

DATA SHEET



**LATROBE SPECIALTY
STEEL COMPANY**

Latrobe, PA 15650-0031 USA

LESCALLOY[®] M50 VIM-VAR

HIGH PERFORMANCE BEARING STEEL

Typical Composition	C	Si	Mn	Cr	Mo	V
	0.85	0.20	0.30	4.10	4.25	1.00

GENERAL CHARACTERISTICS

LESCALLOY M50 VIM-VAR (AISI M50) steel is a through hardening grade with high hardness and high compressive strength at elevated temperatures. It is produced exclusively as a double vacuum melted product using vacuum induction melting plus VAC-ARC[®] remelting. This VIM-VAR process provides for optimum control and reproducibility of chemistry, microcleanliness and superior fatigue resistance.

The grade is widely used for critical aircraft engine bearings operating at elevated temperatures. With its combination of good hot hardness and excellent rolling contact fatigue strength, M50 VIM-VAR steel is ideally suited for highly stressed parts such as bearings and gears designed for service up to about 800°F (427°C).

PHYSICAL PROPERTIES

Density: 0.29 lb/in³ (7.87 g/cm³)

COEFFICIENT OF THERMAL EXPANSION

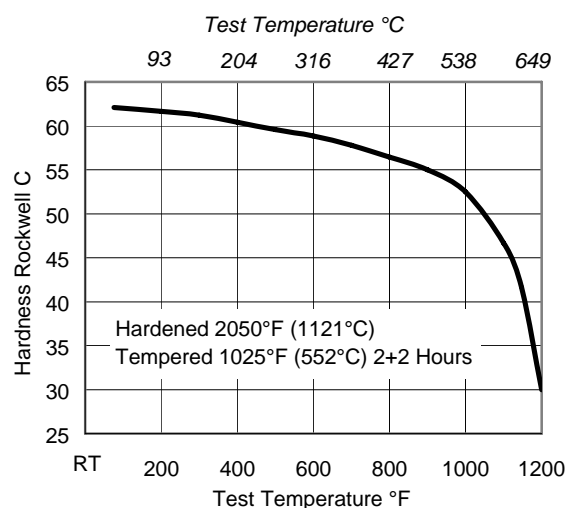
Temp Range		in / in / °F	mm / mm / °C
°F	°C	(x 10 ⁻⁶)	(x 10 ⁻⁶)
-100-70	-73-21	5.59	10.06
70-200	21-93	6.23	11.21
70-300	21-149	6.39	11.50
70-400	21-204	6.58	11.84
70-500	21-260	6.72	12.10
70-600	21-316	6.83	12.29
70-700	21-371	6.95	12.51
70-800	21-427	7.05	12.69
70-900	21-482	7.20	12.96
70-1000	21-538	7.38	13.28

Heat treated to 63-64 HRC.

MODULUS OF ELASTICITY

Test Temperature		Modulus	
°F	°C	10 ⁶ psi	GPa
70	21	29.5	203.4
200	93	27.5	189.6
400	204	24.5	168.9
600	316	21.5	148.2
800	427	18.5	127.6
1000	538	15.5	106.9
1200	649	12.5	86.2

ELEVATED TEMPERATURE HARDNESS



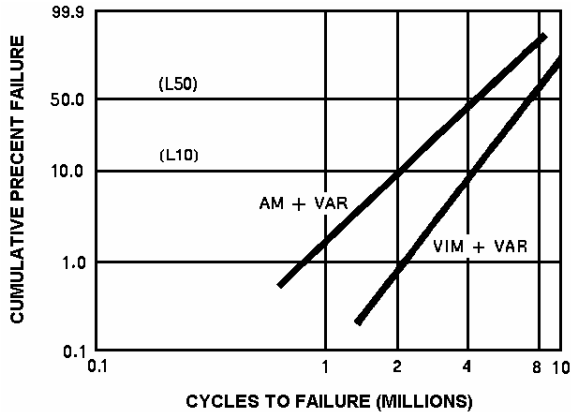
FORGING

Preheat at 1400-1500°F (760-816°C) and hold until uniformly heated; then heat rapidly to 2025-2100°F (1107-1149°C) and again hold until parts are uniformly heated. Do not forge below 1700°F (927°F). Parts should be slow cooled after forging by furnace cooling or by burying in an insulating medium. A full annealing treatment should always follow forging.

