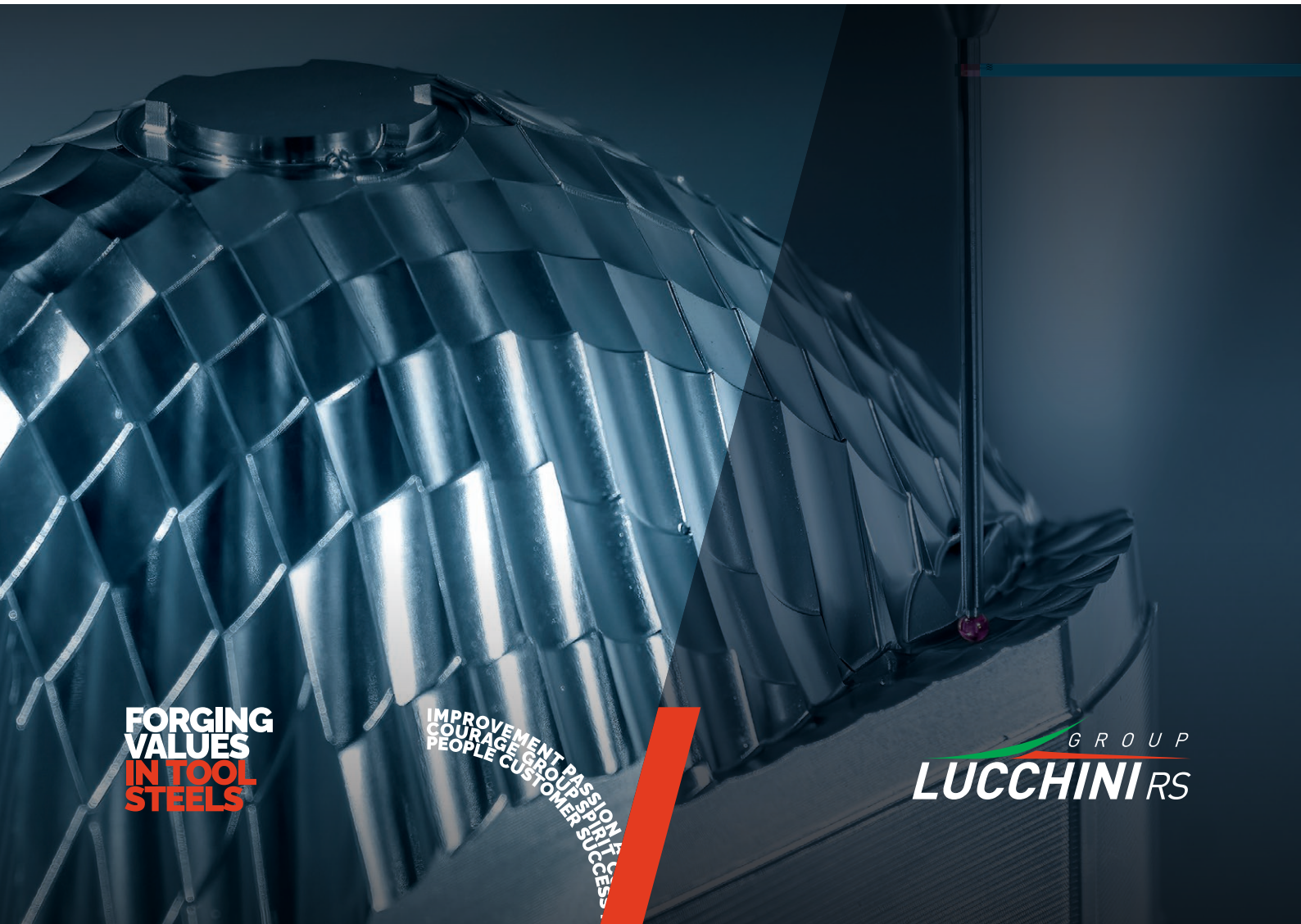
LUCCHINI 2714

SPECIAL ALLOYED STEEL DESIGNED FOR LARGE-SURFACE PLASTIC MOULDS AND FOR HOT WORK TOOLS



General characteristics

Lucchini 2714 is an alloy steel grade designed for the manufacture of dies, moulds, punches and other components subjected to high working temperatures and for high quality surface finishes.

Lucchini 2714 is also suitable for plastic moulding applications, where high mechanical properties are required and it is recommended for processing transparent melts and for large-surface plastic parts.

