

**KEY**  
**LOS® 2003**

Pre-treated steel for  
plastic moulding

The logo for Lucchini RS features a stylized swoosh above the text. The swoosh is green on the left and red on the right. The text 'LUCCHINI' is in a bold, italicized, dark grey font, and 'RS' is in a smaller, regular, dark grey font.

**LUCCHINI** RS

## General characteristics

KeyLos<sup>®</sup> 2003 is a pre-treated steel, suitable for the manufacture of injection moulds.

This steel has been designed to enhance the following characteristics:

- suitability to hardening
- toughness
- weldability
- machinability

KeyLos<sup>®</sup> 2003 is obtained through a special 'super clean' production process and special heat treatments.

KeyLos<sup>®</sup> 2003 is normally supplied in the pre-treated condition with a surface hardness of 310-350 HB. Thanks to the carefully chosen chemical analysis and to the particular manufacturing process, KeyLos<sup>®</sup> 2003 is characterised by its little variation between superficial and internal mechanical characteristics and is suitable for the production of blocks up to 600 mm thick.

Taking into consideration its low carbon equivalent content, KeyLos<sup>®</sup> 2003 has excellent weldability level compared to the other grades normally used in this field. Moulds can be subjected to repairs without compromising their integrity.

Being calcium treated, KeyLos<sup>®</sup> 2003 has an excellent level of machinability and micro-purity. Because of its high level of micro-purity and micro-structural homogeneity, KeyLos<sup>®</sup> 2003 is very suitable for polishing and guarantees excellent suitability to photo-engraving. KeyLos<sup>®</sup> 2003 is the best option for the production of blocks with thicknesses up to 600 mm as there is no major variation of internal hardness.

KeyLos<sup>®</sup> 2003 offers the following advantages:

- excellent toughness level
- excellent suitability for photo-engraving
- excellent suitability for polishing
- excellent suitability for nitriding, in order to increase the wear resistance
- excellent wear resistance
- internal homogeneous hardness on blocks with thickness up to 600 mm
- excellent weldability.

KeyLos<sup>®</sup> 2003 is 100% ultrasonically inspected, according to the most demanding of standards.

## Chemical analysis

| KEYLOS <sup>®</sup> 2003 |             | Alloying % |             |
|--------------------------|-------------|------------|-------------|
| C                        | 0,20 ÷ 0,30 | Cr         | 1,20 ÷ 1,50 |
| Si                       | 0,10 ÷ 0,40 | Mo         | 0,40 ÷ 0,70 |
| Mn                       | 1,30 ÷ 1,60 | Ni         | 0,90 ÷ 1,20 |

## Main applications

KeyLos<sup>®</sup> 2003 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

| KEYLOS 2003  | at 20 °C | at 250 °C | at 500 °C |
|--|----------|-----------|-----------|
| Modulus of elasticity [kN/mm <sup>2</sup> ]                          | 210      | 193       | 175       |
| Coefficient of thermal expansion from 20 °C at [10 <sup>-6</sup> /K] | -        | 12,7      | 14,8      |
| Thermal conductivity [W/mK]  | 34,8     | 34,3      | 33,9      |

### Main mechanical properties

| KEYLOS 2003  | at 20 °C |
|--|----------|
| Ultimate tensile strength (UTS) [N/mm <sup>2</sup> ] | 1.020    |
| Yield stress (YS) [N/mm <sup>2</sup> ]               | 960      |

These values are average values obtained from the middle of the section of a 600 mm thick bar, subjected to hardening at 900 °C, oil quenching and tempering at 600 °C.

