

BEYLOS[®] 2329

Steel designed for
hot working


LUCCHINI RS

General characteristics

BeyLos[®] 2329 is alloyed steel designed for the manufacture of dies, moulds, punches and other components subjected to high working temperatures.

The best features of this steel are:

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

BeyLos[®] 2329 is obtained through a special 'super clean' production process, which allows a high level of micro-purity to be achieved.

BeyLos[®] 2329 is normally supplied in the annealed condition with hardness values lower than 220 HB, thereby guaranteeing a good machinability.

If subjected to suitable heat treatment, BeyLos[®] 2329 can reach a hardness of 48 HRc without affecting the toughness.

In order to improve further the mechanical characteristics of the surface, BeyLos[®] 2329 can be coated with PVD or PA/CVD methods.

Alternatively it can be hardened through flame hardening, induction tempering or subjected to nitriding.

This allows a hardness value of about 52 HRc to be reached. The hardness of the nitrided layer is about 900-1000 HV_{0,2Kg}.

The high micro-purity and structural homogeneity levels give this grade good suitability to polishing and photo-engraving.

If required, it is possible to carry out welding operations with TIG or MMA methods on dies made of BeyLos[®] 2329.

Chemical analysis

BEYLOS[®] 2329		Alloying%	
C	0,46 ÷ 0,52	Cr	1,70 ÷ 2,00
Si	0,65 ÷ 0,80	Mo	0,25 ÷ 0,45
Mn	0,70 ÷ 1,00	V	0,15 ÷ 0,25
Ni	0,50 ÷ 0,70		

Table for comparison of international classification

W. Nr. 1.2329

Lucchini RS's tool steels have been researched and formulated to optimize the performance of the materials.

The brand name identifies the Lucchini RS product and the number evokes the Werkstoff classification or other means of reflecting the characteristics of use.

Main applications:

BeyLos[®] 2329 is suitable for the following applications:

- dies subjected to low pressure
- containers for die-casting presses
- extrusion press blocks
- sleeves for extrusion presses.

Physical and mechanical properties

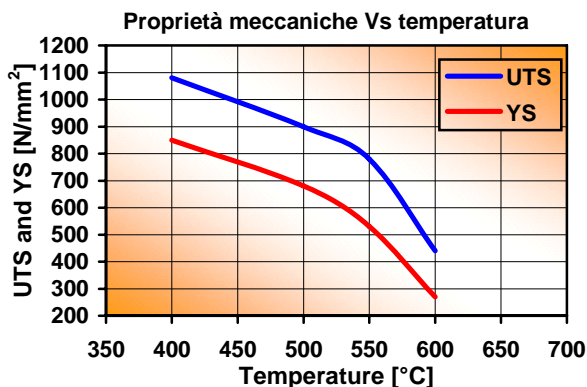
Main physical properties

BeyLos[®] 2329	at 20°C	at 400°C	at 600°C
Modulus of elasticity [kN/mm²]	210	186	179
Coefficient of thermal expansion at 20°C [10⁻⁶/K]	-	13,2	14,5
Thermal conductivity [W/mK]	27,0	29,1	32,4

Main mechanical properties

BeyLos[®] 2329	at 400°C	at 500°C	at 600°C
Ultimate tensile strength (UTS) [N/mm²]	1.080	900	440
Yield stress (YS) [N/mm²]	850	680	270

These are average values obtained on a sample which has been hardened at 870° C, quenched in oil and tempered at 560°C to achieve a hardness of 44 HRC.



Heat Treatments

BeyLos[®] 2329 s supplied in the annealed or in the pre-hardened condition, depending on the application. We suggest applying the following parameters if a different hardness is required or if heat treatment is needed. This information is only indicative and must be adapted depending on the different heat treatment facilities employed and on the thickness of the bar.

Soft annealing

Suggested temperature	700°C
Heating	Maximum 50°C/h
Soaking time	60 min every 25 mm thickness
Cooling	Slow in the furnace

Soft annealing is recommended if optimum machinability of the material is important. After soft annealing a hardness of around 220 HB is achieved.

Stress Relieving

Suggested temperature	650 °C
Heating	Maximum 100°C/h
Soaking time	60 min every 50 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.

Hardening

Hardening should be carried out after the material has been pre-heated according to the following table.

First pre-heating temperature	550°C
Soaking time	60 min every 25 mm thickness

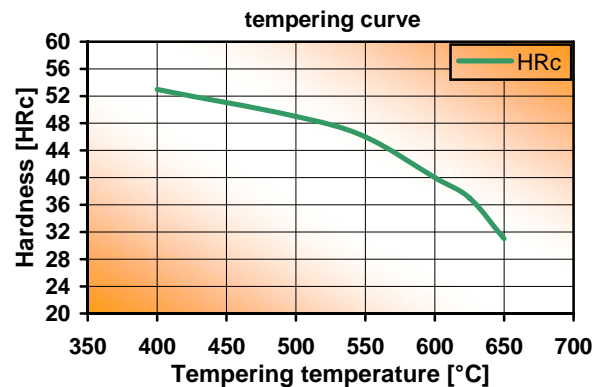
Austenitising temperature	870°C
Soaking time	60 min every 25 mm thickness
Cooling	Air or vacuum cooling salt bath or oil

We suggest to carry out the hardening on material supplied in the annealed condition and to temper the material immediately afterwards. The suggested rate of heating is less than or equal to 30 °C.

