



# Datasheet

## HardCORE Futuron

Stainless damascus with Elmax/VANAX/AEB-L core



**FF Elmax core** is a stainless damascus steel, where we combine AEB-L + 304 steel placed on sides of a composite, with Elmax Superclean core. Elmax Superclean (by Uddeholm) is powder steel with an excellent grain structure, providing great wear resistance, corrosion resistance, and dimensional stability. Its high hardness, up to 62 HRc, makes this steel optimal for knife blades.

Our production of damascus steel is a highly controlled process, made under high pressure in a protective atmosphere. Due to its composition, #HardCOREfuturon damascus excels in high visual contrast, together with sharpness and durability.

**FF AEB-L core** has the same san-mai layers philosophy as Elmax core, but in this case, we produce a core from AEB-L steel, which we also use as a component for damascus on the sides of a blade. AEB-L steel (by Uddeholm) is martensitic stainless steel with a fine structure developed for razors and surgical scalpels production. This steel is hardenable up to 64 HRc; however, we recommend reaching 60-61 HRc hardness for knife blades.

# Technical information

## Composition

For the production of our damascus steel, we use premium martensitic stainless steels. For damascus cores, it's AEB-L or Elmax Superclean, made by powder metallurgy. Both steels are predetermined for knife blades due to their fine grain structure, wear resistance, and corrosion resistance. Together with AEB-L+304 layers on blade sides, it brings durable edge and superior contrast of the side layers.

Steel	Color	C	Si	Mn	P	S	Cr	Mo	V	Ni
Elmax	Black	1,7	0,8	0,3			18	1	3	
AEB-L	Black - Grey	0,65	0,4	0,65	<0,025	<0,015	12,8			
304L	Silver - shiny	<0,03	<0,75	<2	<0,045	<0,03	18-20			9

## Machining conditions

Our products are soft annealed to provide the best possible machining, reaching hardness approx. 280HV. You can use all conventional types of machining. Recommendation of machining condition below:

- Milling – monolithic carbide mill --- Vc50-60 m/min
- For hard-milling (sizing) with monolithic carbide, mill feed up to Vc100 m/min
- Milling with VBD mill --- Vc75-100 m/min
- Milling with HSS-Co mill --- Vc14-16 m/min
- Drilling - HSS-Co drill --- Vc10-12 m/min
- Drilling – PVD coated carbide drill ---Vc60-80 m/min

## Grinding

You can grid our steel on all conventional types of grinders. We recommend belt-grinders or Berger grinding machines.

For belt grinders, we recommend sanding belts with ceramic grains, like 3M Cubitron II; however, all range of conventional abrasives is usable (for example, SAIT, Klingspor, Norton, VSM, etc.)

Watch out for not to overheat (tempering) the steel by grinding. When it's heat-treated, it may lose required properties.



# Heat treatment

## Soft annealing

### *AEB-I*

- Heat the material in a furnace to 820 °C / 1508°F
- Hold at the temperature for at least 4 hours
- Slow cooling in a furnace
- You can remove the steel from a furnace when the temperature drops below 380°C / 716°F

### *ELMAX*

- Protect the material before oxidation and heat in a furnace to 980°C / 1796°F
- Hold at the temperature for at least 2 hours
- Slow cooling in a furnace, until the temperature reaches 850°C / 1562°F (cooling 20°C / 68°F per hour)
- Hold at the temperature for 10 hours
- Slow cooling in a furnace, until the temperature reaches 750°C / 1382°F
- Then remove material from a furnace and keep slow cooling on the air

## Hardening

To reach full corrosion resistance and the final hardness of the steel, it's necessary to harden it. We recommend hardening the steel by heat treatment professionals using vacuum technology like Bodycote.

Recommended hardening process below:

### *Elmax*

- Preheating temperature 600-850 °C / 1112-1562°F
- Austenitizing temperature 1050-1100 °C / 1922-2012°F
- Hold at the temperature for 30 minutes
- Cooling by nitrogen gas (salt-bath is also possible)
- Immediate deep freeze -150/-196 °C / -302/-384 °F and hold for 1-3 hours. (Hardness will increase by +3 HRc)

### *AEB-I*

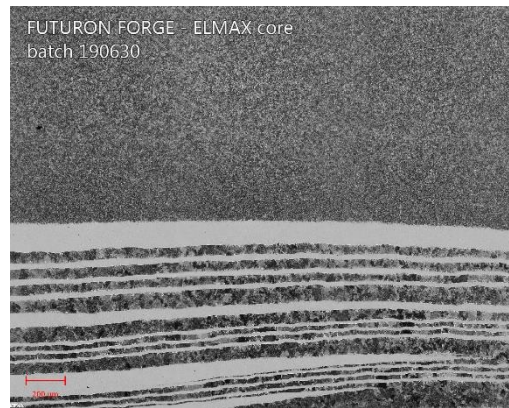
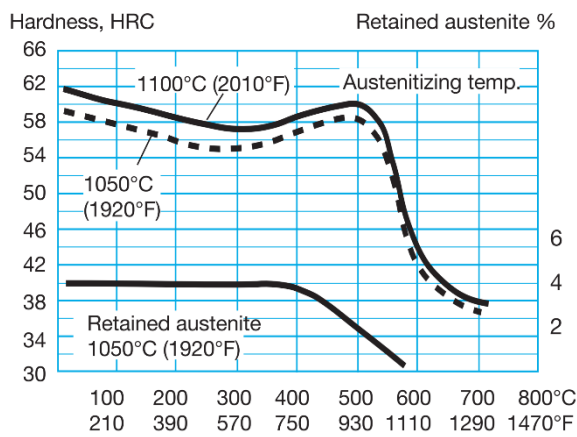
- Preheating temperature 1050-1080 °C / 1922-1976°F
- Hold at the temperature for 15 minutes
- Cooling by nitrogen gas (oil-bath is also possible)
- Immediate deep freeze

