DATA SHEET
DS95X™ AUSTENITIC DAMASCUS PATTERNED STEEL

Product information

Damasteel's austenitic Damascus patterned steel is a stainless, powder-based steel with two alloys, 304L and 316L. They are both variations of the 18 percent chromium – 8 percent nickel alloy and can be considered for a wide variety of applications. The 304L exhibits excellent resistance to a wide range of atmospheric, chemical, textile, petroleum and food industry exposures. 316L is usually regarded as "marine grade stainless steel" and has even better corrosion resistance than 304L. This makes Damasteel's austenitic Damascus-patterned steel suitable for most common applications. Some examples of their uses are in flatware cutlery, jewelry, watches and other applications where corrosion resistance and aesthetics are important.

Distinctive feature

- High corrosion resistance
- Excellent formability
- High purity and cleanliness

Mechanical and physical properties

Grade	C	Si	Mn	Cr	Mo	Ni	P	S	N, B, Ti,	Cu
316L	≤0,03	≤0,75	≤2,0	17	2-2,5	11	<0,040	<0,015	0,1	<0,5
304L	≤0,03	≤0,75	≤2,0	18,5	<0,3	9,5	<0,040	<0,020	0,1	<0,5

Table 1. Nominal chemical compositions in wt-% of the constituent alloys.

Yield strength, Rp 0,2	280	MPa	Young's modulus	200	GPa
Tensile strength, Rm	585	MPa	Poisson's ratio	0,3	-
Elongation, A5	45	%	Thermal conductivity	15	W/m·K
Hardness	215	HB	Heat capacity	500	J/kg·K
Density	7,9	kg/dm3	Electrical resistivity	0,73	µ·Ω·m

Table 2. Mechanical and physical properties of Damasteel austenitic Damascus patterned steel (DS95X™) in annealed condition.

Hot Working

Hot working temperature 950-1160 °C (1740-2120°F). No hot working process should be performed under 930 °C (1700°F).
Stainless steels have a higher, almost double deformation resistance compared to low-alloyed carbon steels. Hand forging is therefore only possible on relatively small dimensions. A good control of the heating temperature is needed. Avoid a carburizing atmosphere in the furnace. Long heating times at temperatures above 850°C (1560°F) lead to scale formation. After hot working, rapid cooling in water will prevent carbide precipitation in the grain boundaries and the risk of pitting is reduced.

Cold working

Like the conventional austenitic stainless steels, these grades can be formed and fabricated by a full range of cold working operations. The cold working ductility is good, and any cold working operations will lead to deformation hardening and increase the strength and the hardness of the material.

Welding

Austenitic stainless steels possess excellent weldability, but the material can change shape due to the release of residual stresses while welding. Welding electrodes and filler metal of 316L type should be used to ensure the best results.

Machining

As with the conventional austenitic stainless steels, Damasteel's austenitic stainless Damascus-patterned steel has some specific machinability properties.

- Low tensile strength but strong work-hardening
- Tendencies for a buildup of material on the tool edge
- Tough and stringy chips
- Generally, machining with a lower cutting speed and a higher feed rate

Grinding and Polishing

Normal grinding and polishing procedures for austenitic stainless steel can also be used for the Damascus-patterned 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
The speed of the workpiece may be 1/60 of the grinding speed.

Heat treatment

Quench annealing: Temperature 1060°C (1940°F) with rapid cooling in water or air for smaller dimensions. If the material has been cooled too slowly after a hot forming or a welding operation, quench annealing should be performed. Undesirable grain structures will be dissolved, and residual stresses will be released.
Hardening:
As opposed to the martensitic alternative, this steel cannot be hardened by any heat treatment.

Etching

To make the pattern in our steel visible, an etching has to be made. Depending on the desired result, different acids and acid mixtures can be used. In Table 3 is a recipe we can recommend.

	Etching Solution	Chem. comp.	Blend (%)	Time (min)	Temp (°C/ °F)	Color 316L	Color 304L
I	Hydrochloric acid 37% Ferro Chloric acid 40%	HCl $FeCl_3$	95 5	2-5	45-50/ 113-122	Bright	Grey

Table 3. Etching suggestions with corresponding colours and relief of the different alloys

Etching procedure:

1. Grind the piece progressively up to the desired grit, 600 or higher. Finish off with polishing if desired.
2. Degrease the piece carefully and finish off using glass cleaner.
3. Mix the etching acid in the recommended ratios and remember to always pour the acid into the water.
4. Heat the acid mixture in a water bath.
5. Immerse the piece in the mix and leave it in for the time you choose. A longer soaking time will give deeper relief.
6. Neutralize the piece by dipping it into water with bicarbonate.
7. A light buff with 2500 grit or more, after etching, can help to make the tops bright.

