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אילור – גרעינים מגנטיים
EILOR - Magnetic Cores

EILOR MAGNETIC CORES

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A. INTRODUCTION

A.1 GENERAL

Grain-oriented silicon steel cut tape wound cores provide the designer with a means for producing very efficient transformers and inductors while minimizing size. Magnetic components designed with EILOR cut cores offer the following advantages:

- Higher permeability than laminations.
- Reduced core losses.
- Improved space factor.
- Better regulation.
- Easily adjustable air-gap.
- Rapid assembly.
- Minimum cost for special sizes.

Additionally, EILOR manufactures tape wound uncut cores (toroidal or rectangular), which provide all the advantages of grain-oriented silicon steel.

A.2 MATERIAL

As is well known, grain-oriented silicon steel has the desirable characteristics of very high maximum flux density, low core losses and high permeability. The phenomenon of grain orientation (crystal texture) is a result of special chemical composition, severe cold rolling and high temperature annealing - all of which contribute to the development of grains (crystals) which are most readily magnetized in the direction of cold rolling but very difficult to magnetize (requiring up to 50 times the excitation) perpendicular to this direction. Therefore it makes sense to utilize this material only in the rolling direction as in tape wound cores, and not cross grain as in the case with laminations.

A.3 MANUFACTURE

In order to take full advantage of the aforementioned properties of grain-oriented silicon steel, it is the responsibility of the core manufacturer to preserve all the basic material properties during the processing of the core. We pride ourselves with not only employing the most advanced techniques and equipment for winding, annealing, impregnating, cutting and gap preparation, but require our Quality Control system to perform incoming electrical and mechanical inspections of all steel received.
Further, our Quality Control system monitors each stage of the core manufacturing process according with ISO 9002. A modern computerized core testing equipment is used, to assure the quality of the product and compliance with the specification.

EILOR offers the following types of cores:

- Toroids- un-bonded, bonded (cut or uncut), coated, gapped, with end caps.
- C-cores- single phase cut cores.
- E-cores- three- phase cut cores.

In addition to our standard and superior quality cores, our Engineering Department has developed cores to meet very special needs of its customers. For example: type HiB manufactured with the newest higher flux material capable of continuous operation at more than 1.8 Tesla, 50Hz.
The cut cores for 50 Hz and 400 Hz are detailed on Tables C1, C2 and tested to meet standard and superior quality grades for C-cores (and standard quality for E-cores).
For any additional information of special requirements please consult our Engineering Department.

A.4 ORDERING INFORMATION

A.4.1 Material Thickness Code

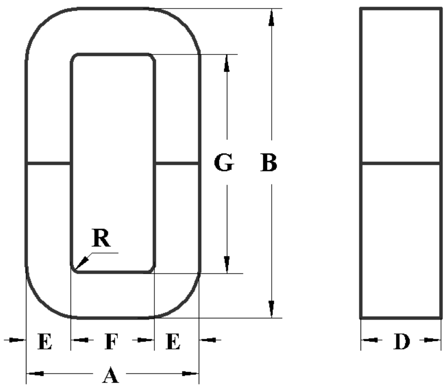
Material thickness, mm	0.30	0.30 (HiB)	0.10	0.05
Thickness code	30	30	10	05
Color code (*)	White	White (2 dots)	Green	Blue (2 dots)

Note: (*)-The material thickness identifying marks (color code) are the color dots located on both halves of cut cores (on the top side of core at each end).

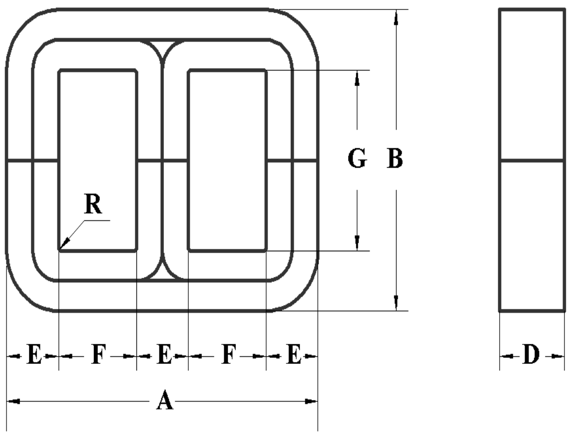
A.4.2 Standard Cut Cores

Designations for standard cut-cores are listed in Section C. When ordering cores, it is necessary to specify the grade for the core required- see Tables B.3.1 and B.3.2.,
e.g.: 30V-51 ELA,
where: 30 = Thickness code (see A.4.1.),
V-51 = Core type (size),
ELA = Grade,
or: 10SM-102b ELHH
where: 10 = Thickness code,
SM-102b = Core type (size),
ELHH = Grade.
0.05mm cores are produced in the same sizes as the thicker materials (see Section C).

C-core



E-core



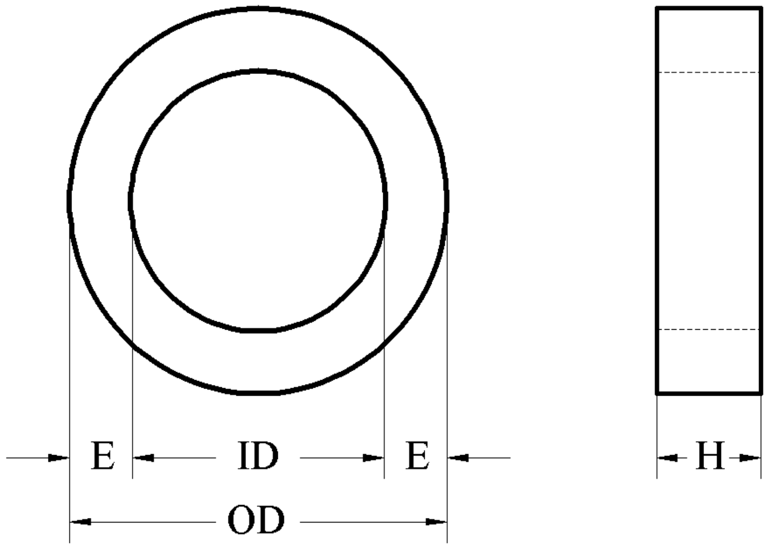
A.4.3Toroids

Toroids are available as follows:

- Un-bonded.
- Bonded - cut or uncut.
- Gapped.
- With end caps.
- Epoxy powder coated.
- Other special requirements.

Toroids should be ordered by specifying outside (**OD**) and inside (**ID**) diameters, strip width (**H**), material thickness and electrical characteristics.
Bonding decreases magnetic properties, therefore it is recommended for cut toroids only.
For best performance the ratio of outside diameter to inside diameter should not exceed 1.5, due to the difference between outside and inside mean flux path length, hence flux density.
Toroid with different ratios can be supplied if required.

Toroid



A.4.4 Non-Standard (Special) Cores

Special cut-cores should be ordered by specifying:

- Minimum window dimensions (**G** and **F**) - preferably taken from one of our catalogue sizes.
- Nominal strip width (**D**) - preferably chosen from our catalogue sizes.
- Nominal build-up (**E**).
- Material thickness.
- Electrical characteristics

Special-size cores will be manufactured to standard tolerances and electrical properties, unless indicated otherwise.

B. ENGINEERING INFORMATION

B.1 PRODUCTS

Type	Typical application
C-cores	Single-phase transformers, inductors, pulse transformers
E-cores	Three-phase transformers
Toroid	High inductance coils, inverter transformers, current transformers

B.2 MATERIAL DATA

Cold rolled grain-oriented silicon steel, insulated by special heat resistant coating.
Density - 7.65gr/cm ^{3}.
Composition - 3.25% silicon, 96.75% iron (nominal).
Resistivity - 48 μΩ-cm.
Thermal conductivity - 0.043 cal/cm/sec/C°.

