

Microsteel®

**Turned-Ground
& Polished**

**Chrome-Nickel-Moly
Alloy Steel**



ST. LAWRENCE

Alloys for Industry Since 1955

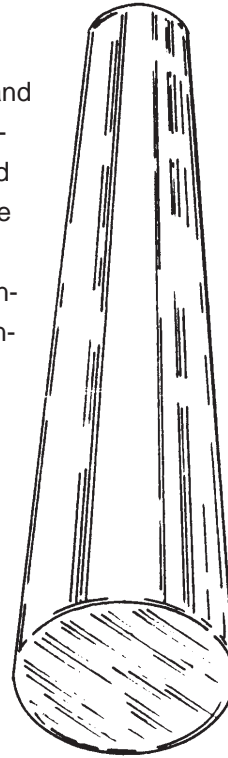
Microsteel®

Turned-Ground & Polished (TG&P)

Chrome-Nickel-Moly Alloy Steel

Microsteel® is a tough, shock and fatigue resisting Chrome-Nickel-Moly alloy steel. In the delivered heat treated condition, it has the highest combination of tensile strength and ductility while maintaining comparable high machinability.

Bars are delivered in the heat treated hardness range of 269-341 BHN. For most applications, **Microsteel** is both hard and tough enough to be used without additional hardening.



Microsteel is quenched and tempered, stress relieved and machine straightened prior to grinding. This process insures proper grain structure alignment, removal of longitudinal stress factors and confines hardness range to within 2% variance in any bar or plate section. Most air-cooled alloy products, except tool steel, cannot meet these qualifications. A slight reduction in hardness from surface to core is more desirable than “air-hardened **through hardness**” since this provides much higher ductility and resistance to shock.

Advantages

- Precision Ground Diameter Tolerance
- Quenched and Tempered
- Fully Stress Relieved
- Uniform Fine Grain Structure
- Deep Hardened
- Easily Machinable
- Precision Straightness Tolerance
- Demagnetized
- Random Ultrasonic Tested
- Electric Furnace Quality
- Fatigue Resistant
- High Tensile and Yield Strength
- High Shear Strength

Chemistry (%)

C	Mn	P	S	Si	Ni	Cr	Mo	Cu	Ti	Al	B
.38-.43	.60-.80	.035 max	.035 max	.20-.35	1.65-2.00	.70-.90	.20-.30	.20 max	.15 max	.035 max	.0025 max

Mechanical Properties

Typical Range for Standard Hardness

BHN Hardness	Tensile PSI	Yield PSI	Elong. 2"	Red. Area %
269-341 BHN	149-183,000	131-162,000	18.0-14.0	60-44

Physical Constants:

Density, lb/cu. in.0.283
 Melting point, °F (approx.)2740
 Thermal conductivity, BTU/hr./ft.2/in./°F
 Coefficient thermal expansion, in./in./°F
 0-200° F0.000063
 0-1200° F0.000081

Specific heat, BTU/lb/°F0.107
 Electrical resistance, microhm-cm
 at 120° F30
 at 570° F48
 Modulus of elasticity, psi29-30 x 10⁶

Table 1 – Typical Properties

	Annealed	Normalized	Normalized & Drawn
Tensile Strength, psi	120000	180000	142000
Yield Strength, psi	80000	145000	110000
Elongation, % in 2"	18	8	20
Reduction of Area, %	35	22	38
Brinell Hardness	250	370	260

Table 2 – Low Temperature-Chardy Impact, Ft. Lbs. (V-Notch)

	Temperature of Test			
	+68° F	+14° F	-10° F	-94° F
Normalized to 40Rc	12.4	7.4	6.4	4.8
Hardened to 35Rc	81.8	82.3	87.1	77.3
Hardened to 28Rc	93.6	78.0	74.8	36.0

Table 3 – Oil Hardened Properties (Oil quenched from 1550°F and tempered as shown)

Size of Round Inches	Tempering Temperature °F	Tensile Strength psi	Yield Point psi	Elongation % in 2"	Reduction of Area %	Brinell Hardness
1	1000	188000	169000	13.9	44.0	379
1	1100	174000	154000	15.5	47.3	352
1	1200	156000	135000	17.4	51.0	316
2	1000	188000	169000	13.9	44.0	379
2	1100	174000	154000	15.5	47.3	352
2	1200	156000	135000	17.4	51.0	316

Table 4 – Oil Hardened and Tempered at Temperature Indicated

	400° F	600° F	800° F	1000° F	1200° F	1300° F
Tensile Strength, psi	287000	255000	217000	180000	148000	125000
Yield Strength, psi	270000	235000	198000	168000	125000	108000
Elongation, % in 2"	11	12	14	17	20	23
Reduction of Area, %	39	44	48	53	60	63
Brinell Hardness	520	490	440	360	290	250
Rockwell "C" Hardness	53	50.5	46	39	31	24
Torsion, Ultimate Strength, psi	–	225000	185000	155000	132000	127000
Torsion, Elastic Limit, psi	–	145000	130000	104000	88000	80000
Izod Impact, Ft. lbs.	15	10	12	35	74	75

