



**SPECIAL<sup>TM</sup>**  
**STEEL**  
The stars of Tool Steel

# DATA SHEET



**SIRIO<sup>TM</sup>**  
Hot Work  
Tool Steel



# SPECIAL<sup>TM</sup> STEEL

The stars of Tool Steel

## ABOUT US

RR Special Steel combines the experience & know-how of two specialists in their respective fields, Steel Making and Remelting (Rubiera Special Steel) and Forging and Heat Treatment (Ringmill).



### RUBIERA SPECIAL STEEL

Since 1965 supplying high integrity ingots with superb homogeneity and cleanliness and since 2009 top quality large size ESR and VAR ingots to the market.

### RINGMILL

Since 1978 supplying top quality forgings to the most demanding markets using the latest state of the art technologies and machinery.

With RR Special Steel the ownership family, with a centenary experience in the steel and forging industry, has created the stars of tool steel.

## RR SPECIAL STEEL UNIQUENESS

**VAR:** The largest top-quality Vacuum Arc Remelted materials on the market.

**ESR:** The largest single electrode static Electro Slag Remelted materials on the market.

	Conventional material	ESR material	VAR material
Cleanliness	● ● ●	● ● ● ●	● ● ● ● ●
Homogeneity	● ● ●	● ● ● ● ●	● ● ● ● ●
Isotropy of toughness	● ●	● ● ● ●	● ● ● ● ●
Manufacturing complexity	● ● ●	● ● ● ●	● ● ● ● ●

## CERTIFICATE QUALITY

Manufacturing parameters and material properties are monitored and controlled by RR's quality management system. The results of cleanliness, microstructure, and toughness for example are available for internal- and external certification at any time.

## REFERENCE COMPOSITION OF STEEL GRADE RR SIRIO / 1.2367MOD.

C	Si	Cr	Mo	V
0.3 %	0.2 %	5.0 %	2.3 %	0.5 %

Comparable tool steel grades: NADCA #207 type C

### MATERIAL PROPERTIES

- High hot strength and tempering resistance against softening in critical tool areas
- Excellent creep resistance
- High toughness and ductility
- High resistance at elevated temperature against heat checking and washout wear
- Excellent homogeneity and cleanliness
- Good machinability in the fine annealed condition
- Reasonable weldability
- Good for nitriding and coating
- High polishability
- Hardness up to 54 HRC, working hardness 42-50 HRC

