

Principais aplicações

KeyLos[®] 2738 na condição pré-endurecida é adequado para as seguintes aplicações:

Moldagem de plástico:

- moldes de médio e grande porte para a indústria automotiva;
- moldes para produtos da indústria alimentar;
- moldes para prensagem de borracha;
- moldes de pressão (SMC, BMC);
- reforçadores.

Extrusão:

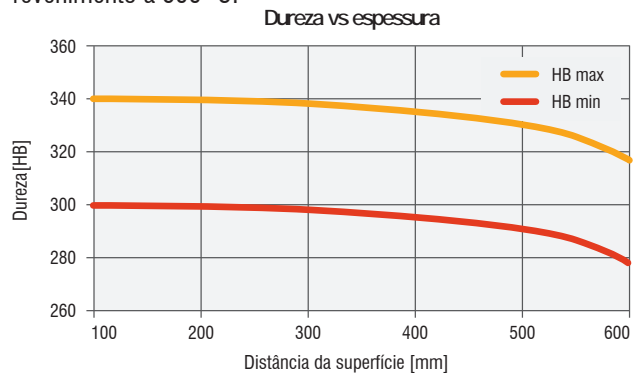
- matrizes e medidores para extrusão de PVC;
- peças mecânicas para prensas de extrusão.

Propriedades físicas e mecânicas

Propriedades físicas principais

KEY[®] LOS 2738	20°C	250°C	500°C
Módulo de elasticidade [GPa] (1GPa=1000 MPa)	210	196	177
Coefficiente de dilatação térmica [$10^{-6}/K$]	-	12,7	14,3
Condutividade térmica [W/mK]	32,0	31,1	30,0

Estes valores são valores médios obtidos a partir do meio da seção de uma barra de 900 mm de espessura, submetida ao endurecimento a 850 °C, resfriamento e revenimento a 600 °C.



QURSUHGDGHVPHFKLFDMVSULFLSDLM

KEY[®] LOS 2738	20°C	200°C
Ultimate Tensile strength (UTS) [MPa]	1.020	900
Yield stress (YS) [MPa]	900	760
Elongation (A) [%]	17	-
Reduction of area (Z) [%]	53	-

Heat treatments

KeyLos[®] 2738 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

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

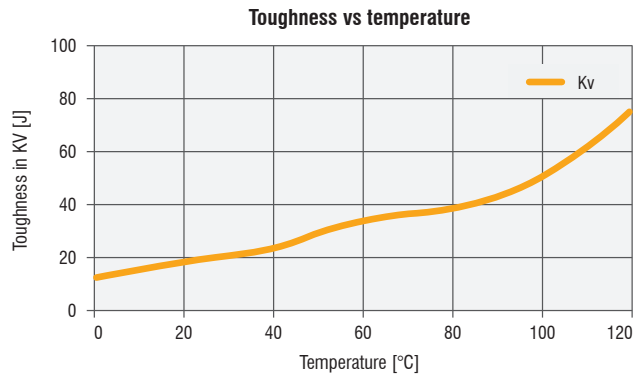
Soft annealing is useful to improve machinability. The obtained hardness is lower than 250 HB.

Stress Relieving

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

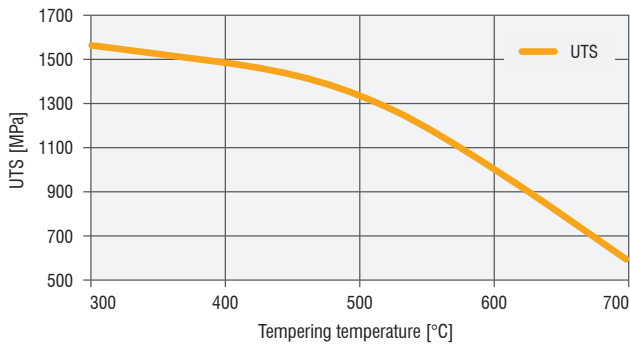
Suggested temperature	850 °C
Soaking time	60 min every 25 mm thickness
Cooling	Polymer or water quench

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

Tempering

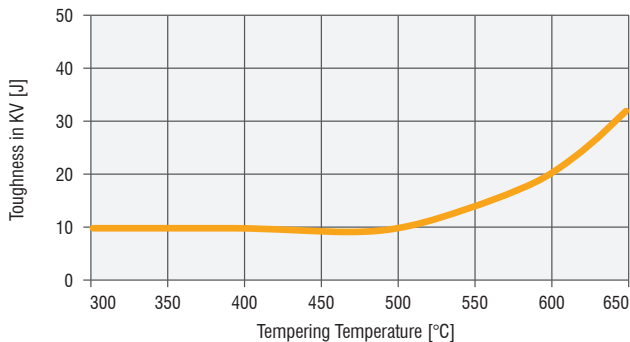
Suggested temperature	The tempering temperature to be applied to the material depends on the required mechanical properties.
See following graph.	60 min every 25 mm thickness
Soaking time	60 min every 25 mm thickness
Cooling	Room temperature

Tempering curve



Tempering curve of a sample which has been austenized at 950 °C.

