

SILICON CORE IRON B

Type analysis

Single figures are nominal except where noted.

Iron	Balance	Silicon	2.50 %
Manganese	0.15 %	Carbon	0.03 %

Forms manufactured

Bar-Rounds	Bar
Billet	Many forms and conditions
Strip	(request for cold drawn finish should be referred to Technical Department for acceptance)

Description

Silicon Core Iron B is melted in electric arc furnaces to exacting chemical specifications, and carefully controlled in rolling and annealing practices to produce a fine-grained uniform quality magnetic core alloy.

Silicon Core Iron B is not recommended for components that must be cold formed due to its high silicon content.

Key Properties:

- Very low hysteresis loss
- Medium electrical resistivity
- High initial permeability in AC and DC circuits
- Low residual magnetism in DC circuits
- Freedom from magnetic aging

Markets:

- Aerospace
- Automotive
- Consumer
- Industrial

Applications:

- Solenoid switches
- Armatures
- Pole pieces
- Relays

> SILICON CORE IRON B

Physical properties

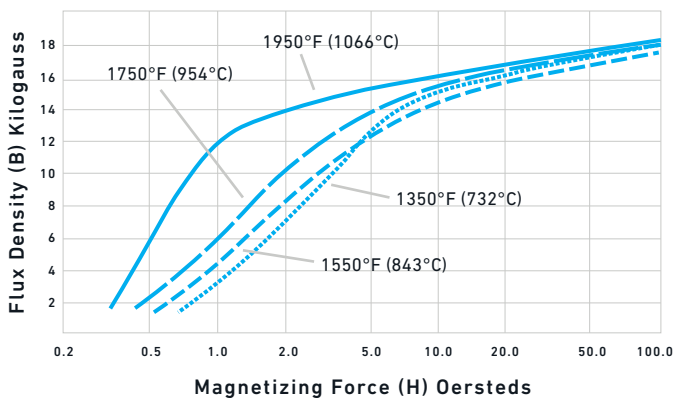
PROPERTY	At or From	English Units	Metric Units
SPECIFIC GRAVITY	—	7.65	7.65
DENSITY	—	0.2760 lb/in ³	7640 kg/m ³
MEAN COEFFICIENT OF THERMAL EXPANSION	77 to 750°F (25 to 399°C)	7.35 x 10 ⁻⁶ length/length/°F	13.23 x 10 ⁻⁶ length/length/°C
ELECTRICAL RESISTIVITY	70°F (21°C)	240.7 ohm-cir-mil/ft	40 microohm-cm
CURIE TEMPERATURE	—	1470°F	799°C

Magnetic properties

SATURATION FLUX DENSITY (Bs)	20600 G	20.6 kG
COERCIVITY	0.700 Oe	
MAXIMUM PERMEABILITY	5000	
RESIDUAL INDUCTION	6000 G	6 kG
HYSTERESIS LOSS	0.00178 J/cm ³ /cycle	1.78 kJ/m ³
TREATMENT FOR FINAL CLOSED PACK ANNEAL	1550°F	843°C

Normal direct current (DC) magnetization curves

ANNEALED AT VARIOUS TEMPERATURES



> SILICON CORE IRON B

Typical mechanical properties

5/8 IN (15.87 MM) DIAMETER BAR						
HEAT TREATMENT	0.2% YIELD STRENGTH		ULTIMATE TENSILE STRENGTH		ELONGATION IN 4D	HARDNESS
	ksi	MPa	ksi	MPa	%	ROCKWELL B
Mill anneal	70	483	85	586	Not reported	90
Annealed ¹	65	448	80	552	40	88

¹ Annealed for magnetic properties — 1550°F (843°C), 4 hrs

Heat treatment

Magnetic property requirements	Items as supplied from the mill are not in the most magnetic soft condition, nor are they supplied to magnetic property requirements. As supplied magnetic property requirements must be approved by the mill.
Heat treatment	Finish fabricated parts must be heat treated to achieve soft magnetic characteristics. Suggested heat treating atmosphere is a wet hydrogen atmosphere in the temperature range of 1550/1600°F (843/871°C), 2 to 4 hours at temperature and cooled 100/200°F (55/111°C) per hour to 1000°F (538°C) and any rate thereafter.
Other heat treating atmospheres	Other heat treating atmospheres can be employed, such as nitrogen-hydrogen combinations, vacuum, exothermication, and inert atmosphere retort. Resulting magnetic characteristics will not be as good as the wet hydrogen atmosphere, which provides the best degree of decarburization.
Other heat treatment temperatures	Other heat treatment temperatures in the range of 1350/1950°F (732/1038°C) can be employed to achieve certain advantages such as brazing and fine grain size as required by end application. A sacrifice in certain magnetic characteristics will be realized. A dry atmosphere must be employed at 1750°F (954°C) and above.

> SILICON CORE IRON B

Typical feeds and speeds

TURNING — SINGLE-POINT AND BOX TOOLS

DEPTH OF CUT, IN	HIGH-SPEED TOOLS			CARBIDE TOOLS			
	SPEED, FPM	FEED, IPR	TOOL MATERIAL	SPEED, FPM		FEED, IPR	TOOL MATERIAL
				BRAZED	THROW AWAY		
.150	80	.015	M-2	350	400	.020	C-6
.025	110	.007	M-3	400	490	.007	C-7

TURNING — CUT-OFF AND FORM TOOLS

SPEED, FPM	FEED, IPR							TOOL MATERIAL
	CUT-OFF TOOL WIDTH, IN			FORM TOOL WIDTH, IN				
	1/16	1/8	1/4	1/2	1	1-1/2	2	
70	.001	.0015	.002	.0015	.001	.001	.0007	M-2
250	.003	.0045	.006	.003	.0025	.0025	.0015	C-6

DRILLING

SPEED, FPM	FEED, IPR								TOOL MATERIAL
	NOMINAL HOLE DIAMETER, IN								
	1/16	1/8	1/4	1/2	3/4	1	1-1/2	2	
70	.001	.002	.004	.007	.010	.012	.015	.018	M-42

TAPPING

SPEED, FPM	TOOL MATERIAL
15-20	M-1, M-7, M-10

DIE THREADING

SPEED, FPM				TOOL MATERIAL
7 OR LESS	8 TO 15	16 TO 24	25 AND UP, TPI	
8-20	10-25	15-30	20-35	M-1, M-2, M-7, M-10

> SILICON CORE IRON B

MILLING — END PERIPHERAL												
DEPTH OF CUT, IN	HIGH-SPEED TOOLS						CARBIDE TOOLS					
	SPEED, FPM	FEED, IN PER TOOTH				TOOL MATERIAL	SPEED, FPM	FEED, IN PER TOOTH				TOOL MATERIAL
		CUTTER DIAMETER, IN						CUTTER DIAMETER, IN				
		1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
.050	60	.002	.003	.005	.006	M-42	300	.0025	.004	.006	.008	C-6

Additional machinability notes

Figures used for all metal removal operations covered are average. On certain work, the nature of the part may require adjustment of speeds and feeds. Each job has to be developed for best production results with optimum tool life. Speeds or feeds should be increased or decreased in small steps.

Other information

Applicable specifications	ASTMA867 Alloy 2
----------------------------------	------------------

**For additional information, please
contact your nearest sales office:**

electrification@cartech.com | 610 208 2000

The information and data presented herein are typical or average values and are not a guarantee of maximum or minimum values. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make their own evaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes. There is no representation that the recipient of this literature will receive updated editions as they become available.

Unless otherwise specified, registered trademarks are property of CRS Holdings Inc., a subsidiary of Carpenter Technology Corporation.
