

A larger version of the KEYLOS PLUS logo, with the same stylized "KEY" and solid "LOS PLUS" text, and a horizontal line below "KEY".

Pre-treated steel,  
suitable for the most  
demanding plastic  
moulding



## General characteristics

KeyLos® PLUS is the new steel grade that Lucchini RS proposes for the most difficult plastic moulding applications as a result of the mix between tradition and innovation.

KeyLos® PLUS is a pre-treated steel, suitable for the manufacture of medium and big size injection moulds.

KeyLos® PLUS is obtained through a special 'super clean' production process and special heat treatments. This steel has a balanced mixture of characteristics that make it particularly suitable for the manufacture of dies and moulds subjected to high mechanical stress.

It guarantees excellent mechanical properties with a limited variation between surface and core. Thanks to the low value of Carbon equivalent the weldability and thermal conductivity are very good.

Its micro-purity and homogeneous microstructure guarantees to this steel high polishing and texturing performances.

KeyLos® PLUS is normally supplied in the pre-treated condition with a surface hardness of 300-350 HB.

KeyLos® PLUS is the best option for the production of blocks with thicknesses up to 1000 mm in that there is no major variation of internal hardness.

KeyLos® PLUS offers the following advantages:

- excellent toughness level
- excellent suitability for photo-engraving
- excellent suitability for polishing
- excellent wear resistance
- excellent weldability.

KeyLos® PLUS is 100% ultrasonically inspected, according to the most demanding of standards.

## Chemical analysis

KEYLOS PLUS		Alloys %	
C	0.25 ÷ 0.35	Cr	1.30 ÷ 1.70
Si	0.20 ÷ 0.60	Mo	0.20 ÷ 0.60
Mn	1.30 ÷ 1.70	Ni	0.20 ÷ 0.60

## Main applications

KeyLos® PLUS is suitable for the following applications.

Plastic moulding:

- medium and big sized moulds for the automotive industry
- moulds for the food industry
- moulds for rubber pressing
- pressure moulds (SMC, BMC)
- bolsters.

Extrusion:

- dies and gauges for PVC extrusion
- mechanical parts for extrusion presses

## Physical and mechanical properties

### Main physical properties

<b>KEYLOS PLUS</b>	at 20 °C	at 250 °C	at 500 °C
<b>Modulus of elasticity [kN/mm<sup>2</sup>]</b>	215	190	170
<b>Coefficient of thermal expansion from 20 °C at [10<sup>-6</sup>/K]</b>	-	12,4	14,2
<b>Thermal conductivity [W/mK]</b>	34,7	34,2	33,9

### Main mechanical properties

<b>KEYLOS PLUS</b>	a 20 °C
<b>Ultimate tensile strength (UTS) [N/mm<sup>2</sup>]</b>	1.160
<b>Yield stress (YS) [N/mm<sup>2</sup>]</b>	960
<b>Elongation (A) [%]</b>	14
<b>Reduction of area (Z) [%]</b>	54

These values are average values obtained from the middle of the section of a 1000 mm thick bar, subjected to hardening at 900 °C, oil quenching and tempering at 580 °C.

## Heat Treatments

KeyLos<sup>®</sup> PLUS is supplied in the pre-treated condition. If it is necessary to obtain different hardness levels or if a heat treatment cycle is necessary, the parameters in the following table are recommended. The attached data are for information purposes only and must be varied dependent on the heat treatment facility and the thickness of the bar.

### Soft annealing

<b>Suggested temperature</b>	700 °C
<b>Soaking time</b>	60 min every 25 mm thickness
<b>Cooling</b>	Slow in the furnace

Soft annealing is useful to improve machinability. The obtained hardness is lower than 250 HB.

### Stress Relieving

<b>Suggested temperature</b>	550 °C
<b>Soaking time</b>	60 min every 25 mm thickness
<b>Cooling</b>	Slow in the furnace

If the suggested temperature is lower than the tempering temperature, the stress relieving temperature will be 50° C lower than the tempering temperature previously applied

Stress relieving is recommended where it is necessary to eliminate residual stresses induced by mechanical working or by a preceding heat treatment.