## Heat Treatments

KeyLos® 2003 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

|                       |                              |
|-----------------------|------------------------------|
| Suggested temperature | 700 °C                       |
| Soaking time          | 60 min every 25 mm thickness |
| Cooling               | Slow in the furnace          |

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

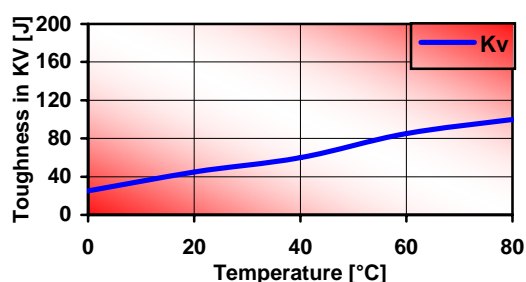
### Stress Relieving

|                       |                              |
|-----------------------|------------------------------|
| Suggested temperature | 550 °C                       |
| Soaking time          | 60 min every 25 mm thickness |
| Cooling               | 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.

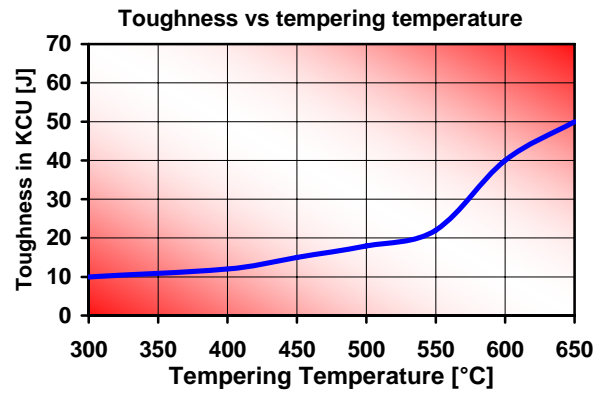
### Toughnes vs temperature



*Hardening*

|                              |                              |
|------------------------------|------------------------------|
| <b>Suggested temperature</b> | <b>900 °C</b>                |
| <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.



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

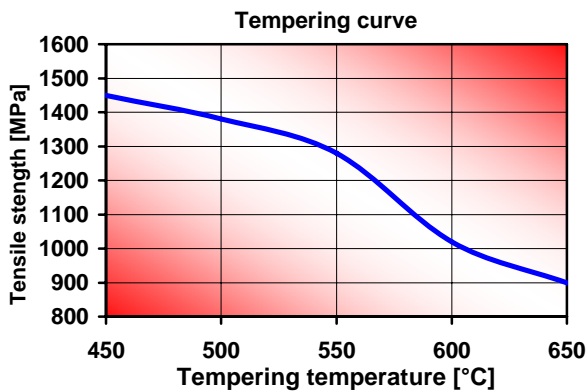
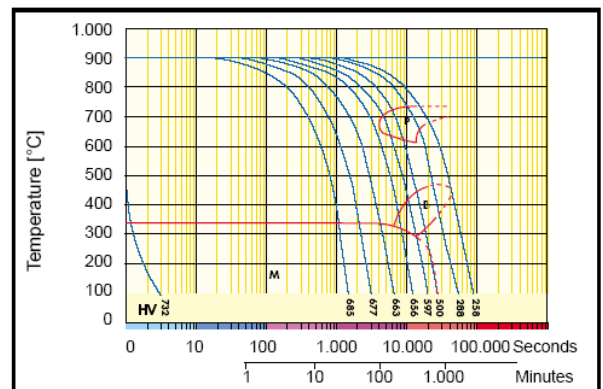
*Induction hardening*

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

*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  |

*CCT Curve*



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

*Critical points*

|            |              |           |              |
|------------|--------------|-----------|--------------|
| <b>Ac1</b> | <b>710°C</b> | <b>Ms</b> | <b>305°C</b> |
| <b>Ac3</b> | <b>840°C</b> | <b>Mf</b> | <b>75°C</b>  |

## Welding

Welding of KeyLos® 2003 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® 2003 is suitable for photo-engraving to obtain various patterns. For further information, please refer to the brochure.

## Polishing

KeyLos® 2003 is particularly suitable for polishing. For further information, please refer to the brochure.



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