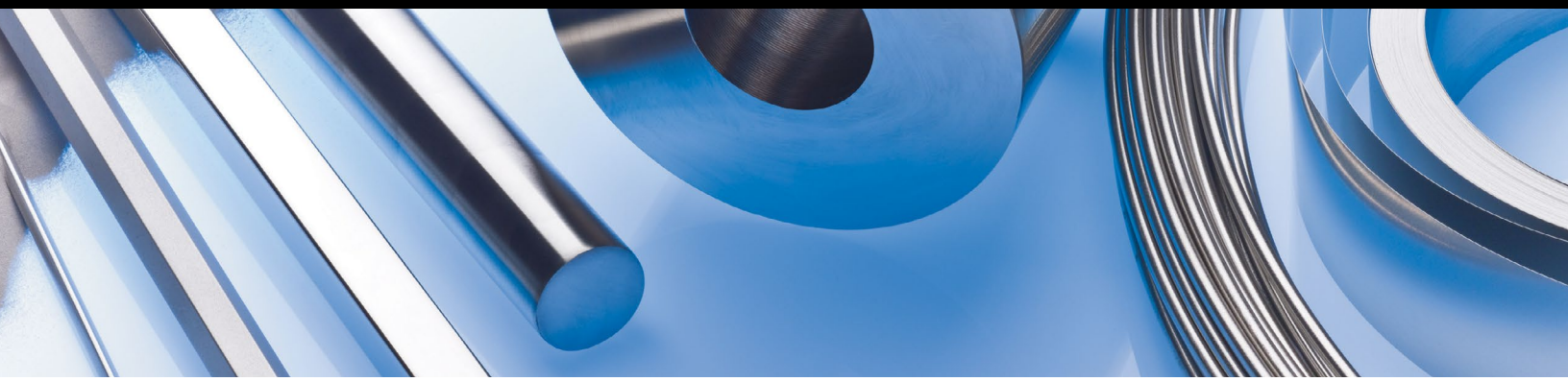


Carpenter Technology PremoMax™ Alloy

COMPOSITION (NOMINAL)

C	Mn	Si	Cr	Ni	Mo	V	Cu
0.22	2.0	1.0	2.0	0.70	0.20	0.35	0.50

Carpenter Technology PremoMax™ alloy is a premium melted, quenched and tempered, cost-effective alloy steel that offers an attractive combination of high strength, excellent impact toughness and good hardenability in large section sizes. Its moderate carbon content facilitates weldability, while vacuum arc remelting ensures superior cleanliness, excellent high cycle fatigue strength, and outstanding fracture toughness.

MECHANICAL PROPERTY DATA

Product	3.5" Ø 89 mm	5" Ø 127 mm	7" Ø 178 mm	ASTM A579 (Grade 85)*
0.2% YS (ksi/MPa)	182/1255	184/1269	184/1269	180/1241
UTS (ksi/MPa)	232/1600	223/1538	228/1565	210/1448
% Elongation	15	14	15	12
% RA	50	50	55	35
Hardness	46 Rc	45 Rc	47 Rc	...
Grain Size	ASTM #7	ASTM #7	ASTM #6.5	...
CVN (ft.-lb./J))	55/75	74/100	57/77	45/61

* Currently being balloted; minimum values.

HIGH CYCLE FATIGUE

Rotating Bending Fatigue Properties (R = -1, Kt = 1)

10 million cycle run-out stress: 120 ksi (827 MPa)

30 million cycles run-out stress: 100 ksi (690 MPa)

FRACTURE TOUGHNESS

R-L (longitudinal): K_Q = 153 ksi √in. (167 MPa √m)

L-R (transverse): K_Q = 159 ksi √in. (173 MPa √m)

BENEFITS

- High Strength and High Toughness
- Excellent Fracture Toughness
- Good Hardenability
- High Fatigue Strength
- Cost Effective

PRODUCT FORMS

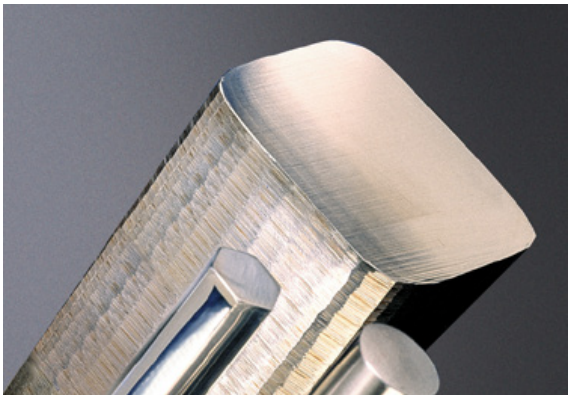
Billets and bars

SPECIFICATIONS

US Patent Pending

APPLICATIONS

- Mud motor shafts and related components
- Suitable alternative for 4330+V and in some cases Carpenter Technology Custom 465®