Table 5 – Torsional Properties (Oil quenched and tempered in sizes shown)

Tempering Temperature °F	1-1/8" Dia. Bar		3-1/2" Dia. Bar	
	Maximum Stress psi	Elastic Limit psi	Maximum Stress psi	Elastic Limit psi
700	205000	140000	180000	110000
800	185000	130000	162000	100000
900	167000	115000	150000	90000
1000	150000	100000	136000	80000
1100	140000	90000	128000	74000
1200	132000	84000	120000	68000
1300	127000	80000	115000	66000

Table 6 – Effect of Mass – Heat treated size shown below, water quenched, .505" Dia. x 2" long test section. Tests taken at mid radius.

	3" Round Quenched 1475° F Tempered 1200° F	4" Round Quenched 1500° F Tempered 1200° F	6" Round Quenched 1500° F Tempered 1200° F
Tensile Strength, psi	153000	150000	145000
Yield Point, psi	135000	130000	123000
Elongation, % in 2"	18	17	16
Reduction of Area, %	52	50	44
Brinell Hardness	340	330	322

Table 7 – Normal Hardenability Data

Distance from Quenched End Inch	Rockwell "C" Hardness	
	Max.	Min.
1/16	60	52
1/8	60	52
1/4	60	52
1/2	60	52
3/4	59	51
1	58	48
1-1/4	57	46
1-1/2	57	44
1-3/4	56	42
2	56	40

Table 8 – Through Hardenability (Estimated Brinell) – Mass Effect

Heat Treatment °F	1/2" Section			1" Section			3" Section			6" Section		
	Outside Surface	Mid Radius	Core	Outside Surface	Mid Radius	Core	Outside Surface	Mid Radius	Core	Outside Surface	Mid Radius	Core
O.Q., T. 800	–	410	410	410	410	410	410	400	370	395	360	320
O.Q., T. 1000	–	355	355	355	355	355	355	350	320	325	280	260
O.Q., T. 1200	–	310	310	310	310	310	310	300	290	285	250	240

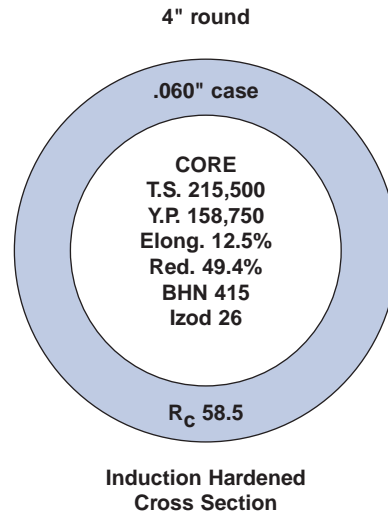
Induction Hardening

The primary frequency used depends on the depth of heating desired and the power required or size of the part. High frequencies tend to hug the skin and heat to shallow depths. However, high frequency heating units are not usually available in the high power output ranges for large size work.

Quenching may be by spray or submersion. Oil and water are the common quenchant, but caustic, brine, or air may be used.

Heating cycles for both quenching and induction tempering are extremely short and must be precisely timed with automatic equipment.

St. Lawrence is equipped to satisfy your surface hardening requirements. Let our engineers make recommendations toward extended service life.



Machining

Microsteel has a fine grain microstructure (8-9) with closely controlled carbide particles which provide improved machinability. The oil quench and temper process of **Microsteel**, followed by controlled stress relieving, insures against distortion and run-out so

commonly found in air-hardened alloys. Turning, boring and facing is more easily accomplished using mated tungsten-carbide inserts with chip-breaker. Listed below are helpful tables as machining guide.



Lathe Turning

Depth of Cut Inches	High Speed Steel Tool			Carbide Tool			
	Speed fpm	Feed ipr	Tool Material	Speed-fpm		Feed ipr	Tool Material
				Brazed	Throw Away		
.150	50	.010	T15, M33, M41 thru M47	215	280	.015	C-7
.025	65	.005	T15, M33, M41 thru M47	280	350	.007	C-7

Cutting Keyways

Use a three or four fluted high-speed end mill; with widths up to 1/2", use up to 60 RPM; over 1/2" wide, reduce RPM to the 25/40 range. Take the full depth of keyways up to 5/8" deep in one pass. Use two passes for depths greater than 5/8". Use a good coolant to keep the cutter and steel cool. A special word about keyways – The majority of fatigue failures in shafting made from

any steel can be traced back to sharp corners and notches like those found at the base of a square cornered keyway. To greatly increase your shafting life put a small radius at the corners of the keyways and put a corresponding radius on the matching corners of the key.