Available grades of grain-oriented silicon steel

Grade	Thickness, mm	Space factor	Maximum specific core losses, W/kg			
			50 Hz		400 Hz	2000 Hz
			1.5 T	1.7 T	1.5 T	0.5 T
M6	0.35	0.96	1.11	1.57		
M5	0.30	0.95	0.97	1.39		
M4	0.27	0.95	0.89	1.27		
M0H (HiB)	0.30	0.96		1.05		
M0H (HiB)	0.23	0.94		0.90		
	0.10	0.92			17.5	
	0.05	0.89				15*

Note:* --not guaranteed.

B.3 ELECTRICAL GUARANTEES

B.3.1 C-Cores

Quality grade	Quality code	Thickness, mm	Test conditions (1)		Guaranteed values for bonded, cut or uncut cores		
			Bm, T	f, Hz	W/kg	VARm/kg (2)	VARg/kg (3)
Standard	ELA	0.30	1.7	50	2.0	9.90	840/Lm (4) (a=0.018mm)
Superior	ELAA	0.30	1.7	50	1.8	5.95	420/Lm (a=0.009mm)
Standard	ELH	0.10	1.5	400	22.0	28.60	8810/Lm (a=0.03mm)
Superior	ELHH	0.10	1.0	400	10.0	6.00	1310/Lm (a=0.01mm)
Standard	ELF	0.05	0.8	2000	45	55	12550/Lm (a=0.03mm)
Superior	ELFF	0.05	0.5	2000	21	27.6	1960/Lm (a=0.012mm)

B.3.2 E-Cores

Quality grade	Quality code	Thickness, mm	Test conditions (5)		Guaranteed values for bonded, cut or uncut cores		
			Bm, T	f, Hz	W/kg (6)	VARm/kg (2)	VARg/kg (3)
Standard	ELA	0.30	1.7	50	2.4	9.90	$\frac{27 \cdot Ac\ min}{W_{t.\ min}}$ (a=0.075mm)
Standard	ELH	0.10	1.5	400	26.4	28.60	$\frac{111 \cdot Ac\ min}{W_{t.\ min}}$ (a=0.05mm)

(1) - on special requirement C-cores may be tested in other induction or frequency.
(2) - VARm/kg - specific reactive power of metal.
(3) - VARg/kg - specific reactive power of air-gap, a = air-gap length (see B.5.3.5. and B.5.3.6).
(4) - Lm- mean length of flux path.
(5) - test conditions based upon mono-phase excitation of center leg.
(6) - values are 20% higher than for C-core because of third harmonic flux.

B.3.3 Toroids

Guaranteed magnetic properties of annealed non-impregnated toroids are corresponded to standard limiting properties for used grades of grain-oriented silicon steel (see Section B.2.).
Note: for steel thickness 0.30-0.35 mm it is correct only for toroids with inner diameter greater than 30mm and strip width greater than 10mm; for steel thickness 0.10mm correspondent Requirement -inner diameter >10mm and width >4mm.
In epoxy coated or impregnated toroids magnetic degradation is occurred due to mechanical stresses. In these toroids the core losses are increasing approximately by 20-30% in comparison with raw material.

B.4 MECHANICAL TOLERANCES

Explanation of tolerances:

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

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.

B.5 CALCULATION DATA

B.5.1 Characteristic geometrical data

Core type	Mean length of flux path L_m, mm	Effective cross sectional area, A_c, mm²	Weight of core, W_t, g
C-core	$A_{max}+B_{max}+F_{min}+G_{min}-1.72\cdot(R_{max}+E_{max}/2)$	$D_{min}\cdot E_{min}\cdot S$	$A_{c\ min}\cdot L_m\cdot\gamma\cdot 10^{-3}$
E-core	---------	$D_{min}\cdot E_{min}\cdot S$	$\gamma\cdot A_{cmin}\cdot(A_{max}+B_{max}+2F_{min}+2G_{min}-0.074E_{max}-2.58R_{max})\cdot 10^{-3}$
Toroid	$(\pi/2)\cdot(OD_{max}+ID_{min})$	$D_{min}\cdot E_{min}\cdot S$	$A_{c\ min}\cdot L_m\cdot\gamma\cdot 10^{-3}$

Notes:--A, B, D, E, F, G, R, OD, ID--(see Section A.4.),
--γ–material density (7.65 gr/cm³),
--S-space factor (see Section B.2.).

The numerical values of Lm, A_c and W_t, calculated from the above for our standard cores can be seen in Section C.

B.5.2 Transformer Equation

(Sinusoidal voltage excitation)

$$\mathbf{V=4.44\cdot f\cdot B_m\cdot A_c\cdot N\cdot 10^{-6}}$$

where: V =R.M.S. voltage;
f =Frequency (Hz),
B_m =Maximum magnetic induction (Tesla),
$A_{c\ min}$ =Effective cross sectional area (see B.5.1.) (mm^2),
N =Number of turns.

B.5.3 Core Excitation and Losses

B.5.3.1 Total Exciting VA

$$\mathbf{VA = \sqrt{W^2 + (VAR_m + VAR_g)^2}}$$

where: VA = Total exciting RMS Volt-Ampere (VA),
W = Total core (iron) losses (W),
VAR_m = Total reactive power of metal (see Eq. B.5.3.3) (VAR),
VAR_g = Total reactive power of air-gap (see Eq. B.5.3.4) (VAR).

Note: Total exciting power (VA) may be briefly calculated by multiplying the core weight by the guaranteed specific exciting power (VA/kg) from Curves D.7. and D.8.

B.5.3.2 Total Core (Iron) Losses

$$\mathbf{P=W/kg\cdot W_{t\ min}\cdot 10^{-3}}$$

where: P =Total core (iron) loss (W),
W/kg =Specific core loss (see Section B.3. and curves in Section D),
$W_{t\ min}$ =Weight of the core (see B.5.1. and Section C) (gr).

B.5.3.3 Total VAR of Metal

$$\mathbf{VAR_m=VAR_m/kg\cdot W_{t\ min}\cdot 10^{-3}}$$

where: VAR_m/kg =Specific reactive power of metal (see B.5.)
$W_{t\ min}$ =Weight of the core (see B.5.1. and Section C) (gr).

B.5.3.4 Total VAR of Air-Gap

$$\mathbf{VAR_g = VAR_g/kg \cdot W_{t\,min} \cdot 10^{-3}}$$

where: VAR_g/kg =Specific reactive power of air-gap (see Eq.B.5.3.5. and B.5.3.6.),
$W_{t\,min}$ =Weight of the core (see Table B.5.1. and Tables in Section C) (gr).

B.5.3.5 Specific VAR of Air-Gap - C-Core

$$\mathbf{VAR_g/kg = \frac{B_m^{\,2} \cdot f \cdot a \cdot 10^4}{4 \cdot \gamma \cdot L_m}}$$

where: VAR_g/kg =Specific reactive power of air-gap,
B_m =Maximum induction (Tesla),
f =Frequency (Hz),
a =Mean flux path length of two gaps (see Table B.3.) (mm),
γ =Material density (7.65 gr/cm^3),
L_m =Mean flux path length of metal (see Table B.5.1) (mm).

