



Special pre-hardened tool steel
for Plastic Moulds:

GSF ESR

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Premium tool steel with firm and secured tool properties are exemplified by

- excellent high gloss polishability
- excellent texturing properties
- very good machinability
- outstanding ductility
- high fracture toughness
- high homogeneity
- uniform hardness up to 46 HRC
- good wear resistance
- easy weldability

For over 125 years, the development of our company has been shaped by tool steels and their applications. Our many years of experience and our advanced technological equipment - from primary steel melting to ready-to-use tooling - are the basis of the globally recognized quality of the products from Kind & Co., Edelstahlwerk, GmbH & Co. KG.

Reference Analysis in Weight-%

Material	C	Si	Mn	Cr	Mo	V	Ni
GSF ESR	0.28	0.30	0.70	2.80	0.60	0.40	1.00

GSF ESR is an innovative high performance NiCrMoV alloyed pre-hardened and tempered steel, suitable for all components which demand for highest quality requirements.

The well balanced alloying concept offers to the steel GSF ESR a homogenous hardness, outstanding ductility and good wear resistance. The steel has a very good machinability and can be easily welded and machined.

Due to its outstanding purity and mechanical properties GSF ESR is well suited for various dies and moulds in the plastic processing and best conditions on cleanliness is a must to assure high quality textured surfaces or outstanding high gloss surface polish.

The elevated hardness level compared to many standard and non- standard plastic mould steels of up to 44-46 HRC supports the processor with good wear resistance and security for longer production runs.

As a fully pre-hardened and tempered steel, GSF ESR does not require any intermediate outsource in heat treatment to third parties and supports the complete supply chain in faster and more economical mould production processes and helps to improve overall productivity and cost reduction.



Applications

GSF ESR is suitable for many applications in the tooling segment. Examples of applications are:

- Plastic moulds with high surface demands
- Components for mechanical engineering
- Tooling with high demands of fatigue strength
- Moulds requiring high toughness and good heat resistance
- Mould frames with high demands on tool life and minimum maintenance

Efficiency for the toolmaker

- pre-hardened (no additional heat treatment required)
- high polishability
- high machinability
- very good texturing and etching
- high dimensional stability
- faster tool making process

Reliability

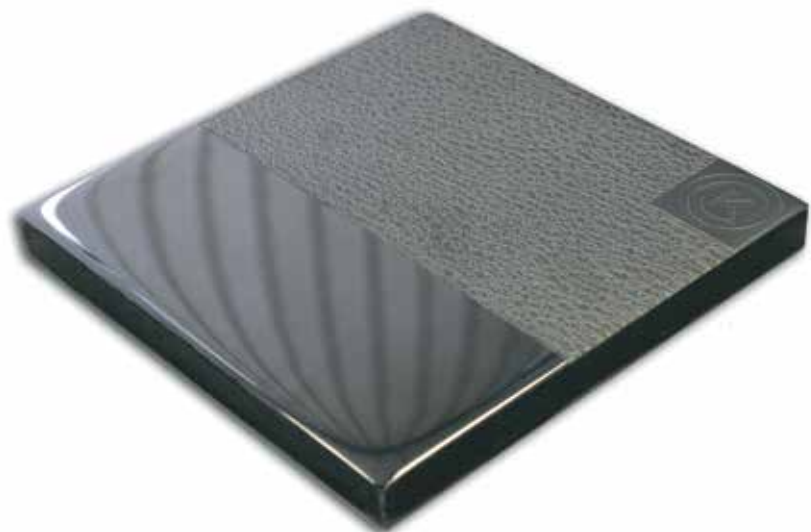
- no third party risk for heat treatment
- low risk for tool cracking due to high toughness
- suiting critical surface finish
- reduced maintenance cost
- improved wear resistance
- higher thermal conductivity



