

Medical products

Sandvik Bioline 316LVM

MATERIAL DATASHEET S-ME019-DS-ENG December 2008

Sandvik Bioline 316LVM is a molybdenum alloyed vacuum remelted stainless steel for the production of both temporary and permanent implants.

It is characterized by:

- high strength
- high fatigue strength
- extremely high purity
- excellent structural homogeneity
- high surface finish

CHEMICAL COMPOSITION (NOMINAL), %

C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N
max.			max.	max.				max.	max.
0.025	0.6	1.7	0.025	0.003	17.5	14	2.8	0.10	0.10

STANDARDS

Sandvik	Bioline 316LVM
ASTM	F138
UNS	S31673
ISO	5832-1
DIN	X 2 CrNiMo 18 15 3

Product standards

Bar and wire: ASTM F138	Strip: ASTM F139
DIN ISO 5832-1	
ISO 5832-1	
BS 7252-1	

FORMS OF SUPPLY

Profiles and shapes

Thickness max 8 mm (0.315 inch)
Width 0.80-21 mm (0.031-0.827 inch)

Wires, straightened lengths

Bright drawn diameter 0.60-5.0 mm (0.02-0.197 inch)
Ground diameter 0.6-10 mm (0.02-0.394 inch)

Wires, spools and coils

Bright drawn diameter
Spools 0.010-2 mm (0.0004-0.79 inch)
Coils 1-5 mm (0.039-0.197 inch)

Round bars

Ground 10-20 mm (0.394-0.787 inch).
Ground and peeled 21-100 mm (0.787-3.94 inch)

Flat and square bars

Width/thickness in straight lengths 5-100 mm

Strip

Coils, spools or straightened lengths.
Thickness 0.015-5 mm (0.0006-0.197 inch)
Width up to 320 mm (12.9 inch)

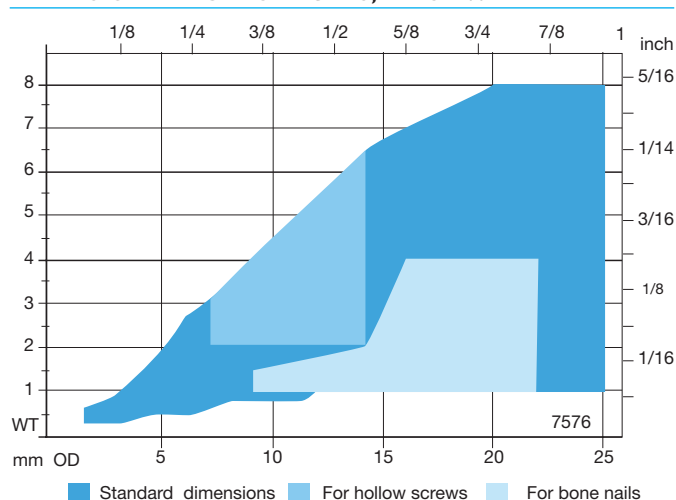
Tubes, thin wall

Extremely polished or bright surface
OD 0.50-20 mm (0.019-0.787inch)
Wall thickness 0.1-2 mm (0.0039-0.078 inch)

Tubes, thick wall

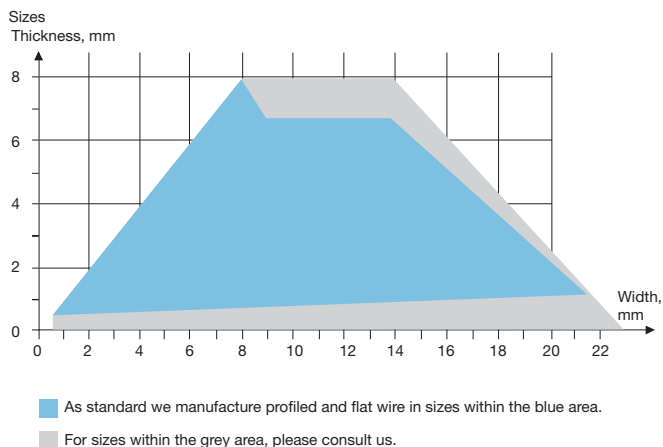
Bright annealed or cold drawn
OD 6.0-25.4 mm (0.236-1 inch)
Wall thickness 2.6-8 mm (0.102-0.315 inch)

