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Sandvik 15LM

(Strip steel)

Sandvik 15LM is a hardened and tempered carbon steel with high tensile strength.

STANDARDS

- ASTM 1074
- W.Nr. 1.1248
- SS 1770

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P	S	Cr	Ni	Mo	Others
			max	max				
0.76	0.2	0.7	0.020	0.010	0.19	-	-	-

DIMENSIONS

Sandvik 15LM is available in a wide range of sizes. The following chart indicates the approximate stand-ard size range.

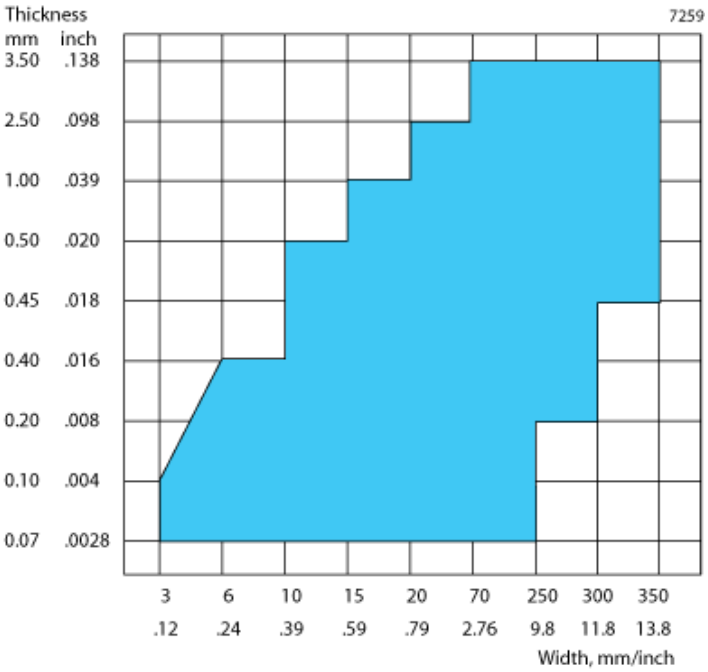


Figure 1 Standard size range

FINISHES AND FORMS OF SUPPLY

The strip steel can be supplied in coils or lengths with edges and surfaces described in the brochure S-300-ENG. See also packing guide at www.steel.sandvik.com/strip.

MECHANICAL PROPERTIES

Nominal values at 20°C.

Thickness		Tensile strength		Proof strength	
		sR_m*		$R_{p0.2}$	
mm	in.	MPa	psi	MPa	psi
<0.125	*<.005*	1950	282 750	1750	253 750
0.125-<0.175	*.005-<.007*	1900	275 500	1700	246 500
0.175-<0.225	*.007-<.009*	1850	268 250	1650	239 250
0.225-<0.275	*.009-<.011*	1800	261 000	1600	232 000
0.275-<0.375	*.011-<.015*	1750	253 750	1600	232 000
0.375-<0.425	*.015-<.017*	1700	246 500	1550	224 750
0.425-<0.475	*.017-<.019*	1700	246 500	1550	224 750
0.475-<0.625	*.019-<.025*	1650	239 250	1500	217 500
0.625-<0.825	*.025-<.032*	1600	232 000	1450	210 000
0.825-<1.000	*.032-<.039*	1550	224 750	1400	203 000
1.000-<1.575	*.039-<.062*	1500	217 500	1350	195 750
1.575-<2.500	*.062-<.098*	1500	217 500	1350	195 750
2.500-<3.500	*.098-<.118*	1500	217 500	1350	195 750

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

Figure 2. Control and registration of thickness, shape and surface.

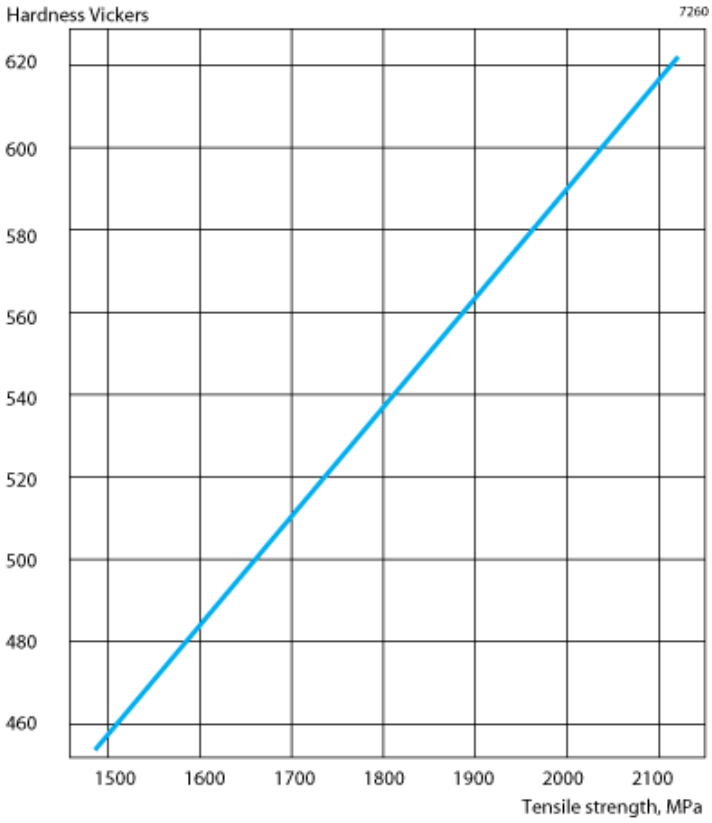
Table 4. Width tolerances, B1

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 & 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

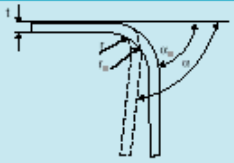
Tool steels of type AISI D2 or D4 with hardness about 63 HRC can be used except where thick gauges, slender tool sections and small corner radii are involved. In that case we recommend high-speed steel, type AISI M2 hardened and tempered to about 63 HRC. Carbide tools are recommended for blanking in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

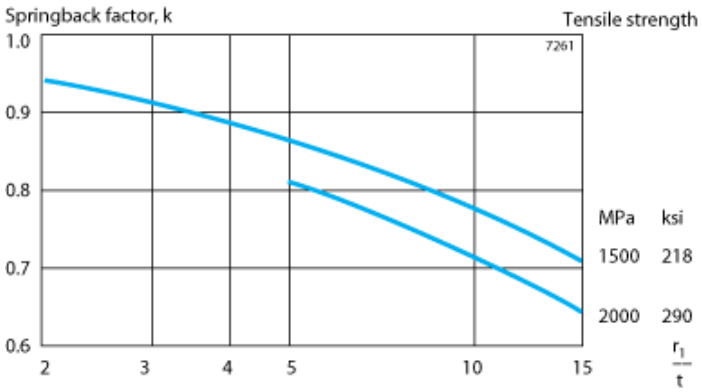
Material thickness		Least bending radii 15LM		20C		Bending calculation (spring back)
mm	inch	||	_|_	||	_|_	
0.10	.004	8t	8t	10t	8t	
0.25	.010	7t	7t	10t	8t	
0.50	.020	6t	4t	10t	6t	
1.00	.040	8t	4t	>10t	6t	

Radius of the punch, $r = k \cdot r_1$

Angle of the V-die $\alpha = \frac{\alpha_1}{k}$

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

k = springback factor, see fig. 4
r_1 = bending radius after springback
α_1 = bending angle after springback



APPLICATIONS

- Springs in general
- Spring washers in cars
- Scraper blades for the pulp and paper industry