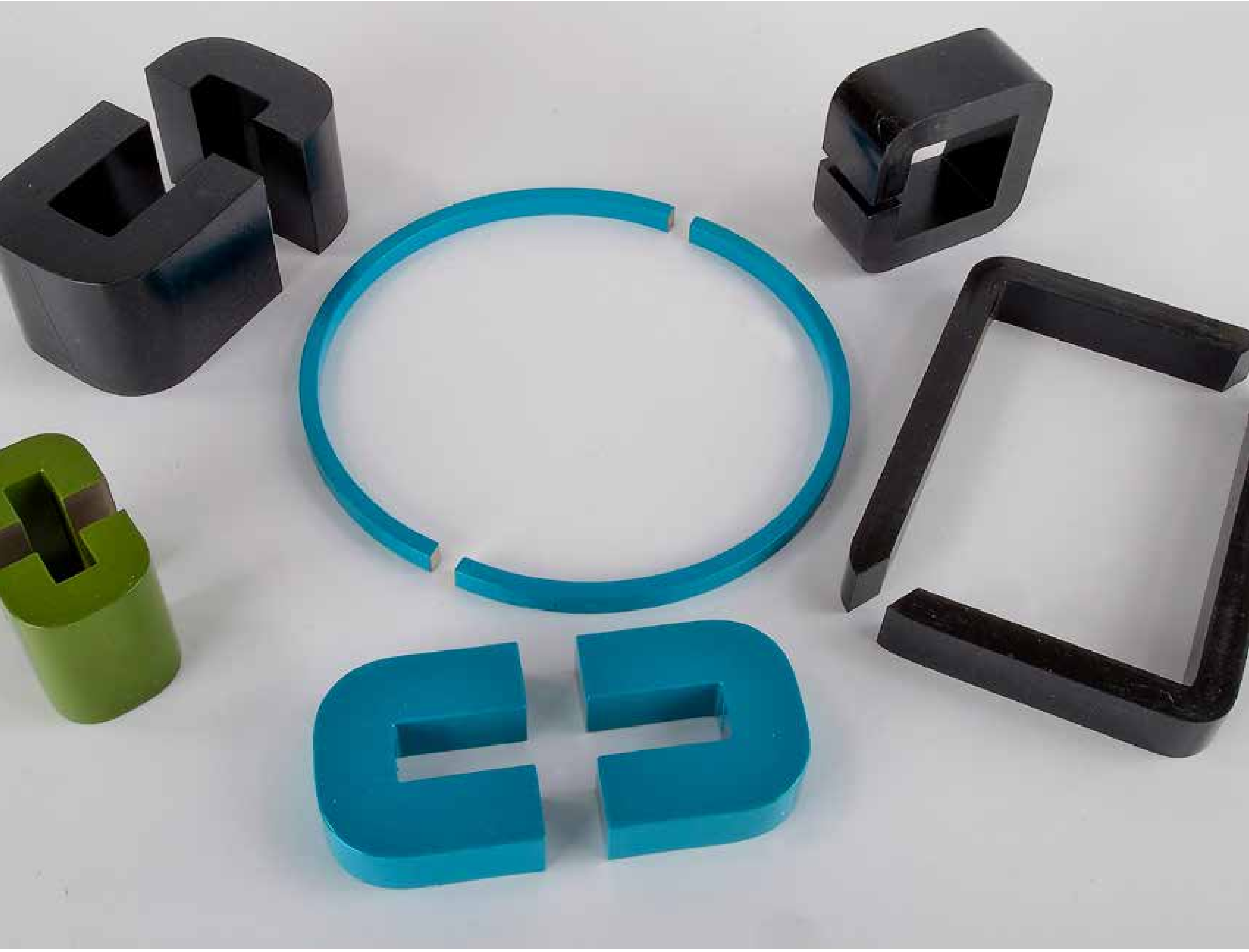


Tape Wound Cut Core Design Manual

Magnetic Metals
Anaheim, California • Nogales, Arizona • Camden, New Jersey

Cut Core Design Manual

Table of Contents

CUT CORES...
SUPERIOR QUALITY, EXCEPTIONAL UNIFORMITY

This bulletin is designed to be helpful in the selection and ordering of cut cores for the production of compact and lightweight power and pulse transformers of a given VA rating.

Cut cores manufactured using Microsil take advantage of the excellent magnetic properties exhibited in the rolling direction of grain oriented silicon steel. Regular grain oriented silicon steel cores can, therefore, be used at flux densities through 18.0 Kilogauss. Superoriented, 9 mil thick, "Z" grade can be used up to 18.5 Kilogauss.

Supermendur has the highest flux density (21.0 kilogauss) of all the materials. Applications are wherever size and weight are a major design consideration.

In addition to data on Microsil cut cores, this bulletin has been expanded to include design data on Superperm 49 (50% Nickel) and Superperm 80 (80% Nickel). These cut cores have lower losses than silicon iron cores. See Figures 12 through 19.

The types of cores available are:
"C" - Single phase cut core
"E" - Three phase cut core

Regular Microsil cores are produced in 1, 2, 4, 7, and 12 mil thicknesses. Superoriented Microsil "Z" grades are produced in 4, 7, and 9 mil thicknesses only. Supermendur cores are produced in 4 mil thickness. Nickel iron (Superperm 49 and 80) cores are produced in 1, 2, 4, and 6 mil thicknesses.

Magnetic Metals Corporation has been a pioneer of magnetic components since the Company's founding over fifty years ago. The success of the Magnetic Metals Corporation is based on team involvment with our customers' engineers in all aspects of magnetic circuit applications, from initial design concepts through material selection, fabrication, and metallurgical processing. Our engineers are available to assist you with your designs to insure improved efficiency, and reduced size and costs.

CUT CORE BENEFITS

Cut cores are ideal for transformer design engineers who require one to several thousand transformers in shapes which are unavailable in standard lamination sizes. Cut Cores are ideally suited where weight or dimensional requirements are critical.

Cut Cores also offer the following:

- Availability in a wide range of geometric shapes to meet your design requirements at minimum costs
- Low assembly costs
- Full magnetic utilization of grain oriented silicon iron in the rolling direction
- Lighter weight for same VA power rating
- Flux densities through 21.0 kilogauss
- Air gap can be easily adjusted for specific choke design
- High pulse permeability with or without reset
- Operating frequency up to 40 kilohertz with thin gauge core material

MAGNETIC METALS CORPORATION MAKES BETTER CUT CORES

- In a wide selection of the following materials: Microsil (silicon steels) - 1, 2, 4, 7, 9, and 12 Mil. (available in selected high flux material, coded "Z") Square 50 (50% nickel iron) - 1, 2, 4, and 6 Mil. Superperm 80 (80% nickel iron) - 1, 2, 4, and 6 Mil.
- In the following core shapes:
    - Single phase cut core
    - Three phase cut core
- Capable of operating at temperatures up to 350 F.
- Outstanding pulse performance
- Reduced core noise available
- Easy selection
- Wide range of cores available from stock for quick delivery
- High quality assurance of finished parts from proven designs and advanced manufacturing facility.
- Special sizes or shapes are readily manufactured to meet your prototype or standard designs.

ELECTRICAL CHARACTERISTICS

Magnetic Metals cut core manufacturing processes are designed to produce cores having the lowest possible losses and magnetizing currents. Where required, special selection of steel is made to meet exacting specifications for very low loss, high pulse permeability, etc. Through improved cutting procedures and butt end preparation, the air gap at the face is kept to an absolute minimum. As a result, the assembled cores exhibit exceptionally low hum and low exciting current.

Data for the cut core materials are given in Figures 2 to 15; they represent typical values for the material normally used. For special applications consult Magnetic Metals.

TEMPERATURE CHARACTERISTICS

Magnetic Metals' Microsil cut cores are designed to perform up to 350° F operating temperature.

PULSE PERMEABILITY

Magnetic Metals' special material selections and unique manufacturing techniques result in outstanding pulse core performance. Typical data is shown in Figure 1. To order cut cores for pulse applications add suffix "P" to the part number.

LOW NOISE CORES

Audible noise suppression has become important in some applications. A process has been developed which will reduce core noise. To order cores for low noise applications add suffix "LN" to the part number.

MATERIAL SELECTION GUIDE: TABLE 1

MATERIAL	THICKNESS	AVAIL. SHAPE	APPLICATIONS
Microsil Silicon Grain Oriented Steel	1,2 mil M,L	C, E	At high frequencies where eddy current loss is significant, pulse transformers, chokes.
	4 mil H	C, E	Up to 16 KG, at 400 Hz; transformers, filter chokes, reactors, amplifiers, pulse transformers
	4 mil Z	C, E	At inductions from 16 KG to 17.5 KG in similar applications as 4 mil H.
	7 mil J	C, E	Up to 18.0 KG, the performance of 7 mil material at 400 Hz will be equal to or better than the performance of 4 mil class MH or MZ cores.
	9 mil AZ, SZ	C, E	Up to 18.5 KG, at 60 Hz. Applications are the same as A and S materials but can be used in smaller envelope requirements.
	12 mil A, S	C, E	Up to 18.5 KG at 60 Hz for transformers, filter chokes, reactors, magnetic amplifiers (exciting current increases rapidly above 15 KG)
Supermendur	4 mil	C, E	At 400 Hz to 800 Hz, highest flux density; power transformer, filter chokes.
Superperm 49 50% NiFe	1, 2, 4 mil	C, E	At high frequencies or in pulse transformers requiring higher pulse permeability and lower cores loss than Microsil
Superperm 80 80% NiFe	1, 2, 4 mil	C, E	At high frequencies, low noise, power and pulse transformers requiring low remanence, highest permeability and lowest loss.

DESIGN GUIDE

The power handling capacity VA, in Volt Amperes, of a transformer at a given current density s, flux density B and frequency f is:
$VA = 4.55 \times s \times DE \times FG \times B \times f \times 10^{-8}$ Eq.1

Where:
s = Current density (A/in^2)
FG = Window area (in^2)
DE = Core cross section (in^2)
B = Flux density (Gauss)
f = Frequency (Hz)

The flux and current densities to be used in the design depend on the allowable regulation and temperature rise. It is best to stay close to the test points given in Table III on page 9. It is sometimes possible to use 5% to 10% higher flux densities than those listed.

Equation (1) determines the required DE x FG dimensions for a specific power rating (VA) and this leads to the selection of the proper core size for the application. For example, the power handling capacity (VA) of a C-Core operating at 18 Kilogauss and a current density of 1500 A/in^2 is computed by:
VA = 74 DE FG for 60 Hz Eq.2a
VA = 491 DE FG for 400 Hz Eq.2b

To design cores of the size determined by Equations 1 and 2 use strip widths (dimension D), which are listed in Table II (Material Standard Stripwidth).
The maximum loss P, in Watts, of a core can be calculated as:
P = Weight x W/lb. Eq.3

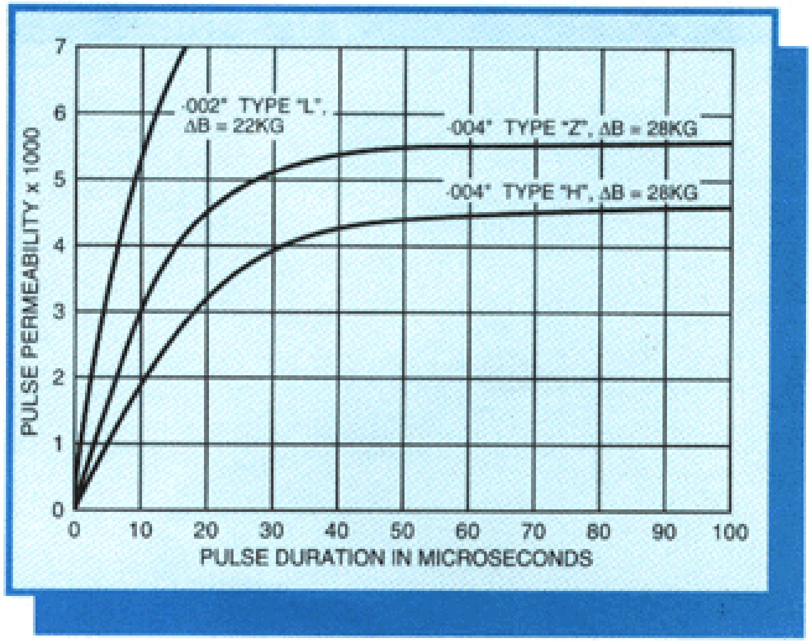
The maximum exciting current I, in Amperes, of a core can be calculated as:
I = Wt x VA/lb / Volts + 1.43 x B x a x S / N Eq.4

The turns/Volt can be calculated as:
Turns/Volt = N/V = 3.5×10^6 / f x B x DE x S Eq.5

Where:
Wt = lb = y x DE x S x (2F + 2G + 2.9E)
W = Watts γ = Spec. Weight, lb/in^2
V = Volt S = Stacking Factor
B = Gauss a = airgap in inches
N = turns a = .001" for DE <2.25 in^2 or E <1
A = Amps a = .002" for DE >2.25 in^2 or E <1

For transformers of 500 watts and greater, the current density of the coils should be 1,500 A/in^2 to 1,700 A/in^2; for smaller transformers 1,800 A/in^2 to 2,000 A/in^2. Higher flux and current densities are possible when forced air cooling is applied.