B.5.3.6 Specific VAR of Air-Gap-E-Core

$$\mathbf{VAR_g/kg} = \frac{2.5 \cdot B_m^{\,2} \cdot f \cdot a \cdot A_{c\,min}}{W_{t.\,min}}$$

where: VAR_g/kg =Specific reactive power of air-gap per leg,
B_m =Maximum induction (Tesla),
f =Frequency (Hz),
$A_{c\,min}$ =Effective cross sectional area of one leg (see B.5.1.) (mm^2)
a =Mean flux path length of three gaps (see B.3.) (mm),
γ =Material density (7.65gr/cm^3),
$W_{t.min}$ =Weight of the core (see B.5.1.) (g).

B.5.4 Power handling capacity

B.5.4.1 General

Power handling capacity of magnetic cores is affected by the required regulation, copper space factor and temperature rise limit. The permissible temperature rise depends upon current density, flux density, frequency, class of insulation, duty cycle and the heat dissipation capability of the transformer. That is why power rating cannot be specified precisely. The power handling capacity of the magnetic cores may be determined from Eq.B.5.4.2-B.5.4.3, using the following values:

Core weight, gram	Current density, A/mm²
0-3500	3.1
3500-10000	2.0
10000-50000	1.5
50000-60000	1.0

B.5.4.2 Power handling capacity-Toroid

$$\mathbf{VA=5.0 \cdot J \cdot B_m \cdot f \cdot A_{c\,min} \cdot ID^2 \cdot 10^{-7}}$$

where: VA =Power handling capacity (VA),
J =Current density (A/ $mm^{2)}$,
B_m =Maximum induction (Tesla),
f =Frequency (Hz),
ID =Inside diameter (mm),
$A_{c\,min}$ =Effective cross sectional area (see Table B.5.1.) (mm^2).

B.5.4.3 Power handling capacity-C-core

$$\mathbf{VA=7.0 \cdot J \cdot B_m \cdot f \cdot GF \cdot A_{c\,min} \cdot 10^{-7}}$$

where: VA =Power handling capacity (VA),
J =Current density (A/ mm^2),
B_m =Maximum induction (Tesla),
f =Frequency (Hz),
GF =Window area (mm^2),
$A_{c\,min}$ =Effective core cross section (see Table B.5.1.) (mm^2).

B.5.4.4 Power handling capacity-E-Core

$$\mathbf{VA=10.5 \cdot J \cdot B_m \cdot f \cdot GF \cdot A_{c\,min} \cdot 10^{-7}}$$

where: VA =Power handling capacity (VA),
J =Current density (A/ mm^2),
B_m =Maximum induction (Tesla),
f =Frequency (Hz),
GF =Window area (mm^2),
$A_{c\,min}$ =Effective core cross section (see Table B.5.1.) (mm^2).

B.5.5 Non-standard cores

The modification of wound cores (cut or uncut) to special size and shape requirements is much easier when compared to the expensive process of punching new lamination shapes.
Determine the core dimensions either by using equation B.5.4. or by other considerations.
Note that a square core cross section (D=E) will result in the minimum mean length of turn of copper wire. It must further be noted, however, that since the induction is in inverse ratio to path length ($B_m \approx 1/L_m$), a large difference between inside (window) core path length and outside (overall) path length will result in premature saturation of the inner wraps of the core.
It is therefore desirable to minimize the difference between the outside and inside path lengths.

B.5.6 Toroids

B.5.6.1 General

The un-bonded uncut toroid is near-perfect magnetic loop. It preserves virtually all the basic material properties. This minimizes losses and decreases the magnetizing force necessary to produce a given flux within the material. In the toroid and coil assembly, the entire magnetic path is contained within the electrical winding, further minimizing leakage flux and increasing winding-to-winding coupling. The toroid also provides a good degree of self-shielding from external magnetic fields. The single, uniform, magnetic path causes any entering magnetic field to split into two and induce equal but opposite voltage in the two halves of a uniformly distributed winding. Thus, there tends to be no voltage apparently induced in the total winding.

B.5.6.2 Mechanical tolerances

Outside diameter OD (mm)	Allowable tolerances (mm)		
	Outside diameter OD	Inside diameter ID	Strip width H
35÷50	± 1.0	± 0.5	+ 0.6
50-80	± 1.25	± 0.75	+ 0.8
80-100	± 1.5	± 1.0	+ 1.0
100-160	± 2.0	± 1.3	+ 1.5
160-200	± 2.5	± 1.5	+ 1.5
200-340	± 3.0	± 2.0	+ 2.0

Note: The tolerances are given for uncut toroids. For cores with E≤10mm
the diameter tolerances rise by +0.3mm.
The shape of toroids after cutting is ovalized.

B.5.7 Pulse cores

B.5.7.1 General

Typical pulse permeability using DC-reset and a flux change of ΔB=2.2 Tesla for 0.05mm material, and ΔB=2.8 Tesla for 0.10mm material is shown in D.11. These curves can also be used for pulse cores having an air-gap reset. In this case the pulse permeability is 60% of the value shown for a flux change ΔB=1.0 Tesla for 0.05mm and ΔB=1.5Tesla for 0.10mm material.

B.5.7.2 Pulse permeability

$$\mu_p = \frac{\Delta B \cdot L_m \cdot 10^4}{4 \cdot \pi \cdot N \cdot I_m}$$

where: μ_p = Pulse permeability,
ΔB = Induction change (Tesla),
L_m = Mean length of core (see B.5.1) (mm),
N = Number of turns,
I_m = Peak exciting current (Amperes).

B.5.7.3 Peak pulse voltage

$$U \cdot t = N \cdot A_{c\,min} \cdot \Delta B \cdot 10^{-6}$$

where: U = Peak pulse voltage (Volts),
t = Pulse length (seconds),
N = Number of primary turns,
$A_{c\,min}$ = Effective cross sectional area (see B.5.1) (mm^2),
ΔB = Induction change (Tesla),

B.5.8 Core assembly

Since the permeability of the air-gap is a unity -thousands of times smaller than that of the core material - the added reluctance of the air-gap is relatively large. EILOR`s manufacturing process minimizes the gap by lapping and cleaning the surfaces. In order to keep the exciting current at a minimum level it is advisable to follow the recommendations below:

- Care should be taken to keep the surfaces in good condition.
- Each core half has an identifying dot. Cores must be assembled with both dots on the same side to assure proper orientation.
- Clean the surface with suitable solvent or rub on a clean sheet of paper.
- While inserting the core halves into coil tube, care should be taken to insure that no foreign material-especially of the coil tube-is scraped into the gap.

Table Banding recommendations

Core Cross-Section, mm²	Core Strip Width, mm	Band Size, mm	Number. of Bands Required	Banding Force, kg
36-120	6-10	5 × 0.15	1	18
120-240	10-25	10 × 0.15	1	35
240-480	10-38	10 × 0.30	1	70
	38 or larger	10 × 0.15	2	35
480-970	13-29	10 × 0.30	1	70
	32 or larger	10 × 0.30	2	70
970-1930	19 or larger	19 × 0.60	1	280
1930-2740	19 or larger	19 × 0.90	1	410
2740-3870	51 or larger	19 × 0.60	2	280
3870-5800	83 or larger	19 × 0.60	3	280

Note: Other band sizes, numbers of bands and banding forces have also been found convenient.

