

Magnetic Material	Three Percent Silicon Electrical Steel								
Coating Material	AISI Type C-5 - Inorganic coating (ASTM A976)								
Characteristic	Width Range (Inch)	Standard Tolerances (Inch unless otherwise specified)							
		Grain Oriented				ARNON™ (Non-Oriented)			
		1-mil	2-mil	4-mil	6-mil	2-mil	4-mil	5-mil	7-mil
Loss per ASTM A348 (Max.)	All Available	11.0 Watts per (LB) @ 12 kG, 400 Hz	8.5 Watts per (LB) @ 15 kG, 400 Hz	6.8 Watts per (LB) @ 15 kG, 400 Hz	9.0 Watts per (LB) @ 15 kG, 400 Hz	6.0 Watts per (LB) @ 10 kG, 400 Hz	5.0 Watts per (LB) @ 10 kG, 400 Hz	5.5 Watts per (LB) @ 10 kG, 400 Hz	6.5 Watts per (LB) @ 10 kG, 400 Hz
Thickness	All Available	±0.00010	±0.00015	±0.00020	±0.00030	±0.00015	±0.0002	±0.00025	±0.00035
Stacking Factor	All Available	Stacking Factor shall be in accordance with IEC 60404-13 for method and IEC 60404-8-8 for limits.							
Coating Thickness	All Available	Material shall be coated with an AISI Type C-5 type insulated coating to a thickness that provides a minimum							
Average Surface Insulation Resistivity per ASTM A 717-81 (Min.)	All Available	10 Ω cm ² per lamination (two surfaces)							
Surface	All Available	<p>Uniformly coated. Minimum surface irregularities such as creases, wrinkles, pinpricks, dents, scratches using the best practices of Precision Thin Metals. Surface irregularities occur randomly; no repeating irregularities within a ten-foot section are permitted.</p> <p>1 & 2 Mill material takes exception to the surface defects: Surface defects such as creases, wrinkles, dents will occur in this material randomly and it cannot be guaranteed that it will not repeat.</p>							
Coil Size (I.D. x Max. O.D.)	> 0.75	6 Center x 20 Max OD							
	0.75 - 16.0	16 Center x 32 Max OD							
Center Type	All widths	Material will be supplied on cardboard unless stated by customer a different center type needs to be used							
Slit Tolerances									
Width	Up to 1.00	±0.003							
	> 1.00 and up to 9.00	±0.005							
	> 9.00 and up to 17.00	±0.010							
Burr (Maximum)	All Available	0.0001	0.0002	0.0004	0.0006	0.0002	0.0004	0.0005	0.0007
Flatness (Max Deviation from Flat)	All Available	The greater of .070 or .030 per Inch of Width				the greater of .070 or .010 per Inch of Width			
Crossbow (Max Deviation from Flat)	All Available	0.500			0.250		Greater of 0.100 or 0.020 per Inch of Width		

As-Rolled Edges Tolerances					
Width	As rolled material	± .125			
Flatness (Maximum)	As Rolled Material	0.500 Max	0.030 per Inch of Width	0.500 Max	0.030 per Inch of Width
Crossbow (Maximum)	As Rolled Material	0.500 Max	0.020 per Inch of Width	0.500 Max	0.020 per Inch of Width
The tolerances listed below are our capabilities but are not checked on all material					
Coil Set (Max. in 3 ft. Vertical)	Up to 0.500	6			
	> 0.500 and up to 16.00	3			
Camber (Max. in 8 ft.)	Up to 0.250	1.50			
	> 0.250 and up to 1.500	0.50			
	> 1.500 and up to 16.00	0.25			
The tolerances listed below are for any material uncoated that is being cut to length only					
Cut to length Machine		± .125" Up to 5 FT long	.003" - .011"	All widths	
Hand Cut to Length		± .250"	.005" - .020"	>12.0"	

Table 1. Max Coil Weights for Non-Oriented and Grain Oriented Silicon Steels		
Characteristic	Width Range (Inch)	Weight (Lbs)
Coil Weights for All Gauges	Up To 4.00	70 lbs. Max
Max Coil Weights for 1-mil (When	> 4.00 and up to 17	Max 100 lbs per inch of width
Max Coil Weights for 2-mil thru 7-mil	> 4.00 and up to 17	Max 185 lbs per inch of width
Max Coil Weights for All Gauges (When Slit Simultaneously With Narrow Slit Widths 4.00" or less)	5.00	700 lbs. Max
	6.00	840 lbs. Max
	7.00	980 lbs. Max
	8.00	1120 lbs. Max
	9.00	1,260 lbs. Max
	10.00	1,400 lbs. Max
	11.00	1,540 lbs. Max
	12.00	1,680 lbs. Max
	13.00	1,820 lbs. Max
	14.00	1,960 lbs. Max
	15.00	2,100 lbs. Max
	16.00	2,100 lbs. Max
17.00	2,100 lbs. Max	

Table 2. Recommended Grain Oriented Silicon Steel Thicknesses for Various Operating Frequency Values		
Frequency	Recommended Thickness	Approximate Induction for 300 mW/cc,
400 Hz	4-mil or 6-mil	15000 G*
1 kHz	4-mil	10000 G
2 kHz	2-mil	6000 G
5 kHz	1-mil	3000 G

*For reference only. Based on Arnold C-core data records.
(Arnold no longer manufactures C-cores.) At 400 Hz, magnetizing current limits the maximum flux density.

