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Sandvik 4C54

(Billets)

Sandvik 4C54 is a ferritic, heat resisting, stainless chromium steel, characterized by:

- Extremely good resistance to reducing sulphurous gases
- Very good resistance to oxidation in air
- Good resistance to oil-ash corrosion
- Good resistance to molten copper, lead and tin

This steel can be used at temperatures up to 1100°C (2010°F). However, allowance should be made for the low creep strength at the highest temperatures in order to avoid distortion due to the mass of the steel.

STANDARDS

- ASTM 446-1
- UNS S44600
- EN number 1.4749

Certificates
Status according to EN 10 204 3.1

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P	S	Cr	N
max			max	max		
0.20	0.5	0.8	0.030	0.015	26.5	0.2

FORMS OF SUPPLY

Sizes and tolerances
Round-cornered square, as well as round billets, are produced in a wide range of sizes according to the following tables. Larger sizes offered on request.

Surface conditions
Square billets
Unground, spot ground or fully ground condition.

Round billets
Peel turned or black condition.

SQUARE BILLETS

Size	Tolerance	Length
mm	mm	m
80	+/-2	4 - 6.3
100, 114, 126, 140, 150	+/-3	4 - 6.3
160, 180, 195, 200	+/-4	4 - 6.3
>200 - 350	+/-5	3 - 5.3

Sizes and tolerances apply to the rolled/forged condition.

PEEL TURNED ROUND BILLETS

Size	Tolerance	Length
mm	mm	m
75 - 200 (5 mm interval)	+/-1	max 10
>200 - 450	+/-3	3 - 8

UNGROUND ROUND BILLETS

Size	Tolerance	Length
mm	mm	m
77 - 112 (5 mm interval)	+/-2	max 10
124, 134	+/-2	max 10
127, 147, 157	+/-2	max 10
142, 152, 163	+/-2	max 10
168, 178, 188	+/-2	max 10
183, 193	+/-2	max 10

Other products
- Hollow bar
- Welding wire
- Covered electrodes

MECHANICAL PROPERTIES

At 20°C (68°F)

METRIC UNITS

Proof strength		Tensile strength	Elong.		Hardness
$R_{p0.2}$ 1)	$R_{p1.0}$ 1)	R_m	A 2)	$A_{2"}$	Vickers.
MPa	MPa	MPa	%	%	
min.	min.		min.	min.	approx.
275	320	500-700	20	18	190

IMPERIAL UNITS

Proof strength		Tensile strength	Elong.		Hardness
$R_{p0.2}$ 1)	$R_{p1.0}$ 1)	R_m	A 2)	$A_{2"}$	Vickers.
MPa	MPa	MPa	%	%	
min.	min.		min.	min.	approx.
40	46	73-102	20	18	190

1 MPa = 1 N/mm^2
1) $R_{p0.2}$ and $R_{p1.0}$ correspond to 0.2% offset and 1.0% offset yield strength, respectively.
2) Based on $L_0 = 5.65 \sqrt{S_0}$, where L_0 is the original gauge length and S_0 the original cross-sectional area.

At high temperatures

METRIC UNITS

Temperature	Proof strength		Tensile strength	Creep-rupture strength	
	$R_{p0.2}$ [1)]	$R_{p1.0}$ [1)]		10 000 h	100 000 h
°C	MPa	MPa	R_m	MPa	MPa
	min.	min.	MPa	approx.	approx.
100	235	280	450		
200	215	260	430		
300	200	250	430		
400	185	245	430		
500	175	240	375	100	55
525	165	230	335	77	43
550	150	200	290	59	33
575				46	26
600				35	20
625				25	14
650				18	10
675				13	7.0
700				9.5	5.0
725				7.6	4.0
750				6.2	3.3
775				5.0	2.7
800				4.3	2.3
825				3.4	1.9
850				2.8	1.5
875				2.3	1.2
900				1.9	1.0