C. CORE LISTING

C.1 C-Cores

TYPE		OVERALL DIMENSIONS (mm)		STRIP WIDTH (mm)		BUILD UP (mm)		WINDOW (mm)		RADIUS (mm)	LENGTH OF FLUX PATH (mm)	EFFECTIVE CORE CROSS SECTION (mm^2)		NOMINAL WEIGHT (gram)	
NFC	HWR	A	B	D	D	E	E	F	G	R	L_m	A_c		W_t	
93325	BS 5347	max	max	min	max	min	max	min	min	max	mean	0.30m	0.10mm	0.30r	0.10mm
D 06	3/4	21.0	29.4	6.4	6.9	6.4	7.2	6.4	14.3		63.2		37.7		18.2
F 08	4/5	25.8	35.7	7.9	8.5	7.9	8.7	7.9	17.5	1.0	77.7		57.4		34.1
H 10	5/6	30.6	43.7	9.5	10.3	9.5	10.3	9.5	22.2		95.4	85.	83.0	62.	60.6
J 10	7/6	32.1	50.0	9.5	10.3	9.5	10.3	11.1	28.6		111.2	85.	83.0	73.	70.7
Q 13	10/8			12.7	13.5							95.	92.3	93.	90.2
Q 19	10/12	30.6	56.4	19.0	19.8	7.9	8.7	12.7	38.1		127.7	142.	138.1	139	134.9
Q 25	10/16			25.4	26.2							190.	184.6	186	180.4
Q 38	10/24			38.1	38.9					1.5		285.	276.9	279	270.6
T 13	30/8			12.7	13.5							114.	111.0	144	140.2
T 19	30/12	36.9	73.0	19.0	19.8	9.5	10.3	15.9	50.8		165.2	171.	166.1	216	209.8
T 25	30/16			25.4	26.2							229.	222.0	289	280.5
T 32	30/20			31.7	32.5							286.	277.1	361	350.1
U 19	40/12			19.0	19.8							171.	166.1	238	230.8
U 25	40/16	40.1	79.4	25.4	26.2	9.5	10.3	19.0	57.2		181.7	229.	222.0	318	308.6
U 32	40/20			31.7	32.5							286.	277.1	397	385.1
U 38	40/24			38.1	38.9							343.	333.0	477	462.8
V 22	50/14			22.2	23.0							267.	259.4	431	418.0
V 29	50/18	49.6	92.1	28.6	29.4	12.7	13.5	22.2	63.5		210.6	345.	334.2	556	538.4
V 38	50/24			38.1	38.9							459.	445.2	740	717.3
V 51	50/32			50.8	51.6					3.0		612.	593.6	987	956.4
X 19	70/12			19.0	19.8							287.	277.9	567	550.0
X 29	70/18	62.3	111.1	28.6	29.4	15.9	16.7	28.6	76.2		258.7	432.	418.4	854	827.9
X 38	70/24			38.1	38.9							575.	557.3	1138	1102.9
X 51	70/32			50.8	51.6							767.	743.1	1518	1470.5
Z 25	90/16			25.4	26.2							458.	444.0	1076	1042.1
Z 38	90/24	75.0	130.2	38.1	38.9	19.0	19.8	34.9	88.9		306.8	687.	666.0	1614	1563.2
Z 51	90/32			50.8	51.6							916.	888.0	2152	2084.2
Z 70	90/44			69.8	71.4							1259	1220.1	2957	2863.7
AD 32	110/20	97.2	169.9	31.7	32.5	25.4	26.2	44.4	114.3		398.1	764	740.8	2329	2256.0
AD 51	110/32			50.8	51.6							1225	1187.1	3733	3615.3

CORE DESIGNATION	Bm=1.7T f=50Hz				CORE DESIGNATION	Bm=1.5T f=400Hz	Bm=1.0T f=400Hz	Bm=1.5T f=400Hz	Bm=1.0T f=400Hz
	TOTAL EXCITATION (VA)		TOTAL LOSSES (W)			TOTAL EXCITATION (VA)		TOTAL LOSSES (W)	
	GRADE A	GRADE AA	GRADE A	GRADE AA		GRADE H	GRADE HH	GRADE H	GRADE HH
30 D 06	0.42	0.23	0.035	0.032	10 D 06	3.09	0.52	0.40	0.18
30 F 08	0.73	0.40	0.069	0.062	10 F 08	4.90	0.85	0.75	0.34
30 H10	1.18	0.66	0.13	0.11	10 H 10	7.45	1.34	1.33	0.61
30 J 10	1.28	0.72	0.15	0.13	10 J 10	7.77	1.44	1.55	0.71
30 Q 13	1.55	0.88	0.19	0.17	10 Q 13	9.02	1.72	1.98	0.90
30 Q 19	2.31	1.31	0.28	0.25	10 Q 19	13.50	2.58	2.97	1.35
30 Q 25	3.09	1.75	0.37	0.34	10 Q 25	18.04	3.44	3.97	1.80
30 Q 38	4.64	2.63	0.56	0.50	10 Q 38	27.06	5.16	5.95	2.71
30 T 13	2.19	1.26	0.29	0.26	10 T 13	11.90	2.41	3.09	1.40
30 T 19	3.28	1.88	0.43	0.39	10 T 19	17.80	3.60	4.62	2.10
30 T 25	4.38	2.51	0.58	0.52	10 T 25	23.80	4.81	6.17	2.80
30 T 32	5.47	3.14	0.72	0.65	10 T 32	29.70	6.00	7.70	3.50
30 U 19	3.49	2.02	0.48	0.43	10 U 19	18.50	3.82	5.08	2.31
30 U 25	4.67	2.69	0.64	0.57	10 U 25	24.74	5.11	6.79	3.09
30 U 32	5.83	3.36	0.80	0.72	10 U 32	30.87	6.38	8.47	3.85
30 U 38	7.01	4.04	0.96	0.86	10 U 38	37.10	7.67	10.18	4.63
30 V 22	6.06	3.52	0.86	0.78	10 V 22	30.84	6.60	9.19	4.18
30 V 29	7.80	4.53	1.11	1.00	10 V 29	39.73	8.50	11.85	5.38
30 V 38	10.39	6.03	1.48	1.33	10 V 38	52.92	11.33	15.78	7.17
30 V 51	13.86	8.04	1.98	1.78	10 V 51	70.57	15.10	21.04	9.56
30 X 19	7.55	4.42	1.14	1.02	10 X 19	36.52	8.20	12.10	5.50
30 X 29	11.37	6.66	1.71	1.54	10 X 29	54.98	12.35	18.21	8.28
30 X 38	15.15	8.87	2.28	2.05	10 X 38	73.24	16.45	24.26	11.03
30 X 51	20.19	11.82	3.04	2.73	10 X 51	97.65	21.93	32.35	14.71
30 Z 25	13.77	8.11	2.15	1.94	10 Z 25	63.98	14.94	22.93	10.42
30 Z 38	20.65	12.17	3.23	2.91	10 Z 38	95.96	22.41	34.39	15.63
30 Z 51	27.54	16.22	4.30	3.87	10 Z 51	127.95	29.88	45.85	20.84
30 Z 70	37.84	22.29	5.91	5.32	10 Z 70	175.81	41.05	63.00	28.64
30AD32	28.36	16.85	4.66	4.19	10AD 32	124.75	30.79	49.63	22.56
30AD51	45.45	27.00	7.45	6.72	10AD 51	199.91	49.35	79.54	36.15