PULSE PERMEABILITY



Typical pulse permeability using DC-reset and a flux change δB = 22 Kilogauss for 2 mil material and δB = 28 Kilogauss for 4 mil material are shown in Figure 1. These curves can also be used for pulse cores having an airgap reset. In this case the pulse permeability is 60% of the value shown for a flux change δB = 10 Kilogauss for 2 mil and δB = 15 Kilogauss for the 4 mil material.

Pulse permeability: **µ**p = 2.54 x δB x ι / .4 x ¶ x n x Im Eq.6

Peak Pulse voltage during pulse duration td = 6.45 x N x DE x δ B x S x 10^{-8} Eq.7

Where:

ι = mean path length (2F + 2G + 2.9E)

Im = peak exciting current in Amperes

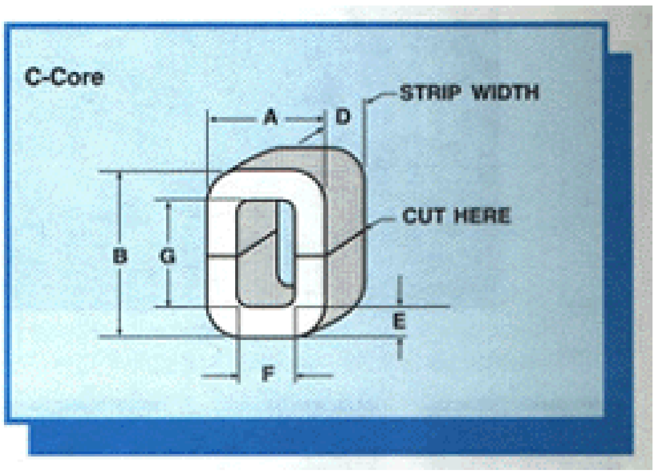
td = seconds

CUT CORE MANUFACTURING

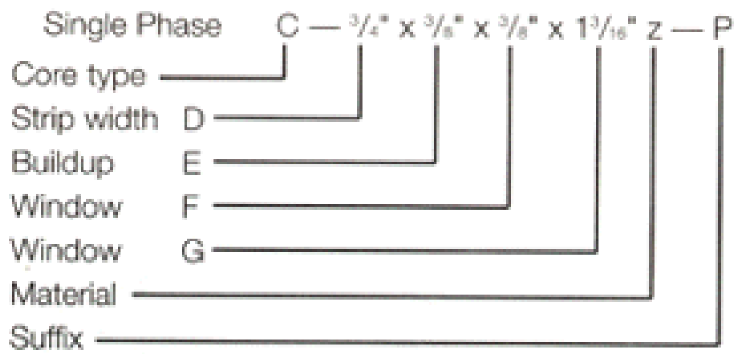
Manufacturing of cut cores requires, in most cases, a 16 step process. Beginning with the slitting and coating of the raw material to the required slit width "D" dimension and throughout each step, the process quality inspections are performed on each core to insure that the final product will meet both mechanical and electrical specifications. In addition, inspections are performed throughout manufacturing to insure process conformance. Finished product is final tested to both mechanical and electrical requirements as described in the EIA Standard for Cut Cores RS-217A and according to Magnetic Metals' own stringent test requirements for cut cores, as described in Table III.

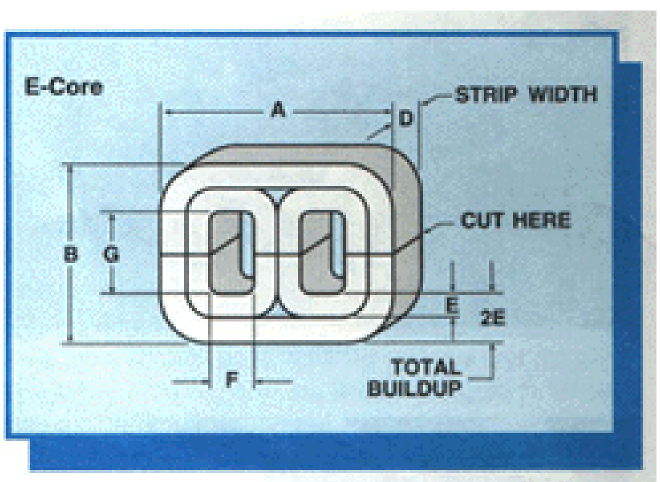
ORDERING INFORMATION

Order by Magnetic Metals Catalog number and / or specify:
For C-Cores 1 -D, E, F, G - Material Code-Suffix
For 3 -E-Cores D, E, F, G - Material Code-Suffix
Material Code: See Table III
Suffix: Add
LN for low noise application
P for pulse application

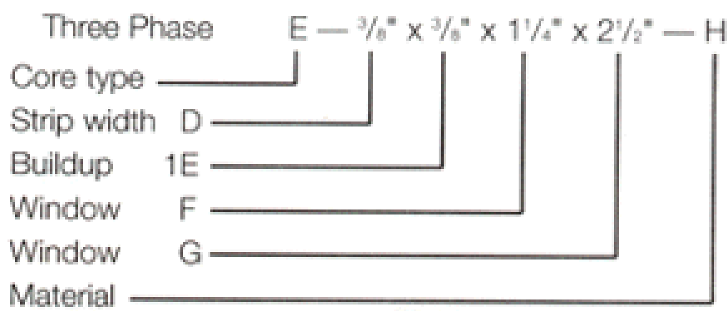


Example (1) Pulse core of .004" Microsil Z material having a window 3/8" x 1 3/16", an iron cross section: 3/4" x 3/8".





Example (2) 3 Ø-E-core of .004" Microsil having a window 1 1/4" x 2 1/2" and an iron cross section: 3/8" x 3/4" (2E).



TO ORDER CALL OR WRITE
Magnetic Metals Corporation
14042 Willow Lane
Westminister, California 92683
714-892-6627
714-987-4064 FAX

HOW TO MAKE CUT CORE SELECTIONS

The information contained in the catalog is a comprehensive listing of Magnetic Metals' cut cores. Core sizes not listed can be fabricated upon request.

SELECTION OF CORES

1. Selection by Catalog Number. In the first section of the catalog, cores are listed with increasing part number for each material and thickness.

2. Selection by Size. In the second section, cores are listed with increasing dimensions. Sorting is done by the window dimensions "F" and "G" first and then by the cross section area dimensions "D" and "E" for each material and grade.

For each core, the dimensions, leg area, DEFG product, the weight and the maximum power handling capacity at the stated flux level, frequency and current density are given.

An example of the way in which the catalog may be used is given below.

TRANSFORMER REQUIREMENTS

Given: 60 Hz (12 mil microsil selected as the gauge and material)
Primary Voltage: 120 V
Secondary Voltage: 12V
The Power Handling Capacity: 48
DEFG Product = VA x 10^8 / 4.55 x sBF
DEFG Product = 48 x 10^8 / 4.55 x 1500 x 18000 x 60
DEFG Product = .651

Referring to the catalog listing any cores which have a power handling capacity of 48 VA or higher and the DEFG product >.65 would be suitable for this application. For example MA314B has a VA = 49.45 and a DEFG product of .671 or MA334A has a VA = 49.02 and a DEFG product of .665. Both cores have sufficient power handling capacity to meet the above requirement. The selection now all depends on the mechanical requirements of the design.

If the listing does not show cores that fit the required geometry, then the designer can choose other dimensions DEFG resulting in a product close to the value calculated. It is of utmost importance to select the D dimension from the preferred strip widths given in Table II. This table should be consulted whenever possible in designing cut cores of dimensions not listed. For strip widths other than those listed consult factory for availability.

MATERIAL STANDARD STRIP WIDTH: TABLE 2

TABLE II- MATERIAL STANDARD STRIP WIDTH (INCH)							
STRIPWIDTH	MM	ML	MH/ MZ	MJ/ MA	MXH	MB	MC
.125	•	•	•	•	•	•	•
.187		•	•	•		•	•
.250	•	•	•	•	•	•	•
.281	•	•					
.312	•	•	•	•	•	•	•
.343		•	•	•			
.375	•	•	•	•	•	•	•
.437		•	•	•			
.468	•	•					
.500	•	•	•	•	•	•	•
.531		•					
.562		•	•	•			
.593			•				
.625	•	•	•	•	•	•	•
.687		•	•	•			
.750	•	•	•	•	•	•	•
.812		•	•	•			
.875		•	•	•			
.937		•	•	•			
1.000	•	•	•	•	•	•	•
1.125			•	•			
1.250		•	•	•			
1.375			•	•			
1.500	•	•	•	•	•	•	•
1.625			•	•			
1.750		•	•	•			
1.875			•	•			
2.000	•	•	•	•	•	•	•

TABLE II- MATERIAL STANDARD STRIP WIDTH (INCH)							
STRIPWIDTH	MM	ML	MH/ MZ	MJ/ MA	MXH	MB	MC
2.250			•	•			
2.500	•	•	•	•	•	•	•
2.750			•	•			
3.000	•	•	•	•	•	•	•
3.250			•	•			
3.500		•	•	•			
3.750			•	•			
4.000		•	•	•			
4.250			•	•			
4.500		•	•	•			
4.750			•	•			
5.000		•	•	•			
5.250			•	•			
5.500		•	•	•			
5.750		•	•	•			
6.000		•	•	•			

MATERIAL CODES AND TEST POINTS: TABLE 3

TABLE III - MATERIAL CODES AND TEST POINTS								
MATERIAL	GAGE	STACKING FACTOR	MATERIAL CODE	B MAX KILOGAUSS	TEST POINT		TYPICAL DATA	
					B (KG)	f (HZ)	W / LB	VA / LB
MICROSIL	1 mil	.83	MM	15.0	10	400	8.0	16.5
	2 mil	.89	ML	16.0	15	400	12.7	20.0
	4 mil	.90	MH	17.0	15	400	10.0	13.1
	4 mil	.90	MTH*	17.0	15	400	12.0	22.0
	4 mil	.90	MZ	18.0	17.6	400	16.9	48.0
	4 mil	.90	MTZ*	18.0	17.6	400	18.0	68.0
	7 mil	.90	MJ	18.0	17.6	400	15.0	30.0
	7 mil	.90	MTJ*	18.0	17.6	400	17.0	50.0
	9 mil	.95	MAZ, MSZ	18.0	17.6	60	1.1	2.1
	9 mil	.95	MTAZ, MTSZ*	18.0	17.6	60	1.2	2.6
	12 mil	.95	MA (≤10LB.)	18.0	15.0	60	.9	1.7
	12 mil	.95	MS(>10 LB.)	18.0	15.0	60	.9	1.7
	12 mil	.95	MTA, MTS*	18.0	15.0	60	1.1	2.5
Supermendur	4 mil	.90	MXH	21.0	21.0	400	15.0	36.0
	4 mil	.90	MTXH*	21.0	21.0	400	20.0	62.0
Superperm 49	1 mil	.83	MBH	15.0	12.0	400	3.0	3.5
	2 mil	.89	MBL	15.0	12.0	400	3.8	4.0
	4 mil	.90	MBH	15.0	12.0	400	4.2	4.5
	6 mil	.90	MBG	15.0	12.0	400	4.5	4.8
Superperm 80	1 mil	.83	MCM	7.0	4.0	400	0.18	0.70
	2 mil	.89	MCL	7.0	4.0	400	0.20	0.70
	4 mil	.90	MCH	7.0	4.0	400	0.25	0.75
	6 mil	.90	MCG	7.0	4.0	400	0.30	0.80

* For Three Phase MT - Cores: Testing will be performed under single conditions and totaled to replicate three phase conditions. The exception to this test method would be when a customer provides a set of three phase.

