DATA SHEET
RWL34™ MARTENSITIC STEEL

Damasteel's martensitic stainless RWL34™ is a Rapid Solidified Powder (RSP) based steel with a Chromium content more than 13 %. The addition of Molybdenum and Vanadium to the steel, gives the RWL34™ even greater corrosion resistance, hardness and strength. The alloy represents an excellent combination of corrosion resistance and hardenability. This combination of properties is a reason for its impressive suitability as knife material. Some other applications are flatware cutlery and other applications where corrosion resistance and hardness are important.

Distinctive feature

- High edge strength
- High hardness after hardening and tempering
- High corrosion resistance
- Easy grinding and polishing
- High purity and cleanliness

Mechanical and physical properties

Grade	C	Si	Mn	Cr	Mo	V	S	P	N
RWL34™	1,05	0,50	0,50	14	4	0,2	<0,03	<004	<0,1

Table 1. Nominal chemical compositions in wt-% of RWL34™ .

Yield strength, Rp 0,2	270	MPa	Young's modulus	200	GPa
Tensile strength, Rm	<700	MPa	Poisson's ratio	0,3	-
Elongation, A5	45	%	Thermal conductivity	15	W/m·K
Hardness	<300	HV	Heat capacity	460	J/kg·K
Density	7,8	kg/dm3	Electrical resistivity	0,73	µ·Ω·m

Table 2. Mechanical and physical properties of Damasteel martensitic stainless RWL34™ in annealed condition and 20°C.

Hot working

Hot working temperature 1050-1160 °C (1920-2120 F)
Compared to low alloyed steels, martensitic stainless steels have higher, almost doubled deformation resistance. Hand forging can therefore only be performed on relatively small dimensions. Melting starts at 1220°C (2230 F) which means that the material is very sensitive to overheating. A good control of the heating temperature is needed. An electric or gas fired furnace is recommended.
Long soaking times above 850°C (1560 F) leads to decarburization and scale formation.
After the hot working process, a slow cooling is recommended due to the risk of cracks when the material phase transforms to martensite at around 200 °C (390 F). Usage of vermiculite or other heat insulating material is recommended.

Cold working

Martensitic stainless steel does not cold work as easily as the conventional austenitic stainless steels but can be formed and fabricated by a full range of cold working operations. The cold working ductility is good and cold working process will increase the strength and the hardness of the material.

Machining

The martensitic stainless steels are generally easier to machine than other stainless-steel grades. The machining characteristics for our martensitic stainless RWL34™ are

- Low tensile strength but a strong work hardening
- Tendencies for buildup of material on the tool edge
- Tough and stringy chips can be prevented by using chip curler tools.

Grinding and polishing

Normal grinding and polishing procedures for austenitic stainless can be used also for the martensitic stainless steel.
Grinding wheel recommendation:
Silicon Carbide, 46 grit, soft, open density, ceramic bonded. (C46J6V)

- Speed: 35 m/sec
- Feed: 0.01-0.05 mm/stroke
- Speed of the work piece may be 1/60 of the grinding speed.

Welding

When cooling martensitic stainless steel after any hot process the martensitic phase transformation occur at around 200 °C and can lead to cracking. This can be avoided either by preheating the piece or do a post-weld heat treatment. Our RWL34™ can be welded by a full range of conventional welding methods.

Heat treatment

Annealing: The recommendation is to have the material fully transformation annealed which means two hours at 910 °C (1670F), then cool in furnace to 750°C (1380F) with a ramp of 15° per hour. Hold for two hours at 750°C (1380F) then air cool to room temperature. Achieved hardness <250 HV (23HRC).
Austenitizing: Holding time at austenitizing temperature 15 min.
Rapid cooling to 50°C. We suggest quenching in air, so the piece reaches 50°C within two min.
Tempering: Between 150°C to 450°C without losing corrosion resistant and for knife applications the following heat treatments can be recommended, se table 3 below. Deep freezing is not necessary but completes the martensite transformation and increases hardness. Hold for 2h in temperature below -100°C(-148F) or in Liquidized Nitrogen -198°C (-324F) a half an hour.

