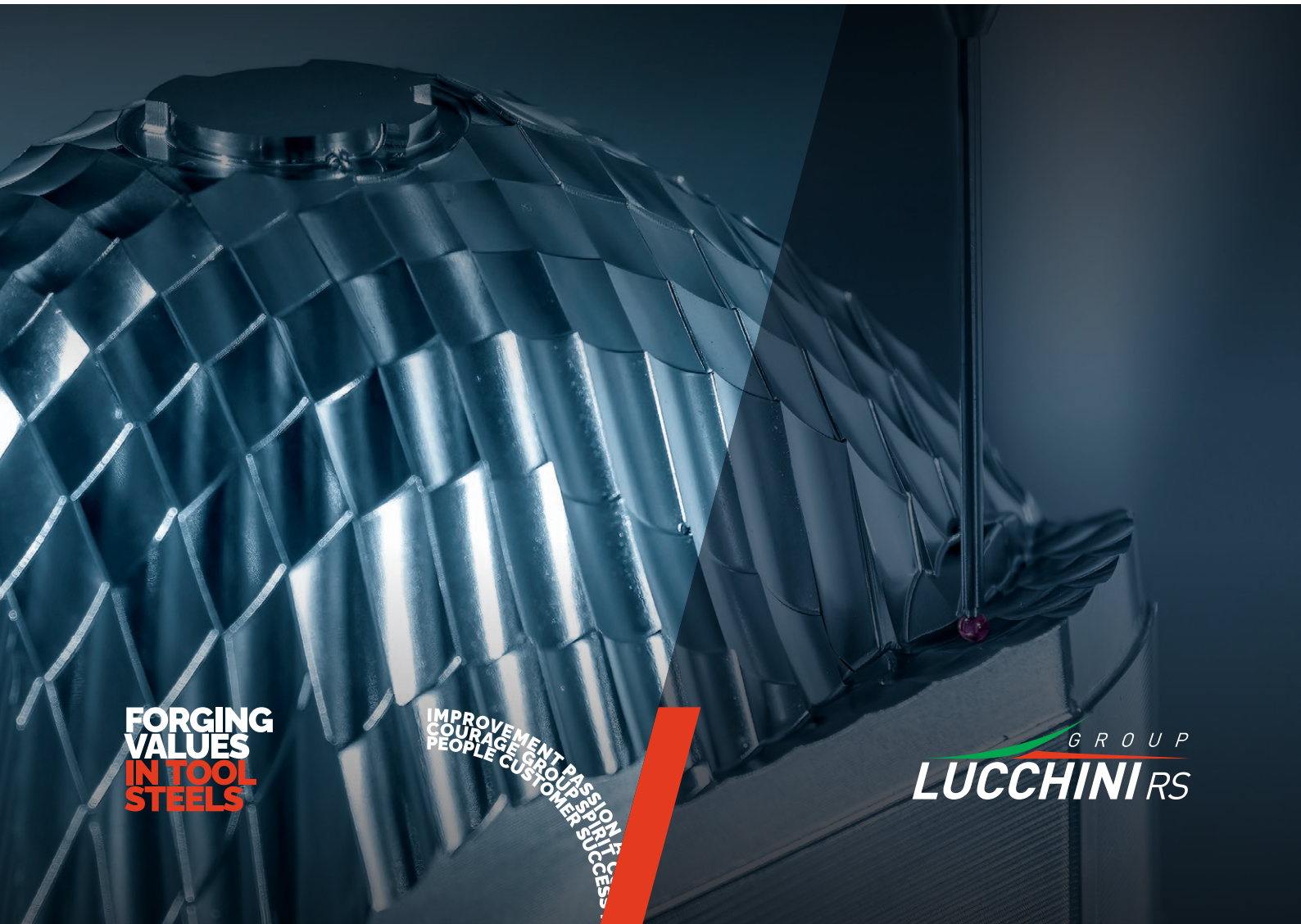
LUCCHINI 2767

HIGH ALLOYED TOOL STEEL FOR HOT AND COLD WORKING DIES WITH EXCELLENT TOUGHNESS



General characteristics

LUCCHINI 2767 is a high alloyed Nickel-Chromium-Molybdenum tool steel, suitable for the production of medium and big sized moulds that need extreme toughness characteristics combined with high hardness through the section.

LUCCHINI 2767 is suitable for the fabrication of tools exposed to repeated impacts and high stresses in service.

LUCCHINI 2767 is obtained through a special 'super clean' manufacturing process, which allows an excellent level of micro-purity to be achieved.

Delivery conditions

LUCCHINI 2767 is in annealed condition in a dimensional range up to 500 mm in thickness.

In the annealed condition the hardness value is lower than 270 HB, thereby guaranteeing a good machinability.

Main features

- good machinability;
- excellent wear resistance;
- excellent toughness;

Main application

- anvils for hammers
- dies for forging machines
- medium and big sized moulds for the automotive industry;
- moulds for food industry products;
- moulds for rubber pressing;
- pressure moulds (SMC, BMC);
- bolsters for plastic pressure pouring.