Tempering

The tempering temperature to be applied to the material depends on the required mechanical properties. A second temper at a temperature of 30-50° C below the maximum temperature previously applied will function as a stress relieving cycle.

Suggested temperature	Depending on the required mechanical properties. See tempering curve
Heating	Less than or equal 30 ° C/h
Soaking time	60 min every 25 mm thickness
Cooling	At room temperature



Tempering curve of a sample which has been austenitised at 870 °C and quenched in oil.

Variation in dimensions during heat treatment

During the heat treatment of BeyLos[®] 2329 the phase transformation points are exceeded. Inevitably this causes a variation in the volume of the material. For this reason we recommend leaving enough allowance to compensate for the change of dimension due to heat treatment. All the corners should be rounded off.

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.

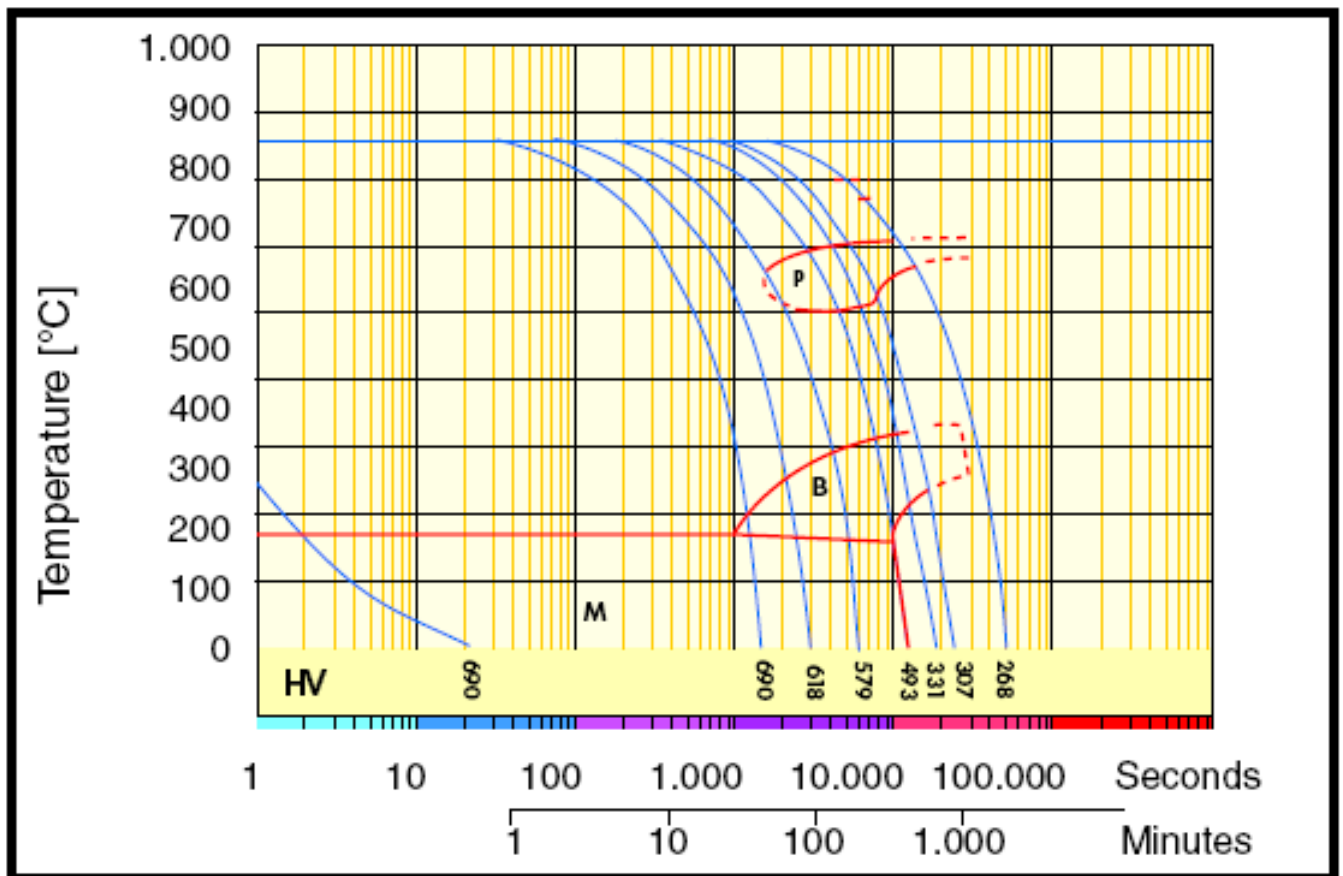
We suggest nitriding the component in the hardened and tempered condition.

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.

CCT curve



Critical points

Ac1	770°C	Ms	220°C
Ac3	810°C	Mf	20°C

Welding

Welding of BeyLos[®] 2329 can give good results if the recommended procedure is followed. Being steel with high carbon equivalent content, BeyLos[®] 2329 is very sensitive to cracking. We recommend carrying out pre-heating and heat treatment after welding.

Condition of material	Annealed with hardness 220 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	
Condition of material	Hardened and tempered	
Welding technique	TIG	MMA
Pre-heating at	250÷300 °C	
Recommended heat treatment	50 °C lower than the tempering temperature previously applied	

For further information, please refer to the brochure.

Electrical Discharge Machining (EDM)

BeyLos[®] 2329 can be machined by EDM to obtain complex shape. Afterwards it is advisable to stress relieving the material.



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