

A larger version of the ESKY LOS4542 logo, with "ESKY" in a stylized, outlined font and "LOS4542" in a bold, solid blue font.

Stainless
precipitation
hardening ESR steel



General characteristics

EskyLos® 4542 is a stainless steel and it is particularly suitable for the manufacture of dies and moulds subjected to high mechanical stress.

EskyLos® 4542 is obtained through a special 'super clean' production process and by using the ESR (Electro-Slag-Melting) technology.

This technology offers the following advantages:

- increase of material toughness
- high micro-cleanness level
- total isotropy of the material
- very low segregation level

EskyLos® 4542 is supplied in the solution treated condition with hardness lower than 38 HRc (355 HB).

If high mechanical properties are required in the pattern and a homogeneous hardness throughout the whole mould is needed, EskyLos® 4542 can be further hardened to reach 28-40 HRc, by means of an age hardening process.

Since the heat treatment occurs below the phase transformation points, this process can also be carried out on a semi-finished mould, causing minimal deformation and no cracking during the hardening phase.

The mechanical characteristics of this steel are adaptable to a wide range of applications, much more so than those obtained through other grades that are normally used in this field

EskyLos® 4542 represents the ideal option for the end user who is looking for:

- high and homogeneous mechanical characteristics throughout the whole mould regardless of its complexity
- machinability
- micro-purity
- resistance to corrosion

Resistance to corrosion allows the surface characteristics of the mould to be maintained over time. It is possible to reduce the expensive and complicated operations of cleaning and setting up of the mould before usage.

EskyLos® 4542 offers the following advantages:

- excellent machinability
- excellent suitability for embossing
- excellent suitability for polishing
- excellent wear resistance related to the mechanical properties obtained on a finished mould
- exceptional dimensional stability after age hardening
- no cracking during heat treatment, regardless of shape and structure of the mould
- excellent weldability
- excellent resistance to corrosion

EskyLos® 4542 is 100% ultrasonically inspected, according to the most demanding of standards.

Chemical analysis

ESKY LOS 4542		Alloying %%	
C	≤ 0,07	Cr	15,00 ÷ 17,50
Si	≤ 1,00	Cu	3,00 ÷ 5,00
Mn	≤ 1,00	Ni	3,00 ÷ 5,00
Nb	0,15 ÷ 0,45		

Table for comparison of international classification

W. Nr. 1.4542

EN X5CrNiCuNb16-4

AFNOR X5CrNiCuNb16-4

AISI 17-4 PH

Lucchini RS's tool steels have been researched and formulated to optimize the performance of the materials.

The brand name identifies the Lucchini RS product and the number evokes the Werkstoff classification or other means of reflecting the characteristics of use.

Main applications

EskyLos[®] 4542 lends itself to the following applications.

Plastic moulding:


- dies of big/medium size for the automotive industry
- special dies for the food industry
- dies for rubber moulding
- dies for compression stamping (SMC, BMC)
- die bolsters for plastic die casting

Extrusion:

- matrices and gauges for PVC
- various components for extrusion

Physical and mechanical properties

Main physical properties

	at 20°C	at 250°C	at 500°C
Modulus of elasticity [kN/mm ²]	210	198	180
Thermal conductivity [W/mK]	19,0	19,8	20,5

Heat treatment

EskyLos[®] 4542 is supplied in the solution treated condition. In the event that it is necessary to obtain different hardness levels or to carry out heat treatment on the material, the following work parameters are recommended. The attached data are for illustration purposes only and must be modified to suit the heat treatment facility and dependent on the thickness of the bar.