If subjected to suitable hardening, LUCCHINI 2714 can reach a hardness of 46 HRC without affecting the toughness.

In order to improve further the mechanical characteristics of the surface, LUCCHINI 2714 can be coated with PVD or PA/CVD methods.

Delivery conditions

LUCCHINI 2714 can be supplied both in round and rectangular cross-section. In round section LUCCHINI 2714 is normally supplied in annealed condition in dimensional range up to 1300 mm diameter; it can be supplied in round section also in pre-hardened condition in dimensional range up to 700 mm in diameter.

In rectangular cross-section LUCCHINI 2714 is normally supplied in pre-hardened condition in a dimensional range up to 500 mm in thickness.

In annealed condition the surface hardness value is lower than 250 HB, guaranteeing a good machinability.

In pre-hardened condition the surface hardness is 370 – 410 HB and the mid-thickness hardness value is guaranteed in section up to 500 mm, according to the following correlation: $(HB_{Surface,min\ required} - HB_{Core}) \leq 25HB$.

Main features

- high resistance to thermal shock and to heat cracking;
- good mechanical characteristics in hot condition;
- excellent mechanical characteristics in cold status;
- excellent toughness in hot condition and in cold status.

Main application

- large sized die blocks;
- plastic moulds;
- moulds subjected to low pressure;
- chill moulds for gravity casting;
- containers for die-casting presses;
- bolsters / die holders;
- sleeves for extrusion presses;
- injection moulds.

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Chemical analysis

	Range	C [%]	Si [%]	Mn [%]	Cr [%]	Mo [%]	Ni [%]	V [%]
LUCCHINI 2714 Alloying [% in weight]	min	0,50	0,10	0,65	1,00	0,45	1,50	0,07
	max	0,60	0,40	0,95	1,20	0,60	1,80	0,12

Comparison with international classifications:
W. Nr. 1.2714
DIN EN ISO4957 56NiCrMoV7

Physical and mechanical properties

Main physical properties

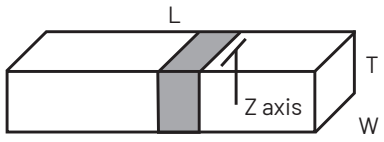
LUCCHINI 2714	20°C	400°C	600°C
Young modulus E [GPa]	210	198	178
Coefficient of linear thermal expansion α [10-6/K]	-	13,3	14,2
Thermal conductivity λ [W/mK]	25,5	25,0	24,6

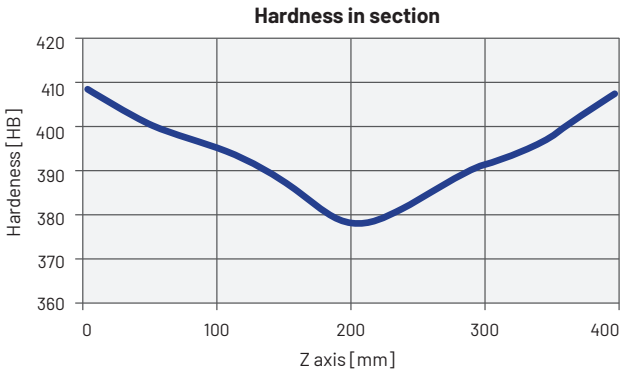
Main mechanical properties

LUCCHINI 2714	20°C	400°C	500°C	550°C	600°C
Ultimate tensile strength UTS [MPa]	1420	1300	1150	950	550
Yield strength YS [MPa]	1240	1090	950	750	350

The above mentioned are average values of a sample hardened at 850 °C, quenched and tempered to achieve hardness value of 44 HRC

