METALLURGICA VENETA
ACCIAI SPECIALI

Certified Company

QUENCHED AND TEMPERED STEELS

This group includes the type of structural steels intended for hardening and tempering treatment (hardening followed by tempering at around 600°C). These steels are usually used to fabricate mechanical parts affected by static and dynamic loads; they are widely used in the mechanical industries, for shafts of any type, semi-axles, rods, con-rods, linkages, levers, rods for power hammers, press uprights, etc. The carbon types can be supplied in natural rolled and normalized condition, while the alloyed types are normally furnished annealed. All the steels of this group can also be supplied hardened and tempered for specific properties. The mechanical properties in the tables below are binding during testing only for the 16 mm diameter hardened and tempered test specimen, after heat treatment according to the temperatures indicated. The wide range of use, dimensions and shape of the mechanical parts for which steels for hardening and tempering are used, requires attentive selection of the steel according to the stresses on the part. It is very important therefore to know the hardening properties of the steels in order to permit correct optimization of the mechanical properties required. Carbon grades, with extremely low hardenability, are still widely requested and appreciated, if used for small section parts, and when the distortions resulting from hardening in water can be tolerated. When specific dimensions are exceeded, the hardening and tempering treatment does not result, as regards these steels, in noteworthy variations in the properties in relation to normalized status.Moving from the low carbon to the higher carbon types, there is a considerable increase in strength accompanied however by a sharp decrease in toughness; therefore, the types with a higher carbon content are not recommended for parts subject to impacts but are suitable where greater hardness and wear strength are required. The C40, C45 types that represent a good compromise between the strength and toughness properties are widely used.
Moving on to alloy steels, the following should be noted: 36CrMn5, steel characterized by moderate cost and low hardenability; if appropriately treated, up to a thickness of 50-60 mm, it may however produce good results; as it is affected by temper embrittlement, it is advisable to cool the parts in oil or in water after tempering. 42CrMo4 (UM8 SIAU), medium hardenability, also suitable for hot work up to a temperature of 500 °C; it is also characterized by a good adaptability to the nitriding treatment. 39NiCrMo3, medium hardenability, this is the most widely used alloy steel for hardening and tempering due to its good hot and cold workability and ease of heat treatment. 40NiCrMo7, corresponding to the well known SAE 4340, this steel is characterized by high level hardenability that makes it suitable for the fabrication of even large highly stressed, high strength parts. 30NiCrMo12, this steel, characterized by high hardenability and endurance, is intended for the construction of larger parts that must be able to withstand extremely harsh working conditions. The Ni-Cr-Mo types are more or less unaffected by temper embrittleness and guarantee excellent toughness also in a crosswise direction and behave very well at low temperatures. Lastly, it is wor th remembering the 34NiCrMo16 type, self-hardening with minimum hardening distortions; it is used hardened and tempered at 200 °C for parts where very high hardness (R=1720 ÷1960 N/mm2) and endurance strength are required, such as gears, semi-axles, torque shafts.