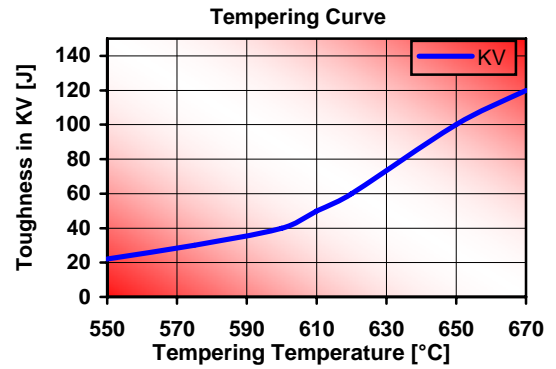
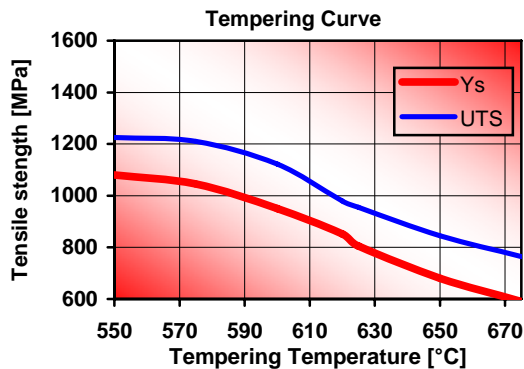
### Hardening

<b>Suggested temperature</b>	950 °C
<b>Soaking time</b>	60 min every 25 mm thickness
<b>Cooling</b>	Oil or water quench

We suggest to carry out hardening on material supplied in the annealed condition and tempering immediately afterwards.

### Tempering

<b>Suggested temperature</b>	The tempering temperature to be applied to the material depends on the required mechanical properties. See following graph.
<b>Soaking time</b>	60 min every 25 mm thickness
<b>Cooling</b>	Room temperature



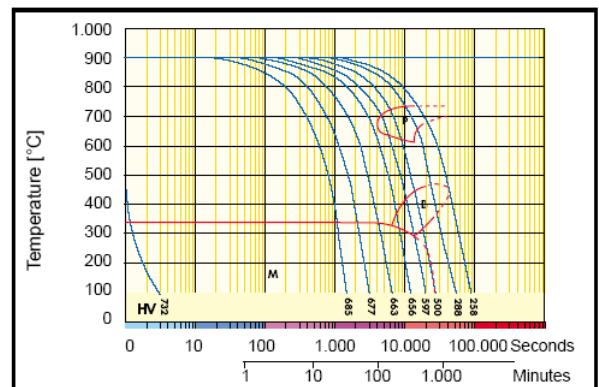
Tempering curve of a sample which has been austenitised at 900 °C.

After tempering we suggest carrying out stress relieving at a temperature lower than 50 °C.