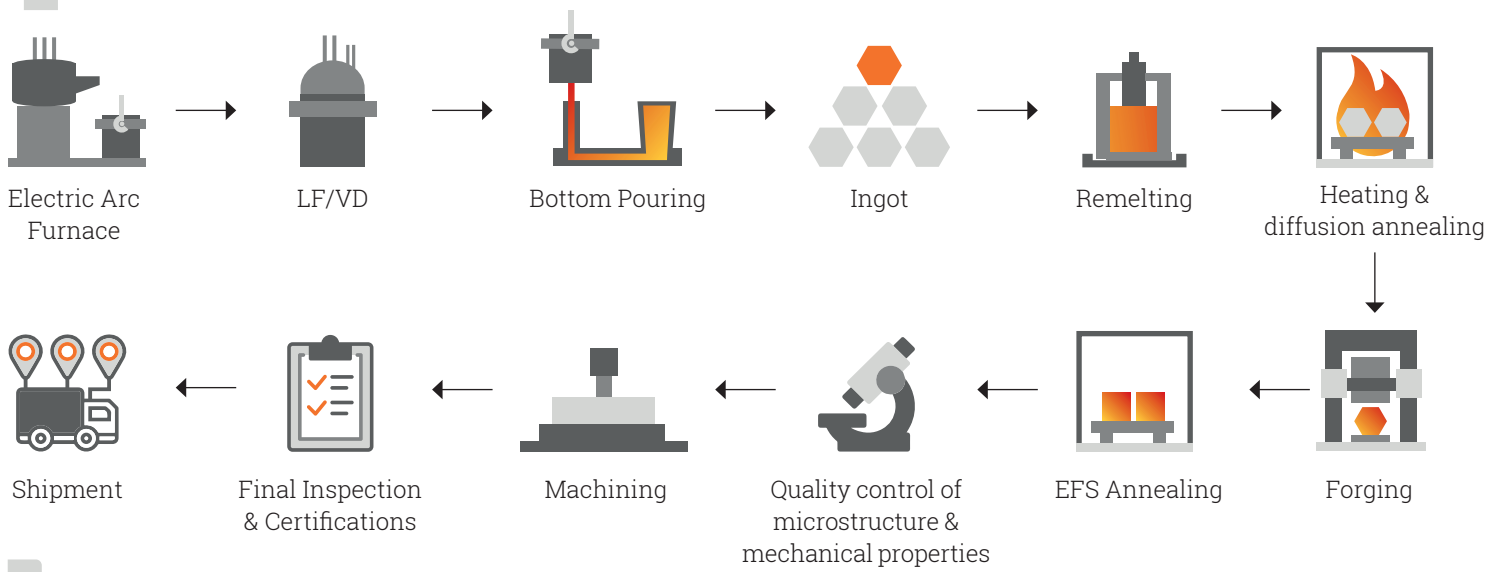
### APPLICATIONS

- Die casting tools with improved resistance against:
  - thermal fatigue cracks
  - heat checking
  - abrasive wear in exposed areas
  - early cracking in deep cavities
- Molds for big castings as structural parts
- Inserts with surface coating
- Al-extrusion tools for high temperatures
- High thermal loaded forging dies and inserts
- Hot stamping tools, punches-and shearing blades >10mm
- Cold forging-and extrusion tools

PROPERTIES	STEEL GRADE*	1	2	3	4	5	
Toughness & Ductility	<b>SIRIO</b>	●	●	●	●	●	Very good toughness and ductility due to homogeneity and isotropy. According to NADCA #207 Charpy-V is guaranteed. Standard Charpy-V toughness is about 24J at 44-46 HRC and room temperature.
	1.2343	●	●	●	●		
	1.2344	●	●	●			
	1.2367	●	●				
Tempering Resistance	<b>SIRIO</b>	●	●	●	●	●	Very good high-temperatures properties. High resistance against softening improves life time.
	1.2343	●	●				
	1.2344	●	●	●			
	1.2367	●	●	●	●	●	
Heat Checking Resistance	<b>SIRIO</b>	●	●	●	●	●	High toughness gives better crack resistance under thermal shock conditions during operations.
	1.2343	●	●	●			
	1.2344	●	●				
	1.2367	●	●	●			
Erosion & Hot Wear Resistance	<b>SIRIO</b>	●	●	●	●	●	Tempering resistance helps against wear and erosion. Optimizing of design and process parameter and nitriding/coating may be decisive factors as well.
	1.2343	●	●				
	1.2344	●	●	●			
	1.2367	●	●	●	●	●	
Resistance to Al sticking (Soldering)	<b>SIRIO</b>	●	●	●			Sticking means that the temperature is high at that region. Try to decrease temperature or/and use nitriding or coating.
	1.2343	●	●	●			
	1.2344	●	●	●			
	1.2367	●	●	●			
Machinability	<b>SIRIO</b>	●	●	●	●		Tough material can be even more tough in machining - optimize machining parameters. We help by providing a low EFS hardness.
	1.2343	●	●	●	●		
	1.2344	●	●	●	●		
	1.2367	●	●	●			
Polishability	<b>SIRIO</b>	●	●	●	●	●	ISO/SPI: NO/A-1 at 48-52 HRC: "lense quality". Keep attention on right polishing steps.
	1.2343	●	●	●	●		
	1.2344	●	●	●			
	1.2367	●	●				
Weldability	<b>SIRIO</b>	●	●	●			CET= 0.85% acc. DIN EN 1011-2: pre- and after-heating necessary.
	1.2343	●	●	●			
	1.2344	●	●	●			
	1.2367	●	●				
Texturability	<b>SIRIO</b>	●	●	●	●	●	Hardened and homogeneous material is excellent for texturing.
	1.2343	●	●	●	●		
	1.2344	●	●	●			
	1.2367	●	●	●			
Nitridability	<b>SIRIO</b>	●	●	●	●	●	Hardness of nitrided surface 900-1250 HV1: avoid brittle surface layer.
	1.2343	●	●	●	●		
	1.2344	●	●	●	●		
	1.2367	●	●	●	●		
Chrome Plating Ability	<b>SIRIO</b>	●	●	●	●	●	High cleanliness improves Cr plating ability.
	1.2343	●	●	●	●		
	1.2344	●	●	●			
	1.2367	●	●	●			

