



The pre-treated  
steel for low  
thickness mould



## General characteristics

KeyLos® 2311 is a steel designed for the manufacture of small sized moulds.

KeyLos® 2311 represents the ideal option for the end-user who is looking for:

- good toughness and mechanical proprieties
- machinability
- micro-purity.

This steel is obtained through a special 'super clean' production process, which allows a high level of micro-purity.

KeyLos® 2311 is supplied in the pre-treated condition with surface hardness between 280 and 330 HB.

It is suitable for mould with thickness up to 500 mm

High level of machinability and microstructural homogeneity are obtained thanks to a calcium treatment process and to careful heat treatment.

KeyLos® 2311 is the best option for the production of blocks with low thickness in that there is no major variation of hardness.

KeyLos® 2311 offers the following advantages:

- good machinability
- good suitability for photo-engraving
- good suitability for polishing
- good wear resistance
- optimized manufacturing cycle: from steel block to mould, with no need for intermediate treatments
- good weldability.

KeyLos® 2311 is 100% ultrasonically inspected, according to the most demanding of standards.

## Chemical analysis

KEYLOS® 2311		Alloying %	
C	0,35 ÷ 0,45	Cr	1,80 ÷ 2,10
Si	0,20 ÷ 0,40	Mo	0,15 ÷ 0,25
Mn	1,30 ÷ 1,60		

Table for comparison of international classification

**W. Nr.** 1.2311

**DIN** 40CrMnMo7

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

KeyLos® 2311 in the pre-treated condition is suitable for the following applications.

Plastic moulding:

- small and medium sized moulds for the automotive industry
- moulds for food industry products
- 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® 2311</b>	at 20 °C	at 250 °C	at 500 °C
<b>Modulus of elasticity</b> [kN/mm <sup>2</sup> ]	210	196	177
<b>Coefficient of thermal expansion from 20 °C at</b> [10 <sup>-6</sup> /K]	-	12,6	14,4
<b>Thermal conductivity</b> [W/m K]	34,0	33,4	33,0

### Main mechanical properties

<b>KEYLOS® 2311</b>	at 20°C
<b>Ultimate tensile strength (UTS)</b> [N/mm <sup>2</sup> ]	980
<b>Yield stress (YS)</b> [N/mm <sup>2</sup> ]	860

These values are average values obtained from the middle of the section of a 400 mm thick bar, subjected to hardening at 860 °C, oil quenching and tempering at 600 ° C.

## Heat treatment

KeyLos® 2311 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>	<b>700 °C</b>
<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>	<b>550 °C</b>
<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.

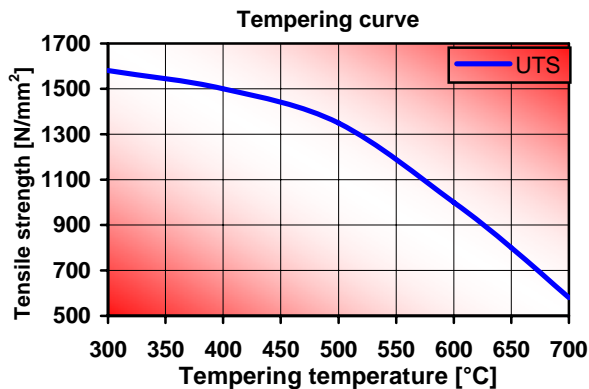
## Hardening

<b>Suggested temperature</b>	860 °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



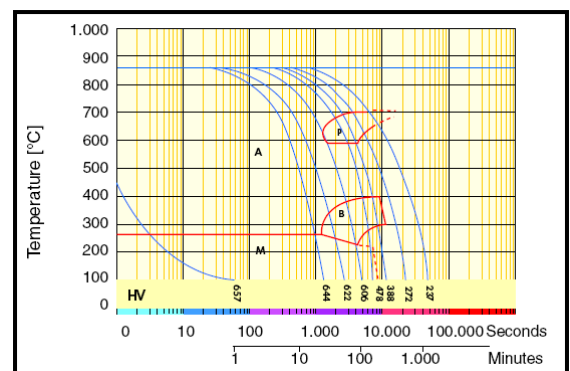
Tempering curve of a sample which has been austenitised at 860 °C.