CORE DESIGNATION	Bm=1.7T f=50Hz TOTAL EXCITATION (VA)		Bm=1.7T f=50Hz TOTAL LOSSES (W)		CORE DESIGNATION	TOTAL EXCITATION (VA) Bm=1.5T f=400Hz	TOTAL EXCITATION (VA) Bm=1.0T f=400Hz	TOTAL LOSSES (W) Bm=1.5T f=400Hz	TOTAL LOSSES (W) Bm=1.0T f=400Hz
	GRADE A	GRADE AA	GRADE A	GRADE AA		GRADE H	GRADE HH	GRADE H	GRADE HH
30 AJ 32	43.76	26.16	7.45	6.70	10 AJ 32	184.58	47.62	79.36	36.07
30 AJ 51	69.75	41.69	11.87	10.69	10 AJ 51	294.18	75.89	126.47	57.49
30 AP 32	66.27	39.82	11.60	10.44	10 AP 32	269.99	72.30	123.60	56.18
30 AP 51	105.62	63.46	18.49	16.64	10 AP 51	430.30	115.23	196.98	89.54
30 AS 51	164.62	99.39	29.57	26.61	10 AS 51	649.18	180.21	315.01	143.19
30 AS 70	225.95	136.41	40.59	36.53	10 AS 70	891.03	247.35	432.37	196.53
30 AS 100	322.79	194.88	57.98	52.18	10 AS 100	1272.90	353.35	617.67	280.76
30 HB 32	136.64	82.55	24.63	22.16	10 HB 32	536.54	149.66	262.34	119.25
30 HB 51	217.77	131.56	39.25	35.32	10 HB 51	855.10	238.51	418.10	190.05
30 HF 38	193.19	117.17	35.55	32.00	10 HF 38	738.22	212.33	378.70	172.14
30 HG 38	357.02	216.85	66.19	59.57	10 HG 38	1350.82	392.93	705.07	320.49
30 HJ 51	255.47	155.26	47.50	42.75	10 HJ 51	962.80	281.32	506.02	230.01
30 HK 51	572.08	348.15	107.11	96.40	10 HK 51	2136.15	630.86	1141.02	518.65

CORE DESIGNATION	Bm=1.7T f=50Hz TOTAL EXCITATION (VA)		Bm=1.7T f=50Hz TOTAL LOSSES (W)		CORE DESIGNATION	TOTAL EXCITATION (VA) Bm=1.5T f=400Hz	TOTAL EXCITATION (VA) Bm=1.0T f=400Hz	TOTAL LOSSES (W) Bm=1.5T f=400Hz	TOTAL LOSSES (W) Bm=1.0T f=400Hz
	GRADE A	GRADE AA	GRADE A	GRADE AA		GRADE H	GRADE HH	GRADE H	GRADE HH
30 SM 30a	0.21	0.12	0.02	0.02	10 SM 30a	1.48	0.25	0.20	0.09
30 SM 30b	0.34	0.19	0.03	0.03	10 SM 30b	2.39	0.41	0.32	0.15
30 SM 42	1.00	0.56	0.11	0.10	10 SM 42	6.27	1.13	1.15	0.52
30 SM 55	2.33	1.32	0.28	0.25	10 SM 55	13.73	2.60	2.96	1.35
30 SM 65	3.94	2.25	0.50	0.45	10 SM 65	22.18	4.36	5.32	2.42
30 SM 74	6.01	3.45	0.80	0.72	10 SM 74	32.64	6.60	8.47	3.85
30 SM 85a	8.21	4.74	1.12	1.01	10 SM 85a	43.40	8.98	11.96	5.44
30 SM 85b	11.60	6.69	1.59	1.43	10 SM 85b	61.31	12.69	16.89	7.68
30 SM 102a	12.26	7.13	1.77	1.60	10 SM 102a	61.54	13.34	18.89	8.59
30 SM 102b	18.30	10.65	2.65	2.38	10 SM 102b	91.87	19.91	28.20	12.82

TYPE	OVERALL DIMENSIONS (mm)		STRIP WIDTH (mm)		BUILD UP (mm)		WINDOW (mm)		RADIUS (mm)	LENGTH OF FLUX PATH (mm)	EFFECTIVE CORE CROSS SECTION (mm^2)		NOMINAL WEIGHT (gram)	
DIN 41309	A	B	D	D	E	E	F	G	R	L_m	A_c		W_t	
SE RANGE	max	max	min	max	min	max	min	min	max	mean	0.30mm	0.10mm	0.30mm	0.10mm
SE 60	30.5	52.2	19.7	20.5	9.1	9.9	10.5	32.0	1.5	114.1	170.3	164.9	148.7	144.0
SE 66	33.5	57.2	21.7	22.5	10.1	10.9	11.5	35.0		125.3	208.2	201.6	199.5	193.2
SE 78	39.5	68.2	26.1	27.0	12.1	12.9	13.5	42.0		148.7	300.0	290.6	341.2	330.4
SE 84a	42.6	73.4	28.0	29.0	13.1	13.9	14.5	45.0		160.1	348.5	337.5	426.8	413.3
SE 84b			42.0	43.0							522.7	506.2	640.2	620.0
SE 92a	46.2	77.6	23.0	24.0	10.6	11.4	23.0	54.0		187.6	231.6	224.3	332.3	321.8
SE 92b			32.0	33.0							322.2	312.1	462.3	447.8
SE 106a	53.2	88.6	32.0	33.0	13.6	14.4	24.0	59.0	2.0	209.0	413.4	400.4	661.0	640.1
SE 106b			45.0	46.0							581.4	563.0	929.5	900.1
SE 130a	65.3	108.8	36.0	37.2	16.5	17.4	30.0	73.0		258.7	564.3	546.5	1116.8	1081.5
SE 130b			46.0	47.2							721.0	698.3	1427.0	1381.9
SE 150a			40.0	41.2							718.2	695.5	1629.2	1577.8
SE 150b	75.2	123.8	50.0	51.2	18.9	19.8	35.0	83.0		296.5	897.8	869.4	2036.5	1972.2
SE 150c			60.0	61.2							1077.3	1043.3	2443.8	2366.7
SE 170a			54.5	56.0							1092.5	1058.0	2896.9	2805.4
SE 170b	85.0	145.8	64.5	66.0	21.1	22.1	40.0	100.0		346.6	1292.9	1252.1	3428.5	3320.2
SE 170c			74.5	76.0							1493.4	1446.2	3960.0	3835.0
SE 195a			55.5	57.0							1381.4	1337.8	4532.1	4389.0
SE 195b	98.2	186.8	68.5	70.0	26.2	27.3	42.5	130.0	3.0	428.9	1705.0	1651.1	5593.6	5417.0
SE 195c			83.5	85.0							2078.3	2012.7	6818.5	6603.2
SE 231a			61.5	63.0							1799.5	1742.7	6867.0	6650.2
SE 231b	116.1	216.0	77.5	79.0	30.8	32.1	50.5	149.0		498.8	2267.7	2196.0	8653.5	8380.3
SE 231c			96.5	98.0							2823.6	2734.4	10780.0	10430.0