TYPICAL LOSS CURVES AT VARIOUS FREQUENCIES

FIGURE 2 – MICROSIL .001" THICKNESS – "M" MATERIAL CODE

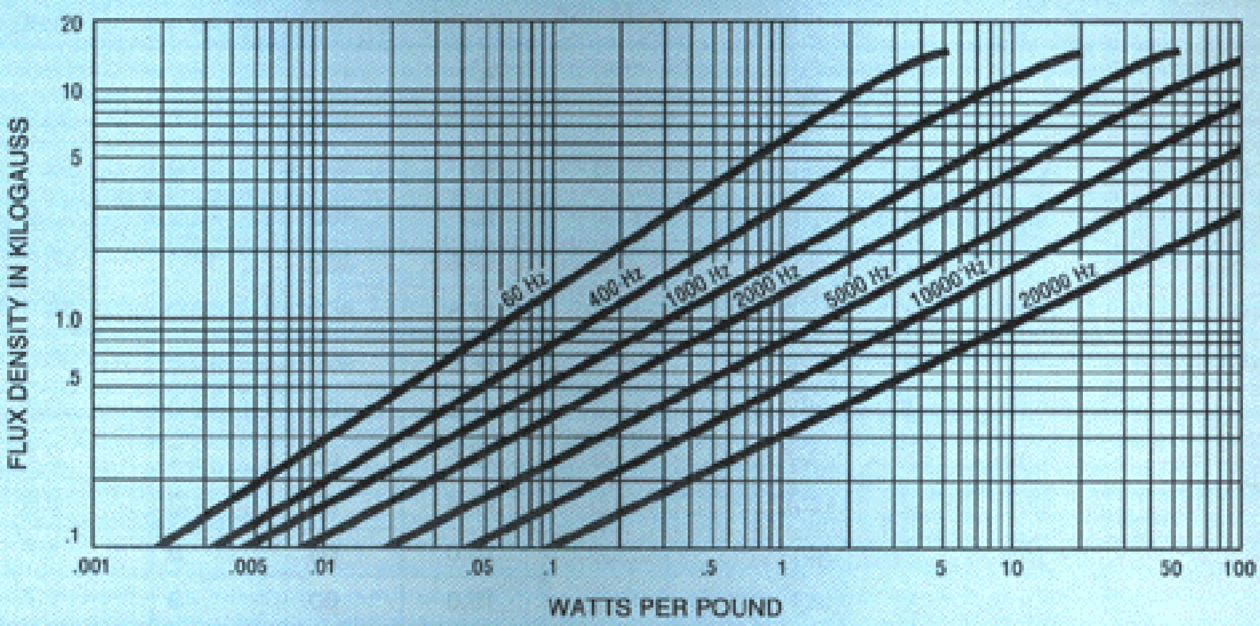


FIGURE 3 – MICROSIL .001" THICKNESS – "M" MATERIAL CODE

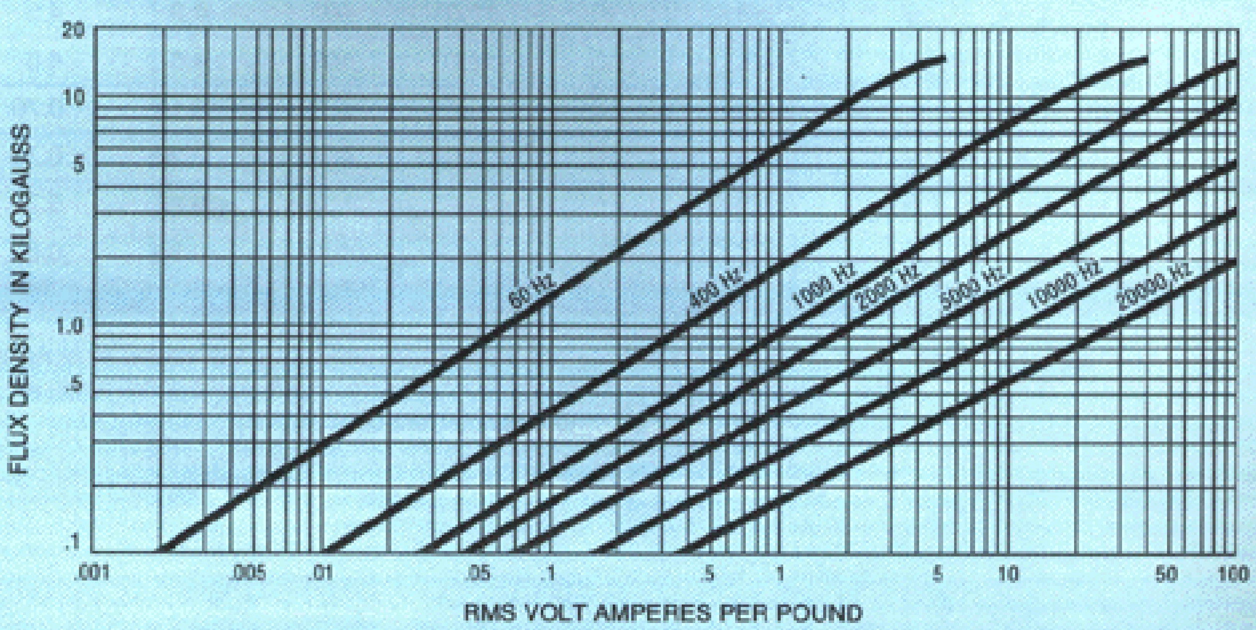


FIGURE 4 – MICROSIL .002" THICKNESS – "L" MATERIAL CODE

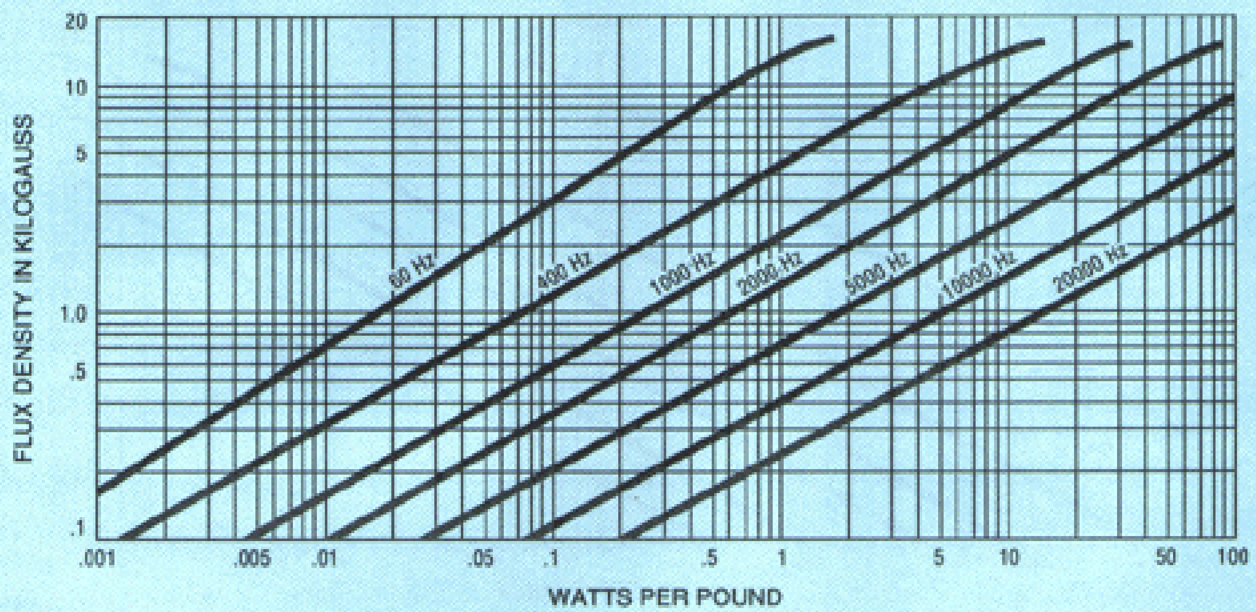


FIGURE 5 – MICROSIL .002" THICKNESS – "L" MATERIAL CODE

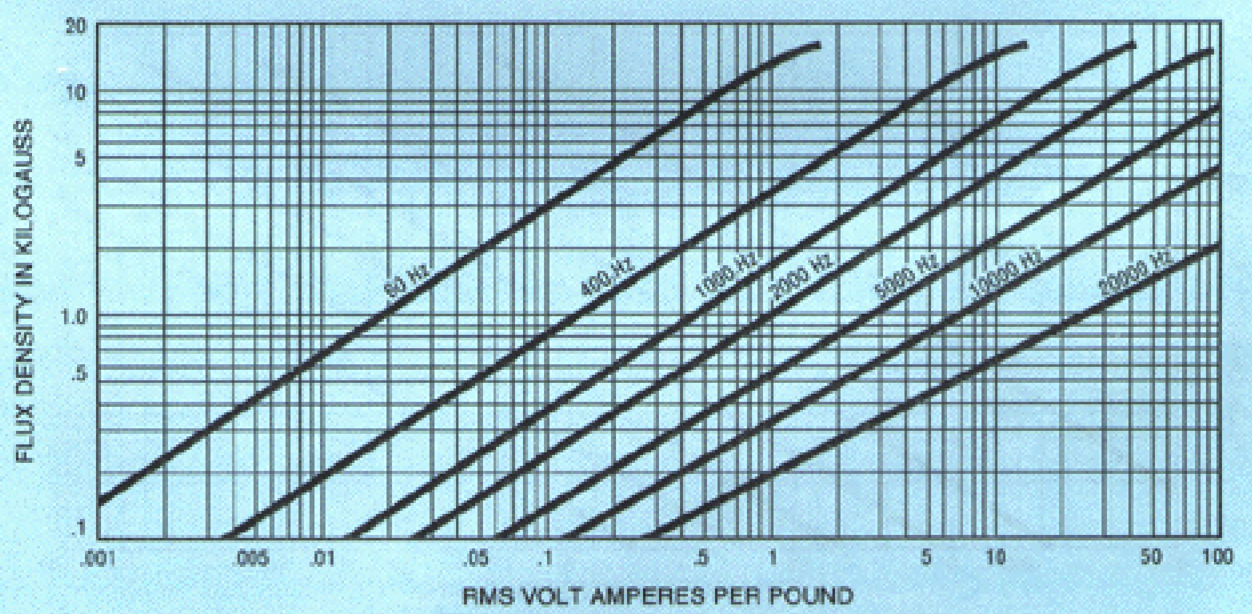


FIGURE 6 – MICROSIL .004" THICKNESS – "H" & "Z" MATERIAL CODES

