

Remelting  
for highest  
standards

Know-how and  
process engineering:  
Optimally adapted  
to the requirements  
of our customers

Under the umbrella of the Swiss Steel Group,  
Deutsche Edelstahlwerke are a leading company with  
regard to manufacturing, processing and distributing  
specialty steel long products.

Around 4,000 employees produce a world-wide  
unique product range, which is used in the

most diverse industries, for example in mechanical  
and plant engineering, in aerospace as well as the chemical  
and automotive industry.





Deutsche Edelstahlwerke manufacture ingots, slabs, steel bars, bright steel, wire bars, wire products as well as special products from specialty steel.

For highest quality demands, Deutsche Edelstahlwerke use the electroslag remelting (ESR) as well as the vacuum arc remelting procedure (VAR). Based on more than forty years of experience with both processes, Deutsche Edelstahlwerke have excellent know-how and process engineering in place, which is optimally adapted to meet their customer's requirements.

The 5 ESR units located at the site in Siegen predominantly supply remelting blocks for producing rolled bar steel, wire and sheet metal. Larger block diameters and weights (max. 30t) are produced at the site in Krefeld which operates 3 ESR and 3 VAR furnaces. This facility supplies our forging shops as well as the rolling mill in Witten.



## The processes

### ESR process

Melting of a consumable electrode, which is immersed in liquid slag, occurs in electroslag remelting furnaces. The current running through the slag via the electrode heats up the slag due to its high electric resistance to the point that the tip of the electrode, which is immersed in the slag, is liquefied. The steel dripping from the electrode is then freed from contamination when passing through the liquid slag. Oxides and sulphur are bound in the slag. After passing through the slag, the steel solidifies again to form a remelted block.

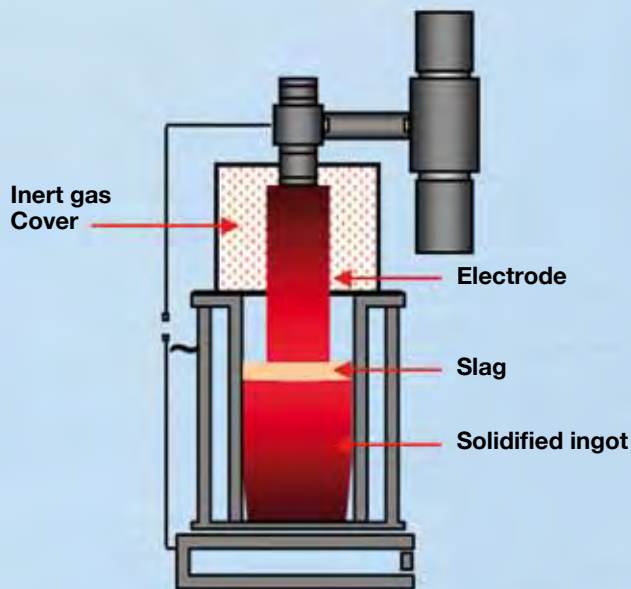
The remelting process takes place in a water-cooled copper mould, so that the block solidifies quickly and very uniformly.

The slag that gave this process its name mostly consists of a mixture of fluorspar, chalk and clay.

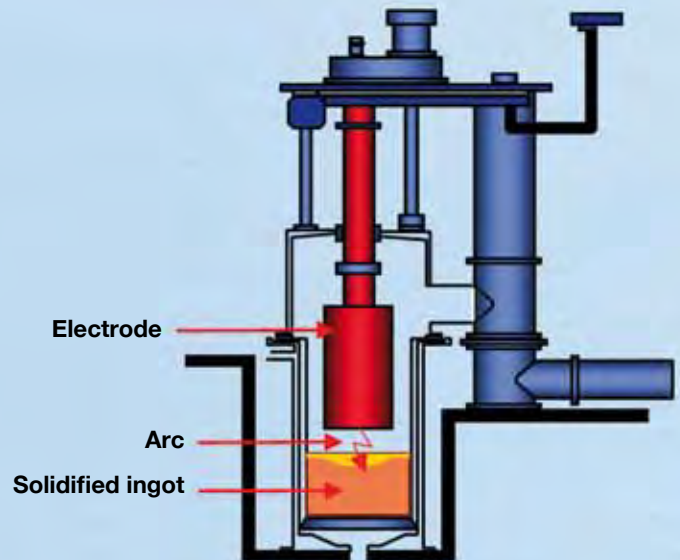
### VAR process

The vacuum arc remelting procedure has continuously gained importance in the past decades and has gained a firm position for producing high-quality specialty steel.