Toughness vs tempering temperature



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

In any case, other properties can be deeper analysed by Lucchini RS against specific Customer request: please contact our Metallurgy Department.

Induction hardening

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

Nitriding

KeyLos[®] 2738 is suitable for ionic and gas nitriding.

This treatment is very useful for moulds or dies subjected to extremely stressful applications.

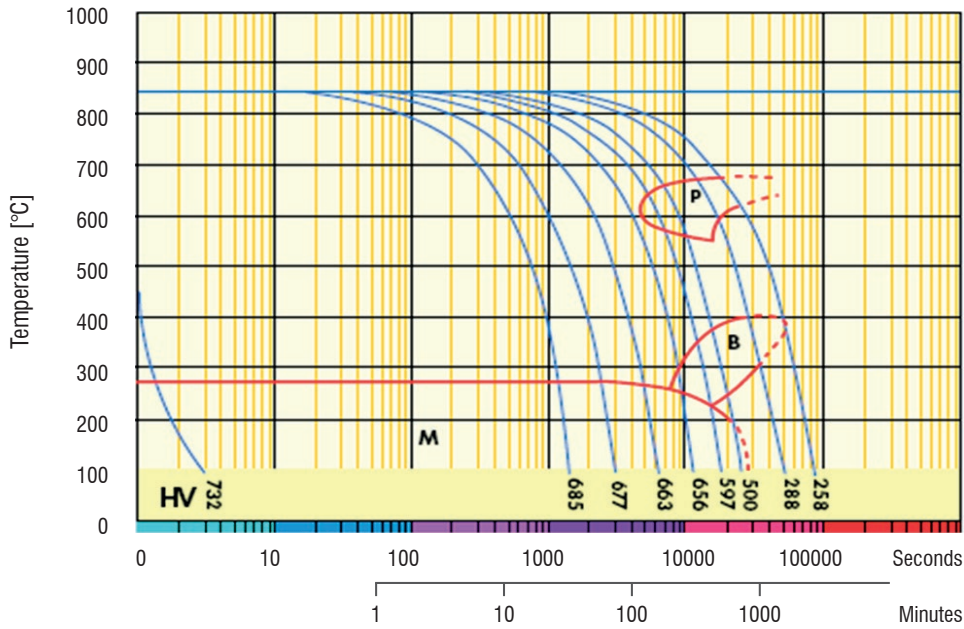
The increase of the surface hardness, following nitriding, lengthens the component life cycle. Modern nitriding processes allow the original dimensions of the component to be maintained.

We recommend heat treating the component in the finish machined condition.

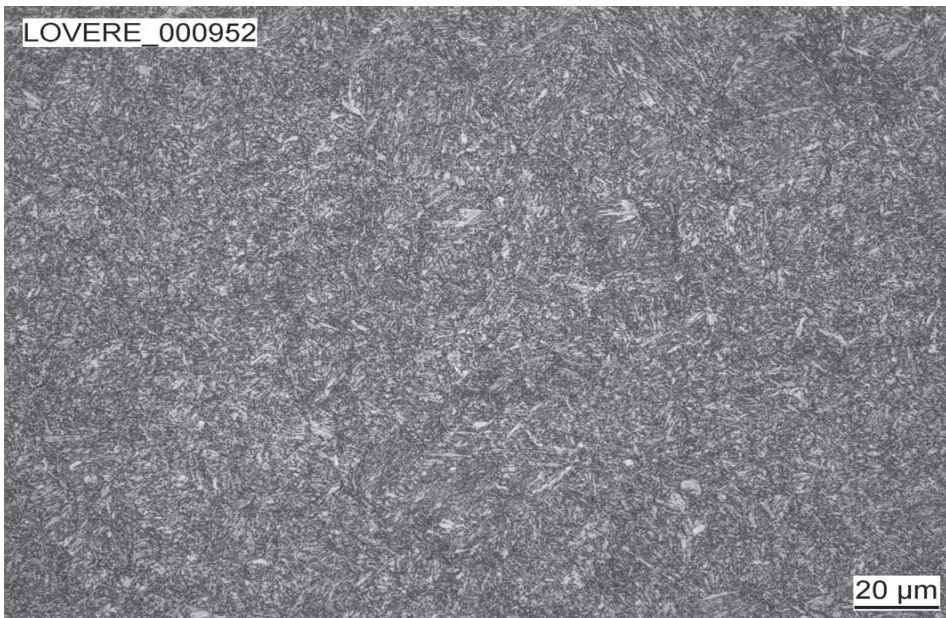
We recommend the following manufacturing cycle, in order to obtain the best results:

- rough machining;
- stress relieving;
- finish machining;
- nitriding.