CORE DESIGNATION	Bm=1.7T f=50Hz TOTAL EXCITATION (VA)		Bm=1.7T f=50Hz TOTAL LOSSES (W)		CORE DESIGNATION	Bm=1.5T f=400Hz TOTAL EXCITATION (VA)	Bm=1.0T f=400Hz	Bm=1.5T f=400Hz TOTAL LOSSES (W)	Bm=1.0T f=400Hz
	GRADE A	GRADE AA	GRADE A	GRADE AA		GRADE H	GRADE HH	GRADE H	GRADE HH
30 SE 60	2.58	1.46	0.30	0.27	10 SE 60	15.56	2.90	3.17	1.44
30 SE 66	3.34	1.89	0.40	0.36	10 SE 66	19.58	3.71	4.25	1.93
30 SE 78	5.35	3.06	0.68	0.61	10 SE 78	29.93	5.91	7.27	3.30
30 SE 84a	6.52	3.74	0.85	0.77	10 SE 84a	35.74	7.17	9.09	4.13
30 SE 84b	9.78	5.61	1.28	1.15	10 SE 84b	53.61	10.76	13.64	6.20
30 SE 92a	4.82	2.79	0.66	0.60	10 SE 92a	25.33	5.27	7.08	3.22
30 SE 92b	6.71	3.88	0.92	0.83	10 SE 92b	35.24	7.34	9.85	4.48
30 SE 106a	9.29	5.39	1.32	1.19	10 SE 106a	47.43	10.13	14.08	6.40
30 SE 106b	13.07	7.59	1.86	1.67	10 SE 106b	66.70	14.25	19.80	9.00
30 SE 130a	14.85	8.69	2.23	2.01	10 SE 130a	71.82	16.13	23.79	10.82
30 SE 130b	18.98	11.11	2.85	2.57	10 SE 130b	91.77	20.61	30.40	13.82
30 SE 150a	21.00	12.35	3.26	2.93	10 SE 150a	98.33	22.78	34.71	15.78
30 SE 150b	26.25	15.44	4.07	3.67	10 SE 150b	122.91	28.48	43.39	19.72
30 SE 150c	31.50	18.53	4.89	4.40	10 SE 150c	147.50	34.18	52.07	23.67
30 SE 170a	36.17	21.39	5.79	5.21	10 SE 170a	163.62	39.24	61.72	28.05
30 SE 170b	42.80	25.32	6.86	6.17	10 SE 170b	193.65	46.44	73.04	33.20
30 SE 170c	49.44	29.24	7.92	7.13	10 SE 170c	223.67	53.64	84.37	38.35
30 SE 195a	54.50	32.45	9.06	8.16	10 SE 195a	236.31	59.21	96.56	43.89
30 SE 195b	67.27	40.05	11.19	10.07	10 SE 195b	291.66	73.08	119.17	54.17
30 SE 195c	82.00	48.82	13.64	12.27	10 SE 195c	355.53	89.08	145.27	66.03
30 SE 231a	80.72	48.25	13.73	12.36	10 SE 231a	340.66	87.82	146.30	66.50
30 SE 231b	101.73	60.80	17.31	15.58	10 SE 231b	429.29	110.67	184.37	83.80
30 SE 231c	126.66	75.71	21.55	19.40	10 SE 231c	534.53	137.81	229.57	104.35

TYPE	OVERALL DIMENSIONS (mm)		STRIP WIDTH (mm)		BUILD UP (mm)		WINDOW (mm)		RADIUS (mm)	LENGTH OF FLUX PATH (mm)	EFFECTIVE CORE CROSS SECTION (mm^2)		NOMINAL WEIGHT (gram)	
DIN 41309	A	B	D	D	E	E	F	G	R	L_m	A_c, min		W_t, min	
SU RANGE	max	max	min	max	min	max	min	min	max	mean	0.30	0.10m	0.30mm	0.10mm
SU 15a	15.0	28.7	5.0	5.4	4.4	4.9	5.0	18.5		60.4	20.9	20.2	9.7	9.4
SU 15b			8.0	8.4							33.4	32.4	15.5	15.0
SU 24a	24.0	42.7	8.0	8.5	7.3	7.9	8.0	26.5		91.8	55.5	56.7	39.0	37.7
SU 24b			13.0	13.5							90.2	87.3	63.3	61.33
SU 30a	30.0	52.7	9.5	10.1	9.1	9.9	10.0	32.5	1.5	114.1	[illegible]	79.5	71.7	69.4
SU 30b			15.5	16.1							[illegible]	129.8	117.0	113.3
SU 39a	39.1	67.9	12.5	13.4	12.1	12.9	13.0	41.5		147.8	[illegible]	139.2	162.5	157.4
SU 39b			19.5	20.4							[illegible]	217.1	253.5	245.5
SU 48a	48.0	82.9	15.5	16.5	14.9	15.8	16.0	50.5		181.2	[illegible]	212.5	304.2	294.6
SU 48b			24.5	25.5							[illegible]	335.9	480.8	465.6
SU 60a	60.1	103.6	19.5	20.6	18.9	19.8	20.0	63.0		226.2	[illegible]	339.1	606.0	586.8
SU 60b			29.5	30.6							[illegible]	513.0	916.7	887.7
SU 75a	75.0	128.6	25.0	26.1	23.7	24.7	25.0	78.0	2.0	281.9	[illegible]	545.1	1213.9	1175.6
SU 75b			40.0	41.1							[illegible]	872.2	1942.3	1889.0
SU 90a	90.0	155.8	29.5	30.9	28.5	29.6	30.0	95.0		340.2	798.7	773.5	2078.6	2012.9
SU 90b			49.5	50.9							1340.	1297.9	3487.8	3377.6
SU 102a	102.4	175.4	34.0	35.4	32.5	33.7	34.0	106.0		383.7	1049.	1016.6	3081.0	2983.7
SU 102b			55.0	56.4							1698.	1644.5	4984.0	4826.6
SU 114a	114.4	195.6	37.5	39.2	36.3	37.6	38.0	118.0		428.5	1293.	1252.3	4239.1	4105.3
SU 114b			61.5	63.2							2120.	2053.9	6952.2	6732.7
SU 132a	132.1	225.4	43.5	45.2	42.0	43.4	44.0	136.0		495.0	1735.	1680.8	6572.7	6365.1
SU 132b			69.5	71.2							2773.	2685.5	10500.0	10170.0
SU 150a	150.2	255.6	49.5	51.2	47.9	49.4	50.0	154.0	3.0	562.2	2252.	2181.4	9686.9	9381.0
SU 150b			74.5	76.2							3390.	3283.1	14580.0	14120.0
SU 168a	168.3	286.0	55.0	57.0	53.7	55.3	56.0	172.0		629.6	2805.	2717.2	13510.0	13090.0
SU 168b			89.0	91.0							4540.	4397.0	21870.0	21180.0
SU 180a			60.0	62.0							3300.	3196.1	17070.0	16530.0
SU 180b	181.3	307.2	75.0	77.0	57.9	59.7	60.0	184.0		676.0	4125.	3995.1	21330.0	20660.0
SU 180c			90.0	92.0							4950.	4794.1	25600.0	24790.0
SU 210a			69.5	71.7							4463.	4322.3	26880.0	26040.0
SU 210b	211.2	357.2	99.5	101.7	67.6	69.6	70.0	214.0		787.4	6389.	6188.1	38490.0	37270.0
SU 210c			129.5	131.7							8316.	8053.9	50090.0	48510.0