	Austenitizing temperature (A)	Tempering temperature (T)	Tempering time (h)	Hardness RWL34™ (HRC)
I	1050 °C / 1920 F	220 °C / 430 F	2	59 HRC
II	1050 °C / 1920 F	175 °C / 345 F	2	62 HRC
III	1080 °C / 1980 F	220 °C / 430 F	2	58 HRC
IV	1080 °C / 1980 F	175 °C / 345 F	2	63 HRC
V	1100 °C / 2010 F	175 °C / 345 F	2	64 HRC

Table 3. Hardening and tempering suggestions with corresponding hardness.

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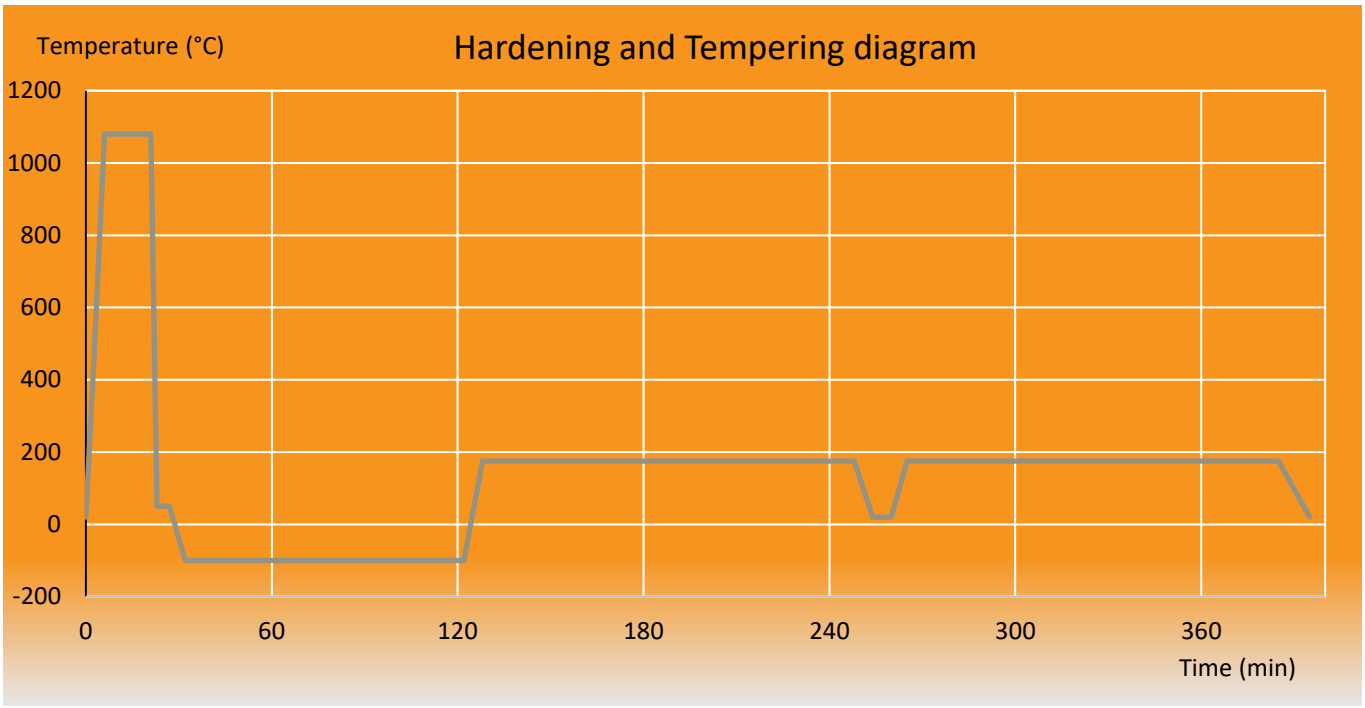

Diagram 1. Schematic hardening and tempering diagram for martensitic material including a deep-freezing treatment with liquified Nitrogen.