DIMENSION RANGE FOR TUBES, THICK WALL

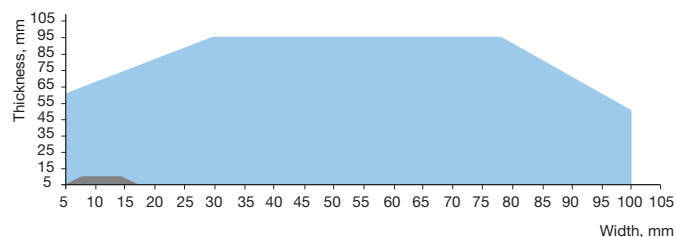


DIMENSION RANGE FOR PROFILES

Wide range of solid profiles shapes



DIMENSION RANGE FOR PROFILES



Wire tolerances:

- ground bars: h8 as standard, h6 on request
- drawn straightened: h9
- drawn in coil/spool: D2

Tighter tolerances to be discussed in each and every individual case.

Fine tube tolerances:

- Thickness tolerance: +/- 10%
- OD tolerance: +/- 0.75% with a minimum of +/-0.02 mm
- Roughness

- for OD> 5mm Ra (outside) < 0.4 (by polishing)
- for ID>3.2mm Ra (inside)< 0.4-depending on thickness/diameter ratio
- Specific roughness can be supplied on request

- Internal cleaning cannot be carried out on inside diameters below 4 mm

All products are supplied either in the annealed or cold worked condition to provide mechanical properties as required

Round bar tolerances:

- h8 - h11 depending on size and tensile strength

MECHANICAL PROPERTIES

Product form	Condition	Tensile strength R _m		Proof strength R _{p0.2}		Elongation A,% typical	Hardness Brinell typical
		MPa min	ksi min	MPa min	ksi min		
Bar & wire	Annealed	490	71	190	28	45	160
Bar & wire	Medium tensile	900	131	700	101	15	285
Bar & wire	High tensile	1100	160	800	116	12	300
Bar & wire	Extra high tensile	1400	203				
Tube, thick wall	Bright annealed	515-690	75-100	220	32	min 45	155-210
Tube, thick wall	Cold finished	860-1100	125-160	690	100	min 12	260-330
Profile	Cold rolled	860-1100	125-160	690	100	12	260-330
Strip	Annealed	490-690	71-100	190	28	40	95 max
Strip	Cold worked	860-1100	125-160	690	100	12	
Tube, thin wall	Annealed	490-690	71-100	190	28	40	
Tube, thin wall	Cold worked	860-1100	125-160	690	100	12	

NB: Extra high tensile strength can be achieved for diameter ≤ 5 mm

PHYSICAL PROPERTIES

Density (20 °C)	8.0 g/cm ³	0.29 lb/in ³
Modulus of elasticity, x10 ³ (20°C)	200 MPa	29.0ksi
Specific heat capacity (20°C)	485 J/(kg °C)	0.11Btu/(lb°F)
Thermal conductivity (20°C)	14W /(m°C)	8 Btu/(lb°F)
Thermal expansion, x10 ⁻⁶ (30-100°C)	16.5 per °C	9.5 per °F

APPLICATIONS

Sandvik Bioline 316LVM is used for implant applications: hip stems, femoral heads, spinal systems, acetabular cups, intramedullary nails, bone screws, knee joints, and pins, bone and nail plates, internal fixation devices, dental implants, staples.

This grade is also used for cardiovascular applications: guide wires, cardiac stents and for surgical instruments and tools: blood lancets, stylets, trocars.

CORROSION RESISTANCE

Sandvik Bioline 316LVM has very good resistance in physiological environments to:

- general and intergranular corrosion due to high purity and low ferrite content
- pitting and crevice corrosion due to the high molybdenum content

Sandvik Bioline 316LVM is capable of passing the Money penny Strauss intergranular corrosion test, in accordance with ISO / ASTM requirements.

MACHINING

	Hardness	Cutting speed range		Feed range	
		SFM	m/min	IPR	mm/rev
Turning	160-300	900-145	275-45	0.002-0.024	0.05-0.6
Milling	160-300	870-165	265-50	0.002-0.016	0.05-0.4
Drilling	160-300	115-195	35-60	0.002-0.012	0.05-0.3

FURTHER INFORMATION

NB: Mechanical properties, dimensions, tolerances and forms of supply can be discussed on request.

Material datasheets and in-depth technical information about Sandvik Bioline grades and products are available on the Sandvik website, www.sandvik.com/medical.

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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 data sheet is only valid for Sandvik material. Other material, covering the same international specifications, does not necessarily comply with the mechanical and corrosion properties presented in this datasheet.

