FORGING &
CASTING
DIVISION

GROUP
LUCCHINI RS

KEY® LOS ON

Special and Innovative
pre-hardened steel
for injection dies
of small sizes

LOOK BEYOND

General characteristics

KeyLos® ON is a Chromium Molybdenum alloyed steel intended for injection dies of small size, up to 500 mm, bolsters or for all the moulds where short manufacturing time and low tooling cost are necessary.

KeyLos® ON represents the economic option for small moulds that need a good equilibrium between:

- mechanical properties;
- machinability;
- micro-purity.

KeyLos® ON can be supplied in the pre-hardened state to gives hardness in surface between 280 and 330 HB.

For the detected hardness values in standard sized products, the following correlation is usually valid and guaranteed:

$$(HB_{Surface,min\ required} - HB_{Core}) \leq 20HB$$

KeyLos® ON is 100% ultrasonically tested in accordance with the most stringent NDT standards.

KeyLos® ON can represent a perfect cost/performances ratio, thanks to the mix between its particular chemical analysis and the specific heat treatment.

Good mechanical properties are combined with a quite good machinability and high finishing properties.

Polishing and Photoengraving are lightly good, thanks to a low S content and thanks to the fine and homogeneous microstructure.

Tests carried out together with highly qualified partners have confirmed the high qualities of KeyLos® ON, particularly suited when easy design modifications can be required.

Also welding, in case of extreme repairing only, is possible.

Thanks to a controlled chemical analysis and a particular manufacturing process, KeyLos® ON benefits from a small variation in mechanical characteristics between surface and core and it is recommended for blocks of thickness up to 500 mm.

KeyLos® ON is the ideal choice when customer looks for a tooling cost reduction, through a suited steel grade with good balanced mechanical characteristics, without recourse to materials richest in alloying elements.

KeyLos® ON is also designed with the aim to guarantee the minimum use of virgin materials, moving toward the use of scrap categories difficult to be recycled, that can became food for the steel making production of KeyLos® ON grade.

KeyLos® ON represents a quick and cost effective way to obtain high quality plastic parts at low cost, collecting a quite long mould life and optimizing the environmental sustainability of the product.

It is difficult to predict the improvement that a innovative material will provide over the traditional one: it's only the feedback from service and the cooperation with Customers that can validate the longer mould life of the proposed materials.

KeyLos® ON is demonstrating good resistance to fatigue in many applications and a significantly longer mould life than conventional steel grades.

Continuous improvement of materials technology is managed in safety and in accordance with eco-consistency and sustainability criteria, because Lucchini RS believes that Safety and Environment are the main priorities in all the phases of the manufacturing process.

Chemical analysis

	Range	C [%]	Si [%]	Mn [%]	Cr [%]	Mo [%]	Ni [%]
KEYLOS ON Alloying [% in weight]	min	0,40	0,50	0,90	0,80	/	/
	max	0,50	0,80	1,30	1,20	0,30	0,50

Table for comparison of international classification

W. Nr. /
DIN designation: **≈45CrMo4**

Lucchini RS's tool steels have been researched and formulated in order to optimize the material performances.

Main applications

The pre hardened steel KeyLos® ON lends itself to the following applications:

Plastics moulding:
- dies of small size for the automotive industry;
- particular dies for the food industry;
- dies for the stamping of rubber;
- dies for compression stamping (SMC, BMC);
- die bolsters for plastic dies;
- mechanical components.

Physical and mechanical properties

Main physical properties

KEYLOS ON	20°C	250°C	500°C
Modulus of elasticity [GPa] (1GPa=1000 MPa)	210	196	177
Coefficient of thermal expansion [10^{-6}/K]	-	12,8	15,2
Thermal conductivity [W/mK]	33,5	34,0	34,2

Main mechanical properties

KEYLOS ON	20°C	250°C
Ultimate Tensile strength (UTS) [MPa]	820	680
Yield stress (YS) [MPa]	620	490

The data are average values on standard production.