Stress relieving

Suggested temperature	400°C
Heating	< 30°C/h
Soaking time	60 min every 25 mm thickness
Cooling	Slow in the furnace

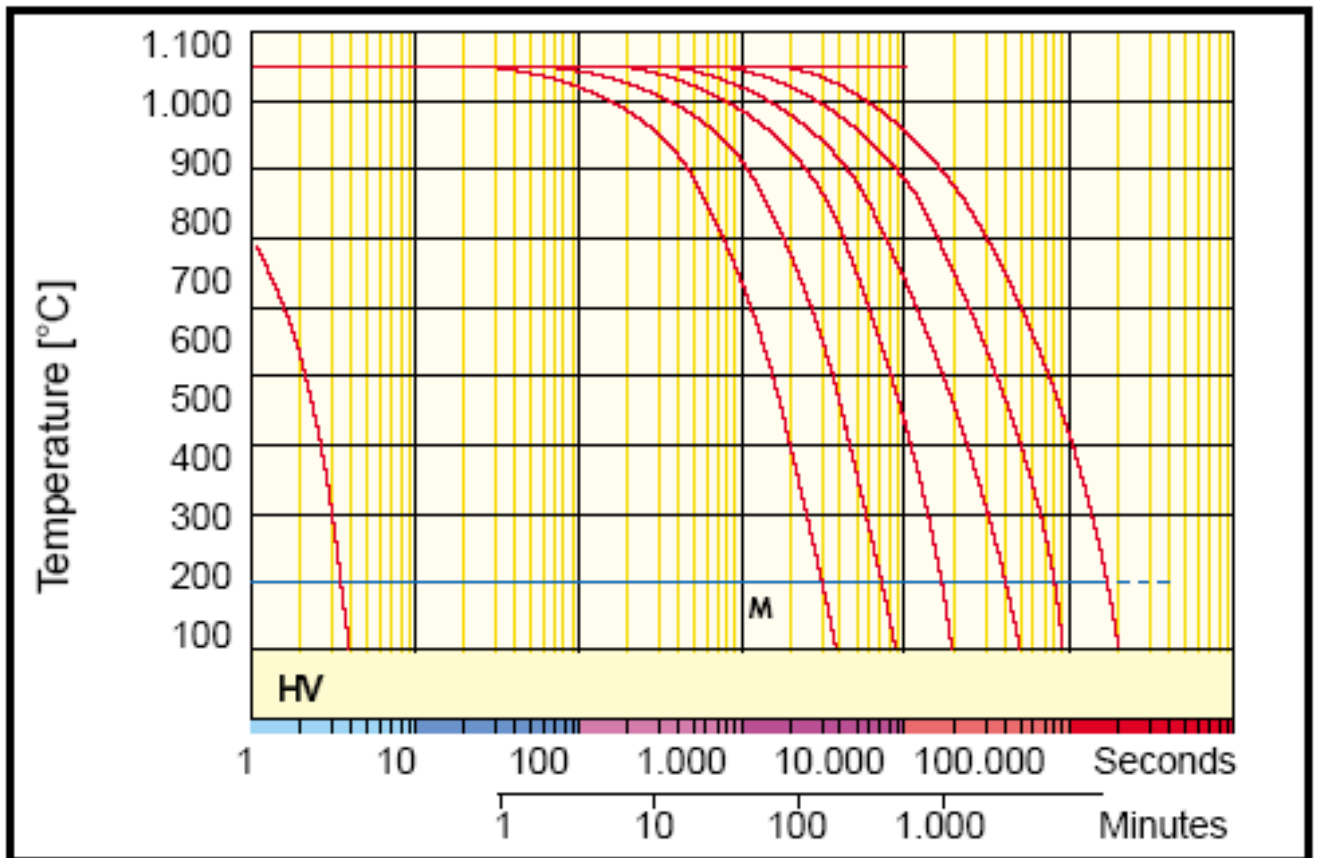
Stress relieving is recommended where it is necessary to eliminate the residual stresses induced by mechanical working or by a previous heat treatment process. It is not necessary to solution treat before stress relieving.

Solution treating and age hardening

The purpose of solution treating is to bring the material back to its original condition and eliminate the effects of previous heat treatments. We suggest carrying out a stress relieving at 400 °C after solubilization.

