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Böhler L306 VMR is a wrought, age-hardenable nickel-chromium alloy, strengthened by additions of titanium, aluminum, and carbon. It has been developed as a creep-resisting alloy for service at temperatures up to 815 °C (1500 °F).

Chemical Composition

Element	Composition, wt%(a)
Carbon	0.060
Manganese	(c)
Silicon	(c)
Sulfur	(c)
Chromium	19.50
Titanium	2.50
Aluminum	1.70
Iron	≤ 1.50
Nickel	bal

(a) Average values unless indicated otherwise. (b) Not disclosed in the Böhler L306 VMR brochure

Physical Properties

Property	Unit	At	Value
Density	kg/m ³ (lb/in. ³)	20 °C (68 °F)	8200 (0.296)
Coefficient of linear thermal expansion	10 ⁻⁶ /K (10 ⁻⁶ /°F)	20–100 °C (68–212 °F)	12.9 (7.2)
		20–200 °C (68–392 °F)	13.4 (7.4)
		20–300 °C (68–572 °F)	13.8 (7.7)
		20–400 °C (68–752 °F)	14.3 (7.9)
		20–500 °C (68–932 °F)	14.7 (8.2)
		20–600 °C (68–1112 °F)	15.2 (8.4)
Thermal conductivity	W/(m·K) (Btu/(h·ft·°F))	20 °C (68 °F)	13.0 (7.5)
Specific heat capacity	J/(kg·K) (cal/(g·°C))	20 °C (68 °F)	460 (0.110)
Electrical resistivity	μΩ·m (Ω·circular-mil/ft)	20 °C (68 °F)	1.24 (746)
Magnetic properties	...	RT	(a)

RT = room temperature. (a) Nonmagnetic. Can be slightly magnetic in the quenched condition. Magnetic properties may increase with cold forming

Mechanical Properties

See Tables 1–6.

Hot Forming

Forging. Heat to 1150 °C (2100 °F). Wait for equalization of the temperature. Do not finish below 950 °C (1740 °F). Cool slowly in the furnace or in thermoinsulating material.

Heat Treatment

Solution Heat Treatment. Heat to 1050–1080 °C (1920–1975 °F). Wait for equalization of the temperature. Soak for 8 h. Cool in air or quench in water.

Precipitation Heat Treatment. Heat to 690–710 °C (1275–1310 °F). Wait for equalization of the temperature. Soak for 16 h. Cool in still air.

Comparable Grades

voestalpine Böhler Edelstahl GmbH & Co KG	Böhler L306 VMR
ASTM	UNS N07080
EN	NiCr20TiAl (2.4952)

General Characteristics

Creep resistant up to 850 °C (1560 °F); excellent oxidation resistance.

Product Forms

Bar; forgings.

Applications

Highly stressed components such as chambers for diesel engines, combustion valves, discs, gas turbine blades, and shafts; bolts and nuts; forging hammers; hot work tools; pressing tools; shear blades; springs; swaging dies.

Table 1 Room temperature mechanical properties in the precipitation hardened condition

Product	Dimension		Tensile strength, min		0.2% Proof strength, min		Elongation (A_5), min	Reduction of area, min
	mm	in.	MPa	ksi	MPa	ksi	L	L
							%	%
St, Sch	≤ 160	≤ 6.30	1000	145	600	87	12	12

Key: St = bar, Sch = forging, L = longitudinal. (a) For information only.

Table 2 0.2% Proof strength in the precipitation hardened condition

Temperature		0.2% proof strength	
°C	°F	MPa	ksi
300	572	735	107
400	752	726	105
500	932	716	104
600	1112	696	101
700	1292	628	91
800	1472	431	63
900	1652	196	28
1000	1832	39	6

Average values

Table 3 Modulus of elasticity

Temperature		Modulus of elasticity	
°C	°F	GPa	10 ⁶ psi
20	68	216	31.3
200	392	208	30.2
400	752	196	28.4
600	1112	179	26.0
800	1472	130	18.9

Typical values

Table 4 0.2% Creep limit in the precipitation hardened condition

Duration	0.2% creep limit, in MPa (ksi), at a temperature, in °C (°F), of					
	650 (1200)	700 (1290)	750 (1380)	800 (1470)	815 (1500)	900 (1652)
h						
100	510 (74)	353 (51)	...	157 (23)	...	47 (7)
300	441 (64)	294 (43)	...	118 (17)	...	33 (5)
1,000	382 (55)	235 (34)	...	83 (12)	...	22 (3)
10,000	245 (36)	122 (18)	69 (19)	...	27 (4)	...

Average values

Table 5 0.5% Creep limit in the precipitation hardened condition

Duration	0.5% creep limit, in MPa (ksi), at a temperature, in °C (°F), of			
	650 (1200)	700 (1290)	750 (1380)	815 (1500)
h				
100	265 (38)	147 (21)
300	481 (70)	333 (48)	221 (32)	118 (17)
1,000	412 (60)	275 (40)	167 (24)	78 (11)
10,000	280 (41)	157 (23)	78 (11)	29 (4)
10,000	216 (31)	108 (16)	49 (7)	20 (3)

Average values

Table 6 Creep rupture strength in the precipitation hardened condition

Duration	Creep rupture strength, in MPa (ksi), at a temperature, in °C (°F), of			
	650 (1200)	700 (1290)	800 (1470)	900 (1652)
h				
100	579 (84)	441 (64)	206 (30)	69 (10)
300	510 (74)	382 (55)	162 (23)	44 (6)
1,000	461 (67)	333 (48)	127 (18)	25 (4)
10,000	363 (53)	235 (34)	73 (11)	...

Average values

Supplier

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