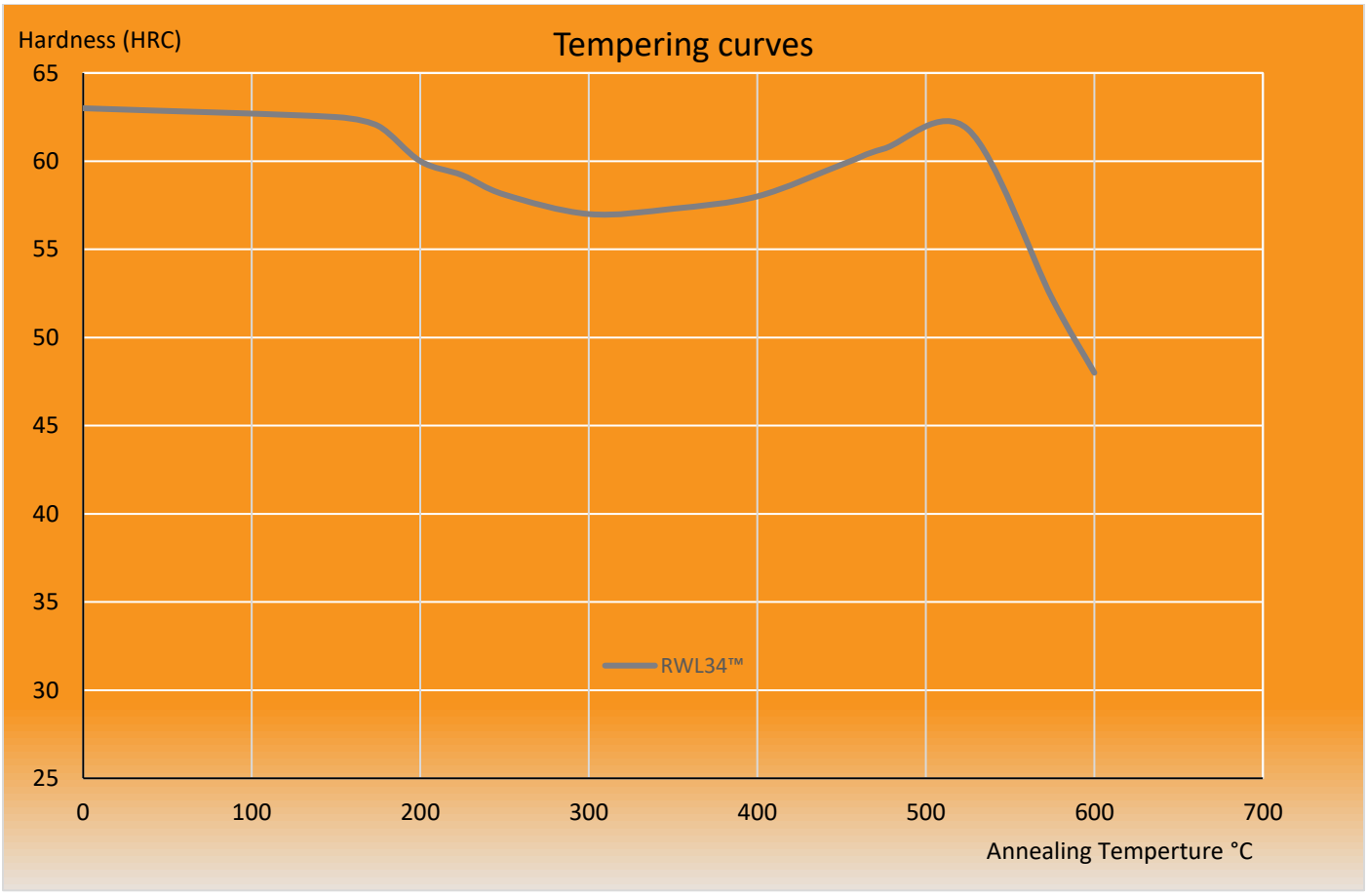

Diagram 2. Annealing temperature for RWL34™ ,austenitzing temperature 1080°C (1976F).

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Products dimensions and delivery conditions.

Damasteel has a standard product program that can be found on our website www.damasteel.com.
We supply RWL34™ in following formats and conditions:

- Sheets in 600 mm (24") by 900 mm (36")
- Flat bars in 1 m (39") lengths and selected sizes, se table 4.
- Annealed condition hardness < 25 HRC.

Bar crosssection	Thickness				
Width	2,6mm/.102"	3,2mm/.125"	3,5mm/.138"	4,0mm/.157"	5,2mm/.205"
32,0mm/1.26"		x			
38,0mm/1.5"	x		x	x	
51,0mm/2.0"	x	x		x	x

Table 4. Size range.

If you like to create customized patterns on our Damascus products or dimensions outside our standard do not hesitate to contact us.

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