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FREE-CUTTING STEELS

The significant increase in mechanical machining costs has led to a reappraisal of the importance of the technological characteristics of steel machinability.
In order to achieve higher automation and cost competitiveness, a series of steels commonly known as free-cutting steels (S minimum 0.10%) are increasingly being used.
Special leaded steels differ from the normal structural, quenching and tempering and case-hardening steels due to the presence of Pb (approximately 0.15-0.35%) in order to improve their machinability.

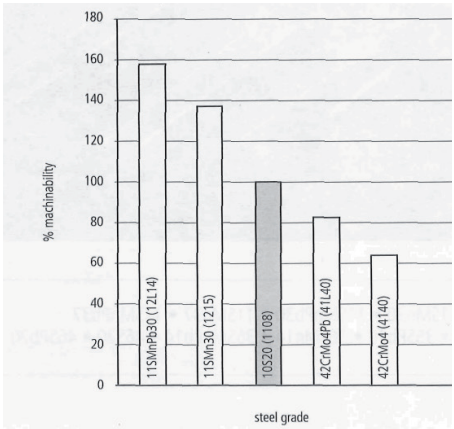
These steels can be divided into three groups:
- not for heat treatment
- for case-hardening
- for quenching and tempering

Compared to the hot-rolled product, the cold-drawing condition offers the following advantages for all of these steels:
1) Tighter dimensional tolerances, more suitable for machining on automatic lathes
2) Absence of surface oxides which are harmful for the life of tools

These steels offer excellent chip removal and are particularly suitable for large production volumes. Lead has a very good lubricating effect and, combined with the heating produced by the tools, breaks chips thus allowing for higher productivity resulting in more advantageous production runs. It also guarantees lower tool wear.
It is known that lead does not have any influence on the mechanical features (longitudinally) of cold-processed steels, while it has been proved that it helps reduce up to 20% the fatigue limit of steels treated for R 1600÷1800 N/mm2.

On the contrary, the use of lead worsens the steel's mechanical features in the tangential direction, therefore designers will need to take this phenomenon into account by selecting more load-bearing sections. These steels are not suitable for the manufacture of gears, due to their lack of toughness in a transversal direction.

% machinability compared to SAE 1108



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No negative aspects have yet been noted on case-hardened surfaces. On the other hand their better workability makes them suitable for use in the entire sector, where the high levels of hardness make the finishing operations more difficult.
Lead tends to refine the austenitic grain size, but does not worsen hardenability. Leaded steels do not require different parameters than those commonly used for heat treatment, peeling, reeling, cold-drawing and grinding.
They allow for a machinability increase of up to 25-50%, depending on the type of steel used.
In free-cutting steels, the bench hardening obtained through cold-drawing favours chip removal and this explains why the demand for cold-drawn free-cutting steels is very high.
It should also be noted that they are difficult to weld and whenever this operation is indispensable, the use of special electrodes is recommended to avoid cracking and porosity of the welding beads.
In such cases the welding area shows a lack of lead which causes a reduction of machinability.
It is not always easy to set up the casting with lead as this element has a tendency to segregate and position itself towards the outside of the billet or bloom.
However, the best steelworks have found complex and innovative techniques to overcome this problem.
In order to check the satisfactory distribution of lead in the steel, the Wragge print is carried out. The aim of the precise carbon content is to limit excessive work hardening during cold-drawing, and to give a homogeneous hardness to the whole product in order to guarantee good and reproducible results.
Fields of use: starter motor shafts, fittings in general, brake couplings, hydraulics, lubricators, low-quality bearings, special screws, nuts, bolts, the furniture industry and small metal parts in general.