CORE DESIGNATION	Bm=1.7T f=50Hz				CORE DESIGNATION	Bm=1.5T f=400Hz	Bm=1.0T f=400Hz	Bm=1.5T f=400Hz	Bm=1.0T f=400Hz
	TOTAL EXCITATION (VA)		TOTAL LOSSES (W)			TOTAL EXCITATION (VA)		TOTAL LOSSES (W)	
	GRADE A	GRADE AA	GRADE A	GRADE AA		GRADE H	GRADE HH	GRADE H	GRADE HH
30 SU 15a	0.23	0.13	0.02	0.02	10 SU 15a	1.64	0.28	0.21	0.09
30 SU 15b	0.37	0.20	0.03	0.03	10 SU 15b	2.63	0.44	0.33	0.15
30 SU 24a	0.75	0.42	0.08	0.07	10 SU 24a	4.77	0.85	0.83	0.38
30 SU 24b	1.21	0.68	0.13	0.11	10 SU 24b	7.76	1.39	1.35	0.61
30 SU 30a	1.25	0.70	0.14	0.13	10 SU 30a	7.50	1.40	1.53	0.69
30 SU 30b	2.03	1.15	0.23	0.21	10 SU 30b	12.24	2.28	2.49	1.13
30 SU 39a	2.55	1.46	0.32	0.29	10 SU 39a	14.30	2.82	3.46	1.57
30 SU 39b	3.98	2.27	0.51	0.46	10 SU 39b	22.31	4.40	5.40	2.45
30 SU 48a	4.46	2.57	0.61	0.55	10 SU 48a	23.65	4.89	6.48	2.95
30 SU 48b	7.05	4.07	0.96	0.87	10 SU 48b	37.38	7.72	10.24	4.66
30 SU 60a	8.34	4.85	1.21	1.09	10 SU 60a	41.68	9.07	12.91	5.87
30 SU 60b	12.61	7.34	1.83	1.65	10 SU 60b	63.06	13.72	19.53	8.88
30 SU 75a	15.82	9.29	2.43	2.19	10 SU 75a	74.96	17.17	25.86	11.76
30 SU 75b	25.32	14.87	3.88	3.50	10 SU 75b	119.94	27.47	41.38	18.81
30 SU 90a	26.04	15.40	4.16	3.74	10 SU 90a	118.30	28.26	44.28	20.13
30 SU 90b	43.70	25.83	6.98	6.28	10 SU 90b	198.51	47.41	74.31	33.78
30 SU 102a	37.75	22.40	6.16	5.55	10 SU 102a	167.27	40.98	65.64	29.84
30 SU 102b	61.07	36.24	9.97	8.97	10 SU 102b	270.58	66.29	106.18	48.27
30 SU 114a	50.99	30.35	8.48	7.63	10 SU 114a	221.10	55.39	90.32	41.05
30 SU 114b	83.62	49.78	13.90	12.51	10 SU 114b	362.61	90.84	148.12	67.33
30 SU 132a	77.35	46.22	13.15	11.83	10 SU 132a	326.84	84.15	140.03	63.65
30 SU 132b	123.58	73.85	21.00	18.90	10 SU 132b	522.20	134.44	223.73	101.70
30 SU 150a	112.06	67.18	19.37	17.44	10 SU 150a	463.76	122.09	206.38	93.81
30 SU 150b	168.66	101.10	29.16	26.24	10 SU 150b	697.99	183.76	310.61	141.19
30 SU 168a	154.20	92.67	27.03	24.32	10 SU 168a	627.38	168.26	287.91	130.87
30 SU 168b	249.53	149.96	43.74	39.36	10 SU 168b	1015.22	272.27	465.90	211.77
30 SU 180a	193.21	116.28	34.13	30.72	10 SU 180a	778.28	211.02	363.62	165.28
30 SU 180b	241.51	145.36	42.67	38.40	10 SU 180b	972.85	263.78	454.52	206.60
30 SU 180c	289.82	174.43	51.20	46.08	10 SU 180c	1167.42	316.54	545.43	247.92
30 SU 210a	299.70	180.90	53.77	48.39	10 SU 210a	1183.74	328.02	572.78	260.36
30 SU 210b	429.07	258.98	76.98	69.28	10 SU 210b	1694.70	469.61	820.03	372.74
30 SU 210c	558.44	337.07	100.19	90.17	10 SU 210c	2205.67	611.20	1067.27	485.12

C.2 E-Cores

TYPE	OVERALL DIMENSIONS (mm)		STRIP WIDTH (mm)		BUILD UP (mm)		WINDOW (mm)		RADIUS (mm)	EFFECTIVE CORE CROSS SECTION (mm^2)		NOMINAL WEIGHT (gram)	
	A	B	D	D	E	E	F	G	R	Ac, min		Wt, min	
FA RANGE	max	max	min	max	min	max	min	min	max	0.30m	0.10mm	0.30mm	0.10mm
EA 8			7.9	8.7						60,0	58.1	77,7	75.3
EA 13	53.0	45.0	12.7	13.5	8.0	8.8	13.0	25.0		96,5	93.5	125,0	121.0
EA 16			15.9	16.7						120,8	117.0	156,4	151.5
EB 10			9.5	10.3						90,3	87.4	146,4	141.8
EB 13			12.7	13.5						120,7	116.8	195,7	189.6
EB 16	65.0	56.0	15.9	16.7	10.0	10.8	16.0	32.0		151,1	146.3	245,0	237.3
EB 19			19.0	19.8					1.6	180,5	174.8	292,8	283.6
EB 22			22.2	23.0						210,9	204.2	342,2	331.4
EC 13			12.7	13.5						153,2	148.4	300,2	290.7
EC 16	79.5	67.5	15.9	16.7	12.7	13.5	19.0	38.1		191,8	185.8	375,8	363.9
EC 19			19.0	19.8						229,2	222.0	449,0	434.9
EC 25			25.4	26.2						306,5	296.8	600,3	581.4
ED 25	92.0	79.6	25.4	26.2	15.6	16.6	20.6	44.4		376,4	364.5	853,1	826.2
EF 29	95.2	86.2	28.6	29.4	15.6	16.6	22.2	50.8		423,9	410.5	1044,2	1011.2
EH 32	111.1	99.0	31.7	32.5	18.8	19.8	25.4	57.2		566,2	548.3	1583,4	1533.4
EK 32	127.0	111.8	31.7	32.5	22.0	23.0	28.6	63.5		662,5	641.6	2093,4	2027.3
EM 32	148.4	130.8	31.7	32.5	25.1	26.1	34.9	76.2		755,9	732.0	2840,5	2750.8
EP 32	174.2	156.6	31.7	32.5	31.5	32.5	38.1	88.9		948,6	918.7	4166,5	4034.9
ER 38	206.0	175.9	38.1	38.9	37.8	39.0	44.4	95.3	3.2	1368,	1325.0	6804,9	6590.0
ET 41	222.2	195.3	41.3	42.1	41.0	42.2	47.6	108.0		1608,	1557.8	8827,4	8548.6
EV 48	254.7	221.5	47.6	48.4	47.4	48.9	54.0	120.7		2143,	2075.7	13340,0	12920.0
EX 54	286.8	241.3	54.0	55.6	53.7	55.2	60.3	127.0		2754,	2667.8	18760,0	18170.0
EZ 60	326.1	268.2	60.3	61.9	60.1	61.8	69.9	140.0		3442,	3334.1	26370,0	25540.0

CORE DESIGNATION	Bm=1.7T, f=50Hz		CORE DESIGNATION	Bm=1.5T, f=400Hz	
	TOTAL EXCITATION (VA)	TOTAL LOSSES (W)		TOTAL EXCITATION (VA)	TOTAL LOSSES (W)
30 EA 8	2.40	0.19	10 EA 8	8.83	1.99
30 EA 13	3.85	0.30	10 EA 13	14.20	3.19
30 EA 16	4.83	0.38	10 EA 16	17.78	4.00
30 EB 10	3.90	0.35	10 EB 10	14.26	3.74
30 EB 13	5.22	0.47	10 EB 13	19.06	5.00
30 EB 16	6.53	0.59	10 EB 16	23.86	6.27
30 EB 19	7.80	0.70	10 EB 19	28.51	7.49
30 EB 22	9.12	0.82	10 EB 22	33.32	8.75
30 EC 13	7.15	0.72	10 EC 13	25.95	7.67
30 EC 16	8.95	0.90	10 EC 16	32.48	9.61
30 EC 19	10.69	1.08	10 EC 19	38.82	11.48
30 EC 25	14.29	1.44	10 EC 25	51.89	15.35
30 ED 25	18.72	2.05	10 ED 25	67.70	21.81
30 EF 29	21.93	2.51	10 EF 29	79.12	26.70
30 EH 32	31.19	3.80	10 EH 32	112.27	40.48
30 EK 32	38.94	5.02	10 EK 32	139.85	53.52
30 EM 32	49.01	6.82	10 EM 32	175.64	72.62
30 EP 32	67.60	10.00	10 EP 32	242.07	106.52
30 ER 38	105.58	16.33	10 ER 38	377.97	173.98
30 ET 41	132.53	21.19	10 ET 41	474.52	225.68
30 EV 48	192.65	32.02	10 EV 48	690.17	341.13
30 EX 54	264.01	45.03	10 EX 54	946.42	479.72
30 EZ 60	359.64	63.29	10 EZ 60	1290.60	674.21