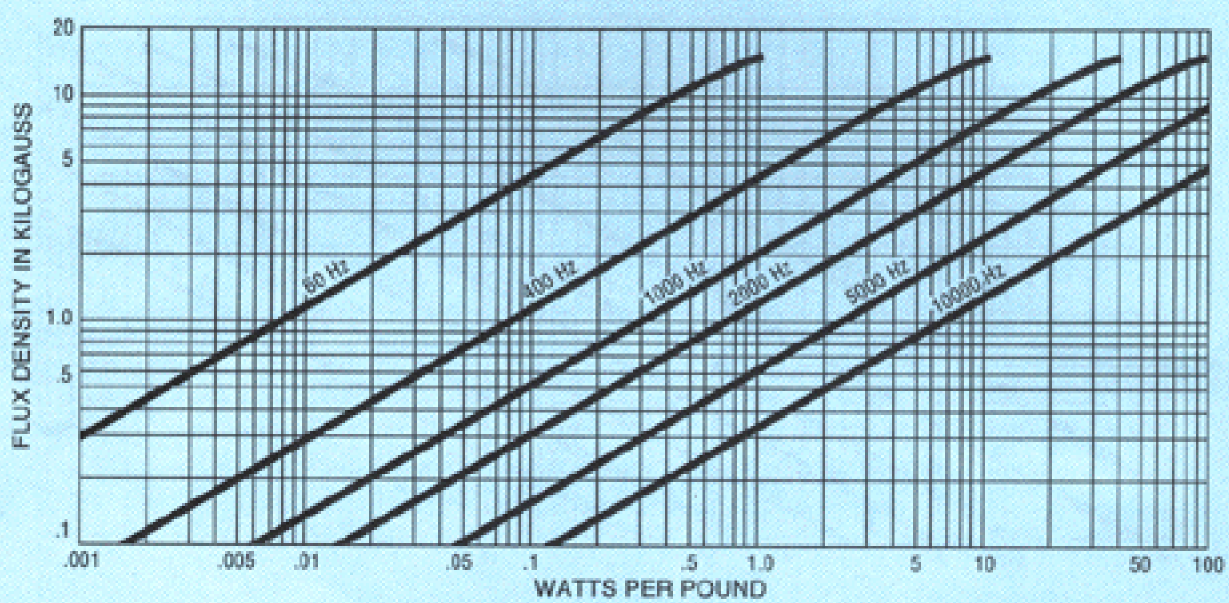


FIGURE 7 – MICROSIL .004" THICKNESS – "H" & "Z" MATERIAL CODES

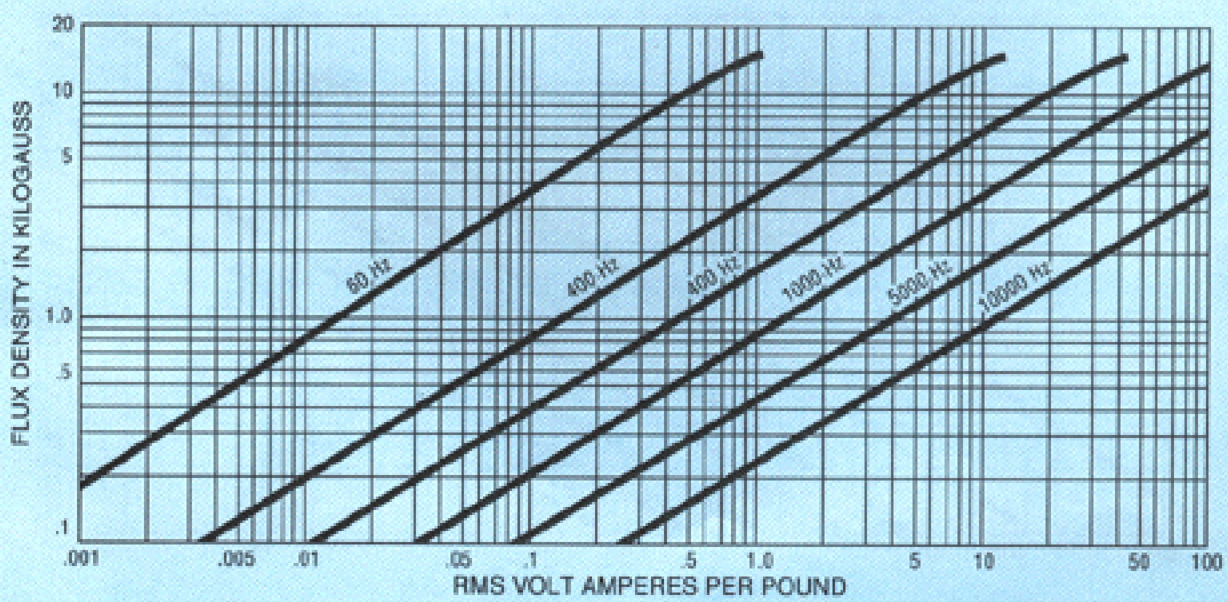


FIGURE 8 – MICROSIL .007" THICKNESS – "J" MATERIAL CODE

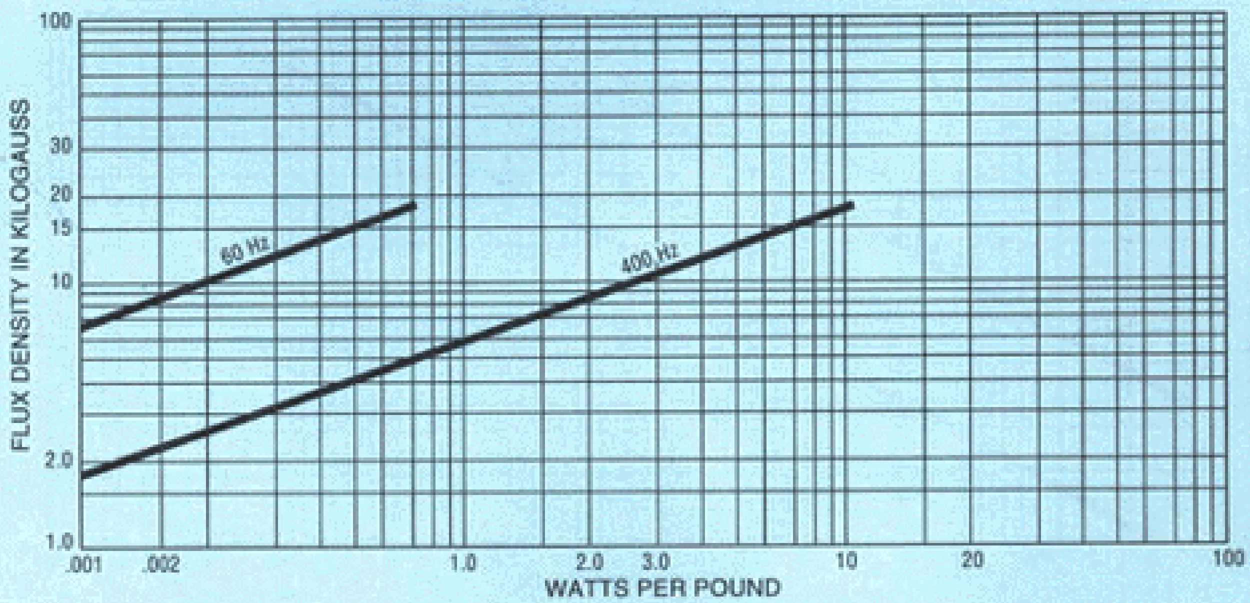


FIGURE 9 – MICROSIL .007" THICKNESS – "J" MATERIAL CODE

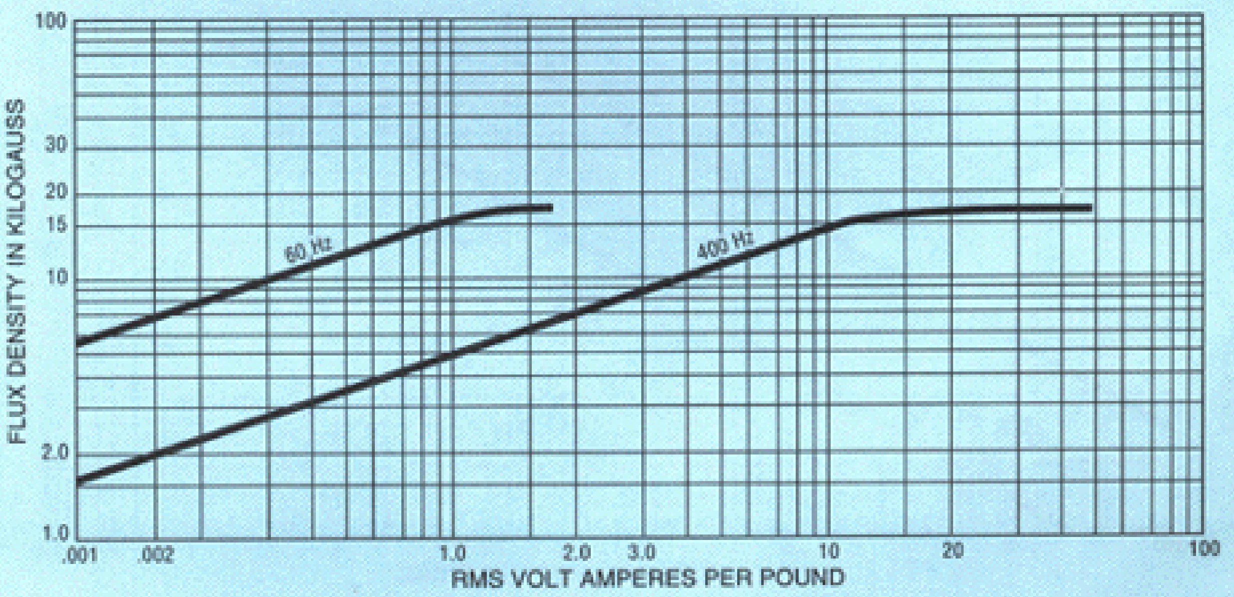


FIGURE 10 – MICROSIL .012" THICKNESS – "A" & "S" MATERIAL CODES

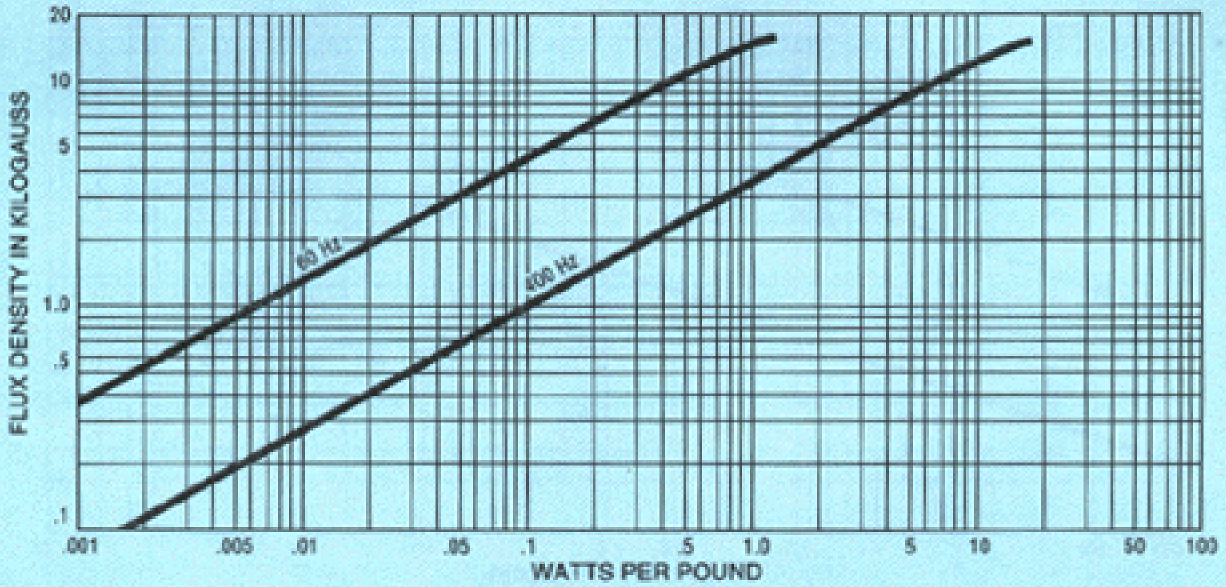
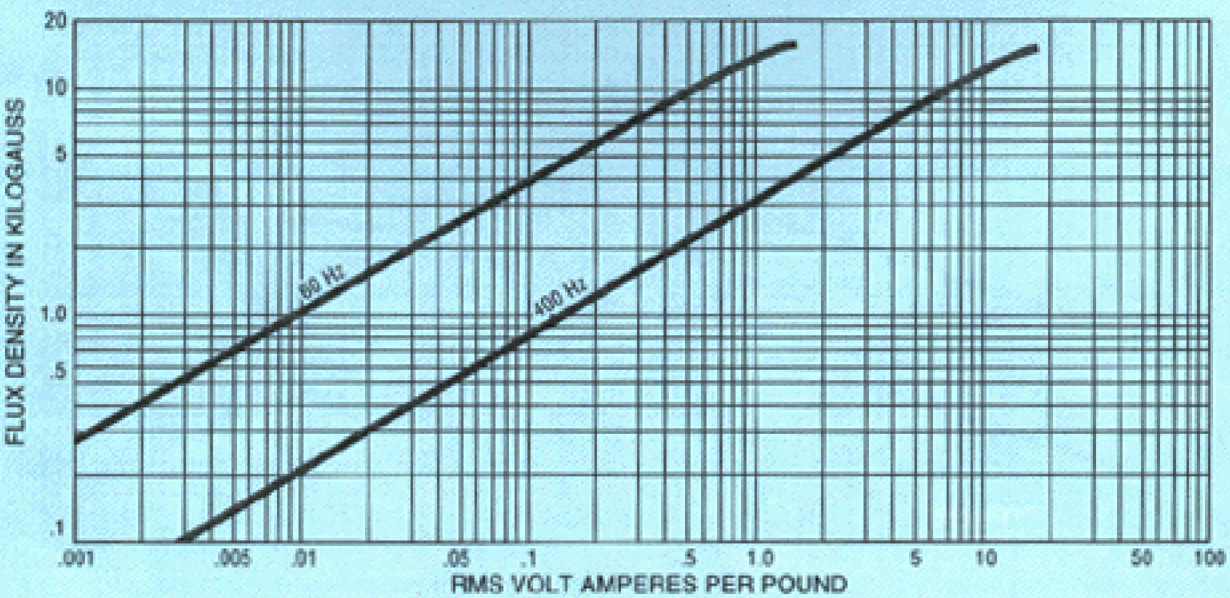