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FATIGUE DATA

Fatigue properties of Lescalloy M50 VIM-VAR have been shown to be significantly superior. This attribute is best illustrated by the Weibull plots presented below. These curves represent average rolling contact fatigue (RCF) rig test data developed from a number of air melt plus VAC-ARC heats and VIM plus VAC-ARC heats. The VIM-VAR data are not only better, but also more consistent. The specifics of the test can be provided.



MACHINABILITY RATING

In the annealed condition Lescalloy M50 VIM-VAR has a machinability rating of 65% of a 1% carbon tool steel and 50% of AISI B1112 screw stock.

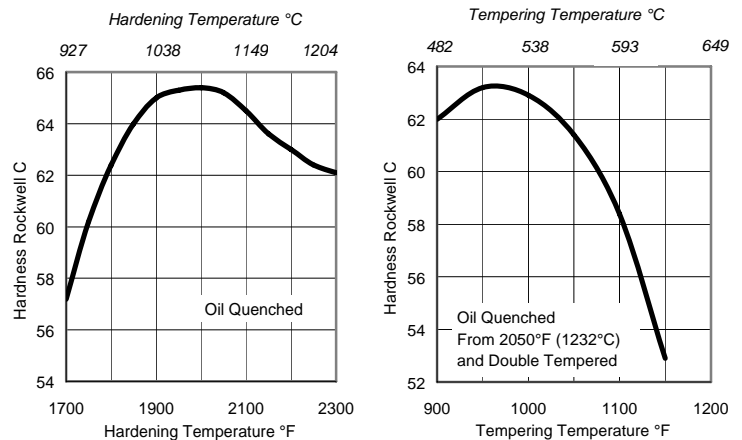
HEAT TREATMENT

Annealing: Heat uniformly to 1650°F (899°C) and soak 8-10 hours. Cool 25-50°F (14-28°C) per hour to 1000°F (538°C). Air cool. Typical annealed hardness: 235 HBW.

Hardening: Harden in a properly rectified salt bath or controlled atmosphere furnace. Preheat at 1500-1600°F (815-871°C) and equalize. Raise uniformly to 2000-2025°F (1093-1107°C). Quench into salt maintained at 1050-1150°F (566-621°C) or warm oil. Complete the quench in still air to at least 150°F (66°C) prior to beginning the tempering temperature for 2-4 hours.

Tempering: Temper between 975-1025°F (524-552°C) for most applications. Parts should always be double tempered and, in some instances, it may be advantageous to use a third tempering cycle. Hold at tempering temperature for 2-4 hours.

HARDENING & TEMPERING DATA



CLEANLINESS STANDARDS

Typical Microscopic Cleanliness (JK ASTM E45) Severity					
		A	B	C	D
Worst Field	Thin	1.5	1.0	1.0	1.5
Worst Field	Heavy	1.0	1.0	1.0	1.0

For type A, B and C combined, there shall be not more than three fields of 1.5 A type or 1.0 B and C types and not more than five other lower ratable A, B and C type thin fields per specimen. For type D thin, there shall be not more than three 1.5 fields and not more than five other lower ratable D type thin fields per specimen. There shall be not more than one field each of 1.0 A, B, C or D type heavy per specimen. Note: Fields of less than 1.0 are not ratable.

SPECIFICATIONS

The following specifications are offered for general reference and should not be considered a complete listing.

AMS 6490 (VAR) 6491 (VIM-VAR)	Timken Aerospace EMS 5.1 EMS 5.4	Barden Corp. SA-2947
G.E. B50TF103 C50TF56	EMS 5.7 EMS 88	SNR LA 14.05.01
Pratt & Whitney PWA 793 PWA 725 CPW 378	SNFA CFR 5200	Bell Helicopter 299-947-087
Rolls-Royce MSRR 6083	McGill Mfg. 10-42	NHBB PES 1.105
MRC-SKF MS-45 MS-171 MS-187	Snecma DMD 119.20	RBC MP-19
	RHP/AEB 14-06	Winsted MS-115
	FAG FL-LA 2372.2 SX PL 1.801A	



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