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Sandvik 20C

(Strip steel)

Sandvik 20C is a hardened and tempered carbon steel characterized by good properties in respect of:

- Fatigue strength and wear resistance
- Hardness combined with ductility
- Dimensional tolerances
- Surface and edge finishes
- Shape

The material also have good blanking and forming properties with retaining shape of the parts after the blanking operation.

STANDARDS

- ASTM 1095
- EN number 1.1274

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn
1.00	0.25	0.45

DIMENSIONS

Sandvik 20C is available in a wide range of sizes. The following chart indicates the approximate standard size range.

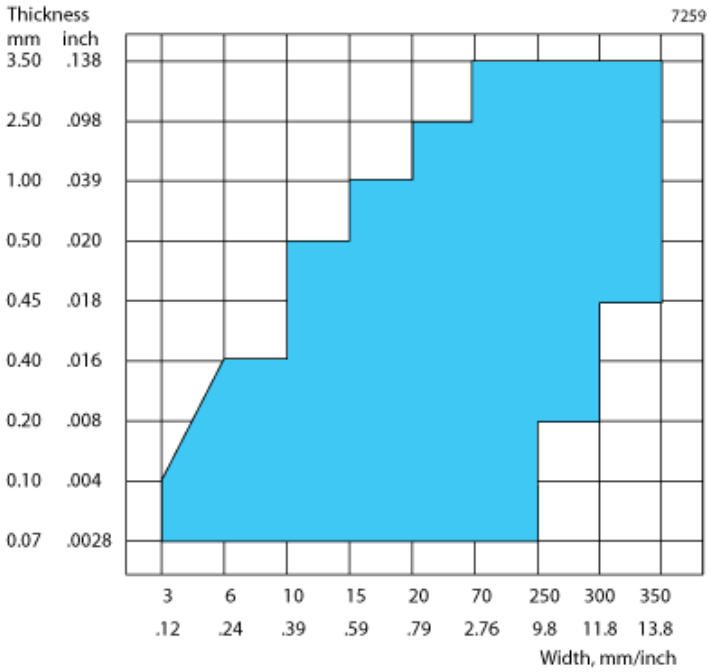


Figure 1: Standard size range

FINISHES AND FORMS OF SUPPLY

The strip steel can be supplied in coils or lengths with various edges and surfaces.

MECHANICAL PROPERTIES

Nominal values at 20°C.

Thickness		Tensile strength		Proof strength	
mm	in.	MPa	psi	MPa	psi
<0.125	<.005	2100	304 500	1900	276 000
0.125-<0.175	.005-<.007	2050	297 250	1850	268 000
0.175-<0.225	.007-<.009	2000	290 000	1800	261 000
0.225-<0.275	.009-<.011	1950	282 750	1750	254 000
0.275-<0.375	.011-<.015	1900	275 500	1700	247 000
0.375-<0.425	.015-<.017	1850	268 250	1650	239 000
0.425-<0.475	.017-<.019	1800	261 000	1600	232 000
0.475-<0.625	.019-<.025	1750	253 750	1600	232 000
0.625-<0.825	.025-<.032	1700	246 500	1550	225 000
0.825-<1.000	.032-<.039	1650	239 250	1500	218 000
1.000-<1.575	.039-<.062	1600	232 000	1450	210 000
1.575-<2.500	.062-<.098	1600	232 000	1450	210 000
2.500-<3.500	.098-<.118	1600	232 000	1450	210 000

PHYSICAL PROPERTIES

The physical properties of a steel are related to a number of factors, including alloying elements, heat treatment and manufacturing route, but the data presented below can generally be used for rough calculations.

Density, g/cm^3: 7.85
lb/in^3: 0.28

Thermal expansion per °C, x10 –6:
from 20°C to 100°C: 10.4
to 200°C: 11.6
to 300°C: 12.4
per °F, x 10 –6 ,
from 68°F to 210°F: 5.8
to 390°F: 6.4
to 570°F: 6.9
Thermal conductivity
at 20°C, W/(m · °C): 49
68°F, Btu/(ft · h · °F): 28

TOLERANCES

In the standard finish, the tolerances is symmetrical, half above and half below the nominal size. Other tolerances can be discussed. The tolerances are based on the Swedish Standards SS 21 21 10 and 21 21 11 respectively.