Hardness profile





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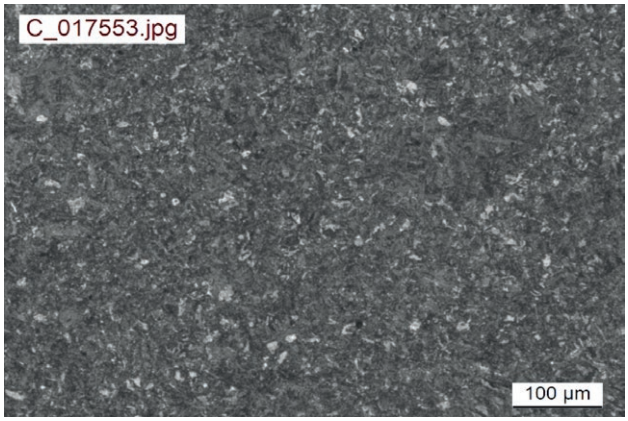
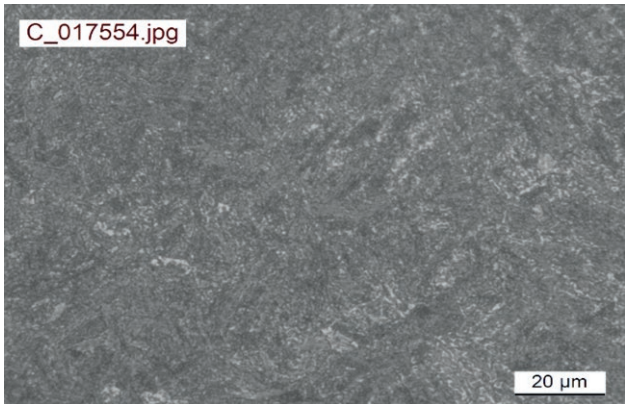
Microstructure

The main microstructure of LUCCHINI 2714 is tempered martensite.

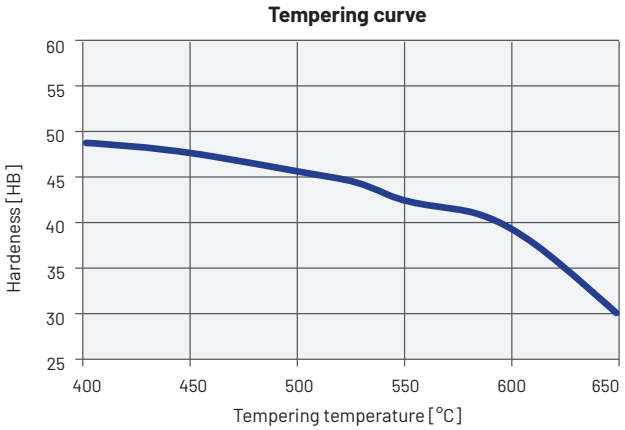


100x



500x

Surface hardness vs tempering temperature



Remark: the above data are representative of the typical behaviour of a 400 mm thick block made in LUCCHINI 2714 and are reported for information only

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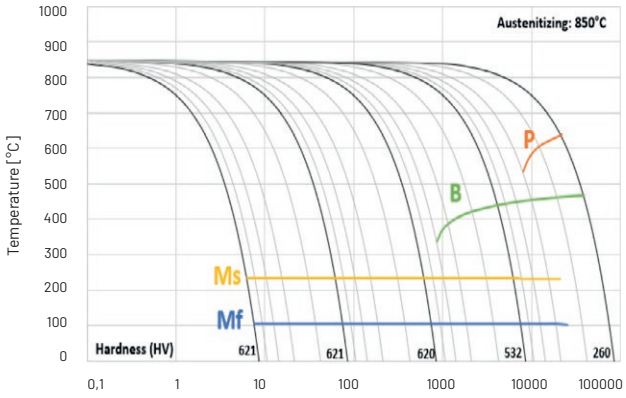
Heat treatment

Lucchini 2714 is supplied in the annealed condition or in the pre-hardened condition, depending on the application.

if different hardness/heat treatment procedure are required, we recommend the following parameters.

Note that the reported data are for information purpose only and must be adjusted to the heat treatment facility and the dimensions of the block therefore, before carrying out any heat treatment operation, it is strongly recommended to contact Lucchini RS for help and support.

Continuous cooling transformation curve (CCT)



Soft annealing

Suggested temperature	700 °C
Soaking time	60 min every 25 mm thickness
Cooling	Slow cooling in furnace (20°C/h)

Soft annealing is useful to improve machinability reducing hardness at 250 HB.

Stress relieving

Suggested temperature	550 °C
Soaking time	60 min every 25 mm thickness
Cooling	Slow cooling in furnace (20°C/h)

Stress relieving is recommended to reduce the tensions generated by certain manufacturing operations (e.g. machining) without affecting the hardness in the as-delivered conditions.

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.