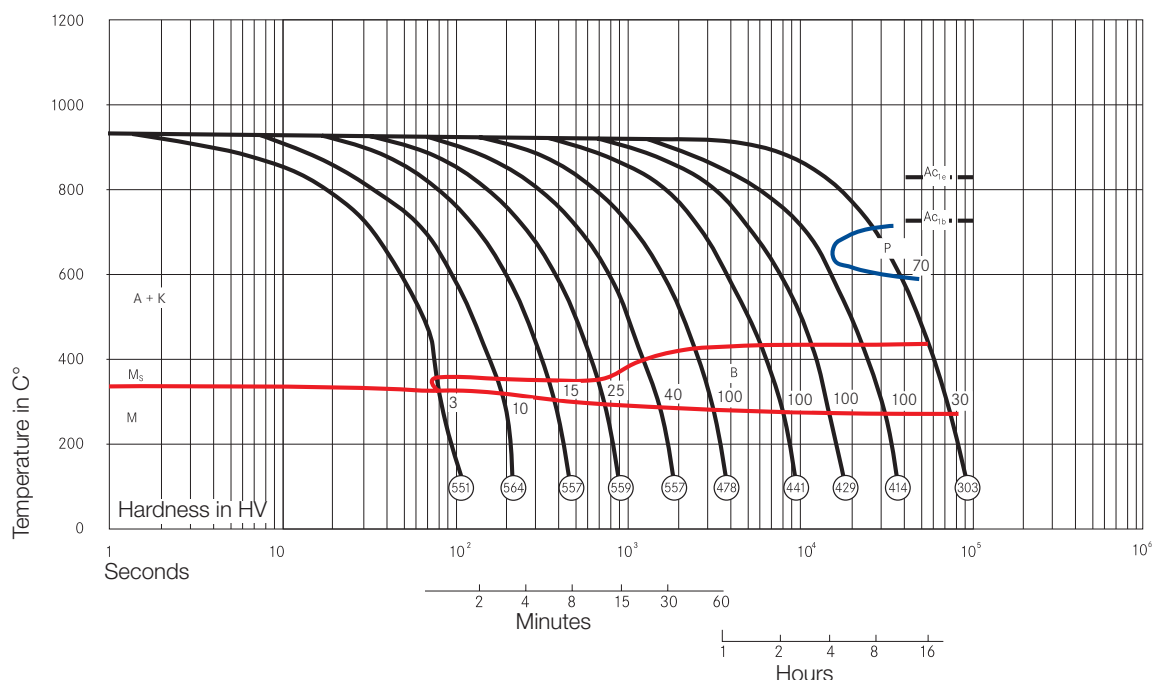
**cost reduction and improved productivity
for toolmakers and processing plants**

Further Advantages

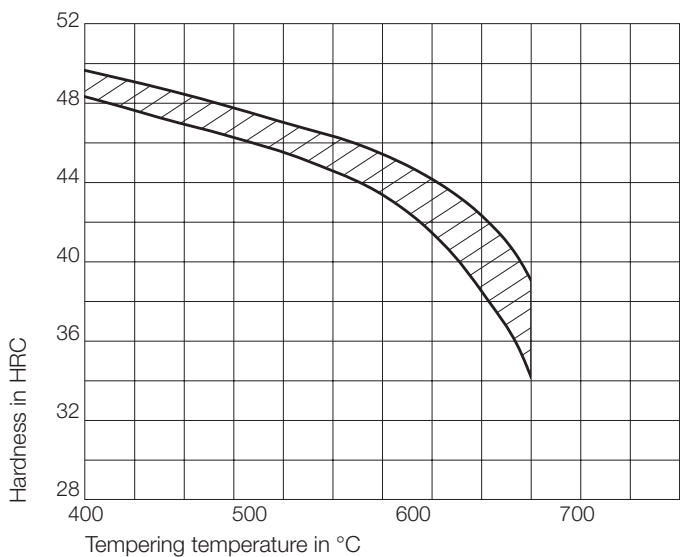
- easy and safe welding
- good etching properties
- suitable for all nitriding processes to improve wear resistance
- good compressive strength



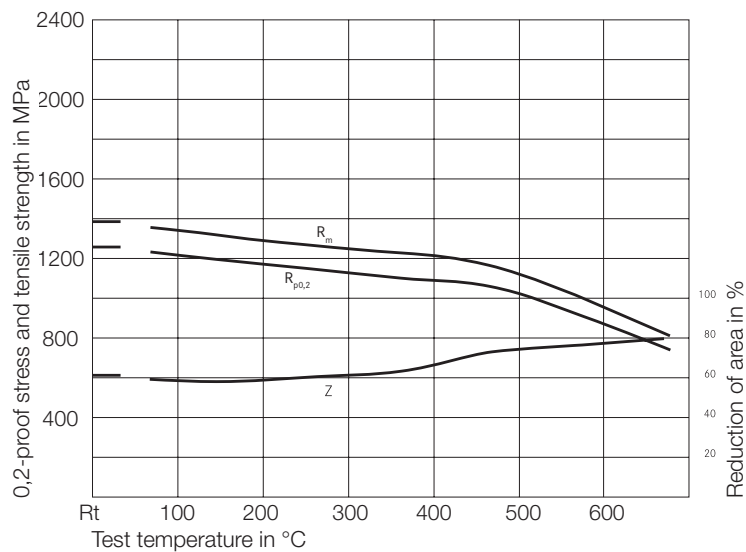
TTT-Diagram



Tempering Diagram



High temperature strength diagram



Mechanical properties at different strength classes

Ø / mm Applicable	Yield point Rp 0.2 / MPa	Tensile Strength Rm / MPa	Elongation A5 / %	Notch impact strength ISO-V / Joule
250 - 500	min. 950	1300 - 1450	min. 12	min. 25
	min. 880	1150 - 1300	min. 14	min. 30
	min. 780	1000 - 1150	min. 16	min. 40

Physical-mechanical properties of GSF ESR

Temperature	°C	20	100	200	300	400	500	600
Thermal conductivity	W/(m x K)	31	34	34	34	33	33	31
Coefficient of linear thermal expansion	10 ⁻⁶ /K	11.8	11.8	12.0	13.0	13.0	14.0	14.0
Density		7.76 g/cm ³						



Polishing

The process of milling is mainly and often not adequate to achieve the necessary surface roughness for any subsequent surface coatings required.