Heat treatments

KeyLos® ON is supplied in the pre-hardened 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

Recommended temperature	700°C
Soaking time	60 minutes every 25 mm of thickness
Cooling	Slow in the furnace at max 20 °C/h to **600 °C**, then at room temperature

Annealing can be useful where an improvement in the machinability of the material is required.

Stress Relieving

Recommended temperature	500°C
Soaking time	60 minutes very 25 mm of thickness
Cooling	Slow in the furnace at max 20 °C/h to **200 °C**, then at room temperature

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.

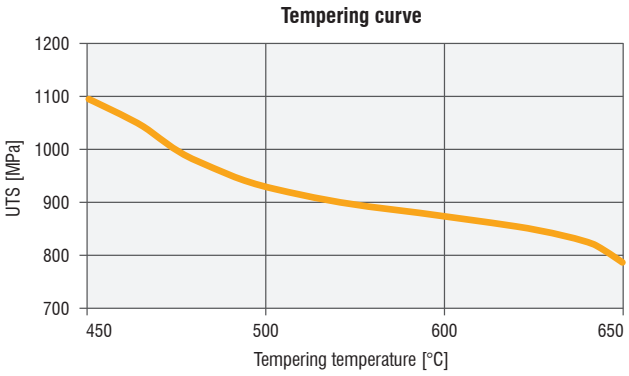
Hardening

Recommended temperature	890°C
Soaking time	60 min every 25 mm thickness
Cooling	Polymer or Water quench

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

Tempering

Recommended temperature	The tempering temperature may be selected from the graph attached in accordance with the mechanical properties to be achieved. See attached graph.
Soaking time	60 min every 25 mm thickness
Cooling	Room temperature



Tempering curve obtained on a test piece austenitised at 890 °C. After tempering it may be useful to carry out a stress relieving cycle at 50 °C less.

Induction hardening

It is possible to interpose an induction hardening cycle. Air-cooling is recommended, followed by tempering.

Nitriding

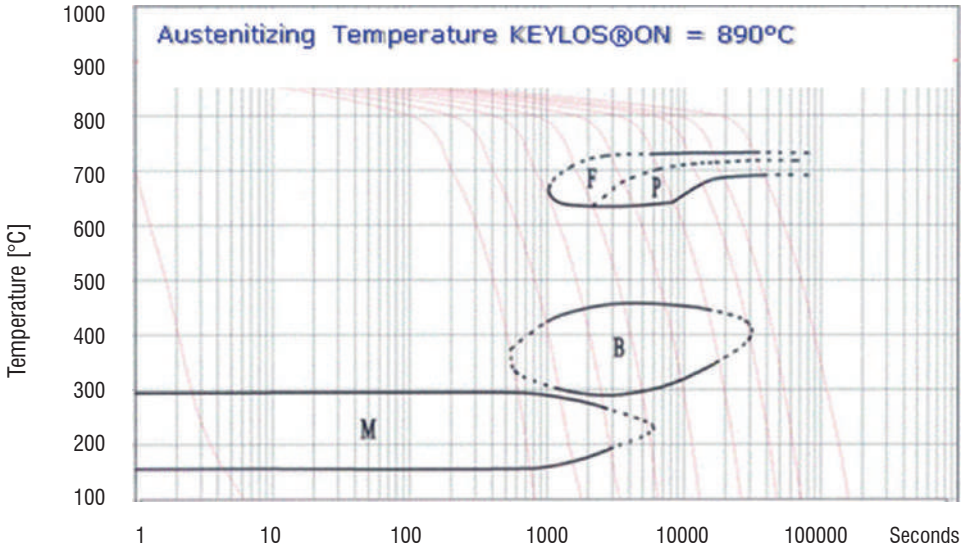
KeyLos® ON is suitable for ion and gaseous nitriding. Such a treatment is very advantageous in the case of extremely severe applications for the die or matrix.

