METALLURGICA VENETA
ACCIAI SPECIALI

PIARNE AND INDUCTION HARDENING STEELS

Certified Company

These hot-rolled carbon and alloy steels are delivered in bars and coils.
The UNI 7847 standard includes the families with C, Cr, Cr-Mn, Cr-Mo and Ni-Cr-Mo.
In case of low stress levels, normalized or quenched and tempered carbon steels are used, while for high stress levels the use of quenched and tempered alloy steels is recommended.
They are carefully prepared in order to obtain a constant level of chemical elements, especially with regard to carbon, which is fundamental in guaranteeing hardenability.
Designers select the right steel on the basis of the stresses and the dimensions of the parts, starting from the grade C43 up to 40NiCrMo3.
Before surface hardening these steels are generally normalized and quenched and tempered, since the components must have a good toughness even at the core.
Peeled products are recommended in order to achieve excellent results and to avoid decarburization that reduces surface hardness.
Flame hardening and more commonly induction hardening is used to achieve surface hardening. Heating is sudden and cooling is equally strong, therefore stress relieving (140-180 °C) is recommended after hardening.
The penetration of induction hardening into the parts depends on the medium or high frequency. Lower frequency allows for a better penetration.
In some cases, where the treated areas are too small or access is difficult, laser hardening may be used. This practice is usually very fast, causes minimum distortions and results in high surface hardness.
Let us mention one particular experience on Metallurgica Veneta. The structure of induction-hardened, tempered and cold-drawn steel C43 in bars of Ø 30 mm was very good for the first 4 mm, whereas it decreased towards the core.
Decarburization was very low (0.04-0.08 mm) and there were minimum deformations. The mechanical values after cold-drawing were excellent: Rp/R = 0.90 with toughness of Kv > 70 J at +20 °C.
Induction hardening also causes compression stresses on the surface which increase the fatigue strength.
Recommended hardened depths are as follows:

- 0.10-0.60 mm for medium stresses
- up to 6 mm for abrasive attack
- 4-14 mm for fatigue stresses

The products manufactured with these steels range from camshafts and crankshafts to pins, gearwheels, links in general, worm screws, crown gears and so on.
The induction-hardening process is not advised for thickness lower than 6 mm because the mass is very small and heat reaches the core too quickly, causing considerable stresses.
These steels should be welded only after hardening.