The degree of purity of a plastic moulds steel resulting from the manufacturing process is one of the key factor for a high quality of the polish. Based on a modern technology in melting and re-finishing by ESR the contents of harmful elements like sulfur, oxygen and others kind of non metallic inclusions are reduced to a minimum compared to conventional steels. Additional key points are a fine grain size, low level of segregation and a high homogeneity and uniform hardness.

Based on above technological advantage GSF ESR allows excellent high polishing which usually exceed the surface quality with moulds made of conventional plastic mould steels like P 20 / P 20 +Ni, P 20 Ni HH as well as other types of pre-hardened steel in the range of 33 – 42 HRC inclusive low alloyed precipitation hardening steels.

Surface texturing/Etching

The process of photo etching has become very popular for plastic moulds. The surface texturing is mainly carried out instead of polishing to give a plastic part an improved visual appeal and attractive surface in order to improve the sales of the part in the market. Typical finish surface are easy to clean surfaces for domestic household appliances or the quite popular leather type finish for automotive parts used inside the passenger compartment of a car. Moreover texturing is carried out in order improve the resistance to minor scratching and other kind of surface damage or to cover some slight imperfections resulting from irregularities during production like flow chains and to reduce further on the economic advantages during the filling process in the moulds. Therefore it is important that the plastic moulds steel used is able to be textured well.

GSF ESR is perfectly suitable for a proper etching process because the uniform microstructure, the high purity and low segregation level achieved by ESR re-melting and special processes during production as well as a very uniform hardness results in a high surface gloss and a uniform etching depth.

Due to those advantages GSF ESR will assist the moulds maker in producing moulds with uniform etching depth and a high surface gloss.

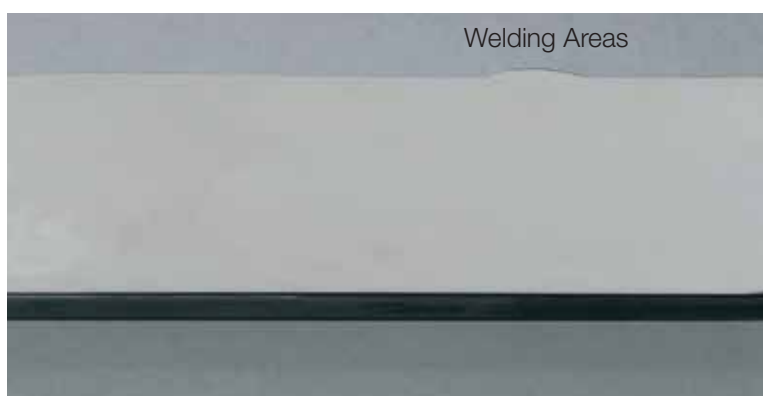
Welding of dies and moulds

Mould repairs by welding are sometimes necessary due to design changes, minor machining errors or repair welding during maintenance. Easy and safe welding is of major importance to allow the mould maker to carry out repairs rapidly in order to avoid long production standstill times and secure reliability of the repaired mould area. Polished surfaces require smooth transition zones in particular in order to fulfill the requirements of the quality demanding industry.

GSFESR is produced in a way to support outstanding welding properties. As a result of the low carbon contents and the very homogeneous hardness course and specific material properties, the welding process is significantly improved. The risk of cracks and outbreaks in the heat effective zone is decreased which supports the die maker in its demand to supply a shiny surface quality.

The homogenous hardness course after welding effecting in a smooth and shiny transition surface polish supports the mould maker in its way to produce dies of highest quality and efficiency

For details on welding please contact our technical application experts.



Machining parameters

The machining of a plastic moulds is a process which covers most of the tool costs, especially when the cavity is a very complex one. The most important machining is the milling process, but also the deep drilling of cooling holes inside the plastic moulds.

For GSF ESR grade in a range of hardness of 38-46 HRC we recommend to use the following parameters for machining with typical machines in a well fitted tool shop for producing moulds.



Service

Tool Steels

Melting

Forging

Heat Treatment

Machining

Surface Treatment

Products

Cold Work Tool Steels

Industries

Punching

Cutting

Forming

Bending

Rolling



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