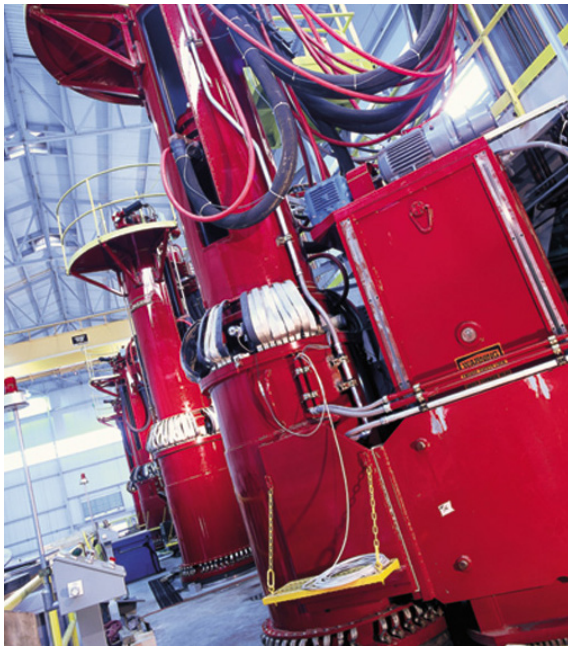


PHYSICAL PROPERTIES

Density: 0.28 lb./in.^{3} (7.77 gm/cm^3)

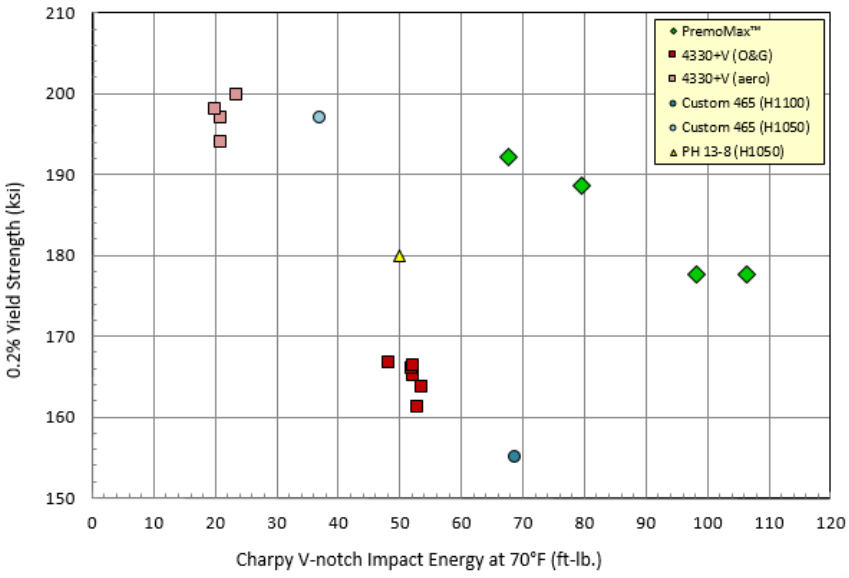
Mean Coefficient of Thermal Expansion

Temp Range		in/in/°F (x 10^{-6})	mm/mm/°C (x 10^{-6})
°F	°C		
75-212	24-93	6.3	11.3
75-400	24-204	6.9	12.4
75-600	24-316	7.3	13.1
75-800	24-427	8.1	14.6

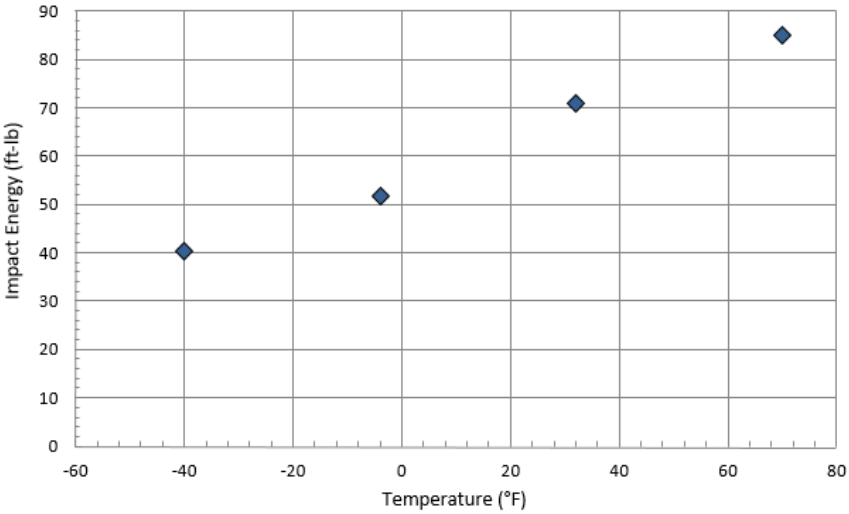


STRENGTH AND TOUGHNESS COMPARISON

(typical properties)