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

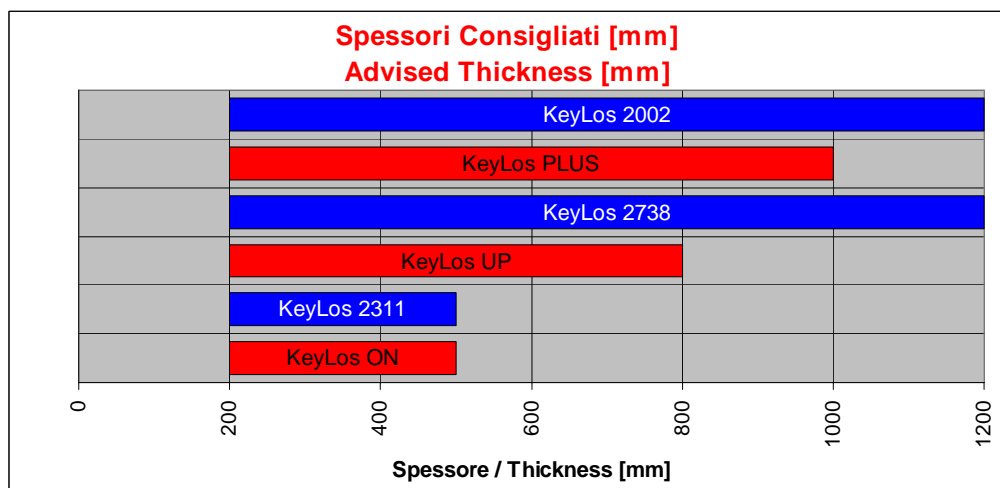
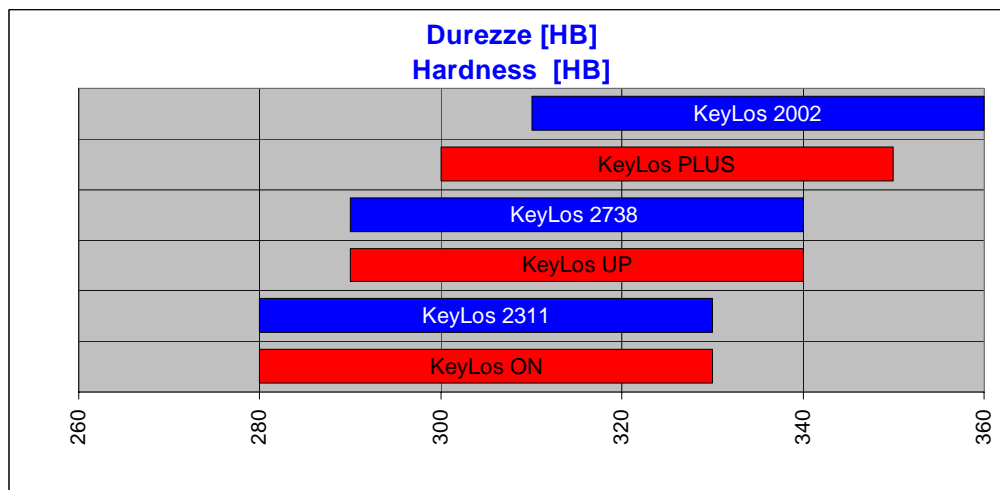


## Critical points

<b>Ac1</b>	735°C	<b>Ms</b>	330°C
<b>Ac3</b>	790°C	<b>Mf</b>	100°C

## Lucchini RS Main Tool Steels

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



## Welding

Welding of KeyLos® 2311 can give good results if the following procedure is followed:

<b>Welding technique</b>	TIG	MMA
<b>Pre-heating at</b>	250÷300 °C	
<b>Recommended heat treatment</b>	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® 2311 is suitable for photo-engraving to obtain various patterns. For further information, please refer to the brochure.

## Polishing

KeyLos® 2311 is particularly suitable for polishing. For further information, please refer to the brochure.



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