Standard Tolerance

Diameters	Limits
7/16 thru 4	+.000 - .002
4-1/8 thru 6	+.000 - .003

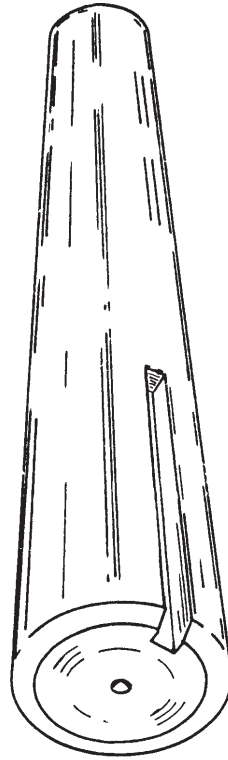
Standard Stock Sizes

7/16" thru 6" in 1/16" increments

Standard Stock Lengths

20 - 24 Ft.

Color Code: PINK/BLACK

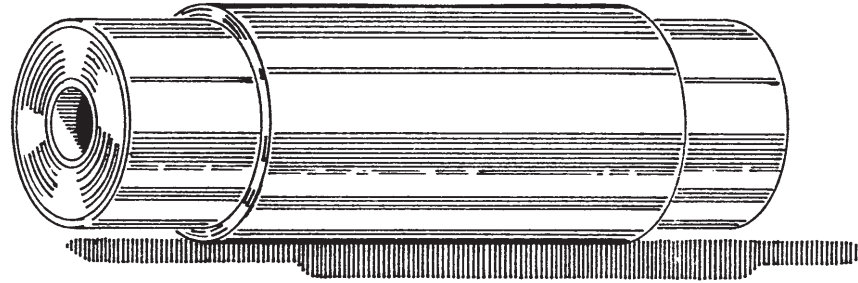


Miscellaneous

Special lengths, non-standard diameters, metric sizes and special tolerances can be manufactured to your specifications.

All bars are inspected for total indicator reading (RUN-OUT) and surface condition prior to shipment.

Bars are sprayed with protective coating. Individual fiber tubes or canvas wrap/wood slats are used for all shipments. Wooden boxes available upon request.



Microsteel®

Suggested Uses

Arbors

Axles

- Cranes
- Locomotive
- Mine Car
- Transfer Car

Bolts

Boring Bars

Connecting Rods

Cylinders

Journals

Mandrels

Pins

- Anchor
- Bucket
- Crank

Drift

Guide

Hoist

Link

King

Wrist

Push Rods

Rollers

Rotors

Screws

Adjusting

Feed

Lead

Pitman

Set

Transmission

Shafts

Armature

Cam

Conveyor

Crane

Crank

Drill

Drive

Flywheel

Gear

Generator

Hammer Mill

Hoist

Impeller

Jack

Line

Motor

Propeller

Pump

Stub

Turbine

Studs

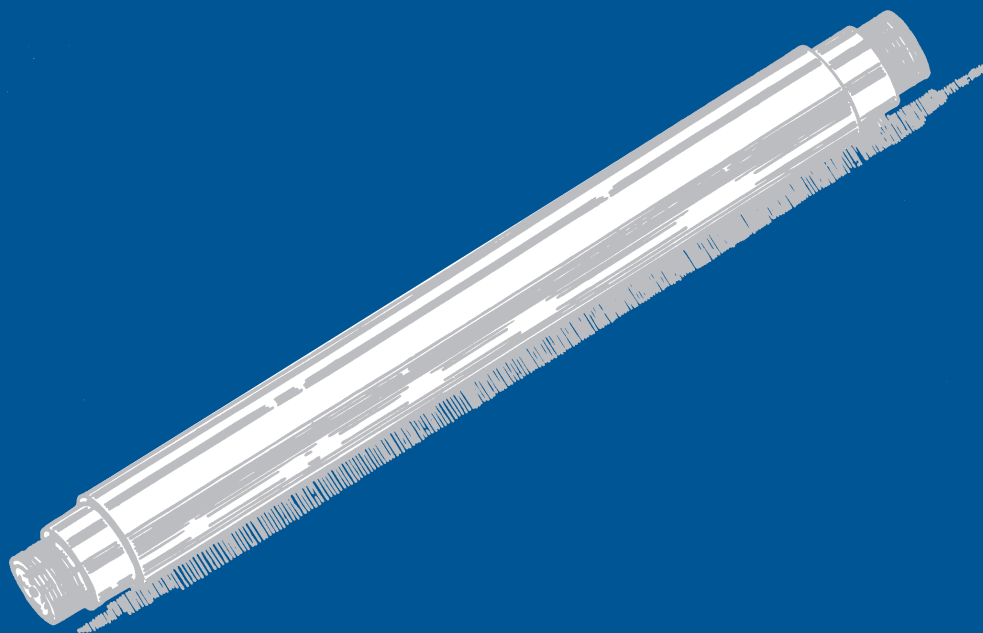
Tie Rods

Valve Stems

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Chrome-Nickel-Moly Alloy Steel



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2500 Crane Centre Drive P.O. Box 2490 Streetsboro, Ohio 44241

330-562-9000 or 1-800-837-3789 Fax 330-562-1100

www.stlawrencesteel.com