Beware of noxious fumes. Etching must be performed in a well-ventilated area.
All acids are highly corrosive and must be handled with great care.

Product dimensions and delivery conditions

Damasteel has a standard product program that can be found on our website www.damasteel.com.
We supply DS95X austenitic Damascus-patterned steel in the following formats:

- Round bars in selected sizes, ranging from 24-51 mm.
- Flat bars in dimensions shown in the chart below, see diagram 1.
- Length 500-1100 mm.
- Quench annealed.

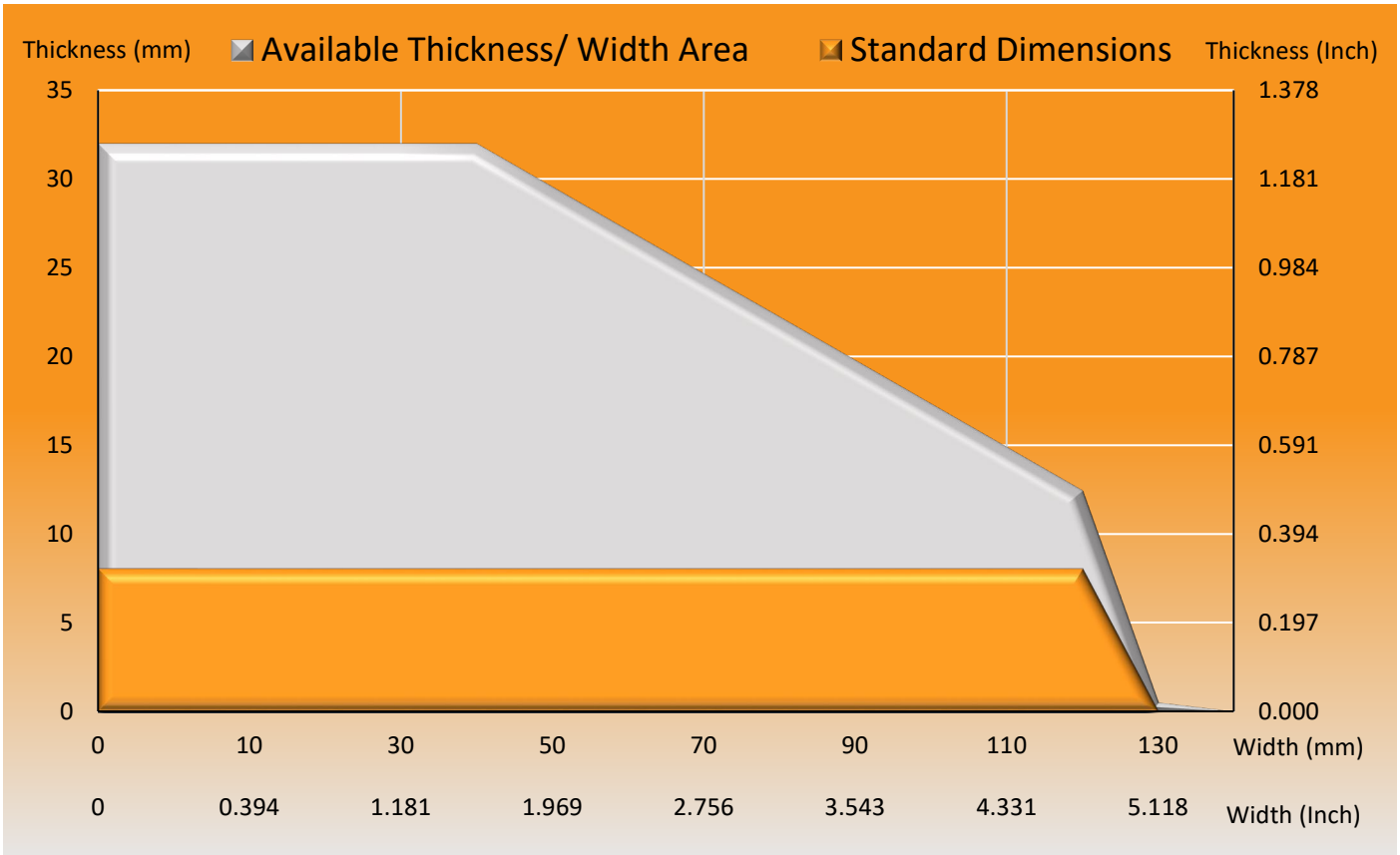

Diagram 1: Size range.

Even if it comes to creating customized patterns on Damascus products or if you like dimensions outside the standard range, contact us through our sales channel.

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