Thickness tolerance

The standard tolerance is T1 according to table 3. Closer tolerances can be agreed upon.

Width tolerance

The standard tolerance is B1 according to table 4. Closer tolerances can be agreed upon.

TABLE 3. THICKNESS TOLERANCES, T1

Strip thickness		Thickness tolerance	
mm	in.	mm±	in.±
<0.063	<0.0024	0.005	0.00020
<0.100	<0.0039	0.006	0.00024
<0.125	<0.0049	0.007	0.00028
<0.160	<0.0063	0.009	0.00035
<0.200	<0.0079	0.010	0.00039
<0.250	<0.0098	0.011	0.00043
<0.315	<0.0124	0.013	0.00051
<0.400	<0.0158	0.015	0.00059
<0.500	<0.0197	0.017	0.00067
<0.630	<0.0248	0.020	0.00079
<0.800	<0.0315	0.023	0.00091
<1.000	<0.0394	0.027	0.00106
<1.250	<0.0492	0.034	0.00134
<1.600	<0.0630	0.039	0.00154
<2.000	<0.0787	0.046	0.00181
<2.500	<0.0984	0.050	0.00197
<3.150	<0.1240	0.056	0.00220
<3.500	<0.1380	0.063	0.00248

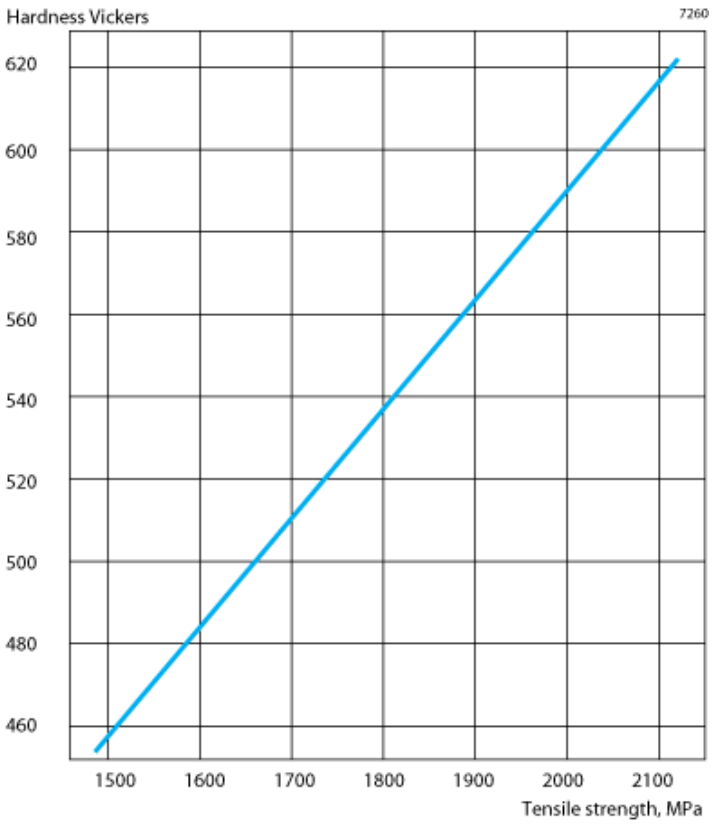
Table 4. Width tolerances, B1

Thickness		Width									
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
		<20	<0.70	<50	<1.97	<125	<4.92	<250	<9.84	<350	<13.8
			tolerance								
		mm±	in. ±	mm±	in.±	mm±	in.±	mm±	in.±	mm±	in.±
<0.25	<0.098	0.07	0.0028	0.10	0.0039	0.15	0.0059	0.20	0.0079	0.30	0.0118
<0.50	<0.020	0.10	0.0039	0.15	0.0059	0.20	0.0079	0.25	0.0098	0.35	0.0138
<1.00	<0.039	0.15	0.0059	0.20	0.0079	0.25	0.0098	0.30	0.0118	0.40	0.0157
<1.60	<0.063	0.20	0.0079	0.25	0.0098	0.30	0.0118	0.35	0.0138	0.45	0.0177
<2.00	<0.079	0.25	0.0098	0.30	0.0118	0.35	0.0138	0.40	0.0157	0.50	0.0197
<2.50	<0.098	0.35	0.0138	0.35	0.0138	0.40	0.0157	0.45	0.0177	0.55	0.0217
<4.00	<0.158	–	–	0.40	0.0157	0.45	0.0177	0.50	0.0197	0.60	0.0236