### ESR process



### VAR process



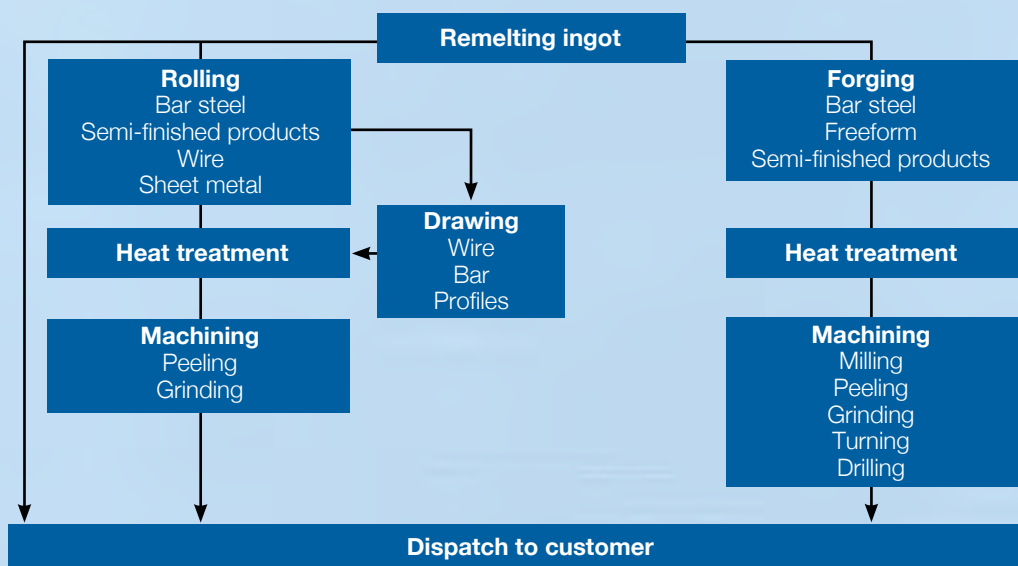
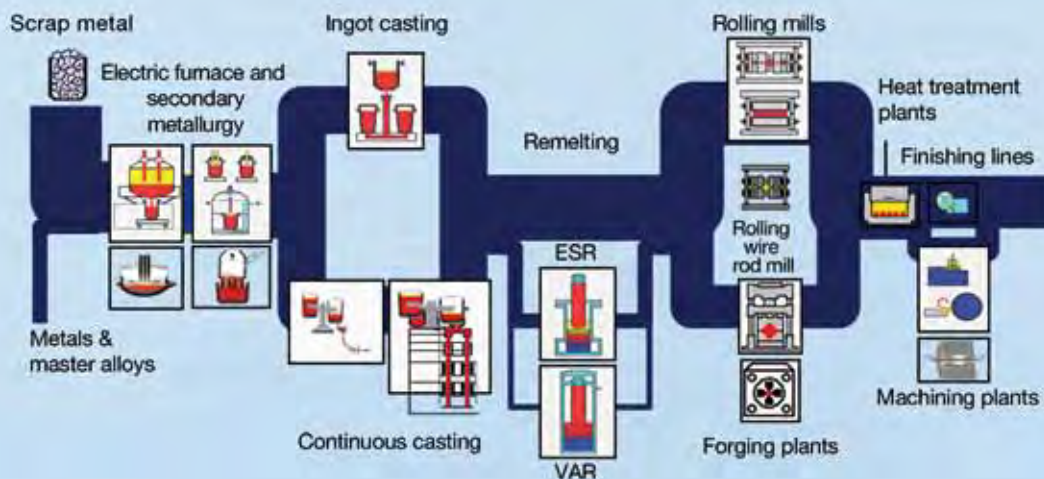
During the remelting process, a consumable electrode is melted under a vacuum.

The energy required for melting is created by applying an electric voltage, which generates an arc between the electrode tip and the metal sump below, produced by the molten ingot.

Remelting occurs under vacuum at a pressure of only approx. 0.001 mbar. The lower part of the remelting unit consists of a water-cooled

copper mould, which ensures uniform heat dissipation and even solidification.

In this mould, the resultant remolten ingot grows to the extent the electrode melts. In addition, through this process undesired accompanying elements are evaporated and oxidic inclusions are removed.





Properties

Degree of purity

The main purpose of the remelting process is to clean the steel.




In the ESR process, all oxidic particles are absorbed by the slag when the metal drops pass through the remelting slag. Apart from the deposition of macroscopic inclusions, the microscopic cleanliness is also significantly improved.

By remelting under inert gas the oxide cleanliness can be further improved.