Hardening

First pre-heating temperature	550°C
Soaking time	60 min every 25 mm thickness
Austenitising temperature	850°C
Soaking time	60 min every 25 mm thickness
Cooling	Air, vacuum cooling, salt bath, polymer, water quench

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

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Tempering

Suggested temperature	Depends on the required echanical properties
Soaking time	120 min every 25 mm thickness
Cooling	At room temperature

The tempering temperature should be selected form the graph "Tempering curve" reported above.

After tempering we suggest to carry out stress relieving at temperature 50°C lower than the last tempering temperature.

Nitriding

The purpose of nitriding is to increase the resistance of the material to wear and abrasion.

This treatment is very useful for components where high performance is necessary, as it extends the life of the material.

The tempering temperature must be at least 50 °C higher than the nitriding temperature.

Modern nitriding processes allow the original dimensions of the component to be maintained.

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

Other properties can be deeper analysed against specific Customer request: please contact our Metallurgy Department.

Polishing and photo-engraving

Lucchini 2714 is the suitable material when polishing and photoengraving are needed. Thanks to its integrated manufacturing process, those material manufactured by Lucchini RS are characterized by a high degree of purity. The high micro-purity and structural homogeneity levels give this grade good suitability to polishing and photo-engraving.

Polishing for graining: 3 Very good
Suitability for medium gloss polishing: 3 Very good
Suitability for mirror polishing: 2 Good
Suitability for engraving: 2 Good

Rating scale:
4 Excellent – 3 Very good – 2 Good – 1 Normal – 0 Unsuitable

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Guidance for machining

The following parameters are approximate only and must be adjusted to the specific application and machine tool.

Turning

	Rough machining	Finish machining		
Type of insert	P20-P40 coated	HSS	P10-P20 coated	Cermet
V_c cutting speed [m/min]	150 ÷ 190	(*)	190 ÷ 230	260 ÷ 320
a_r cutting depth [mm]	5	(*)	< 1	< 0,5

Milling

	Rough machining		
Type of insert	P25-P35 not coated	P25-P35 coated	HSS
V_c cutting speed [m/min]	120 ÷ 140	160 ÷ 180	(*)
f_z feed [mm]	0,15 ÷ 0,3	0,15 ÷ 0,3	(*)
a_r cutting depth [mm]	2 ÷ 4	2 ÷ 4	(*)

	Pre-finishing		
Type of insert	P10-P20 not coated	P10-P20 coated	HSS
V_c cutting speed [m/min]	140 ÷ 160	180 ÷ 200	(*)
f_z feed [mm]	0,2 ÷ 0,3	0,2 ÷ 0,3	(*)
a_r cutting depth [mm]	< 2	< 2	(*)

	Finishing		
Type of insert	P10-P20 not coated	P10-P20 coated	Cermet P15
V_c cutting speed [m/min]	200 ÷ 240	250 ÷ 270	300 ÷ 340
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

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Drilling

Type of insert	tip with interchangeable inserts	HSS	brazed tip
V_c cutting speed [m/min]	130 ÷ 160	(*)	90 ÷ 120
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

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Welding

Welding of Lucchini 2714 can give good results if the recommended procedure is observed.

Being steel with high Carbon Equivalent content, Lucchini 2714 is very sensitive to cracking.

We recommend carrying out pre-heating and heat treatment after welding.

Material condition	Annealed with hardness 250 HB max	
Welding technique	TIG	MMA
Pre-heating at	250 – 300°C	
Recommended Heat treatment	Heating of the material at 700 °C, cooling in the furnace to 600 °C at a rate of 20 °C/h, cooling at room temperature	

Material condition	Hardened and tempered	
Welding technique	TIG	MMA
Pre-heating at	330 – 380°C	
Recommended Heat treatment	650 °C or 50 °C lower than the tempering temperature previously applied	

Electrical Discharge Machining (EDM)

LUCCHINI 2714 can be machined by EDM to obtain complex shape. Afterwards we advise to carry out the stress relieving procedure.

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 its tool steel grades, putting eco-effectiveness into practice.

The main adopted steps are:

- to carry out an environmental assessment on processes and products, with the minimum use of virgin materials and non-renewable forms of energy;
- to move toward zero-waste manufacturing processes, considering that the ultimate destination of scrapped steel moulds becomes food for the next steel making process, that is the "waste equals food" philosophy;
- to carry out a life cycle assessment for each product and process, minimizing the environmental cost of product and service over its complete life cycles, from creation to disposal, that is the "Cradle to Cradle" philosophy

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