FIGURE 11 – MICROSIL .012" THICKNESS – "A" & "S" MATERIAL CODES



SUPERPERM 49

FIGURE 12 – SUPERPERM 49 .001" THICKNESS – "BM" MATERIAL CODE

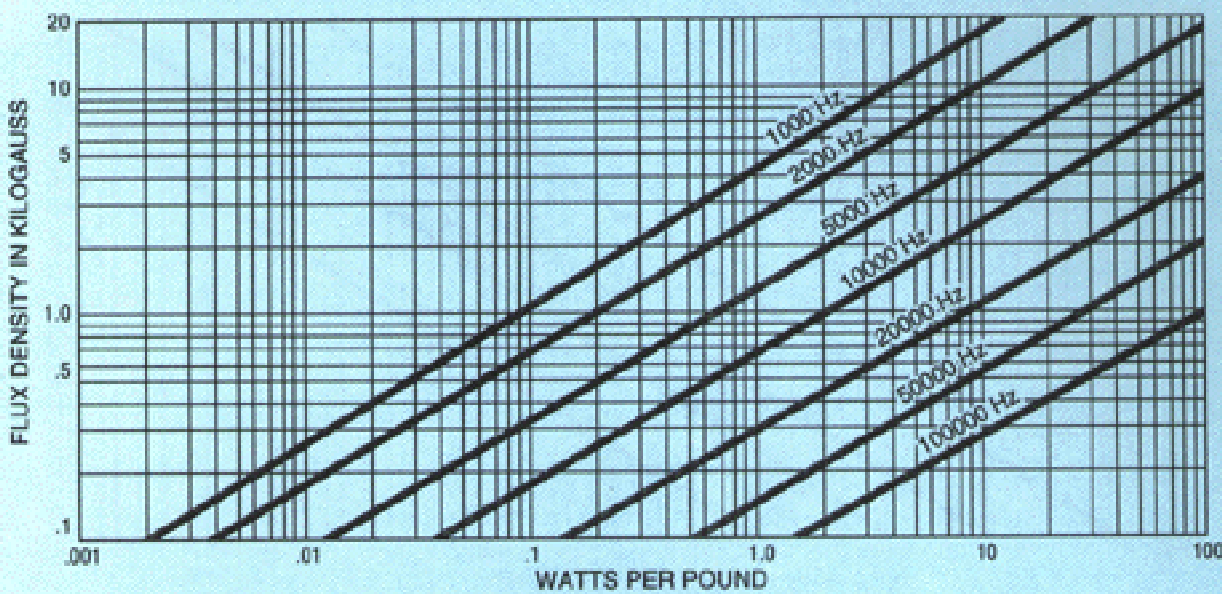


FIGURE 13 – SUPERPERM 49 .002" THICKNESS – "BL" MATERIAL CODE

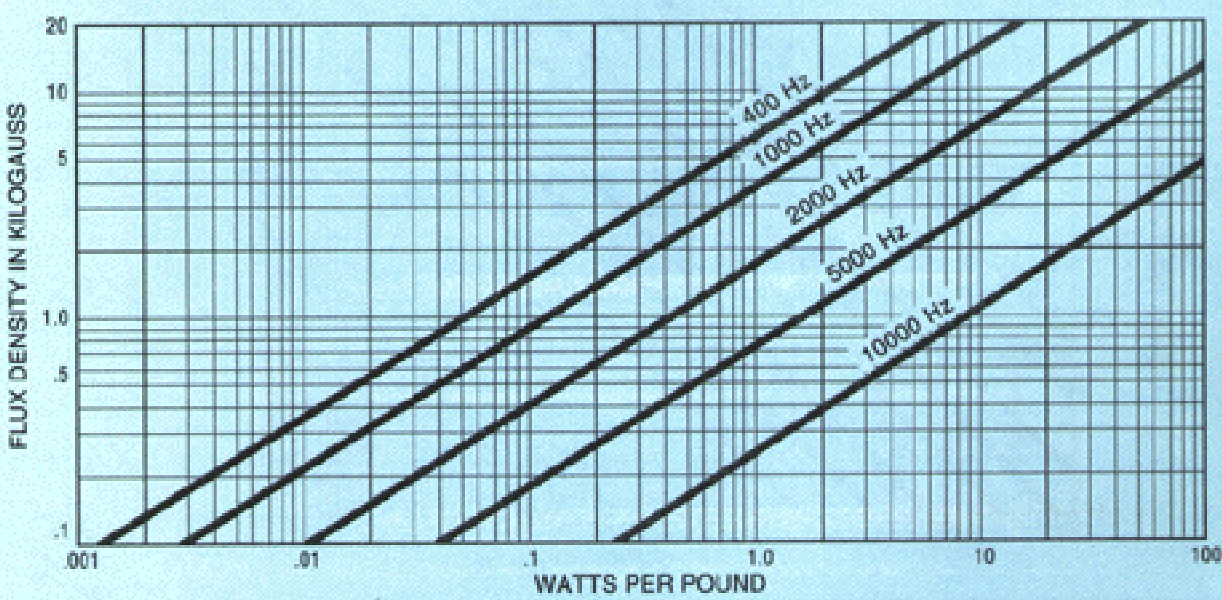


FIGURE 14 – SUPERPERM 49 .004" THICKNESS – "BH" MATERIAL CODE

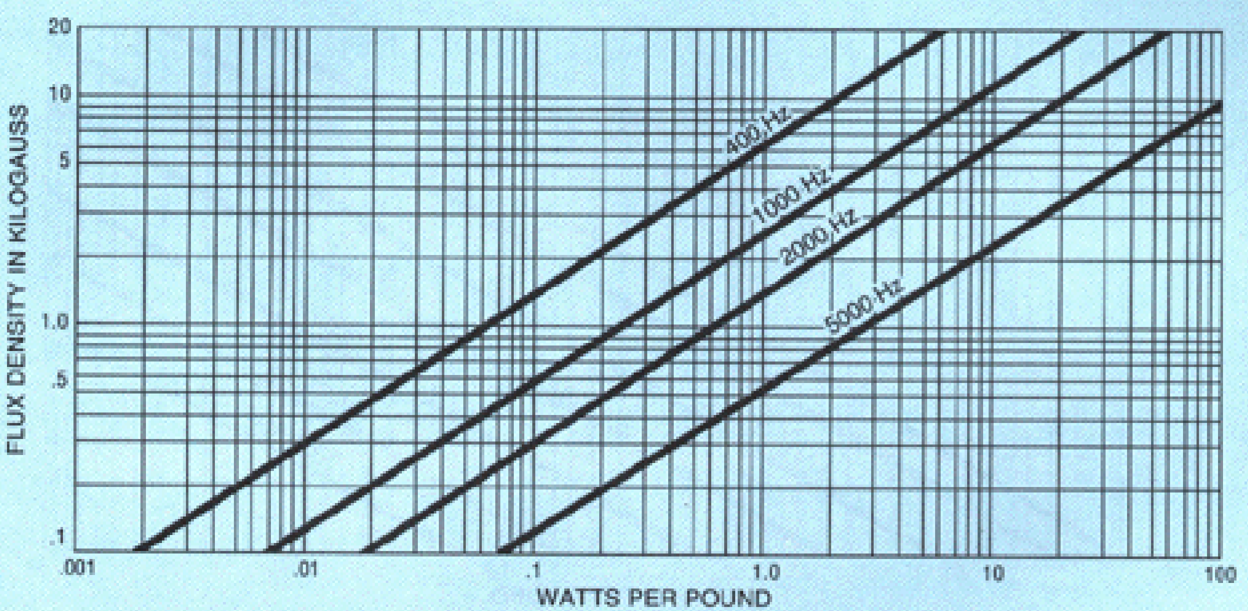
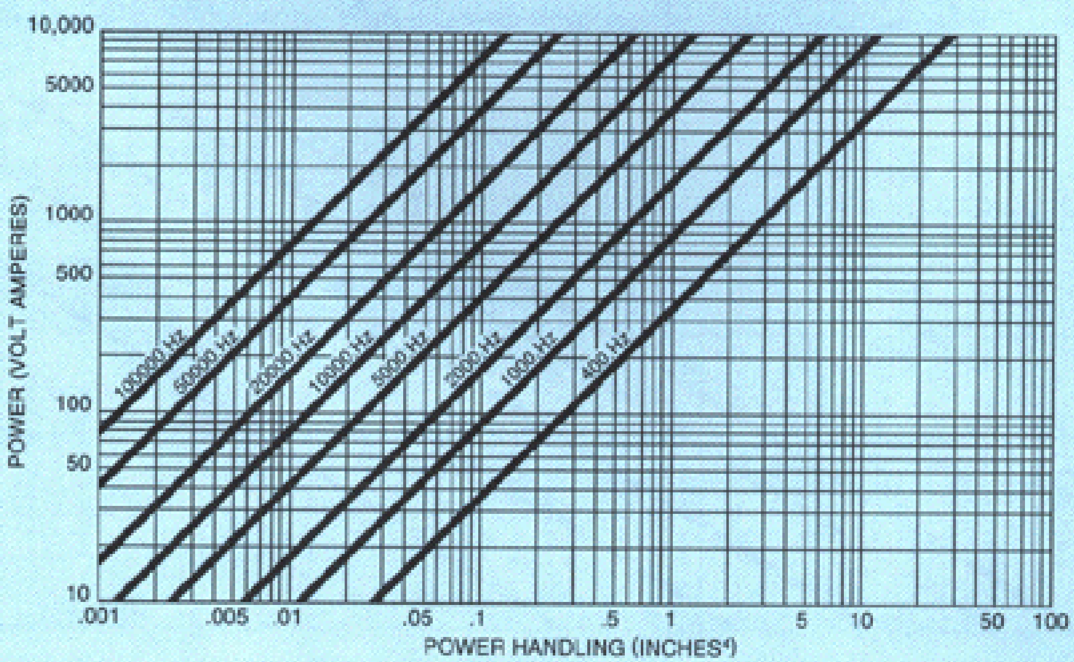


