DATA SHEET

LATROBE SPECIALTY STEEL COMPANY
Latrobe, PA 15650-0031 USA

LESCALLOY® HP 9-4-30 VAC-ARC®

HIGH STRENGTH ALLOY STEEL

Typical Composition	C	Mn	Si	Cr	V	Mo	Ni	Co
	0.30	0.30	0.10	1.00	0.10	1.00	7.50	4.50

GENERAL CHARACTERISTICS

LESCALLOY HP 9-4-30 VAC-ARC steel is a low alloy, high strength steel with a high nickel and cobalt content to promote toughness. The alloy has been designed to have high hardenability, good weldability and excellent fracture toughness. It is typically used in the 220/240,000 psi (1517/1655 MPa) tensile strength range.

Lescalloy HP 9-4-30 VAC-ARC steel is produced by the consumable electrode vacuum arc remelting process to provide optimum cleanliness and preferred ingot structure.

APPLICATIONS

Aircraft structural components, rocket motor cases, armor plate, pressure vessels, gears.

PHYSICAL PROPERTIES

Density: 0.28 lb/in^3 (7.76 g/cm^3)
Mean Coefficient of Thermal Expansion 70-800°F (20-427°C): 6.3x10^{-6} in/in/°F (11.3x10^{-6} mm/mm/°C)

WORKABILITY

Forging: Ingot breakdown: heat to 2200°F (1204°C). For finish forging heat to 1900F (1038°C); do not forge below 1700°F (927°C).
Weldability: TIG welding with an He shield is preferable, using weld wire of HP 9-4-30 composition.
Machinability: General practices used for machining 4340 steel at equivalent hardness levels are recommended for HP 9-4-30.

HEAT TREATMENT

Normalize: 1600-1700°F (871-927°C), 1 hour, air cool.
Austenitize: 1550 ± 25°F (843 ± 14°C), 1 hour, oil quench.
Refrigerate: -100°F (-73°C), 2 hours, air warm to room temperature.
Temper: 400-1100°F (204-593°C) depending on desired properties. Double tempering should be employed (see tempering curve).
Anneal: 1250°F (677°C) 4 hours, air cool to room temperature, plus 1150°F (621°C), 4-8 hours, air cool. Resulting hardness is typically 311-321 HBW. Or, temper (subcritical anneal) at 1150°F (621°C) for 12-24 hours and air cool. Resulting hardness is typically 352 HBW.

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MECHANICAL PROPERTY DATA

ACTUAL CENTER TRANSVERSE MECHANICAL PROPERTIES

RCS Billet Size		U.T.S		0.2% Y.S.		Elongation	R of A
in	mm	ksi	MPa	ksi	MPa	(%)	(%)
13½	343	229	1580	188	1300	14.7	50.3
13½	343	230	1590	183	1260	14.0	45.9
5¾	146	232	1600	194	1340	15.0	52.5
5¾	146	230	1590	190	1310	15.0	51.7

TYPICAL TRANSVERSE CHARPY V-NOTCH IMPACT DATA

RCS Billet Size		Impact Energy ft-lb (J)	
in	mm	R.T.	-65°F (-54°C)
13½	343	25 (34)	20 (27)
5¾	146	26 (35)	20 (27)

FRACTURE TOUGHNESS PER ASTM E 399

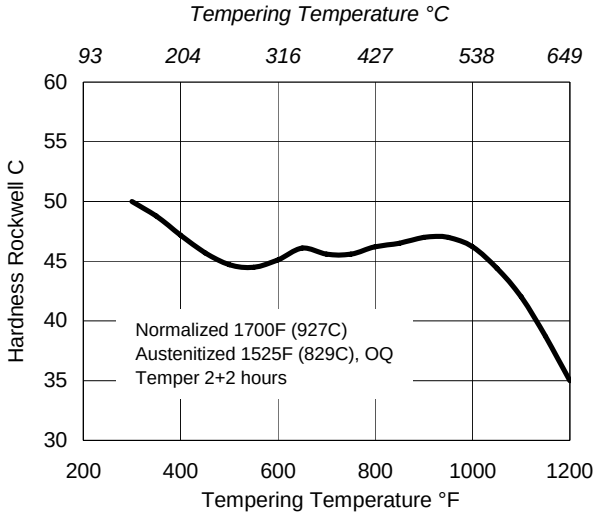
This K_{IC} property is important in some applications for HP 9-4-30 steel. At the 220 ksi (1515 MPa) minimum UTS level, ASTM E 399 plane-strain fracture toughness is typically 130 ksi √in. (143 MPa √m).

AVERAGE JOMINY END QUENCH HARDENABILITY

	Distance from Quenched End (1/16 inch)							
	2	4	8	12	16	20	32	40
Rockwell C	52	51.5	51	51	51	51	51	50

Normalized 1700°F (927°C) 1 hour. Austenitized 1525°F (829°C) ½ hour.

TEMPERING CURVE



SPECIFICATIONS

The following popular industry specifications are offered for general familiarization and cross-reference purposes. This should not be considered a complete listing.

AMS 6526
McDonnell Douglas MMS 2102
Boeing BMS 7-182
Rockwell STO160LB0012

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