

**ROVALMA**

THE STEEL INNOVATOR



ICO-2800

High Mechanical Resistance High  
Toughness Maraging Tool Steel

# ICO-2800

The Tool Steel ICO-2800 is a maraging tool steel featuring an outstanding combination of toughness, hardness and mechanical strength. It provides high resistance to the nucleation of fatigue cracks, and also high fracture toughness against shock and twist. ICO-2800 has excellent forming characteristics, allowing high deformation as well as good weldability and easy machinability. ICO-2800 is hardened by precipitation and a wide range of surface treatments are feasible.

## Applications

ICO-2800 is used in cold and hot work applications. It has shown great advantageous in the manufacture of high precision molds for plastic injection of thermosets, thermoplastics and light alloys under heavy duty working conditions, dies and punches for pressing powder (sintered pieces), hot chamber nozzles for injecting Zamak amongst others, or liners, mandrels and stems of light alloy extrusion processes with increased power, provided that the working temperatures do not exceed 700°C. It is also used in other hot forming applications, in which a combination of high strength and toughness is required. In cold work, ICO-2800 has shown important advantageous in heavy duty dies and punches for cutting, drawing, cold stamping and forging applications with high mechanical resistance and toughness at high hardness requirements. Further applications are in mandrels for cold reduction of calibrated tubes, hollow axes to transmit big torques at high speed and with little weight, high power axes and gears for reduced spaces and small mass, or subjection tooling and high severity springs, temper or endless screws.

## Physical and Mechanical Properties

Properties	300 K	Unit
Density	8.1	g/cm <sup>3</sup>
Mechanical Resistance	2500	MPa
Yield Strength 0,2 %	2400	MPa
Elastic Modulus	200	GPa
Un-Notched Charpy Resilience	380	J

The values given in the tables are typical values (neither maximum nor minimum values), for properly heat treated material at a hardness level of 58-60 HRC. Charpy-resilience tests are performed on longitudinal samples of 10 x 10 x 55 mm from defined extraction locations.

## Hot Work Conformation

Given that ICO-2800 has been subjected to a thermo-mechanical treatment, which should not be manipulated, hot work conformation is not recommended.

## Welding

ICO-2800 can be joined by most of the commonly used methods, including welding. Nevertheless, CO<sub>2</sub> protection baths, electrode-cellulose coverings and oxyacetylene treatments as well as any other process that could provide carbon should be avoided. The best welding methods are: TIG, MIG, MAG, electron beam and laser. In any case, the material used for joining also needs to be ICO-2800.

ICO-2800 does not need to be pre-heat-treated prior to the welding process, both in aged and in solution-annealed state. The best welding method for this tool steel is normally TIG, using Ar as inert gas. For the short arc MIG process, pure helium would be the most indicated inert gas.

It is necessary to perform another aging treatment after welding to obtain hardness in the weld and in the heat affected zone. For welding of highly demanded zones it is strongly recommended to weld in solution-annealed state.

For further information regarding welding parameters, please contact Rovalma S.A.

## Heat Treatment

The heat treatment of the tool steel ICO-2800 consists in a precipitation/ aging process. Vacuum furnaces are the most adequate for the precipitation hardening of this material. Salt furnaces should not be used, since they deteriorate the surface structure of the piece considerably deep and commonly have a detrimental carburizing effect. The process admits precipitation temperatures ranging from 480 °C during 6 hours to 530 °C during 3 hours of holding times. The optimal hardness-toughness ratio is achieved with 4 hours at 520 °C. This heat treatment is also the recommended one when toughness is the main factor sought after. During the aging process, ICO-2800 shows a small, uniform and isotropic shrinkage of around 0,1%, depending on the chosen temperature and duration as indicated above.

Note: Holding times start when the core reaches specified temperature levels, if no thermocouple is available, allow 1 minute for every millimetre of thickness.

## Surface Treatments

Nitriding, except for salt nitriding (sulphurization, etc.), as well as different coatings can be applied. The most appropriated nitriding processes for ICO-2800 are ions and gas plasma. Given that ICO-2800 is a material, which shows a controlled, small and uniform contraction during hardening, CVD could be one of the best coating solutions. As for both cases, nitriding and PVD coating, the temperatures and times that comes closest to the ones of the desired precipitation strategies, should be chosen, as both processes ought to be carried out simultaneously.

## Machining

For a smooth machining and for minimizing the wear of the tools, it is recommendable to use positive rake angle tools like for instance used to cut copper, apply slow speeds (thus that the chips are white colored) and fairly high feed rates. Furthermore, it is recommendable to use tools with lapped faces and sharp edges to smooth out the cutting.

# Designer & Provider of First-Class Tool Materials

ROVALMA, S.A. provides innovation in tool materials. Thanks to comprehensive research, innovative design and development, most recent production techniques as well as in depth quality control, we have achieved significant advances in the knowledge about material forming processes and generated important know-how regarding the production and optimal usage of our materials for a specific application. As a result, we can provide you with **first-class tool steels** for cold and hot work material forming processes and outstanding technical assistance.

We are proud to make our High Performance Tool Steels available to you for your specific applications. Do not hesitate to contact us for the latest information.

## Application Engineering Service

In order to fully exploit the advantages and the potentials of ROVALMA's High Performance Tool Steels, we offer our customers the support of our Application Engineering Service. Our highly qualified and dedicated engineers can assist you in selecting the optimized grade for your application and provide you with the corresponding technical recommendations. It is our mission to increase the competitive-advantage of our customers and support them in achieving the highest possible cost-effectiveness.

You can access our service directly by sending an email to: [ae-fast@rovalma.com](mailto:ae-fast@rovalma.com).



ROVALMA, S.A. carries out ongoing research for many applications regarding the usage of the materials here presented. This research often brings along significant advances in the knowledge of a given process and thus important information regarding the best possible usage of the materials for a specific application. We strongly recommend to get in contact with ROVALMA, S.A. for the latest information regarding a specific application.

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