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Chemical analysis

	Range	C [%]	Si [%]	Mn [%]	Cr [%]	Mo [%]	Ni [%]	V [%]
LUCCHINI 2767 Alloying [% in weight]	min	0,40	0,15	0,40	1,20	0,30	3,50	0,05
	max	0,50	0,55	0,90	1,70	0,60	4,50	0,25

Comparison with international classifications:
W. Nr. 1.2767
DIN EN ISO 4957 45NiCrMo16

Physical and mechanical properties

Main physical properties

LUCCHINI 2767	20°C	400°C	600°C
Young modulus E [MPa]	210	198	175
Coefficient of linear thermal expansion α [10-6/K]	-	13,5	14,7
Thermal conductivity λ [W/mK]	23,7	23,3	22,9

Main mechanical properties

LUCCHINI 2767	20°C	200°C
Ultimate tensile strength UTS [MPa]	1.320	1280
Yield strength YS [MPa]	1220	1190
Elongation (A) [MPa]	14	16
Reduction of area (Z) [MPa]	45	50

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

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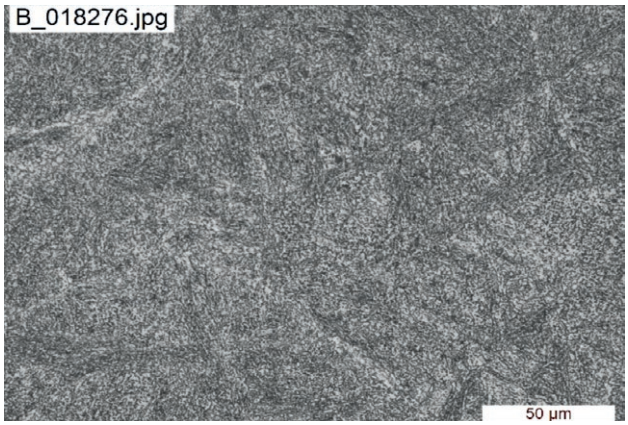
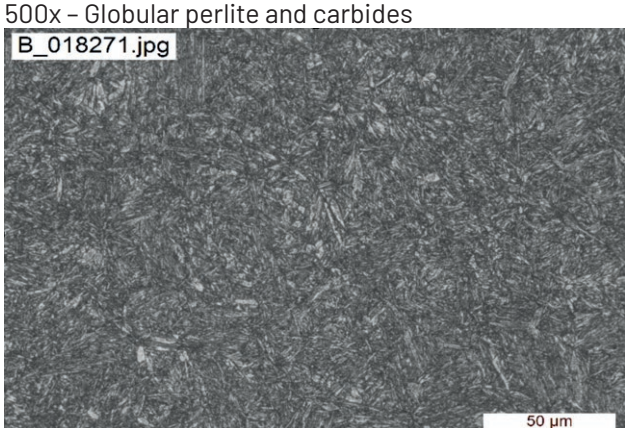
Microstructure

The main microstructure of LUCCHINI 2767 in annealed condition is globular perlite and carbides, in hardened and tempered condition is tempered martensite.

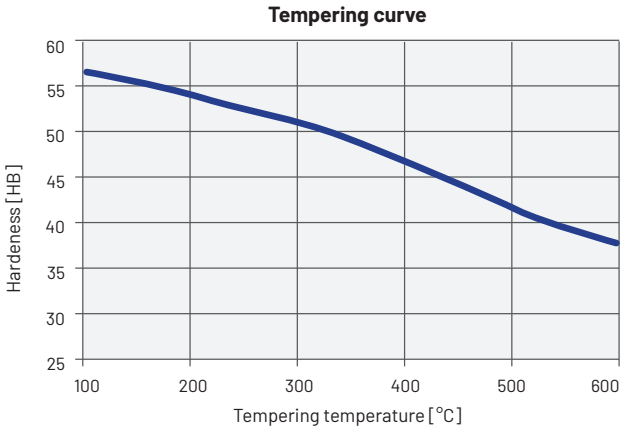


500x – Globular perlite and carbides



500x – Tempered martensite

Surface hardness vs tempering temperature



Remark: the above data are representative of the typical behaviour of a 400 mm thick block made in LUCCHINI 2767 and are reported for information only

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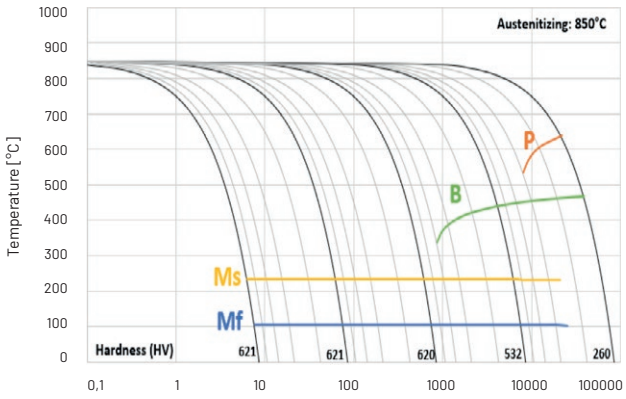
Heat treatment

Lucchini 2767 is supplied in the annealed condition. Heat treatment shall be carried out using the parameters recommended and given below.

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 270 HB.

Stress relieving

Suggested temperature	650 °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

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

Tempering

Suggested temperature	Depends on the required mechanical 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

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relieving at temperature 50°C lower than the last tempering temperature.

Nitriding

LUCCHINI 2767 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

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

Polishing and photo-engraving

Lucchini 2767 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.

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

Welding

In order to obtain the best results, we recommend the following procedure:

Welding technique	TIG	MMA
Pre-heating at	250 – 300°C	
Recommended Heat treatment	Stress relieving (see heat treatment paragraph)	

Electrical Discharge Machining (EDM)

LUCCHINI 2767 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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