### Induction hardening

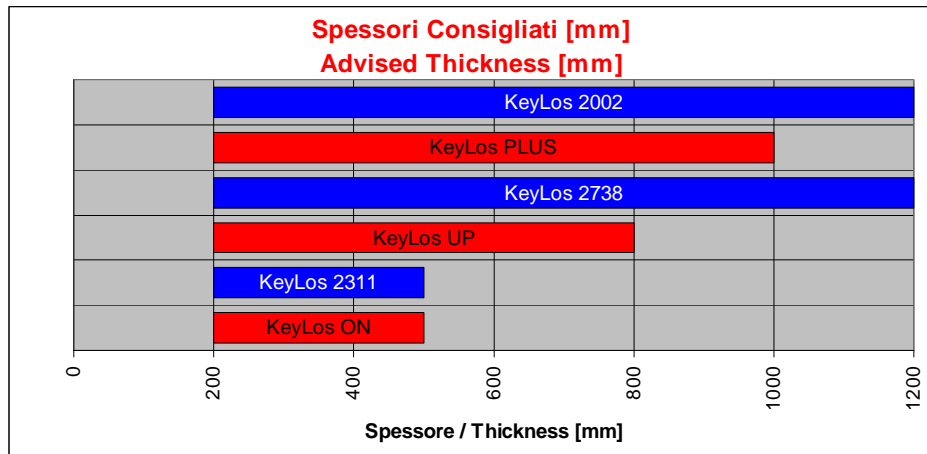
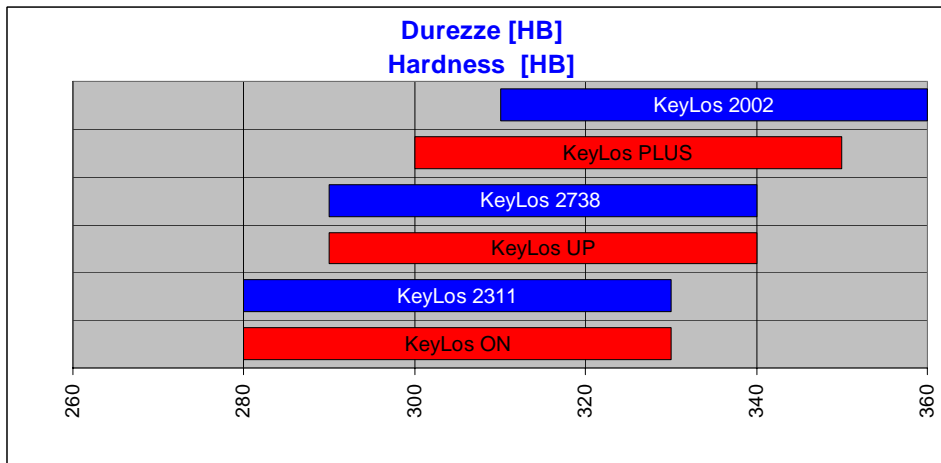
On this steel it is possible to carry out induction hardening. We recommend cooling at room temperature and tempering after heat treatment.

### CCT Curve



## Lucchini RS Main Tool Steels

	Machinability	Polishing	Texturing	Weldability
<b>KEYLOS 2002</b>	★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★
<b>KEYLOS PLUS</b>	★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★ ★
<b>KEYLOS 2738</b>	★ ★ ★	★ ★ ★	★ ★ ★ ★	★
<b>KEYLOS UP</b>	★ ★ ★	★ ★ ★	★ ★ ★ ★	★ ★
<b>KEYLOS 2311</b>	★ ★ ★	★ ★	★ ★	★ ★
<b>KEYLOS ON</b>	★ ★ ★ ★	★ ★	★ ★	★ ★ ★



<b>KEYLOS PLUS</b>		
<b>Machinability</b>	★ ★ ★	Very good, thanks to optimized chemical analysis
<b>Polishing</b>	★ ★ ★	Very good, thanks to a very low sulphur content
<b>Texturing</b>	★ ★ ★ ★	Excellent, thanks to a very low sulphur content and to its homogeneity microstructure.
<b>Weldability</b>	★ ★ ★	Very good, thanks to a limited value of carbon equivalent

## Welding

Welding of KeyLos<sup>®</sup> PLUS can give good results if the following procedure is followed:

Welding technique	TIG	MMA
	Pre-heating at 250÷300 °C	
Recommended heat treatment	Stress relieving (see heat treatment paragraph)	

For further information, please refer to the brochure.

## Photo-engraving

Thanks to modern production processes and to the low sulphur content, KeyLos<sup>®</sup> PLUS is suitable for photo-engraving to obtain various patterns. For further information, please refer to the brochure.

## Polishing

KeyLos<sup>®</sup> PLUS is particularly suitable for polishing. For further information, please refer to the brochure.

The logo for LUCCHINI RS features the company name in a bold, sans-serif font. Above the text is a stylized graphic element consisting of a green swoosh that transitions into a red swoosh, both curving upwards from left to right.

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