T solub. °C	T inv. °C	Tempo h	N/mm ² min
900	485	10	1.310
925	495	10	1.170
1.025	550	10	1.070
1.075	580	10	1.000
1.100	595	10	965
1.150	620	10	930

CCT Curve



The advantages of the ESR technology

The ESR (Electro-Slag-Melting) manufacturing technology offers the following advantages:

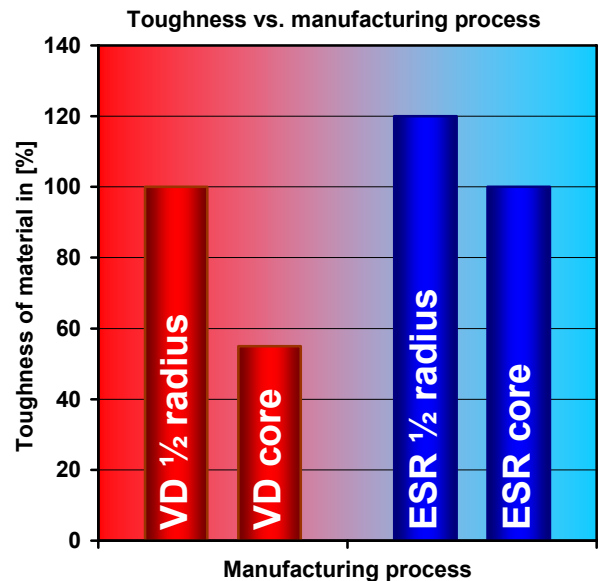
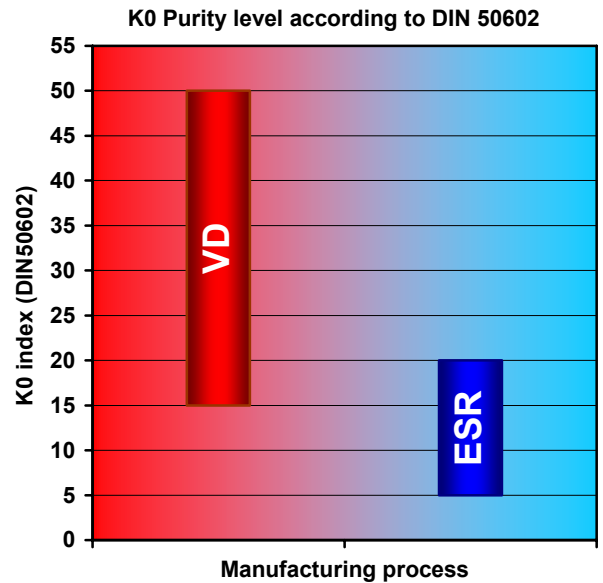
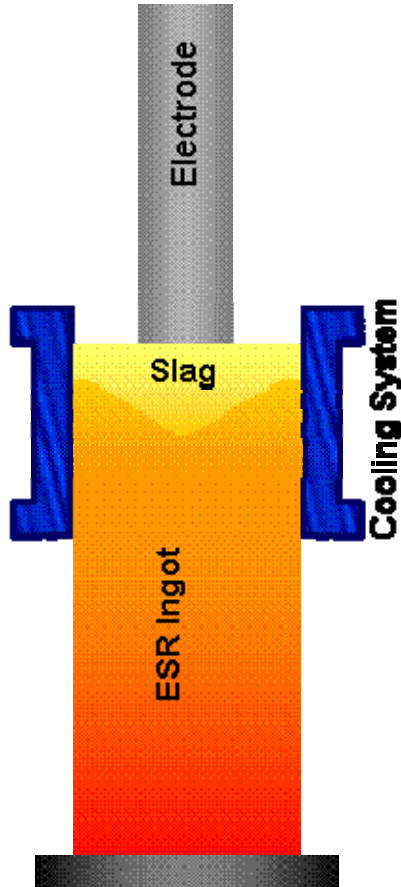
- increase of material toughness
- high micro-cleanness level
- total isotropy of the material
- very low segregation level.

The ESR process is based on ingot remelting, through a traditional VD (vacuum degassing) process, using a particular copper ingot mould that contains basic slag.

The ingot is remelted in a way that the liquid metal passes through the slag, which acts as a filter and retains the inclusions.

The process of solidification inside the ingot mould is faster than in a traditional process.

The result is homogeneous and isotropic steel.