IMPERIAL UNITS

Temperature	Proof strength		Tensile strength	Creep-rupture strength	
	$R_{p0.2}$ [1)]	$R_{p1.0}$ [1)]	R_m	10 000 h	100 000 h
°C	ksi	ksi	ksi	ksi	ksi
	min.	min.		approx.	approx.
200	34.4	40.9	66.7		
400	31.0	37.7	62.3		
600	28.7	36.1	62.3		
800	26.8	35.5	62.2		
1000	22.9	31.9	46.0	9.7	5.5
1050				7.3	4.1
1100				5.5	3.0
1150				3.9	2.2
1200				2.6	1.5
1250				1.9	1.01
1300				1.35	0.71
1350				1.04	0.58
1400				0.83	0.46
1450				0.67	0.38
1500				0.54	0.33
1550				0.43	0.28
1600				0.36	0.20
1650				0.28	0.16
1700				0.26	0.14

Since Sandvik 4C54 has very large creep-rupture elongation, often more than 100%, and little resistance to creep, it is necessary to allow for considerable creep deformation long before rupture occurs. At normal service temperatures, i.e. over 700 °C (1290 °F), even the dead weight of the tubes can cause stresses leading to large deformations.

Careful attention must therefore be given to the way in which the tubes are supported. Sandvik 4C54, in common with other ferritic chromium steels, are less tough than austenitic stainless steels in the as-delivered condition. The transition temperature of Sandvik 4C54 is around 100-150 °C (210-300 °F). After a period of operation, toughness at room temperature can decrease further. For this reason, large impact stresses and the like should be avoided during repairs.

The graph in figure 1 can be used to determine the temperature above which design calculations should be based on creep-rupture strength rather than proof strength.

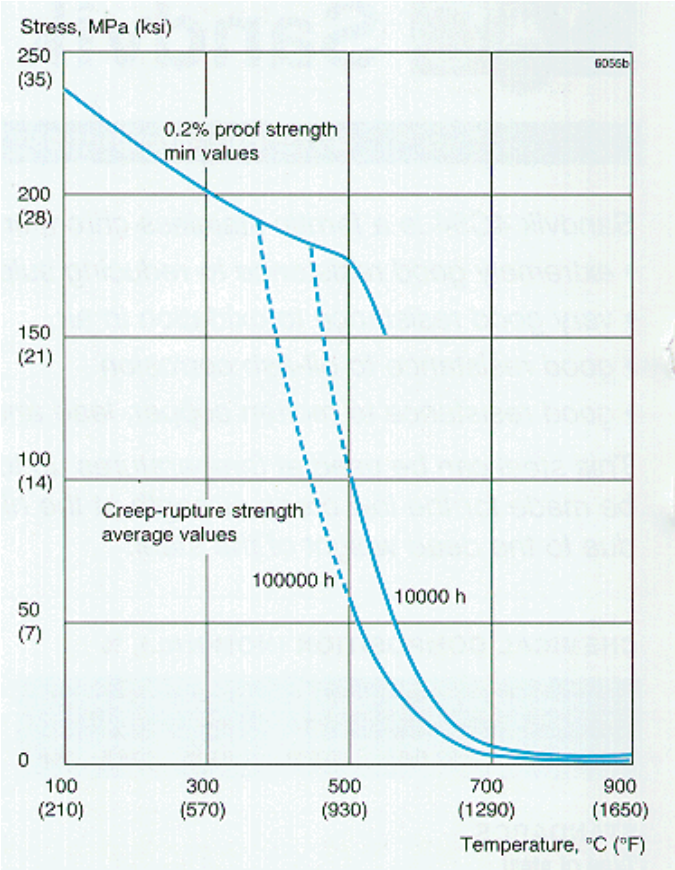

Figure 1. 0.2% proof strength and creep-rupture stress at 10 000h and 100 000h.

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 Sandvik materials.