## Tempering

After hardening, it's necessary to make the tempering process as soon as possible.

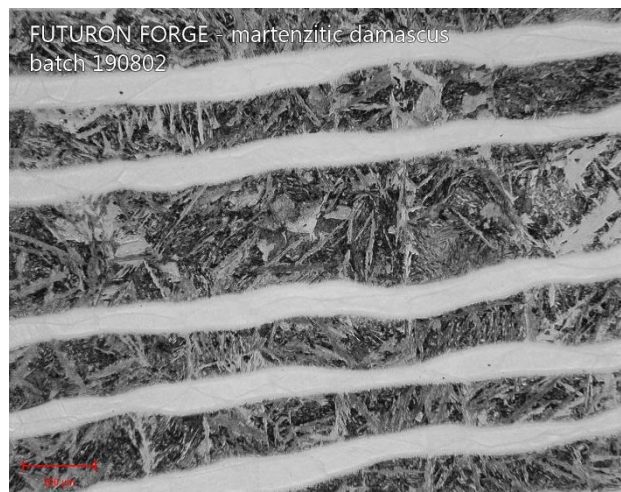
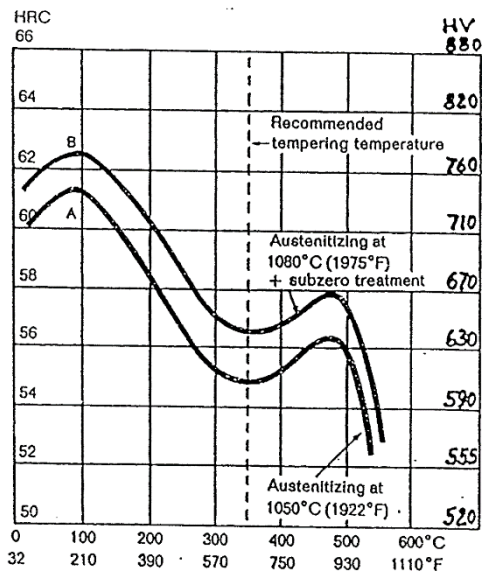
### Elmax

- For knife blades, we recommend tempering process 2x2h 200 °C / 392°F
- To keep enough blade flexibility, we recommend minimal tempering temperature 180 °C / 356°F



### AEB-I

- For knife blades, we recommend tempering process 2x1h 150-180 °C / 302-356°F (60-61 HRC)
- Repeat deep freeze, after the first hour of the tempering process.



# Etching instruction

## Etching

To properly contrast the damascus steel layers, it's necessary to etch the material (blade). You can experiment with various etching techniques depending on your skill; however, following the below-mentioned steps, you'll get nice results.

Etchant	Solution	Concentration	Time	AEB-L	Elmax	304L
Ferric Chloride Fe3Cl	Fe3Cl + Distilled water	20-25%	10-25 minutes	Black-Grey	Black	Silver - shiny

- The surface of the blade has to be smooth, clean and without scratches (etching won't hide them), finished up to 1000+ grit or polished.
- The blade has to be properly degreased (cleaning in the soap-water works fine).
- Before you start etching, you can try the solution on a sample piece of material (heat-treated)
- You can re-used etching solution several times. Before you get the blade into the solution, check if there's no dirt on the surface of a solution.
- When the etching is finished, you have to neutralize the blade using  $\text{Na}_2\text{CO}_3$  (Sodium carbonate) or  $\text{NaHCO}_3$  (Baking soda). You can also use soap-water and properly clean the etching residues from a blade.
- Dry etched blade. We recommend spraying the blade with WD-40 (or similar) and drying it again to remove any possible residues.
- You can slightly polish the etched blade on a buffing wheel for better contrast. We recommend testing it on a sample piece.
- If you want to make your etching solution more reactive, increase a concentration of  $\text{Fe}_3\text{Cl}$  or add vinegar.



# Product marking

ELMAX core	Marking: FF ELMAX core Hashtags: #HardCOREfuturon #FFELMAXcore
VANAX core	Marking: FF VANAX core Hashtags: #HardCOREfuturon #FFVANAXcore
AEB-L core	Marking: FF AEBL core Hashtags: #HardCOREfuturon #FFAEBLcore

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