FIGURE 15 – POWER HANDLING CURVES—SUPERPERM 49 AT 10 KILOGAUSS



SUPERPERM 80

FIGURE 16 – SUPERPERM 80 .001" THICKNESS – "CM" MATERIAL CODE

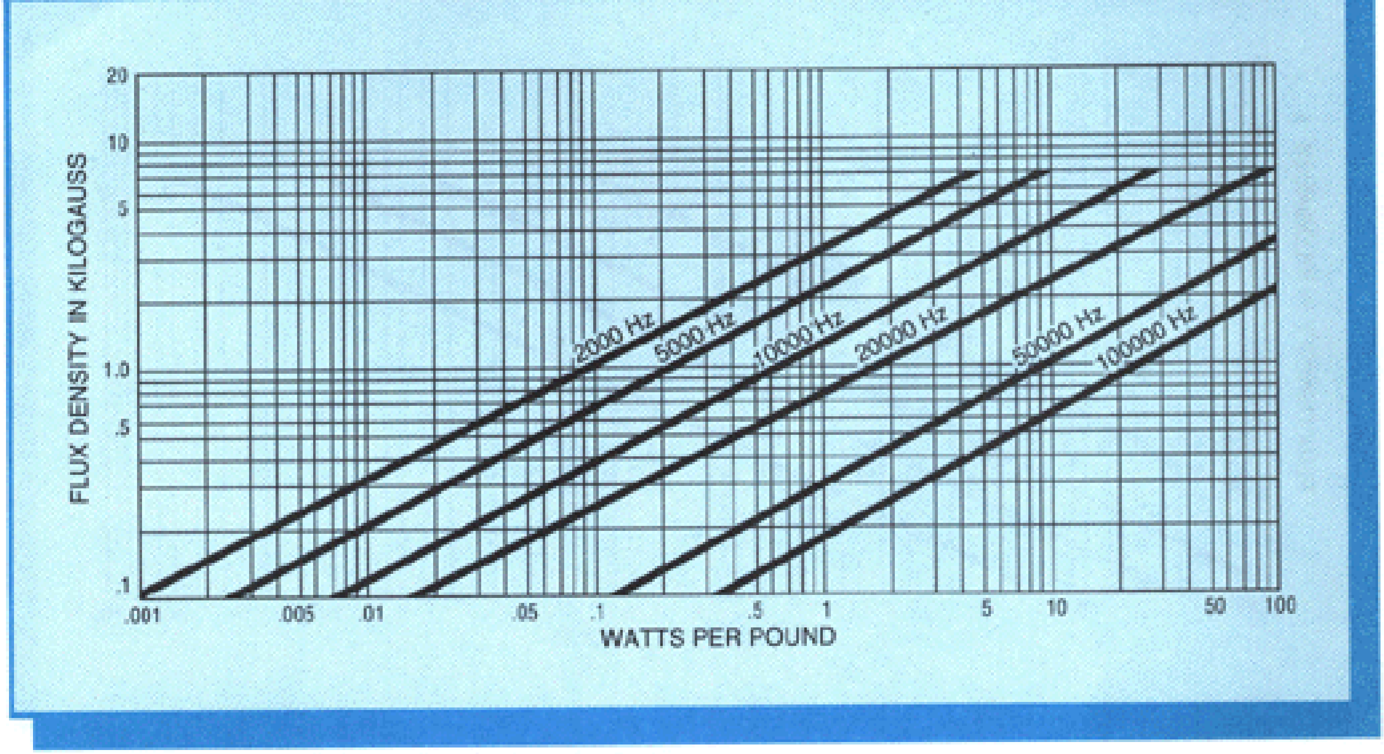


FIGURE 17 – SUPERPERM 80 .002" THICKNESS – "CL" MATERIAL CODE

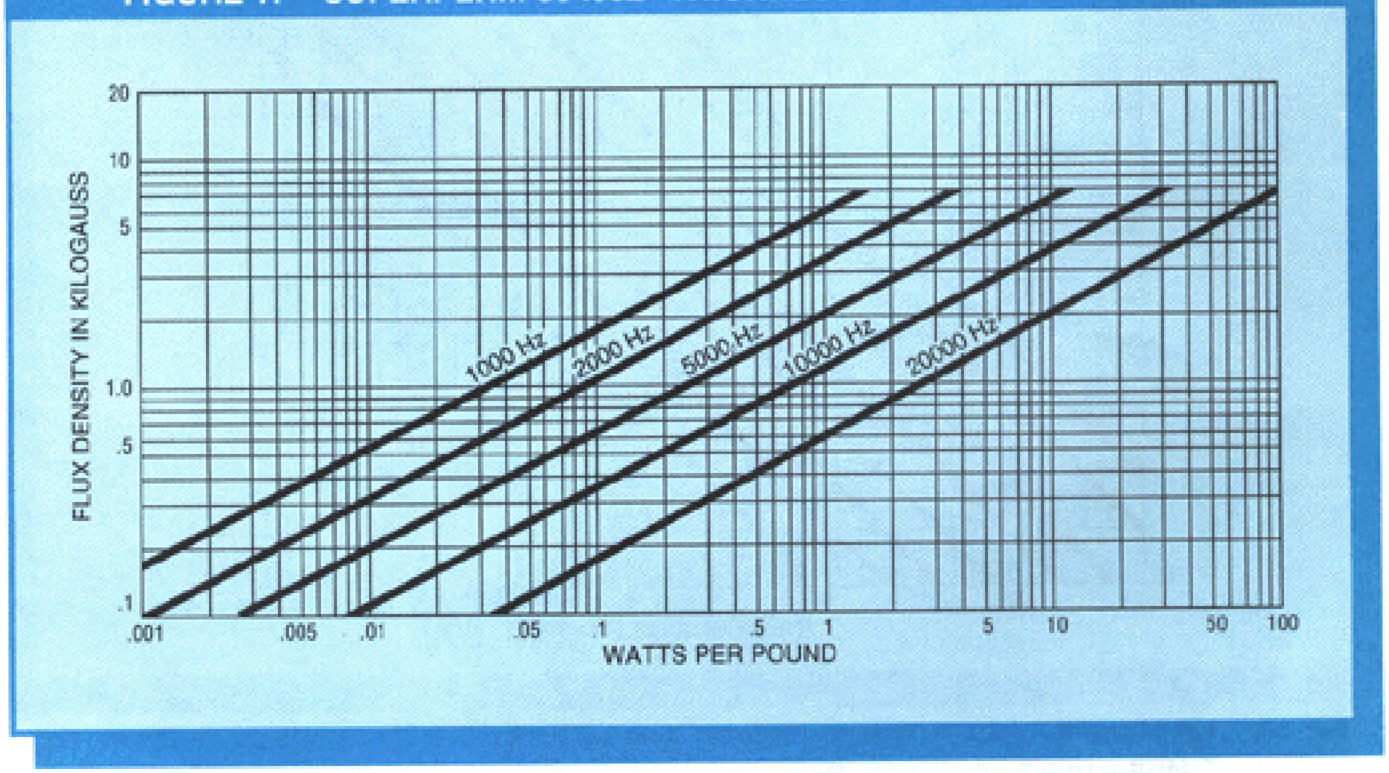


FIGURE 18 – SUPERPERM 80 .004" THICKNESS – "CH" MATERIAL CODE

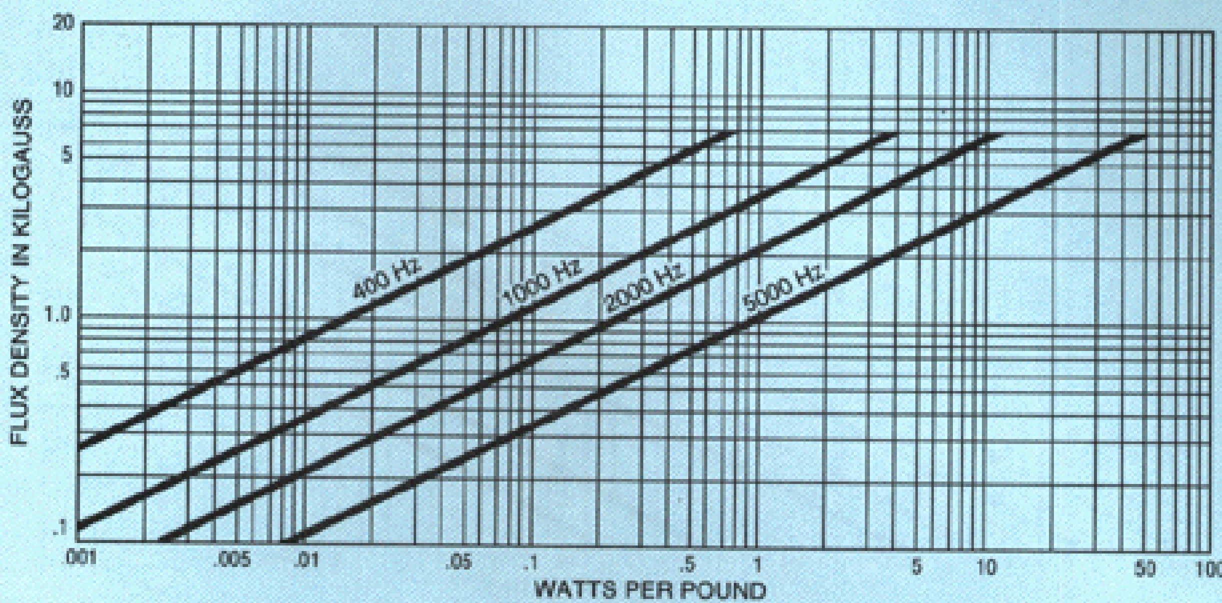
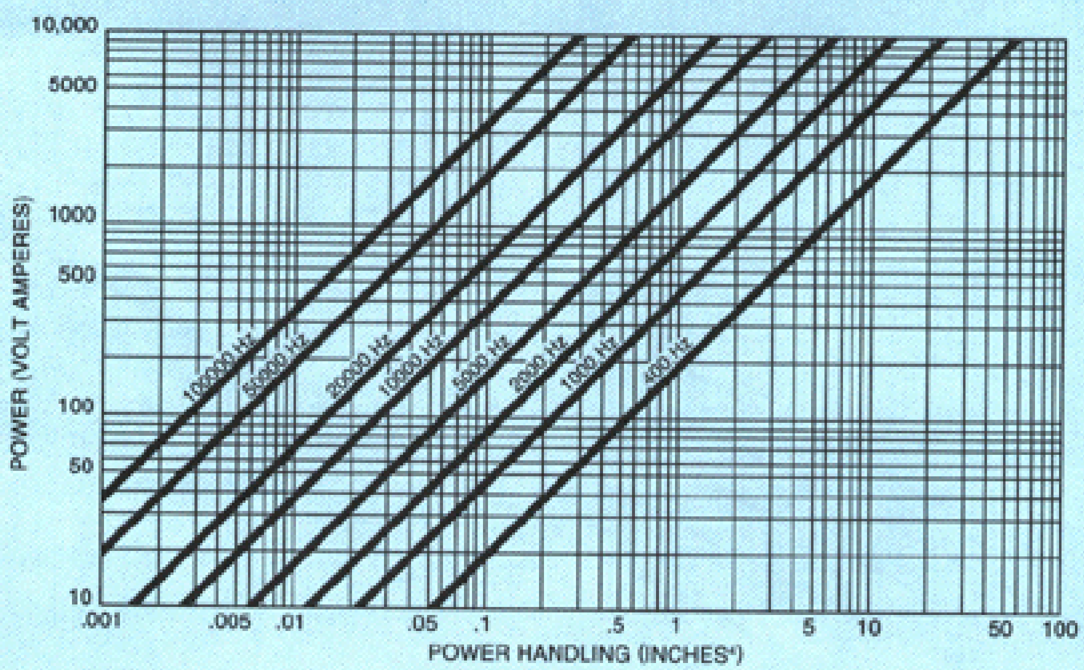


