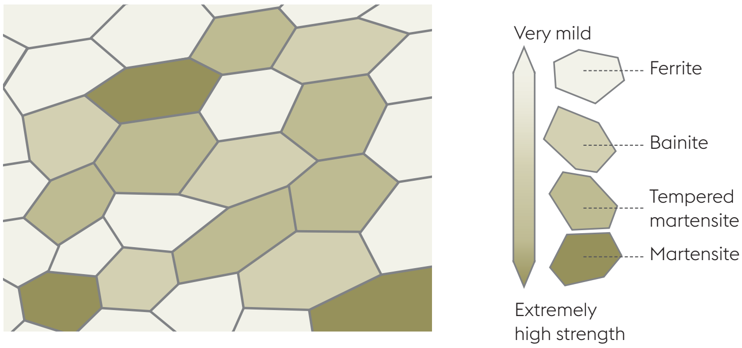
- In comparison with dual-phase steels, these steels have the same tensile strength but a significantly higher yield strength and thus a higher yield ratio.
- The forming properties of stamped edges are remarka-ble baecause of their high stretch flanging capacity.
- Their excellent bendability predestines these steels to roll profiling, bending and edging.

DIFFERENT MICROSTRUCTURES – DIFFERENT PROPERTIES

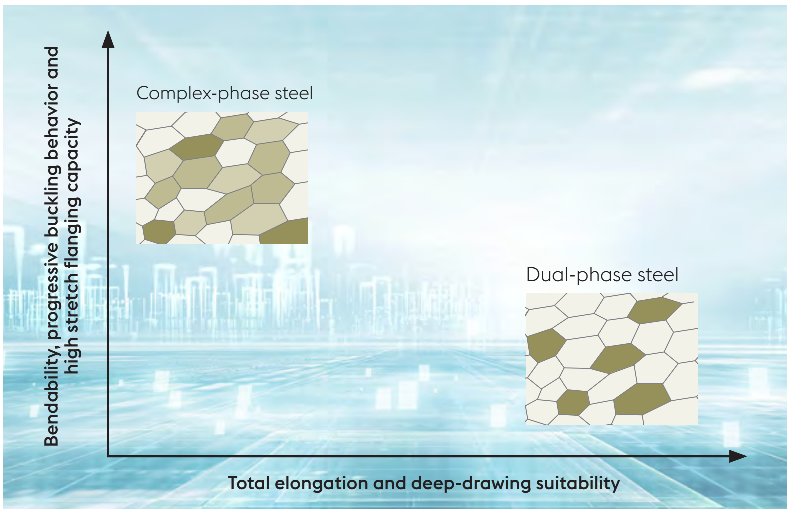
The mechanical and forming properties are determined by the microstructure.



The microstructure of **dual-phase steels** exhibits large differences in strength between the individual constituents in the microstructure.



The differences between the constituents in the microstructure in **complex-phase steels** are much smaller.



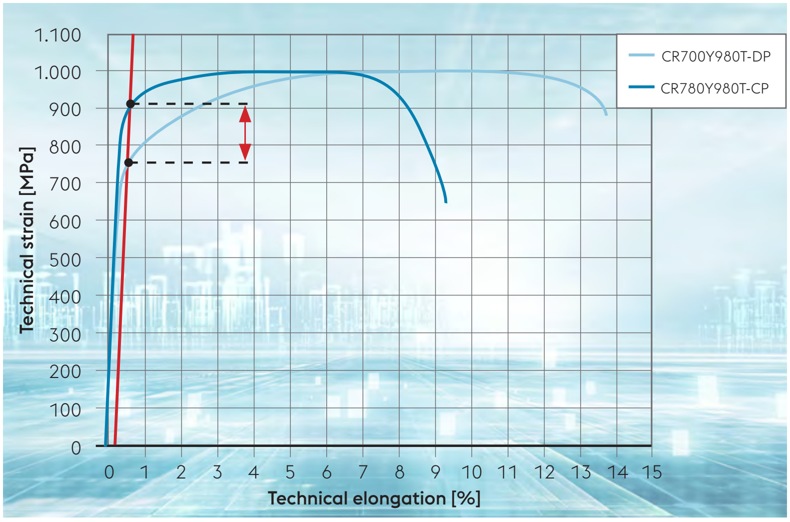
Microstructure influences the following properties:

- Yield strength
- Stretch flanging capacity
- Total elongation
- Bending behavior
- Deep-drawing behavior
- Buckling behavior

YIELD STRENGTH

The strength values of the tensile test results, the yield strength and the tensile strength are of substantial significance to component dimensioning.

