EXERA® 4C27A FREE-CUTTING MEDICAL WIRE

WIRE

DATABLAD

Exera® 4C27A is a hardenable stainless chromium steel alloyed with molybdenum. This grade is supplied in wire form.

It is characterized by:

- Very good machinability
- High wear resistance
- Good toughness
- Good corrosion resistance due to addition of molybdenum

Exera® 4C27A is used for the manufacture of precision components such as watch parts, measuring points, dental tools, precision instruments and drilled surgical needles.

STANDARDS

- ASTM: 420F Mod
- DIN: X 22 CrMoNiS 13 1

Product standard

ASTM F899

APPLICATIONS

Exera® 4C27A is a hardenable grade used for medical and dental tools as dental burrs, dental drills, bone drills, dental taps, reamers, screw drivers and drilled surgical needles.

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P	S	Cr	Ni	Mo
0.22	0.6	1.3	≤0.030	0.2	13	0.8	1.2

MECHANICAL PROPERTIES

Forms of supply/ finishes	Diameter	Tensile strength	Proof strength	Elongation
		R_m [1]	$R_{p0.2}$ [1) 2) 3)]	A [1) 3)]
	mm	MPa	MPa	%
Wire in coils:				
Annealed	0.6-3.0	<800	450	25
Drawn	0.45-4.0	950	770	10

Forms of supply/ finishes	Diameter	Tensile strength	Proof strength	Elongation
		R_m 1)	$R_{p0.2}$ 1) 2) 3)	A 1) 3)
	mm	MPa	MPa	%
Straightened wire:				
Annealed	0.6-10.0	<800	450	25
Drawn	0.6-3.0 >3.0-5.0 >5.0-10.0	950 950 850	770 770 650	10 10 11
Drawn/ground	0.6-3.0 >3.0-5.0 >5.0-10.0	950 950 850	770 770 650	10 10 11
Annealed/ground	0.6-10.0	<800	450	25

1) Nominal values. Other properties on request.
2) Corresponds to 0.2 % proof strength.
3) $R_{p0.2}$ and elongation values are given for information only.

PHYSICAL PROPERTIES

Density (annealed) : 7.8 g/cm^3, 0.28 lb/in^3
Resistivity Cold drawn : 670 µΩm
Heat treated : 740 µΩm

Thermal expansion 1)

Temperature	20-100	20-200	20-300
Cold dawn	10.5	11.0	11.5
Heat treated	11.0	11.5	11.5

1) Mean values in temperature ranges (x10^{-6})

Exera® 4C27A 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.

Hardening

Diameter	Temperature	Soaking time	Quenching 1)
mm	°C	approx. min.	
<6	1030-1050	3-6	in oil at 50 °C
>6	1030-1050	6-10	in oil at 50 °C

1) Diameter <2 mm may also be cooled in air or, to prevent oxidation, in a protective gas.

The smaller the dimensions, the shorter the soaking time. To prevent oxidation and decarburization, hardening should be carried out in a protective gas atmosphere using nitrogen, argon or vacuum.

Tempering

Temperature 100-350°C
Temperatures below 350°C are recommended for the retention of favorable corrosion resistance.
Tempering time 30-60 min.

The core of the material should have a tempering time of at least 30 min. 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.

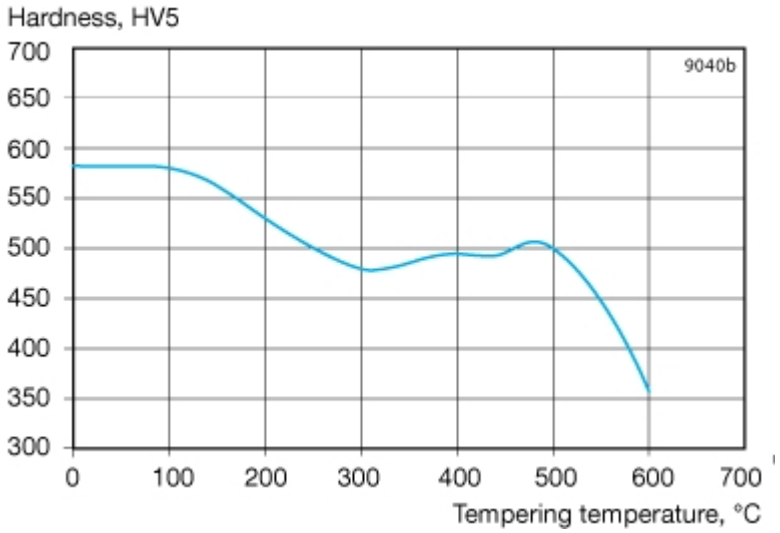

Figure 1. Hardness after recommended hardening procedures, valid for all dimensions.
Soaking time 30 minutes.

