ROVALMA

THE STEEL INNOVATOR

Hot Work Tool Steel
1.2343 ESR

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Hot Work Tool Steel 1.2343 ESR

The steel grade 1.2343 ESR is a chromium-molybdenum-vanadium alloyed hot work tool steel, with good mechanical strength at high temperature, good toughness and ductility, as well as high tempering resistance combined with good machinability and polishability. The grade 1.2343 ESR has been refined trough an electro-slag-remelting process and a tailored thermo-mechanical processing to achieve very high levels of toughness and hence thermal fatigue resistance, enabling longer lifetimes of the moulds, in which it is used.

Applications

Main applications of 1.2343 ESR include: big molds for die casting of light alloys, aluminium extrusion tools, such as liners, extrusion stems, container mantles, pressure pads, liner holders, mandrels, die holders and extrusion dies. It is also used for applications such as sliders, punches, forging stamps and blades for circular cutting, or die inserts for plastic injection requiring high polishing and toughness.

Typical Composition (in %)

C	Si	Mn	Cr	Mo	V	P	S
0.36 - 0.42	0.90 - 1.20	0.30 - 0.50	4.80 - 5.50	1.10 - 1.40	0.25 - 0.50	< 0.01	< 0.01

Physical and Mechanical Properties

Test Temperature		300 K	Unit
Density		7.80	$x10^3$ kg/m^3
Elastic Modulus		216	$x10^3$ MPa
Mechanical Resistance	52 HRc	1850	MPa
Yield Strength 0.2 %	52 HRc	1570	MPa
Strain	52 HRc	10.7	%

The values given in the table are typical values (neither maximum nor minimum values) for properly heat treated materials.

Thermal Properties

Test Temperature	293 K	373 K	473 K	573 K	673 K	873 K	Unit
Linear Thermal Expansion Coefficient	10.4	11.5	12.0	12.2	12.5	13.0	$x\ 10^{-6}/K$
Thermal Conductivity	25				29	30	W/m.K
Specific Heat Capacity	460				510	590	J/kg.K

The values given in the tables above are typical values (neither maximum nor minimum values), for properly heat treated materials. Thermal conductivity values are calculated on the basis of thermal diffusivity values measured by laser flash.

Heat Treatment

Like most tool steels, hot work tool steel grade 1.2343 ESR obtains its optimized mechanical and physical properties through a corresponding heat treatment before final machining.

The following provides a general heat treatment guideline.

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Austenization

- Heating from room temperature to 650 °C (duration 2 hours).
- Hold for homogenization at 650 °C for 2 hours.
- Heating to 850 ºC (duration 2 hours).
- Hold for homogenization at 850 °C for 2 hours.
- Heating to temperature of austenization: 1000-1040 °C.
- Hold at austenization temperature for 30 minutes.
- Cool down in oil, salt bath at 500 °C, or air.
- At any case, the decarburised layer should be removed.

Notes

- Holding times start when the core reaches specified temperature levels, if no thermocouple is available, allow ½ minute for every millimetre of thickness.

- In order to relieve tensions from rough-machining and minimize the risk of bigger and potentially irregular distortions in the heat treatment previous to final machining, ROVALMA, S.A. recommends the implementation of a stress relieving treatment after rough-machining.

Tempering

Tempering cycles should be carried out immediately after the hardening, when the piece has cooled down to room temperature.

- Select the tempering cycle temperature according to the desired hardness (see the tempering graph above).
- Perform 2-3 tempering cycles at the corresponding temperature for the desired hardness (see figure 1):
- Holding time recommendation: 2,5 minutes for every millimetre of thickness, with a minimum holding time of 1 hour.

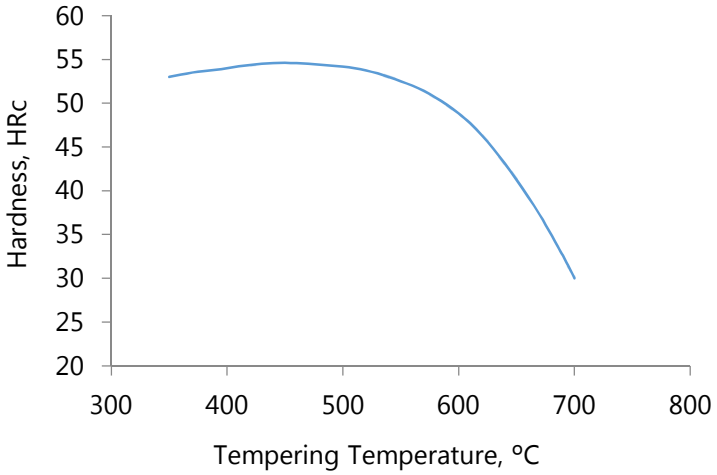

Figure 1. Tempering graph. Austenizing at 1020ºC

Nitriding

- 1.2343 ESR can be both, bath and gas, nitrided.
- To avoid deformations and structural changes, it is recommended to perform the second/third tempering cycle 10- 20 ºC above the temperature, at which the nitriding treatment will be done.
- This consideration is valid for surface coatings such as TiN, or any other that needs to be applied at temperatures above 500 ºC .

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Welding

Joining and Surfacing Hardened Material

Preheat the part until the core reaches 500-550 °C. Weld the piece while keeping it at a temperature between 400-550 °C, reheat if necessary. After every weld bead, conduct a post weld upsetting to reduce tensions originating from solidification and cooling of the area. After welding, subject the pieces to one or two tempering cycles (depending on the geometry of the piece and the amount of welding conducted).

Joining and Surfacing Annealed Material

Weld the part directly, and after every weld bead, conduct a post weld upsetting to reduce tensions originating from solidification and cooling of the area. Conduct an annealing treatment at 800-830 °C before the part has cooled down.

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.

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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.

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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