Thanks to the ESR process, EskyLos® 4542 satisfies the most difficult requirements in terms of toughness and suitability to polishing. It is suitable for the manufacture of moulds subjected to mirror polishing and to high mechanical stress.

Why choose an age hardening steel?

Pre-hardened steels are suitable for several applications in the field of moulding, as they represent a balance of:

- good machinability
- good mechanical characteristics
- simple manufacturing cycle.

However when it is necessary to obtain an elevated hardness in the piece together with homogeneity of values along the whole section, pre-treated steels display certain limits. Moulds of pre-hardened steels are obtained by 'excavating' big sized blocks that inevitably possess mechanical characteristics that reduce towards the centre and are not homogeneous.

In order to limit this problem, the following options are available:

- start the production from a harder block; however the machining will be more difficult and the toughness will decrease
- hard the mould in the semi-finished state; however this increases the risk of cracking and deformation
- apply special surface heat treatments; however the finish machining could be limited by these treatments that are often expensive.

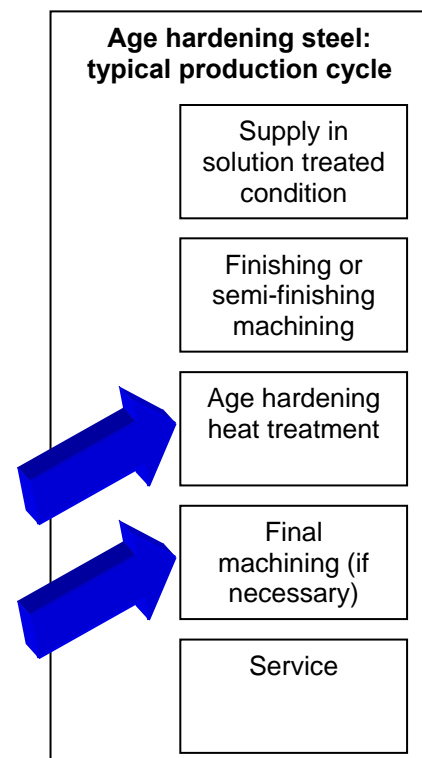
The solution is offered by EskyLos[®] 4542, an age hardening steel.

EskyLos[®] 4542 gives all the advantages of pre-hardened steels, without the restrictions that they present when high mechanical properties are required.

The increase in the mechanical properties is obtained through age hardening, at a temperature between 540 and 600 °C, depending on the mechanical characteristics required, without exceeding the transformation points. Thanks to this technology, users are able to obtain the required hardness in the centre of the mould.

In addition, EskyLos[®] 4542 gives the following advantages:

- no cracking during heat treatment regardless of the shape or thickness of the mould
- limited deformation of the mould
- limited machining allowance, leading to an optimisation of finish machining time after age hardening
- constant fatigue limit throughout the whole mould and consequent increase of the mould life cycle.



Should it be necessary to modify the shape of the mould or to further increase the mechanical properties of the mould, the original hardness and microstructure of EskyLos[®] 4542 can be restored through solution treating.

Welding

Welding of EskyLos[®] 4542 can give good results if the following procedure is followed:

Condition of material	Solution treating	Age hardening
Welding technique	TIG	
Pre-heating at	200÷250 °C	
Heat treatment	(*)	(**)

(*) Please contact our technical service

(**) The need for heat treatment is established by the condition of the weldable area. Should the weldable area be substantial, solution treatment of the piece and a second age hardening treatment will be needed.

For further information, please refer to the brochure

Photo-engraving

EskyLos[®] 4542, as a result of the modern processes utilised and of the low sulphur content, can be photo incised to obtain designs of various types. For further information, please refer to the brochure

Polishing

Due to the ESR (Electro-Slag-Remelting) manufacturing process, EskyLos[®] 4542 has excellent suitability to polishing. For further information, please refer to the brochure



Via G. Paglia, 45

24065 Lovere (BG) - ITALY

Tel. + 39 035 963492

Fax + 39 035 963551

Web <http://www.LucchiniRS.it>

E-mail toolsteels@LucchiniRS.it