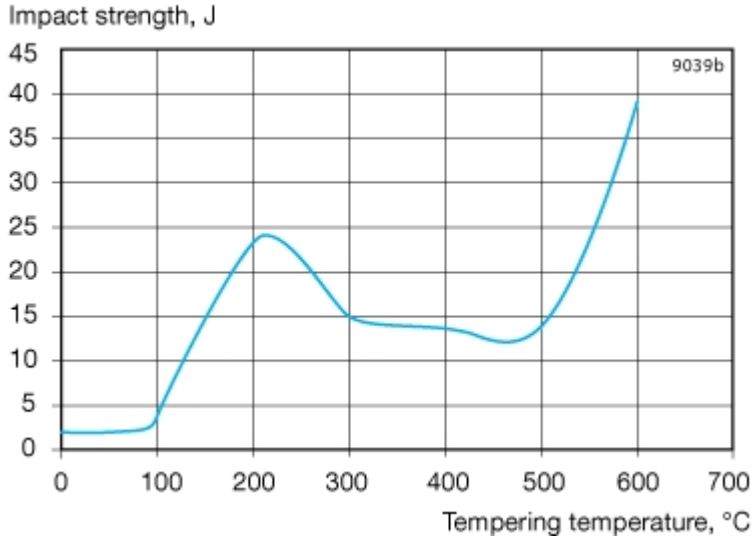

Figure 2. Hardness after recommended hardening procedures, valid for all dimensions.
Soaking time 30 minutes. Standard Charpy V specimens at 20°C.

MACHINING

The recommended values, based on Sandvik Coromant cemented carbide cutting tools or high speed steel tools from Sandvik, are to be regarded as starting data. To obtain the optimal combination of finishes, tolerances and productivity the values should be adjusted for each individual operation.

The data assume the use of a suitable cutting fluid.

When machining without a cutting fluid, the values should be reduced by around 10%. Detailed recommendations can be obtained from your nearest Sandvik Coromant or Sandvik office.

Turning

The charts below give guidance of how speed and feed affects tolerances and surface roughness of turned components. The charts are based on longitudinal turning. The tolerances are given by using the ISO-system, i.e. IT7 could mean h7, k7 or js7. Brazed cemented carbide tools with the following data have been used: Sandvik Coromant tool 310 L197-1212-200 grade H10F, rake angle 0°, clearance angle 6° and entering angle 90°.

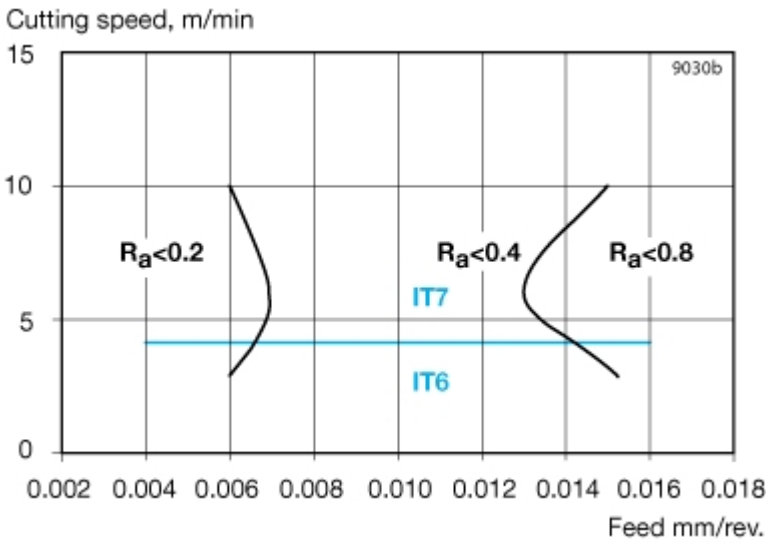

Figure 3. Wire diameter 1.00 mm, depth of cut between 0.15-0.25 mm. Brazed cemented carbide.