FIGURE 19 – POWER HANDLING CURVES—SUPERPERM 80 AT 5 KILOGAUSS



HANNA DESIGN CURVES

FIGURE 20 - MICROSIL (GRAIN-ORIENTED SILICON STEEL) .004" THICKNESS-400 HZ

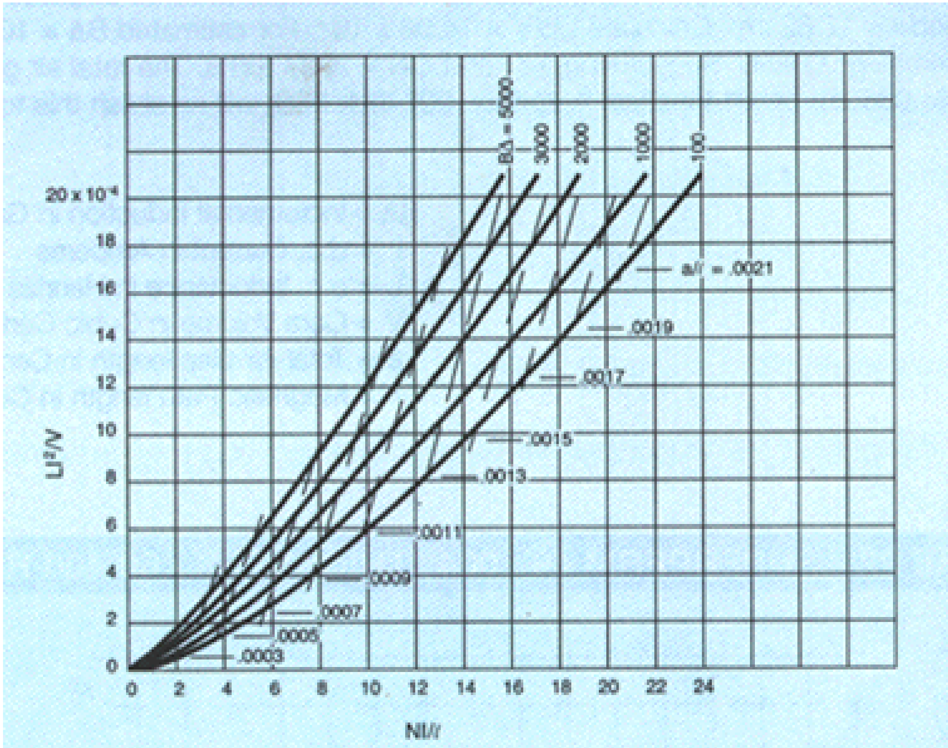
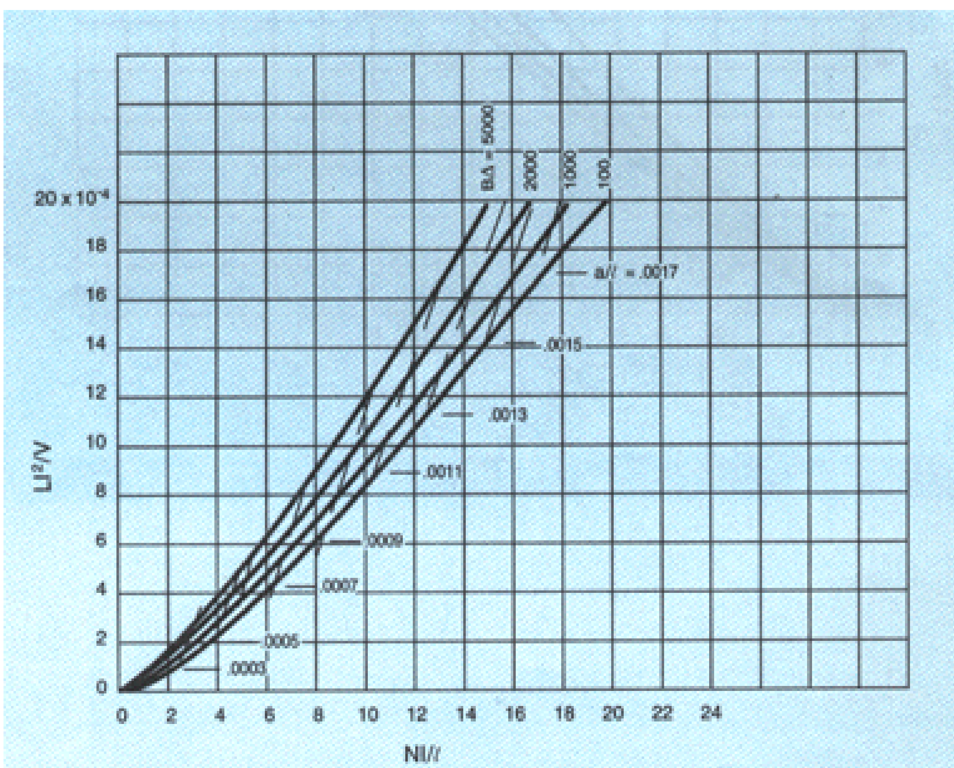


FIGURE 21 - MICROSIL (GRAIN-ORIENTED SILICON STEEL) .012" THICKNESS-60 HZ



HANNA CURVE CALCULATIONS

EXAMPLE:
Required L = 10 henry in an MBH-18 cot core Superperm 49 4 mil with I = .1 amperes dc. As calculated V = 71.02 cm^3 and l = 17.62 cm. Calculate $LI^2/V = 14.08 \times 10^{-4}$. For estimated B = 100g., NI/l = 16, and a/l is approximately .00200. Substituting for I and l, N = 2837 turns. The total air gap is approximately .00s00 x 17.62 = .035 cm or .014 inches. A spacer .007 inch thick will establish this total air gap.

B = Incremental Induction in Gausses.
I = d.c. Current in Amperes.
L = a.c. Inductance in Henries.
V = Core Volume in Cubic Centimeters.
a = Total Air Gap length in Centimeters.
l = Magnetic Path length in Centimeters.

FIGURE 22 - SUPERPERM 49 .004" THICKNESS - 60/400 HZ

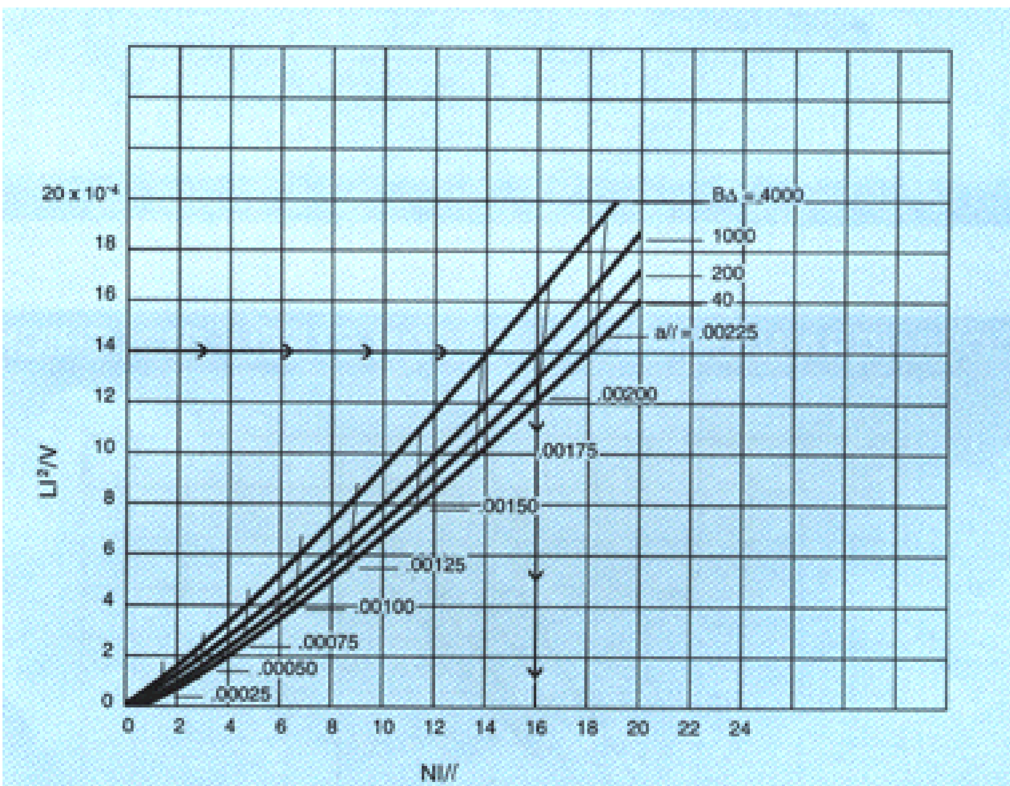
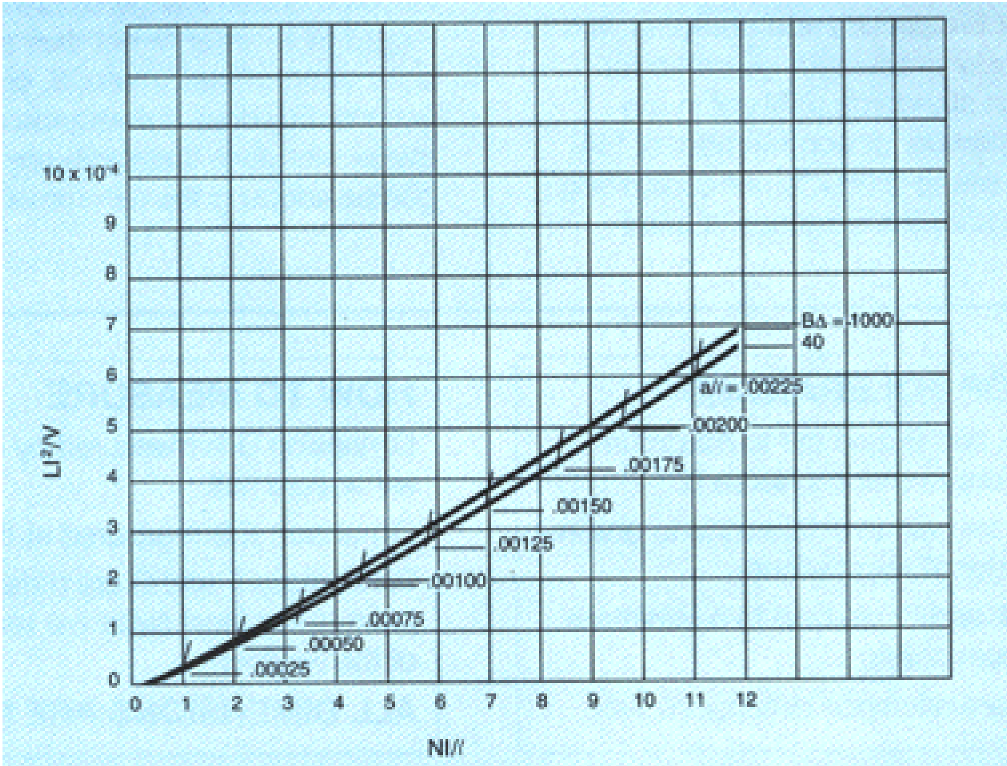


FIGURE 23 - SUPERPERM 80 .004" THICKNESS - 60/400 HZ



HANNA CURVES* provide a simplified method of calculating inductances with direct current, and for determining the optimum air gap. Where L is the a.c. inductance in henries, I is the d.c. current in amperes, and V is the core volume in cubic centimeters; calculate LI2/V and enter the left side of the chart at that ordinate. Extend to the right along this ordinate to the appropriate B, for a.c. induction in gausses, and select the indicated abcissa for NI/I. Calculate required turns by substituting the centimeters of path length in the core material for I, and for the d.c. amperes, I. The optimum ration of air gap length to path length (a/I) applies to the points indicated.

*"Design of Reactors and Transformers Which Carry Direct Current", C.R. Hanna, Journal AIEE, Vol. 46, February 1927.

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EXPLANATION OF TOLERANCES

- Exterior dimensions A and B are held to *maximum tolerance only* to ensure overall enclosure fit.
- Dimensions D and E are held to ± tolerance to ensure magnetic qualities under all applications.
- Window dimensions F and G are held to a *minimum tolerance only* to ensure coil fit.
- Dimensions K and R are reference dimensions only.

