

Exera® Finemac™ free-cutting wire

Wire

Datasheet

Exera® Finemac™ is a lead-free, hardenable, free-cutting carbon steel characterized by excellent machinability and high hardness, high wear resistance and exceptional dimensional stability after hardening.

Hardening operations are very much simplified compared to Sandvik 20AP, owing to the wider temperature and time range available using Exera® Finemac™. This results in significantly reduced failure rates during hardening. Exera® Finemac™ also exhibits very good cold heading properties. The material is suitable for long, narrow components with tight tolerances.

Service temperature -50 to 100°C (-55 to 210°F). Prolonged service at elevated temperatures causes decreased hardness when used in the hardened and tempered condition.

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr
1.0	0.27	0.50	≤0.03	0.10	0.45

Forms of supply

Forms of supply/ finishes	Diameter mm	Cu-Sn coating	Standard tolerance	Length, m
Straightened wire Drawn	0.80-2.49		D4	
	2.50-3.00		D3	2
	3.01-12.0		D2 3	2
Drawn/ground	0.80-3.00		h7	2
Drawn/ground	3.01-12.0		h7	3

Ovality: For D1 and D2, max. 50% of the tolerance width: for D3 max. 25% of the tolerance width: D4 ovality in accordance with the tolerance table below.

Diameter	Diameter tolerance				
mm	D1 +/-	D2 +/-	D3 +/-	D4 +/-	Ovality for D4

	mm	mm	mm	mm	mm
0.80 - 0.99	0.014	0.009	0.005	0.003	0.002
1.00 - 1.59	0.018	0.011	0.006	0.004	0.002
1.60 - 2.49	0.023	0.014	0.008	0.005	0.003
2.50 - 4.00	0.030	0.018	0.010		
4.01 - 6.30	0.038	0.022	0.013		
6.31 - 10.0	0.048	0.028			
10.0 - 12.0	0.060	0.036			

Mechanical properties

Forms of supply/Finishes	Diameter	Tensile strength
	mm	R _m ¹⁾
		MPa
Wire in coils		
Drawn	0.80-3.00	>980
Straightened wire		
Drawn	0.80-1.59	>1000
Drawn/ground	1.60-3.00	>980
	0.80-3.00	>980

1) Nominal values. Other properties on request.

Impact strength

Observe that the quenching time and temperature are dependent on dimension. Specimens for the Charpy-V impact strength test are larger than standard wire dimensions.

Table of impact strength for Sandvik Finemac™, hardened and quenched condition. See Figure 1.

Soaking temperature 810°C (1490°F), soaking time 4 min, tempering time 30 min.

Tempering temperature, °C	Impact strength, J
100	3.0
200	3.7
300	3.0
400	4.3
500	6.0

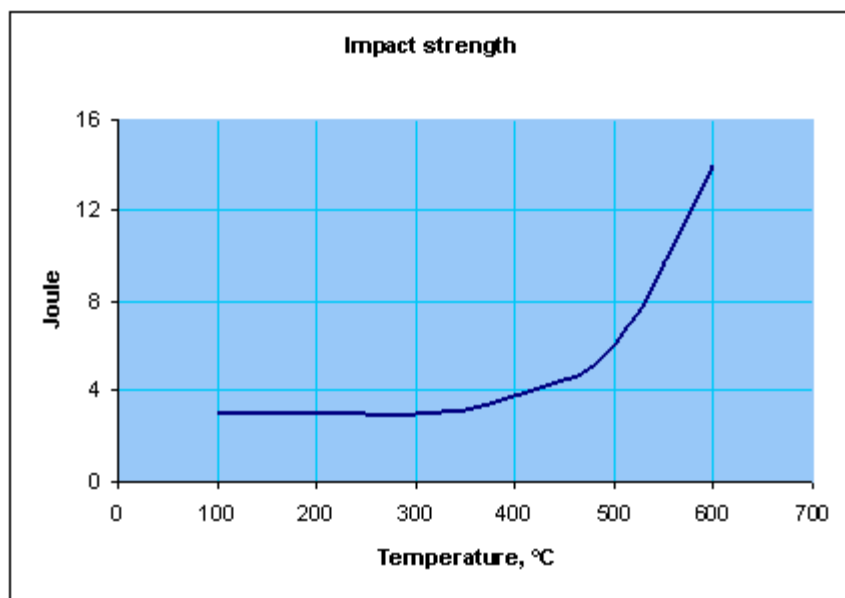


Figure 1. Impact strength after recommended hardening procedures, valid for all dimensions.

Soaking time 30 minutes. Standard Charpy-V specimens at 20°C (68°F).

Physical properties

Density

Cast billets

7.8 g/cm³, 0.28 lb/in³

Resistivity

Cold drawn and tempered

0.20 μΩm at 22°C

Thermal expansion ¹⁾

Temperature, °C

30-100

30-200

30-300

100-200

200-300

Cold drawn and tempered

11

12

13

12.5

14.5

¹⁾ Mean values in temperature ranges (x10⁻⁶)

Exera® Finemac™ is a magnetic material.

Heat treatment

Soft-annealing

When required, soft-annealing should be conducted for a period of one hour at a temperature of 650 - 680°C

(1200-1250°F).

Hardening

Diameter	Temperature	Soaking time	Quenching
mm	°C	approx. min.	
≤5	800 - 820	3 - 6	in oil at 50°C
>5	790 - 810	6 -10	in water

The smaller the diameter, the shorter the soaking time. To avoid oxidation and decarburization, hardening should be conducted in a protective gas atmosphere using nitrogen, argon or vacuum. Contact Sandvik for advice.

Prolonged service at elevated temperatures causes decreased hardness when used in the hardened and tempered condition. See also Impact strength under Mechanical properties.