Table 3. Recommended Grain Oriented Silicon Steel Thicknesses for High-Power Pulse Operating Conditions*		
Pulse Width	Recommended Thickness	Pulses per Second
2 to 1000 microseconds	4-mil or 6-mil (D-U, U-I, L-L Laminations)	To 1000
0.25 to 2 microseconds	1-mil or 2-mil (C-Core)	To 1000

*Reference: **Transformers for Electronic Circuits**, Nathan R. Grossner,
McGraw-Hill, New York, 1967, pp. 285 and 286, Table 11.1.

Table 4. For Grain Oriented and Non-Oriented Silicon Steel Recommended Edge Drop For Slit Widths - All	
Recommended Edge Drop Per Side On An As Rolled Edge	0.50" minimum
Recommended Edge Drop Per Side On An As Slit Edge	0.125" minimum

Non-Oriented coils may be formed by interleaving continuous lengths. Grain Oriented coils may be formed

Table 5. For Grain Oriented and Non-Oriented Silicon Steel - Max Number Of Breaks Per Coil

Gauge	For Slit Material		For As-Rolled Material		Min Between Breaks
	Width	Max # Of Breaks	Width	Max # Of Breaks	
1-mil	Up To 4"	5	As-Rolled	10	100 ft.
1-mil	> 4" and up to 17" and As Rolled	5	As-Rolled	10	100 ft.
2-mil	Up To 4"	4	As-Rolled	8	100 ft.
2-mil	> 4" and up to 17" and As Rolled	5	As-Rolled	8	100 ft.
4-mil	Up To 4"	3	As-Rolled	6	100 ft.
4-mil	> 4" and up to 17" and As Rolled	4	As-Rolled	6	100 ft.
5-mil	Up To 4"	3	As-Rolled	4	400 ft.
5-mil	> 4" and up to 17" and As Rolled	4	As-Rolled	4	400 ft.
6-mil	Up To 4"	3	As-Rolled	4	100 ft.
6-mil	> 4" and up to 17" and As Rolled	4	As-Rolled	4	100 ft.
7-mil	Up To 4"	3	As-Rolled	4	400 ft.
7-mil	> 4" and up to 17" and As Rolled	4	As-Rolled	4	400 ft.

2/11/05	Added header and revision log.	TS
2/14/05	Removed Arnon 5-mil "Special" column. Added footers and "Recommendations" sheet. Extended flatness and crossbow specifications from 6-mil grain oriented through 7-mil Arnon.	TS
2/15/05	Deleted "Loss per ASTM A348 (Max.)" between tables 1 and 2 of "Recommendations" sheet.	TS
7/17/08	Added chemical description of C-5 coating	RRI
8/21/08	Separated Flatness and Crossbow	SJG
10/20/08	Change heading "specifications" to "capabilities". Remove Recommendations from first tab - already on its own tab.	SJG
April 09	modify coating thickness	
4/17/09	update logo	SJG
6/25/09	Changed coil size range from .075 to .75; moved width under thickness; added most recent change field	SJG
7/10/09	Added most recent revisions field; removed separate tab for page 2	SJG
7/14/09	added header and footer to second page	SJG
3/31/11	Changed width max from 14.0 to 16.0 in four places on first page. Added Center Types on first page. Added Coil Weights on second page. Added Table 3 and Table 4 on third page.	SLS
7/11/14	Changed the name from Rolled Products to Precision Thin Metals	MG
7/23/14	Replaced reference to Rolled Products with Precision Thin Metals	MG
5/24/16	Added Stacking Factor row. Removed specific coating thickness range (.000020-.000080) and added the statement "Material shall be coated with an AISI type C-5 type insulated coating to a thickness that provides a minimum insulation resistance of 10Ω/cm ² per lamination when tested in accordance with ASTM A717" Changed Loss per ASTM 348 (Max) for 4-mil from 6.5 Watts per Pound @ 15 kG, 400 Hz to 6.8 Watts per Pound @ 15 kG, 400 Hz	JKW
2/28/22	Added Arnon 2 and 4	LK
3/16/22	Revised the statement to "Material shall be coated with an AISI type C-5 type insulated coating to a thickness that provides a minimum insulation resistance of 10Ω/cm ² per lamination when tested in accordance with ASTM A717. Added 2 Mill to Arnon (Non-Oriented), Revised Arnon (non-oriented) 4,5,and 7 mill, Changed the up to 16.5 in table 1	LK
4/6/2023	Changed the whole layout of the spec added As-Rolled tolerances. Cut to length into a single spec.	JK
4/12/2023	Changed the 6 Mil flatness and crossbow tolerances	JK
4/24/2023	Burr tolerance on 5 mil was in correct changed to .0005	JK
4/28/2023	Added max number of breaks for as rolled material.	JK
6/6/2023	Changed Arnon 5 gauge tolerance back to .00025	JK
4/30/2024	Changed flatness spec	JK