HOW TO MEASURE

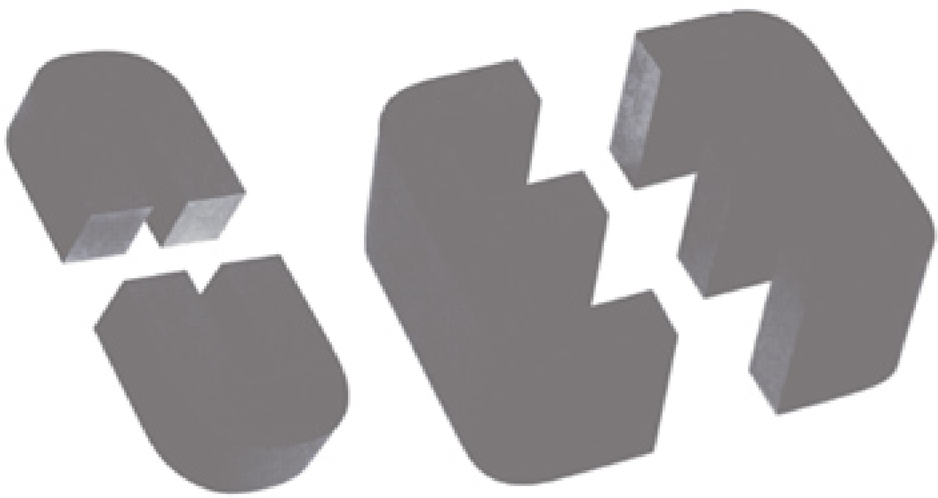
- Dimension D is measured by caliper at any point on either core half.
- Dimension E is measured at the butt joint.
- Dimensions F and G are measured at the shortest point but at least twice the radius "R" from the edge of the window.

ALL DIMENSIONS ARE NOMINAL

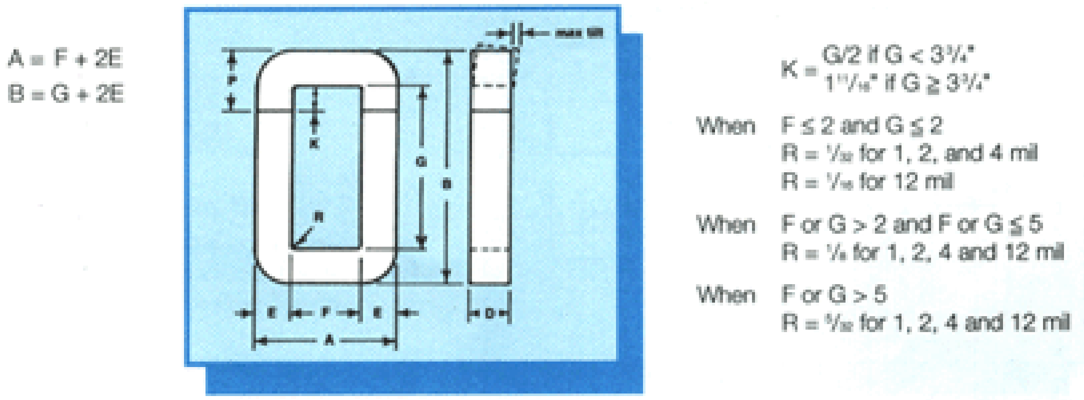
HOW TO MEASURE

Dimension D is measured by caliper at any point on either core half.
Dimension E is measured at the butt joint.
Dimensions F and G are measured at the shortest point but at least twice the radius "R" from the edge of the window.

ALL DIMENSIONS ARE NOMINAL

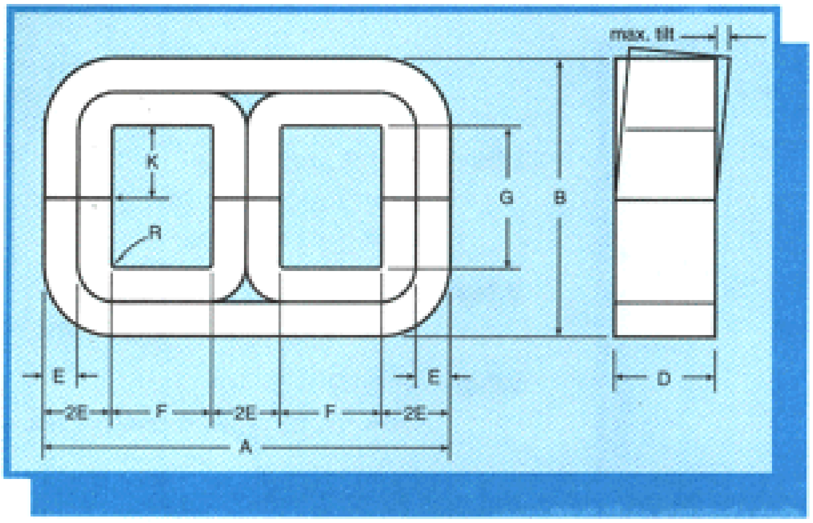


MECHANICAL TOLERANCES FOR SINGLE PHASE "C" CORES



DIM.	MATERIAL	ALLOWABLE TOLERANCES - FINISHED CORES
A	ALL	+ 1/32 max. when A ≤ 1 1/2 +3/64 max. when A > 1 1/2 ≤ 2 1/2 + 1/16 max. when A > 2 1/2 ≤ 3 1/2 + 3/32 max. when A > 3 1/2
B	.001 and .002	+ 1/16 max. when B ≤ 2 +3/16 max. when B > 2 ≤ 4 +3/8 max. when B > 4
	.004 through .012	+ 1/16 max. when B < 3 +5/32 max. when B ≥ 3 ≤ 4 +3/16 max. when B > 4 ≤ 6 +3/8 max. when B > 6 ≤ 12 +7/16 max. when B > 12
D	All	+1/32 - 0 when D ≤ 1 +3/64 - 0 when C > 1 ≤ $2^{13}/16$ +1/16 - 0 when D > $2^{13}/16$ + 3/32 - 0 when E > $2^{1/2}$
E	.001, .002 and .004	±1/64 when E ≤ 1/4 +1/32 - 1/64 when E > 1/4 ≤ 1 ±1/32 when E > 1
	.007 through .012	±1/64 when E < 1/4 +1/32 - 1/64 when E ≥ 1/4 < 9/16 ±1/32 when E ≥ 9/16
F	ALL	-1/64 min.
G	ALL	-1/64 min.
TILT	ALL	1/32 when B < 3 1/2 1/16 when B ≥ 3 1/2

MECHANICAL TOLERANCES FOR THREE PHASE "E" CORES



$A = 2F + 6E$

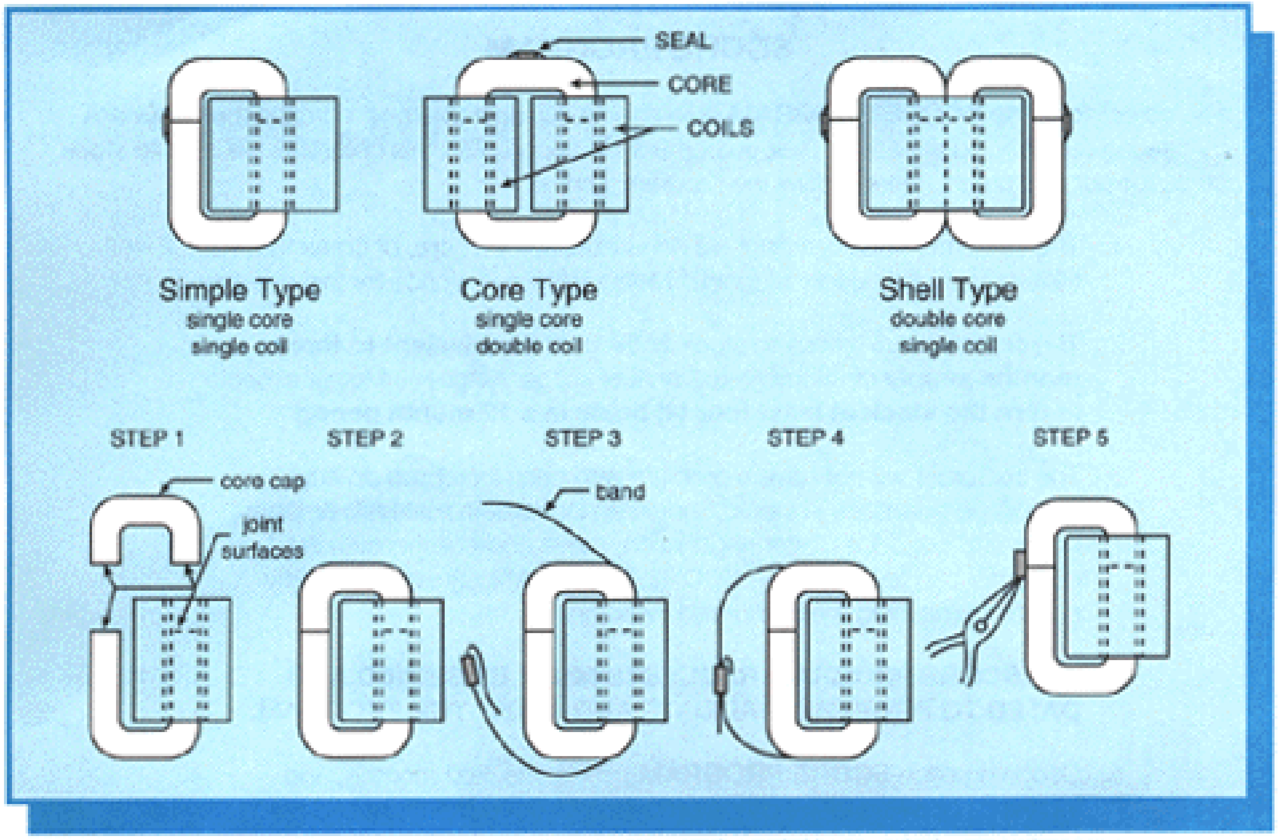
$B = G + 4E$

$K = \begin{cases} G/2 \text{ if } G \leq 5 \\ G/3 \text{ to nearest } 1/16 \text{ if } G > 5 \end{cases}$

$R = \begin{cases} 1/16 \text{ when } F \leq 2 \;\&\; G \leq 2 \\ 1/8 \text{ when } F \text{ or } G > 2 \text{ and } F \;\&\; G \leq 5 \\ 3/32 \text{ when } F \text{ or } G > 5 \end{cases}$

DIMENSION	MATERIAL	ALLOWABLE TOLERANCES - FINISHED CORES
A	.004	+ 3/32 max. when A ≤ 5 +3/16 max. when A > 5 ≤ 10 + 5/16 max. when A > 10
	.007 through .012	+1/8 max. when A ≤ 5 +1/4 max. when A > 5 ≤ 10 +3/8 max. when A > 10
B	.004	+3/32 max. when B ≤ 5 +5/32 max. when B > 5 ≤ 10 + 1/4 max. when B > 10
	.007 through .012	+1/8 max. when B ≤ 12 +3/16 max. when B > 5 ≤ 10 +5/16 max. when B > 10
D	.007 through .012	+1/32 - 0 when D < 1 +3/64 - 0 when D ≥ 1 < 2 +1/16 - 0 when D ≥ 2 +5/32 - 0 when 2E > 2 1/2
2E	.007 through .012	±1/32 when 2E ≤ 1 +1/16 - 1/32 when 2E > 1 ≤ 2 ±1/16 when 2E > 2
F	.004, .012	-1/64 min.
G	.004, .012	-1/64 min.
TILT	.004, .012	1/32 max. when B < 3 1/2 1/16 max. when B ≥ 3 1/2

ASSEMBLY INSTRUCTIONS



Core Cross-Section (DxE)-in^2	Core Strip. Width (in.)	Band Size (inx)	No. Bands Required	Seal Dimension (in.)	Banding Force (lb.)
.188 or less	Any	3/16 x .006	1	3/16 x 1/4	37.5
.188 to .375	3/8 or larger	3/8 x .006	1	3/8 x 3/8	75
.375 to .75	3/8 to 1 1/2	3/8 x .012	1	3/8 x 3/8	150
	1 5/8 o larger	3/8 x .006	2	3/8 x 3/8	75
.75 to 1.5	1/2 to 1 1/8	3/8 x .012	1	3/8 x 3/8	150
	1 1/4 or larger	3/8 x .012	2	3/8 x 3/8	150
1.5 to 3.0	3/4 or larger	3/4 x .023	1	7/8 x 1 7/8	600
3.0 to 4.25	3/4 or larger	3/4 x .035	1	7/8 x 1 7/8	900
4.25 to 6.0	2 or larger	3/4 x .023	2	7/8 x 1 7/8	600
6.0 to 9.0	3 1/4 or larger	3/4 x .023	3	7/8 x 1 7/8	600
9.0 t9 13.5	3 1/4 or larger	3/4 x .035	3	7/8 x 1 7/8	900

NOTE: Cut Cores should be banded with the proper banding force to insure good seating of the mating surfaces.