CARPENTER ELECTRIFICATION®

DATASHEET

HIPERCO® 27

Type analysis

Single figures are nominal except where noted.

Iron	Balance	**Cobalt**	27.00 %	**Chromium**	0.60 %
Nickel	0.60 %	**Manganese**	0.25 %	**Silicon**	0.25 %
Carbon	0.01 %				

Forms manufactured

Strip	**Plate**	**Billet**

Description

Hiperco 27 is an iron-cobalt-chromium soft magnetic alloy possessing the highest degree of ductility and toughness in the commercially available iron-cobalt grades of high saturation soft magnetic alloys. Although the permeability and coercive force of Hiperco 50 are better than Hiperco 27, the magnetic saturation of both alloys is similar. In addition, Hiperco 27 does not exhibit the brittleness of Hiperco 50.

Hiperco 27 has been used in applications requiring a combination of good mechanical toughness, good ductility, and high saturation induction. Examples have included motors, generators, pole pieces, relays, and magnetic bearings.

Key Properties:

- Ductility and toughness
- Magnetic saturation close to Hiperco 50
- Less brittle than Hiperco 50

Markets:

- Aerospace
- Automotive
- Consumer
- Industrial

Applications:

- Motors
- Generators
- Pole pieces
- Relays

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Physical properties

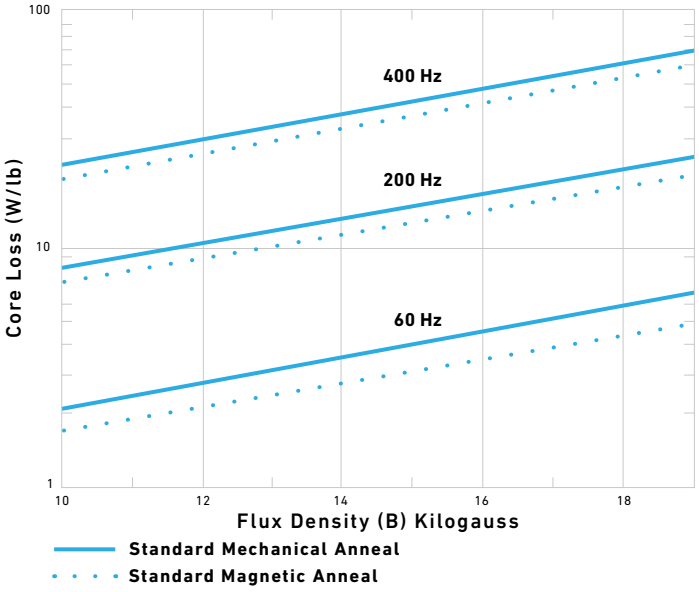
PROPERTY	At or From	English Units	Metric Units
SPECIFIC GRAVITY	—	7.95	7.95
DENSITY	—	0.2850 lb/in^3	7.89 g/cm^3
MEAN COEFFICIENT OF THERMAL EXPANSION	77 to 400°F (25 to 204°C)	5.60 x 10^{-6} length/length/°F	10.1 x 10^{-6} length/length/°C
	77 to 600°F (25 to 316°C)	5.80 x 10^{-6} length/length/°F	10.4 x 10^{-6} length/length/°C
	77 to 800°F (25 to 427°C)	6.00 x 10^{-6} length/length/°F	10.7 x 10^{-6} length/length/°C
	77 to 1000°F (25 to 538°C)	6.10 x 10^{-6} length/length/°F	11.0 x 10^{-6} length/length/°C
THERMAL CONDUCTIVITY	—	380.2 Btu-in/hr/ft^2/°F	54.84 W/m/°C
ELASTIC MODULUS	—	24.0 x 10^3 ksi	165.4 GPa
ELECTRICAL RESISTIVITY	70°F (21°C)	114.0 ohm-cir-mil/ft	19.0 ohm·m
CURIE TEMPERATURE[1]	—	1700°F	927°C

[1] *Curie temperature is phase transition from magnetic to non-magnetic phase*

Magnetic properties

TYPICAL AC MAGNETIC PROPERTIES

Typical AC core loss values of strip are shown for 0.0157 in (0.399 mm) thick strip after heat treating in dry H_2 at 1400°F (760°C) or 1544°F (840°C) for 2 hours, cooled at 300°F/hr (167°C/hr).



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TYPICAL DC MAGNETIC PROPERTIES

INDUCTION AFTER HEAT TREATMENT INDICATED				
INDUCTION (B) AT APPLIED FIELD (H), OERSTEDS	HEAT TREATMENT AND SIZE			
	STANDARD MECHANICAL ANNEAL		STANDARD MAGNETIC ANNEAL	
	0.010 IN STRIP	*0.014 IN STRIP*	*6 IN DIAMETER BAR*	*9 IN X 4 IN SLAB*
10	15.0	15.2	15.2	14.3
50	19.4	18.9	19.3	19.0
100	21.0	20.1	20.7	20.5
150	22.0	21.2	21.6	21.6
200	22.9	22.1	22.3	22.2
250	23.6	22.6	22.9	22.8
Hc from H = 250 Oe	2.5 Oe	2.5 Oe	1.85 Oe	1.85 Oe

Typical mechanical properties

TYPICAL ROOM TEMPERATURE MECHANICAL PROPERTIES

0.010 IN (0.254 MM) THICK STRIP					
HEAT TREATMENT	0.2% YIELD STRENGTH		ULTIMATE TENSILE STRENGTH		ELONGATION 2 IN (50.8 MM)
	ksi	MPa	ksi	MPa	%
Standard magnetic anneal	42	290	77	531	6.5
Standard mechanical anneal	54	372	92	634	16

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Heat treatment

Annealing	All stamped laminations or machined parts must be annealed after fabrication to develop acceptable magnetic properties. Anneal parts at 1400/1652°F (760/900°C) for 2 to 4 hours in dry hydrogen or vacuum and cool at 144/540°F (80/300°C) per hour until 572°F (300°C). All parts must be cleaned prior to heat treating.

Coatings

Inlac	Inlac coating is applied in a continuous process on coils of strip to create a mix of magnesium-based compounds on both sides of the strip surface. This surface layer acts as an inert barrier between laminations during heat treating and prevents adhesion. Additionally, during AC excitation, it provides improved electrical insulation between laminations reducing eddy current effects on core loss.
Oxide	Annealed laminations can be heat treated in an oxygen bearing atmosphere in the range of 600 to 900°F (316 to 480°C) to grow a thin oxide layer on the surface. This coating provides an enhanced level of electrical insulation between laminations, greatly reducing eddy current effects during AC excitation. Oxide heat treatment soak times are generally less than 5 hours and can be adjusted to refine coating thickness.

Workability

Hot working	Hiperco 27 can be forged from a furnace temperature of 2150°F (1177°C). Time at temperature should be approximately 1 hour per inch of thickness. Forging can be conducted down to a temperature of 1700°F (927°C). After forging, items can be air cooled.

Other information

Applicable specifications	ASTM A801 Alloy Type 2

For additional information, please contact your nearest sales office:
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