COMPLEX-PHASE STEEL: HIGHER YIELD STRENGTH AT THE SAME LEVEL OF TENSILE STRENGTH

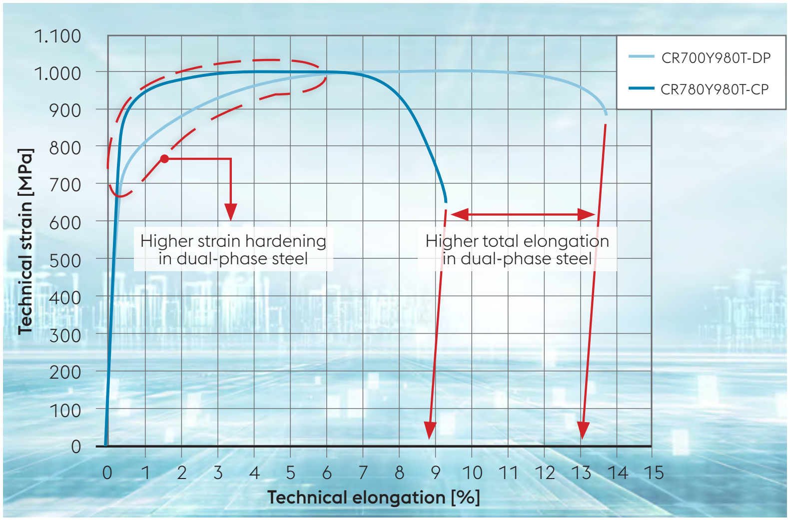


In comparison with dual-phase steels, complex-phase steels have the same tensile strength but a significantly higher yield strength and thus a higher yield ratio. This has the advantage that compo-nents made of complex-phase steels have a high yield strength, even in non-formed areas.

TOTAL ELONGATION AND DEEP-DRAWING SUITABILITY

Tensile test results provide information on the strength values as well as the formability of the material. The pertinent standards for dual-phase steels specify both the total elongation and the strain hardening capacity of a material during forming.

DUAL-PHASE STEEL: BETTER DEEP-DRAWING PROPERTIES AT THE SAME LEVEL OF STRENGTH

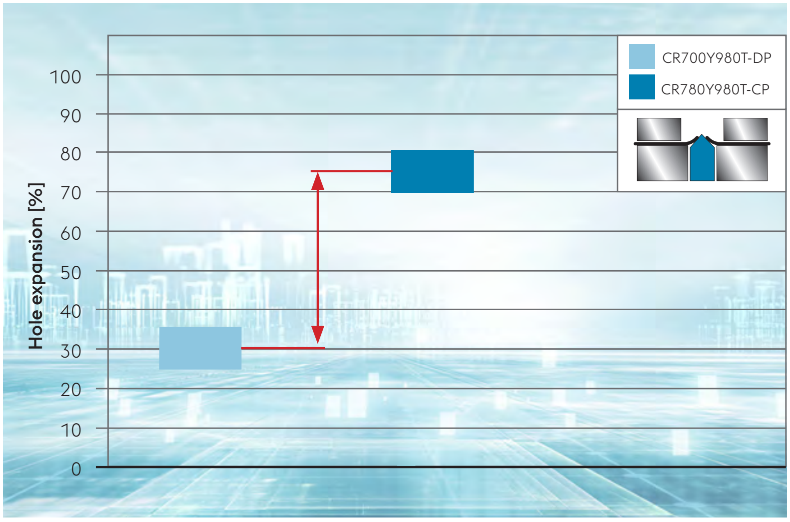


As a result of the large differences in strength between the individual constituents of the microstructure, dual-phase steels feature high strain-hardening capacity and thus high resistance to local necking. They also feature high tensile strength as well as high uniform and total elongation, and they exhibit excellent deep-drawing properties.

STRETCH FLANGING CAPACITY

The formability of stamped edges depends on several factors, an important one of which is the quality of the edge condition after stamping. The differing microstructures of dual-phase and complex-phase steels also have a considerable impact on stretch flanging capacity. The hole expansion test is used to assess the degree of stretch flanging capacity.