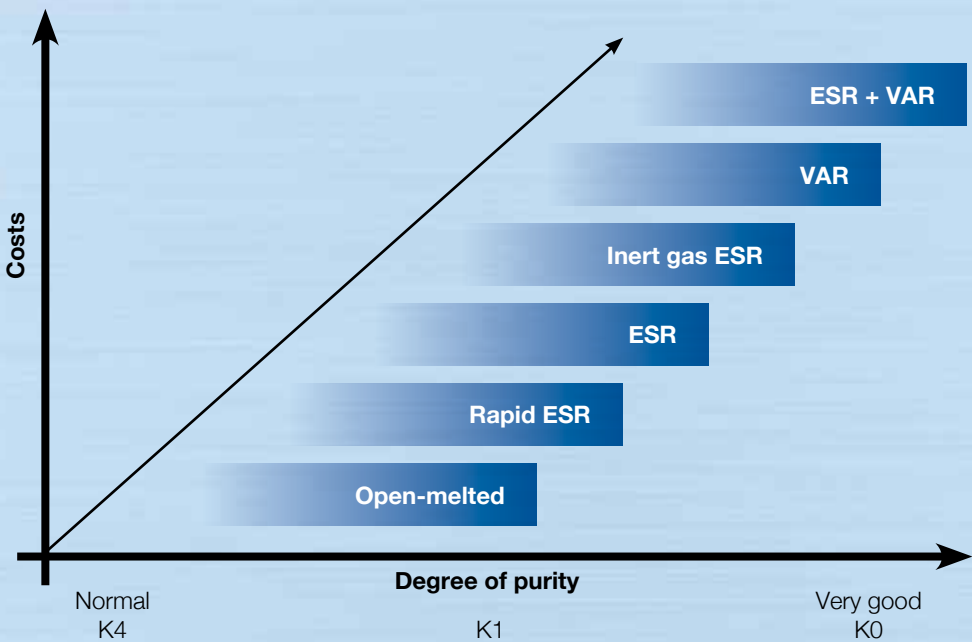
For further optimisation of microscopic purity, the vacuum arc remelting procedure is used.

For the most demanding applications, the ESR and VAR procedures can be combined.

Available block and slab sizes

Format	ESR	ESR-inert gas	VAR
	370, 410, 450	410	
	520 x 1225, 460 x 575		
	390, 440, 460, 480, 510, 570, 680, 830, 900, 980, 1000	680, 1000, 1250	295, 380, 435, 480, 620, 640, 870

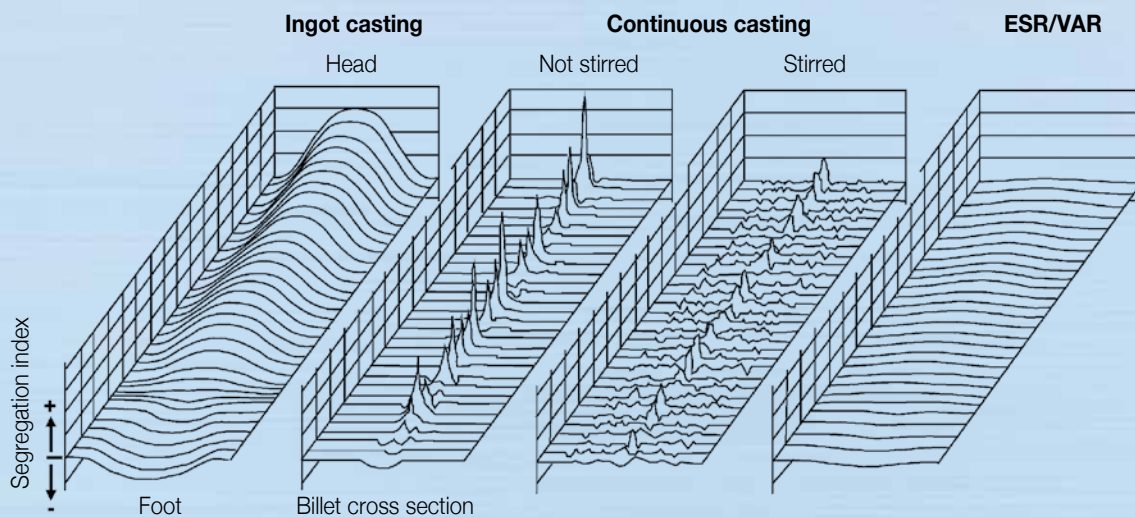
(all dimensions in mm)



### Segregation profile

Low remelting speed combined with the water-cooled mould ensures a particularly homogeneous and balanced/stable solidification. The segregations within a remelted ingot are thus much lower than in open cast continuous cast billets or conventional ingots. For this reason, most segregation-sensitive steels are remelted for homogenisation.

### Segregation profiles depending on the type of production



Segregation profiles in billets of ingot casting, continuous casting and ESR/VAR (schematic)

## Applications

High-grade construction steels, tool and high-speed steels as well as stainless specialty steels and special alloys.

### **High-grade engineering steel**

The range of specialty steels includes low-alloyed and alloyed steels of all material groups like case hardening steels, heat-treated steels, nitriding steels, ball bearing steels and steels with special chemistry. The high-grade engineering steel are mostly supplied to the European automotive and mechanical engineering industries. Typical fields of application are safety critical components with maximum reliability and operational life.