IMPACT TOUGHNESS (CHARPY V-NOTCH)



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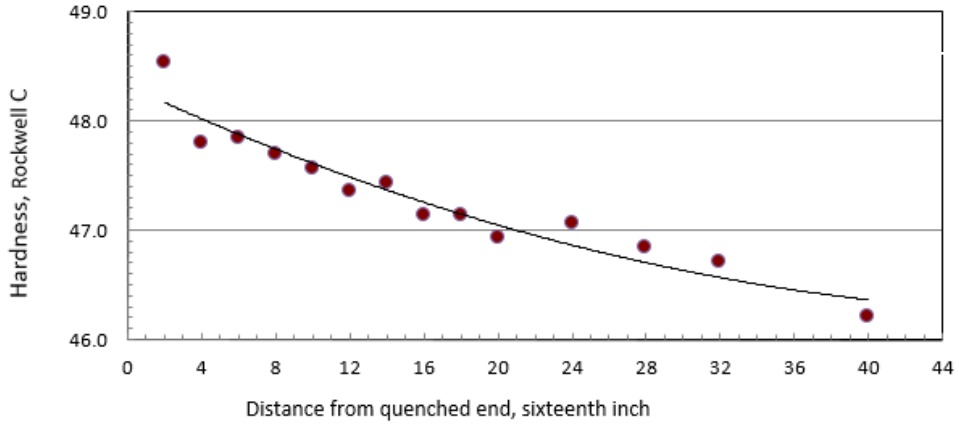
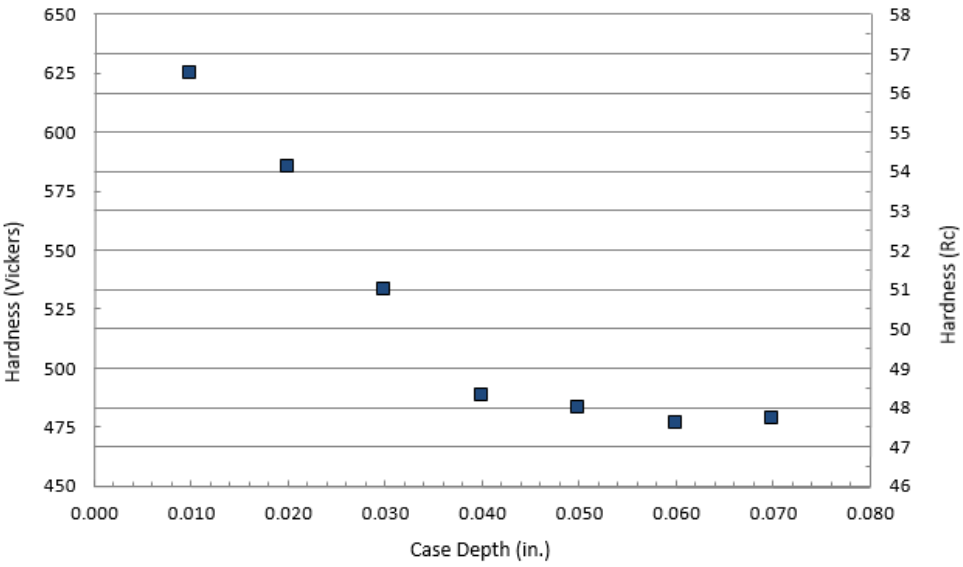
HARDENABILITY - JOMINY END QUENCH DATA



SURFACE CARBURIZING



GALLING

PremoMax-on-PremoMax galling stress (per ASTM G98):

17.5 ksi. (121 MPa)

WORKABILITY

Hot Working / Forging recommended temperature range:

1900°F – 2200°F (1038°C – 1204°C)

Machining:

Machinability is facilitated when PremoMax is annealed to 255 – 285 BHN hardness

HEAT TREATMENT

Austenitize:	1600°F - 1750°F (871°C - 954°C), 1 to 2 hours, water quench
Temper:	450°F - 550°F (232°C - 288°C), 2 to 4 hours, air cool
Anneal:	1250°F (677°C), 2 to 4 hrs, air cool

Contact:

Carpenter Technology Corporation
1735 Market Street, 15th Floor
Philadelphia, PA 19103

www.carpentertechnology.com
service@cartech.com

USA
TF: 800-654-6543
Tel: 610-208-2000

Canada
TF: 800-268-4740

England
Tel: +44-1527-512200

Europe
Belgium
Tel: +32-10-686-010

Mexico and South America
Querétaro
Tel: 52 (442) 29-09-04-001

Palmas
Tel: 52 (55) 50-03-02-33

Asia
Singapore
Tel: 65-6738-2401

China
Tel: 86-021-2411 3500

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