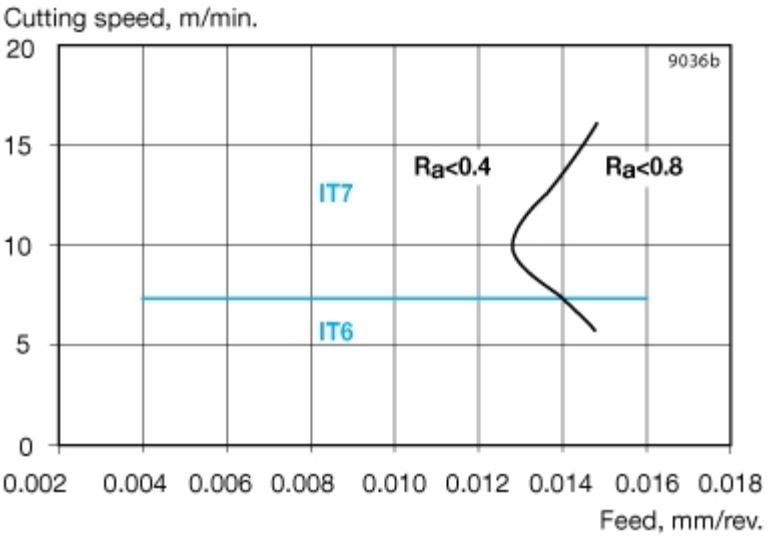

Figure 4. Wire diameter 2.00 mm, depth of cut between 0.30-0.50 mm. Brazed cemented carbide.

CNC lathes and similar

Indexable insert tools. For diameters d < approx. 20 mm lower cutting speeds should be used.

Feed mm/rev.	Cutting speed m/min.		
	GT 4015	CT 525	GC 235
	CT 5015	GC 4015	GC 4035
0.05	330	250	-
0.15	220	210	200
0.5	-	-	165

Longitudinal turning automatics, plunging automatics and similar machines

Diameter < approx. 10 mm

Operation	Cutting depth,	Feed, mm/rev.		
	mm	Finish turning (1)	Medium	Rough turning (2)
Single point turning	<1	0.005-0.01	0.01-0.015	0.025
Forming	1-3	0.02	0.03	0.05
Plunge cutting and parting off	>3	0.01	0.02	0.03
		0.005	0.015	0.03
		0.01	0.02	0.04

1) For parts requiring high precision.
2) For parts with moderate tolerance requirements and parts that must subsequently be machined finished

Parting off and grooving

Parting off in CNC lathes and similar

Tool	Feed mm/rev.	Cutting speed m/mm.
GC 235, 4025	0.05-0.15	80-160
HSS	0.02-0.05	30-40

Bar automatics

Diameter > approx. 2 mm

Tool	Cutting speed m/min
CC	45-60
H2S	25-35

Single and multiple spindle automatic lathes

Diameter >approx. 10 mm

Operation	Feed, mm/rev.	
Finish turning	Rough turning	
Single point	0.05-0.10	0.10-0.25
Forming	0.01-0.03	0.03-0.08
Plunge cutting and parting off	0.02-0.05	0.05-0.10

Threading

Tool	Grade	Cutting speed m/mm.
Threading dies	HSS	1.5-3
Self-opening die heads	HSS	2-5
Thread chasers	HSS CC	15-30 90-150
Thread rolling	HSS CC	5-8 8-10
Thread turning	GC1020	90-110

Drilling

Drill diameter, mm	Feed mm/rev.	Speed rpm
0.5	0.005	2500
1	0.01	2200
3[1)]	0.03	1400
5[1)]	0.05	1100
8[1)]	0.07	800
10[1)]	0.09	700

1) Cemented carbide drills of Delta type with the following data can also be used:
Grade GC1020, speed 70-110 m/min.

Face milling

Operation	Grade	Feed, mm/tooth	Cutting speed m/min.
Finish milling with high cutting speed under favorable working conditions	530 or 1025	0.1 0.2	170-210 150-190
Finish and medium-rough milling under normal to difficult working conditions	4030 or 4040	0.1 0.2	150-180 120-150
Medium-rough to rough milling under difficult conditions	SM30 or 4040	0.1 0.2	110-130 100-110

Endmilling

Tool type	Grade CC	Cutting speed m/min.
Indexable insert tools	530	240
Solid carbide end mills	1025	220
Brazed helical fluted end mills	4040 GC1020 P40	160 140 55

Hobbing

Tool	Cutting speed m/mm.
CC	25-50
HSS	20-40

Reaming

Cutting speed for diameters > about 2 mm

Reamer	Grade	Cutting speed m/min.
Straight/helical fluted	HSS	10
Gun drill geometry	CC HSS	25 15

Feed

Diameter mm	Feed mm/rev.	Allowance mm

1-5	0.05-0.10	0.05-0.10
6-10	0.10-0.20	0.10-0.20
11-20	0.15-0.30	0.20-0.30

All data is nominal. Values refer to 20°C unless otherwise stated.