### **Tool steel**

Tool steels include high temperature resistant steels and plastic mould steels which are used to produce products with optically complex properties and very long service life.

### **High-speed steel**

High-speed steels are used as cutting materials for high chipping performance, i.e. for turning and planing tools, milling cutters and milling teeth, as well as twist drills and screw taps.





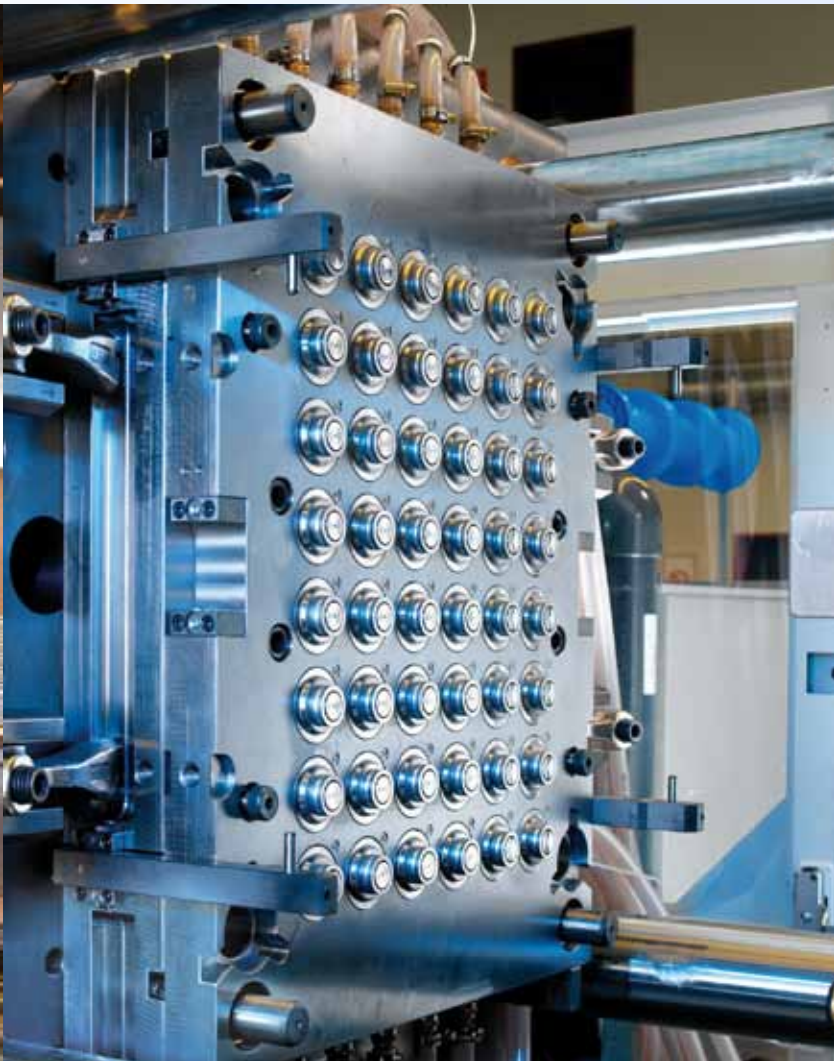
### **Corrosion-, acid- and heat-resistant steels**

The high-alloyed, stainless steels are used in the aerospace, medical and pharmaceutical industries, for the production of high performance, highly stressed and safety-critical components.

These steels are also increasingly used in the roller bearing industry as well as for the production of optical devices (wafers).

### **Implants**

Furthermore, high-alloy specialty steels or cobalt base alloys are used for the production of medical implants.



## Quality management and customer satisfaction

Quality management develops regulations for all important business processes which correspond to the latest in technology, and by involving all employees ensures their practical application and constant improvement.

Test labs have state-of-the-art equipment. Their testing competence was confirmed through accreditation according to EN 4501.

We ensure a uniformly high quality level for all products for our customers. The effectiveness of our system was confirmed with the certification according to DIN EN ISO 9001, QS 9000, DIN EN 16949, DIN EN 14001 and several other approvals from the aerospace, automotive and power plant engineering industries.



**General note (liability)**

Information about the quality or usability of materials or products is for descriptive purposes only. Confirmations in relation to the existence of certain characteristics or with reference to a certain application require written agreement. Printing errors, omissions and changes excepted.



DEUTSCHE EDELSTAHLWERKE GMBH

Austrasse 4  
58452 Witten, Germany  
[www.dew-stahl.com](http://www.dew-stahl.com)

Obere Kaiserstrasse  
57078 Siegen, Germany  
[www.dew-stahl.com](http://www.dew-stahl.com)