BLANKING AND BENDING

Blanking

In order to achieve optimal blanking results tools and presses must be accurate and stable in dealing with hardened and tempered strip. A lubricant is recommended to minimize tool wear.



Clearance between punch and die

A radial clearance of 4–10% of the strip thickness is recommended. This will give low burr height in combination with long tool life and a sheared edge with a narrow shear zone and a wide break zone.

Tools
Tool steels of type AISI D2 or D4 with hardness about 63 HRC can be used except where thick gauges, slender tool sections and small corner radii are involved. In that case we recommend high-speed steel, type AISI M2 hardened and tempered to about 63 HRC.

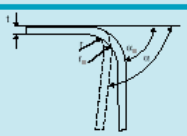
Carbide tools are recommended for blanking in very long runs, unless the strip is too hard and thick or the shape of the items is unsuitable. More detailed recommendations will be furnished on request. The corner radii should be min. 0.25 x the strip thickness, but not smaller than 0.25 mm (0.010 in.), and the diameter of the punch not smaller than 2 x the strip thickness.

The risk of the hole slug or the blanked item being carried along with the punch on its return stroke can be lessened by using a die without a taper, i.e. with a straight section starting from the edge of the tool. The straight section should be at least 5 x the strip thickness or at least 3 mm (0.118 in.) in length.

Bending
Table 6 shows average values for the least bending radius, r min . These figures refer to strip with a nominal tensile strength as per table 5. The bending tests were carried out according to Swedish Standard SS 11 26 26 method 3, i.e.in a 90° vee block with a 25 mm (1 in.) die opening, the blanked test pieces being 35 mm (1.38 in.) wide and turned so that their burr edge was facing inwards in the bend.

Table 6. Bending

Material thickness		Least bending radii 15LM		20C		Bending calculation (spring back)
mm	inch	‖	_|_	‖	_|_	
0.10	.004	8t	8t	10t	8t	
0.25	.010	7t	7t	10t	8t	
0.50	.020	6t	4t	10t	6t	
1.00	.040	8t	4t	>10t	6t	

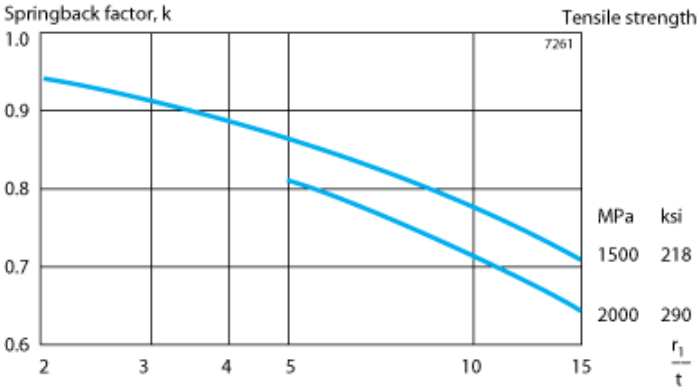


Radius of the punch, $r = k \cdot r_i$

Angle of the V-die $\alpha = \frac{\alpha_i}{k}$

‖ = bending parallel to the rolling direction
_|_ = bending at right angles to the rolling direction
t = strip thickness

k = springback factor, see fig. 4
r_i = bending radius after springback
α_i = bending angle after springback



APPLICATIONS

- Washers in automatic transmissions
- Lapping carriers and cutter blades for the semiconductor industry
- Coater and scraper blades for the pulp and paper industry
- Springs in general
- Doctor blades for printing processes
- Knives
- Trowels

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.