COMPLEX-PHASE STEEL: HIGH STRETCH FLANGING CAPACITY



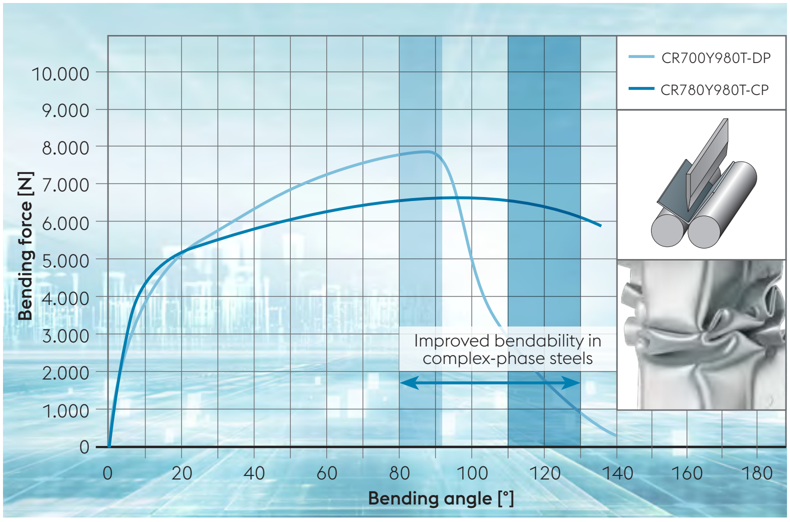
Hole expansion test pursuant to ISO 16630, typical values

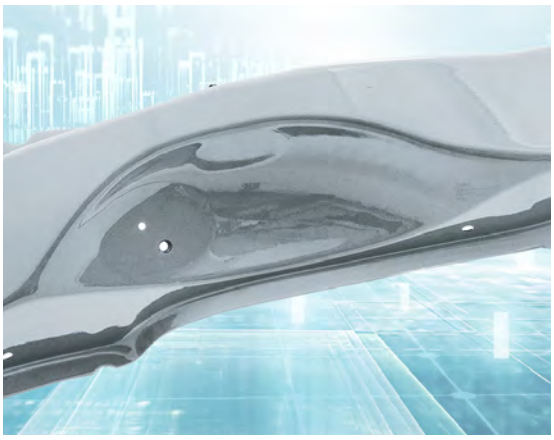
Localized high strain occurs as a result of large differences in strength between the individual microstructural constituents when the stamped edges of dual-phase steels are formed. This localized deformation can lead to damage. The homogeneous distribution of strength in the microstructure of complex-phase steels, however, leads to a uniform distribution of strain. This is the reason that complex-phase steels have a higher stretch flanging capacity and higher hole expansion capacity.

BENDING AND PROGRESSIVE BUCKLING BEHAVIOR

Bending, edging and roll-profiling are common techniques used in the manufacture of crash components and lead to high levels of strain. The bending angle and bending radius are important indicators for material selection. On the other hand, differences in the bendability of complex-phase and dual-phase steels are natural results of the different microstructures.

COMPLEX-PHASE STEEL: GOOD BENDING AND PROGRESSIVE BUCKLING BEHAVIOR





At the same level of tensile strength, complex-phase steels demonstrate better bending and progressive buckling properties than dual-phase steels. This behavior is made clear by the force-displacement curve in the bending test performed pursuant to VDA 238-100. Dual-phase steels do not demonstrate any substantial cracking until a certain bending angle is reached, typically in the range of 80°, followed by rapid failure. In contrast, complex-phase steels demonstrate slight cracking after maximum force is reached at bending angles of 110–130°. When bent further, these steels pro-vide strong resistance to crack growth. For this reason, complex-phase steels are recommended for structural components with narrow bending radii. Their performance in bending also ensures structural integrity in crash events associated with progressive buckling.

OUR PATH TO A GREENER FUTURE

Premium products in the greentec steel Edition

With greentec steel, voestalpine is pursuing an ambitious step-by-step plan in the long-term decarbonization of steel production. The declared objective is to achieve carbon-neutral production by 2050, and the initial steps have already been taken. Process-optimized production operations already prevent up to 10% of the direct CO_2 emissions at the Linz site. The material and processing properties of the steel are not affected in any way in this production route. Each voestalpine steel strip product is available in premium quality in the greentec steel Edition with a reduced carbon footprint and unique benefits.

greentec steel

Premium quality with reduced carbon footprint

ahss classic
greentec steel

Cold-rolled steel strip – greentec steel edition	
Max. carbon footprint 2.15 kg CO_2e per kg of steel [1)]	
Hot-dip galvanized steel strip – greentec steel edition	
Max. carbon footprint 2.30 kg CO_2e per kg of steel [1)]	
Electrogalvanized steel strip – greentec steel edition	
Max. carbon footprint 2.30 kg CO_2e per kg of steel [1)]	

[1)] per EN 15804+A2 (EPD methodology) cradle to gate

All products, dimensions and steel grades listed in each voestalpine supply range are available as greentec steel Edition.

Please find further information at:
www.voestalpine.at/ultralights

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ONE STEP AHEAD.