Tempering

Temperature, °C	100 - 600
Tempering time, min	30 - 60

The core of the material needs a tempering time of at least 30 minutes. To reduce the risk of cracking, tempering should be conducted immediately after hardening. The heating rate should not be too high, particularly in the case of intricately shaped components.

Hardness

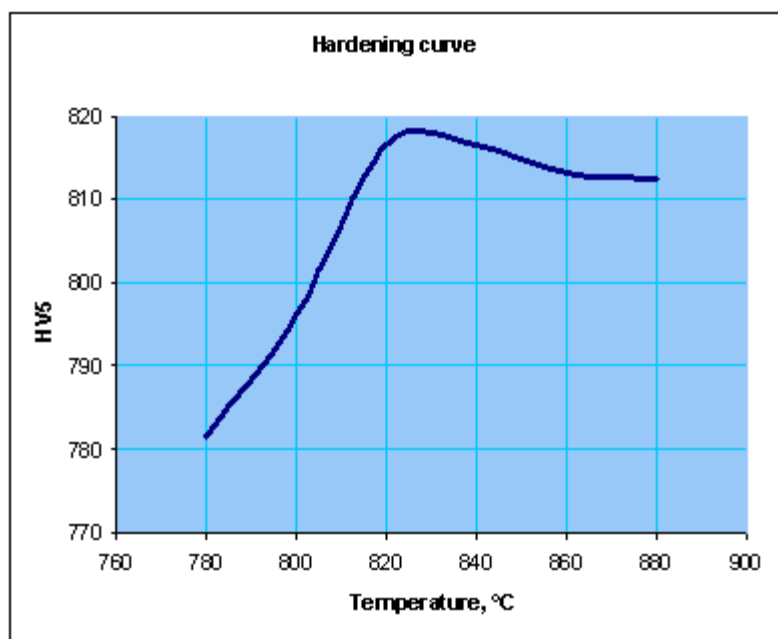


Figure 2. Hardness after quenching in oil at 50°C (120°F), valid for all dimensions.

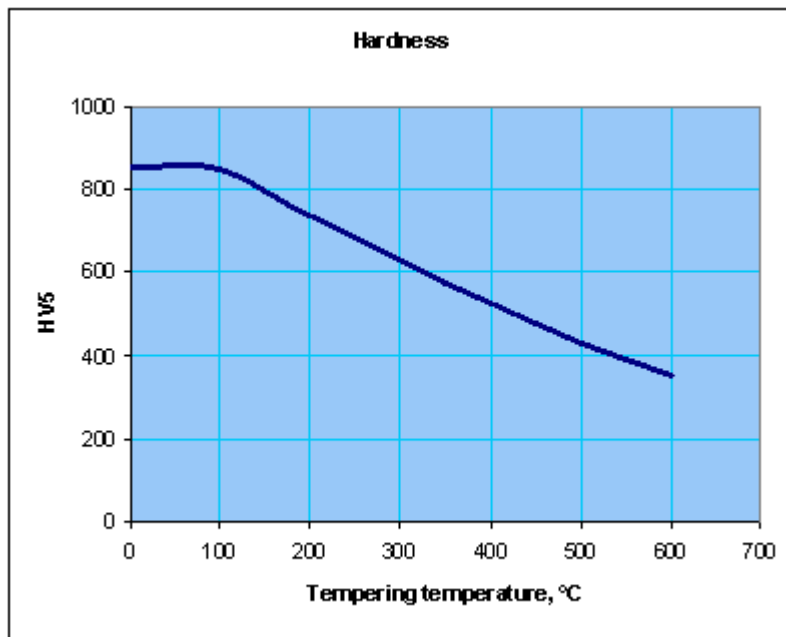


Figure 3. Hardness after recommended hardening and tempering procedures, valid for all dimensions.

Tempering time 30 minutes.

Hardening operations

Hardening operations will be very much simplified compared to Sandvik 20AP, owing to the wider temperature and time range available using Exera® Finemac™. Scrapping rates during hardening will be greatly reduced.

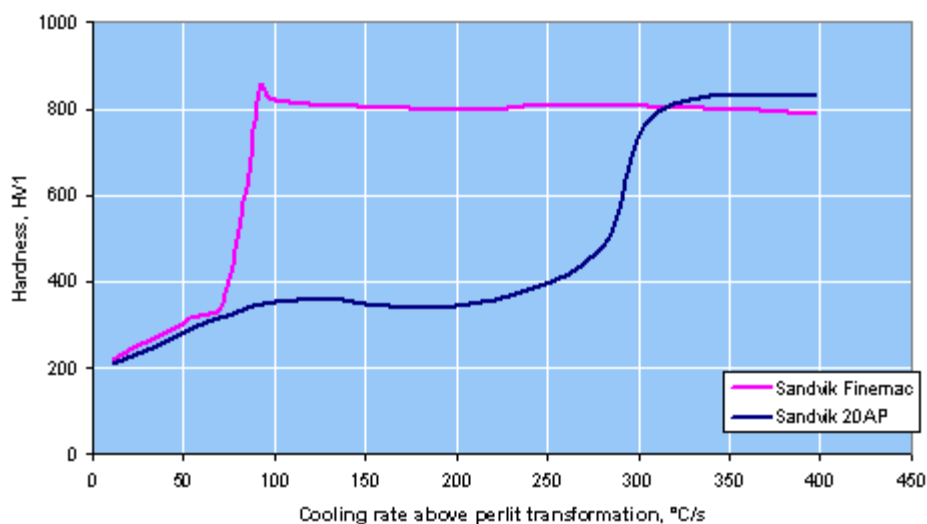


Figure 4. The cooling rate of Exera® Finemac™ vs. that of Exera® 20AP.

Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Alleima materials.