The increase in surface hardness produced by the nitriding treatment prolongs the life of the component.

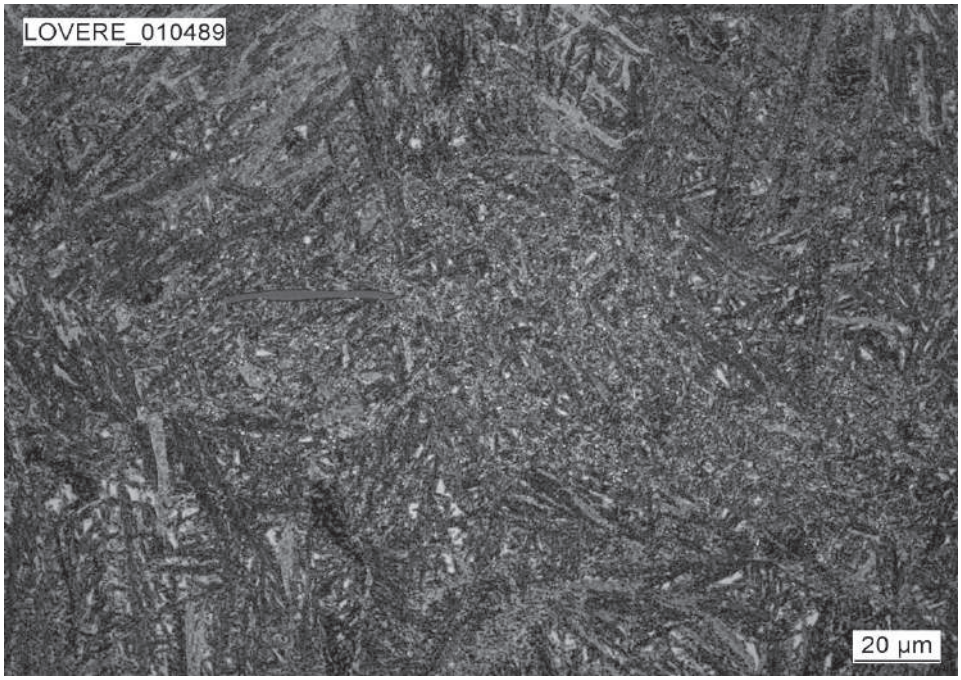
Modern nitriding procedures assure constant dimensions. It is recommended to treat the piece in the finish-machined state.

In any case, other properties can be analyzed and studied deeper by Lucchini RS on specific Customer request: please consult Lucchini RS specialists of MET Department.

CCT Curve



Microstructure of KEYLOS® ON



The microstructure of KeyLos® ON detected about 20 mm under surface is tempered martensite.

Welding

KeyLos® ON can be welded with good results by observing the following procedures:

Welding technique	TIG	MMA
Preheated to	250÷300 °C	
Stress relieving	Stress relieving (see heat treatment paragraph)	

Process and materials selection for product recyclability

According to the potential of steel recycling, Lucchini RS is adopting a strategy for environmental excellence in designing and manufacturing of its tool steel grades, putting eco-effectiveness into practice.

The main adopted steps are:

- conducting an environmental assessment on processes and products, with the minimum use of virgin materials and non-renewable forms of energy;
- moving toward zero-waste manufacturing processes, considering that the ultimate destinity of a scrapped steel mould becomes food for the next steel making process, that is the “waste equals food” philosophy;
- conducting a life cycle assessment for-each product and process, minimizing the environmental cost of product and service over its entire life cycles, from creation to disposal, that is the “Cradle to Cradle” philosophy.

Electrical Discharge Machining (EDM)

KeyLos® ON can be machined by EDM to obtain complex shape.

Afterwards it is advisable to stress relieving the material.

Photo-engraving

KeyLos® ON, in view of the modern production processes employed and the low Sulphur content, is suited to obtain various shapes by Photo-engraving.

Polishing

KeyLos® ON offers good polishing characteristics.