\*All grades in the remelted condition

## PRODUCTION TECHNOLOGY



## PRODUCT RANGE

RR SIRIO	Form	Thickness (mm)	Width (mm)	Length (mm)	Weight (Kg)
	Square/Rectangular Bar	max. 600	max. 1,500	max. 6,000	max. 20,000
	Round Bar	max. 600	N/A	max. 6,000	max. 20,000

## DELIVERY CONDITIONS

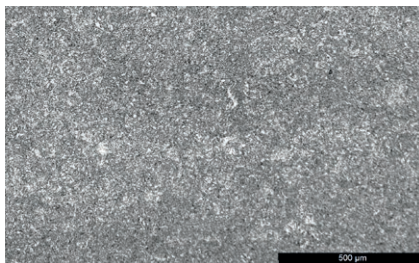
**Heat treatment:** EFS Annealing

**Hardness:** ≤ 220 HBW

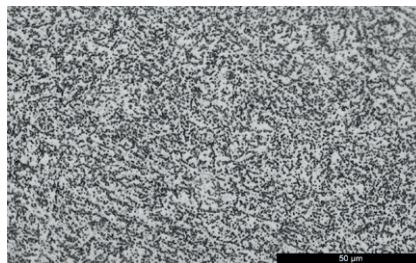
**Surface:** machined

## PHYSICAL PROPERTIES

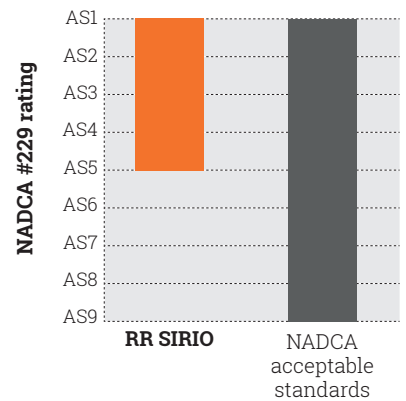
### MICROGRAPHIC EXAMINATION IN EXTRA FINE ANNEALED CONDITION (EFS)



EFS macrostructure at 50X: very low microsegregation of VAR material



EFS microstructure at 500X: AS1-2 rating



\* The examined surface is parallel to the principal direction of deformation

	20°C	400°C	500°C
Elastic Modulus [kN/mm <sup>2</sup> ]	205,000	--	190,000
Thermal Expansion Coefficient [10 <sup>-6</sup> /K]	--	12.4	13.2
Thermal Conductivity [W/mK]	21	30	32

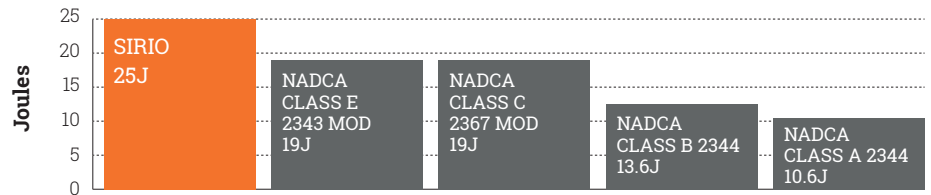
HEAT TREATMENT	TEMPERATURE
Soft Annealing	800-830°C
Stress Relieving (before Q+T)	600-650°C
Hardening (Vacuum)	1010-1025°C
Tempering (2-3X)	550-650°C

## MECHANICAL PROPERTIES AFTER QT

HARDNESS	44 HRC	48 HRC	50 HRC
Yield Strength Rp02 [N/mm <sup>2</sup> ]	~ 1,200	~ 1,400	~ 1,500
Tensile Strength, Rm [N/mm <sup>2</sup> ]	~ 1,500	~ 1,680	~ 1,800