CCT Curve



Microstructure of KEYLOS® 2738



The microstructure of KeyLos® 2738 detected about 20 mm under surface is tempered martensite

Guidance for machining

The following parameters are indicative only and must be adapted to the particular application and to the machinery employed.

Turning

Type of insert	Rough machining		Finish machining	
	P20-P40 coated	HSS	P10-P20 coated	Cermet
V _c cutting speed [m/min]	120 ÷ 160	(*)	160 ÷ 220	220 ÷ 270
a _r cutting depth [mm]	5	(*)	< 1	< 0,5

Milling

Type of insert	Rough machining		
	P25-P35 not coated	P25-P35 coated	HSS
V _c cutting speed [m/min]	80 ÷ 100	120 ÷ 150	(*)
f _z feed [mm]	0,15 ÷ 0,3	0,15 ÷ 0,3	(*)
a _r cutting depth [mm]	2 ÷ 4	2 ÷ 4	(*)

Type of insert	Pre-finishing		
	P10-P20 not coated	P10-P20 coated	HSS
V _c cutting speed [m/min]	100 ÷ 125	145 ÷ 175	(*)
f _z feed [mm]	0,2 ÷ 0,3	0,2 ÷ 0,3	(*)
a _r cutting depth [mm]	< 2	< 2	(*)

Type of insert	Finishing		
	P10-P20 not coated	P10-P20 coated	Cermet P15
V _c cutting speed [m/min]	170 ÷ 210	220 ÷ 240	270 ÷ 310
f _z feed [mm]	0,05 ÷ 0,2	0,05 ÷ 0,2	0,05 ÷ 0,2
a _r cutting depth [mm]	0,5 ÷ 1	0,5 ÷ 1	0,3 ÷ 0,5

(*) not advisable

Drilling

Type of insert	tip with interchangeable inserts	HSS	brazed tip
V_c cutting speed [m/min]	90 ÷ 120	(*)	50 ÷ 80
f_z feed per turn [mm/turn]	0,05 ÷ 0,15	(*)	0,15 ÷ 0,25

(*) not advisable

General formulae

Type of machining	Drilling	Milling
n: number of turns of mandrel	$V_c * 1000 / \pi * D_c$	$V_c * 1000 / \pi * D_c$
V_f : feed speed [m/min]	$V_f = f_z * n$	$V_f = f_z * n * z_n$
f_z feed per turn [mm/turn]	-	$f_n = V_f / n$
Note	D_c : Milling cutter or tip diameter [mm] V_c : cutting speed [m/min] f_z : feed [mm]	f_n : feed per turn [mm/turn] z_n : No. of milling cutter inserts

Approximate comparison between hardness and ultimate tensile strength values.

HB	530	520	512	495	480	471	458	445	430	415	405	390	375
HRc	54	53	52	51,1	50,2	49,1	48,2	47	45,9	44,5	43,6	41,8	40,5
MPa	1.900	1.850	1.800	1.750	1.700	1.650	1.600	1.550	1.500	1.450	1.400	1.350	1.300

HB	360	350	330	320	305	294	284	265	252	238	225	209	195
HRc	38,8	37,6	35,5	34,2	32,4	31	29	27	--	--	--	--	--
MPa	1.250	1.200	1.150	1.100	1.050	1.000	950	900	850	800	750	700	650

Welding

Welding of KeyLos[®] 2738 can give good results if that procedure is followed:

Welding technique	TIG	MMA
Pre-heating at	250 ÷ 300 °C	
Recommended heat treatment	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 destiny 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[®] 2738 can be machined by EDM to obtain complex shape.

Afterwards it is advisable to stress relieving the material.

Chrome Plating

KeyLos[®] 2738 can be Chrome plated in order to enhance the mechanical characteristics on the surface.

Within 4 hours of Chrome plating, in order to prevent Hydrogen embitterment, it is advisable to carry out heat treatment at 200°C for about 4 hours.

Photo-engraving

Thanks to modern production processes and to the low Sulphur content, KeyLos[®] 2738 is suitable for photo-engraving to obtain various patterns.

Polishing

KeyLos[®] 2738 is particularly suitable for polishing.



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