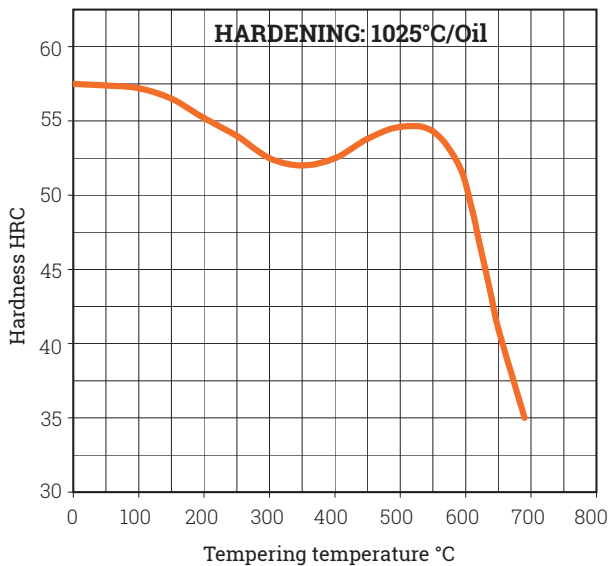
### Toughness Properties

Chapy-V toughness on oil-hardened & double tempered samples, 44-46 HRC, transversal direction, 1/4T, 20°C.

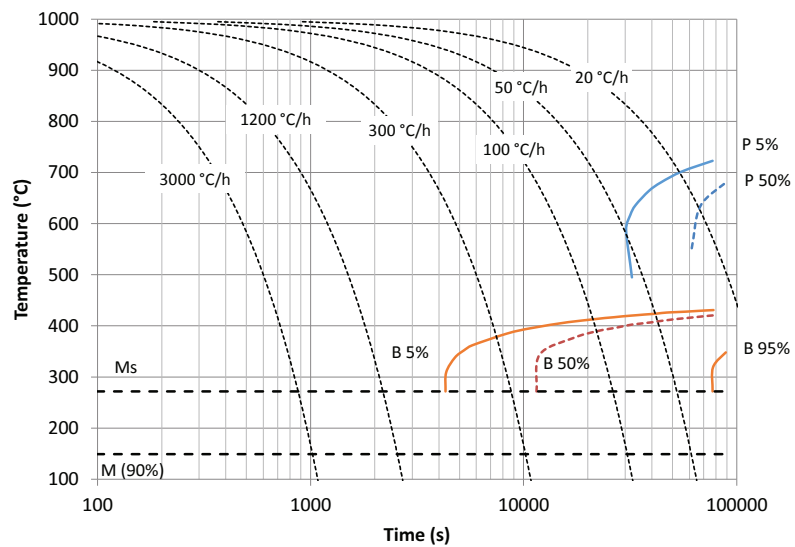


## DIAGRAMS

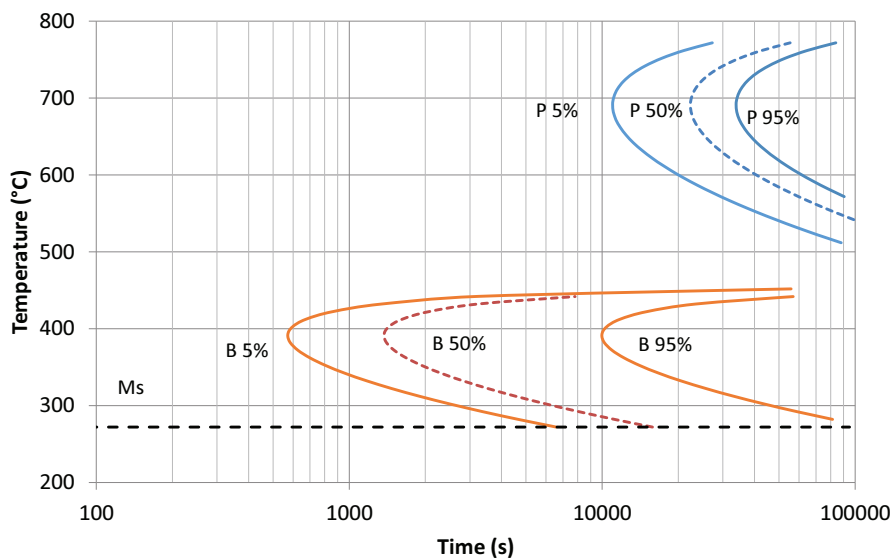
### TEMPERING DIAGRAM



### CCT DIAGRAM



### TTT DIAGRAM





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## V'STEELS



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Hot Work  
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