TYPE	OVERALL DIMENSIONS (mm)		STRIP WIDTH (mm)		BUILD UP (mm)		WINDOW (mm)		RADIUS (mm)	EFFECTIVE CORE CROSS SECTION (mm^2)		NOMINAL WEIGHT (gram)	
	A	B	D	D	E	E	F	G	R	Ac, min		Wt, min	
S3U RANGE	max	max	min	max	min	max	min	min	max	0.30mm	0.10mm	0.30mm	0.10mm
S3U 30a	50.9	53.7	9.5	10.1	9.1	9.9	10.0	32.5		82,1	80.0	116,2	113
S3U 30b			15.5	16.1						134,0	130.9	189,6	184
S3U 39a	66.0	68.9	12.5	13.4	12.1	12.9	13.0	41.5	1,5	143,7	139.1	262,8	253
S3U 39b			19.5	20.4						224,2	217.0	410,0	395
S3U 48a	80.8	83.9	15.6	16.6	14.9	15.8	16.0	50.5		220,8	213.7	494,4	476
S3U 48b			24.6	25.6						348,2	337.0	779,6	753
S3U 60a	100.9	104.6	19.5	20.6	18.9	19.8	20.0	63.0		350,1	338.9	977,3	917
S3U 60b			29.5	30.6						529,7	512.7	1478,5	1426
S3U 75a	125.7	129.7	25.0	26.1	23.7	24.7	25.0	78.0	2,0	562,9	544.9	1956,7	1765
S3U 75b			40.0	41.1						900,6	871.8	3130,7	2842
S3U 90a	150.6	156.8	29.5	30.9	28.5	29.6	30.0	95.0		798,7	773.1	3345,1	3230
S3U 90b			49.5	50.9						1340,2	1297.3	5613,0	5422
S3U 102a	171.1	176.4	34.0	35.4	32.5	33.7	34.0	106.0		1049,8	1016.2	4957,0	4792
S3U 102b			55.0	56.4						1698,1	1643.8	8018,7	7760
S3U 114a	191.0	196.2	37.5	39.2	36.3	37.6	38.0	118.0		1293,2	1251.8	6813,0	6586
S3U 114b			61.5	63.2						2120,8	2052.9	11170,0	10806
S3U 132a	220.5	226.4	43.5	45.2	42.0	43.4	44.0	136.0		1735,7	1680.2	10570,0	10224
S3U 132b			69.5	71.2						2773,0	2684.2	16890,0	16335
S3U 150a	249.6	255.6	49.5	51.2	47.9	49.4	50.0	154.0	3,0	2252,5	2180.4	15540,0	15064
S3U 150b			74.5	76.2						3390,1	3281.6	23390,0	22678
S3U 168a	279.6	286.0	55.0	57.0	53.7	55.3	56.0	172.0		2805,8	2716.0	21670,0	21030
S3U 168b			89.0	91.0						4540,3	4395.0	35070,0	34018
S3U 180a			60.0	62.0						3300,3	3194.4	27370,0	26559
S3U 180b	301.0	307.2	75.0	77.0	57.9	59.7	60.0	184.0		4125,4	3993.3	34210,0	33203
S3U 180c			90.0	92.0						4950,5	4792.1	41050,0	39838
S3U 210a			69.5	71.7						4463,3	4320.5	43130,0	41826
S3U 210b	350.8	357.2	99.5	101.7	67.6	69.6	70.0	214.0		6389,9	6185.4	61740,0	59888
S3U 210c			129.5	131.7						8316,5	8050.4	80360,0	77940

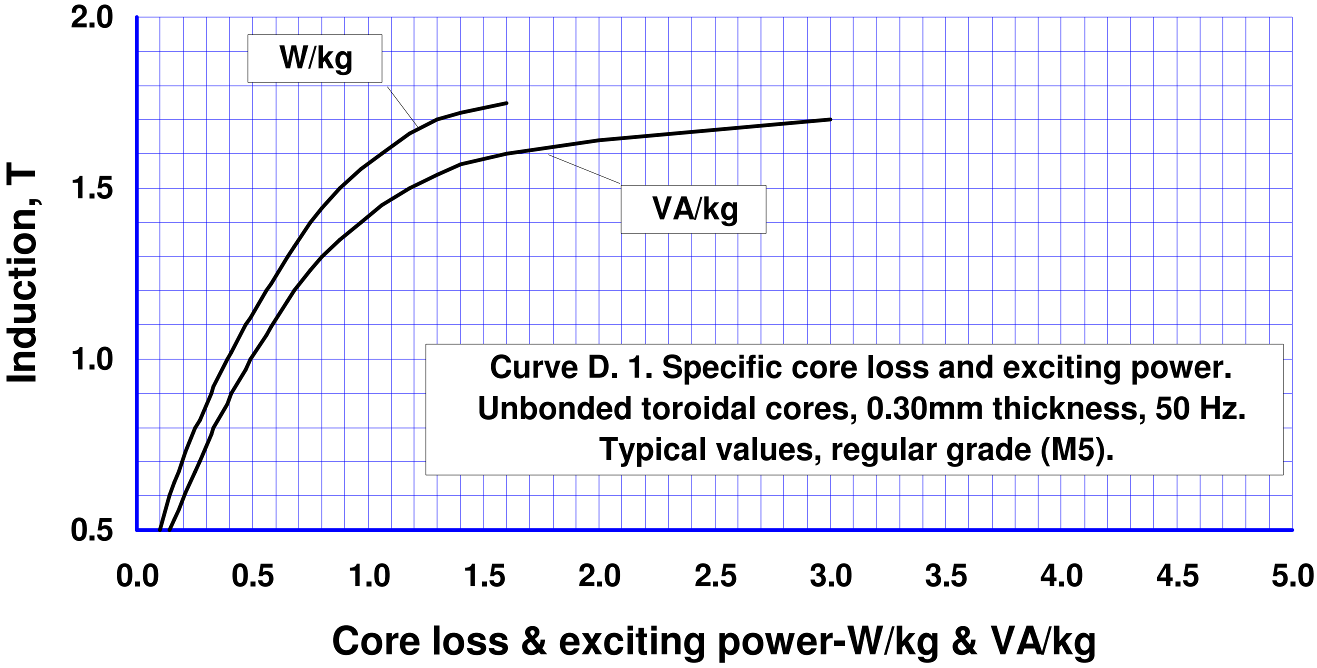
CORE DESIGNATION	Bm=1.7T, f=50Hz		CORE DESIGNATION	Bm=1.5T, f=400Hz	
	TOTAL EXCITATION (VA)	TOTAL LOSSES (W)		TOTAL EXCITATION (VA)	TOTAL LOSSES (W)
30 S3U 30a	3.38	0.28	10 S3U 30a	12.42	2.98
30 S3U 30b	5.51	0.46	10 S3U 30b	17.94	3.01
30 S3U 39a	6.51	0.63	10 S3U 39a	23.63	6.68
30 S3U 39b	10.16	0.98	10 S3U 39b	36.88	10.4
30 S3U 48a	10.92	1.19	10 S3U 48a	39.43	12.6
30 S3U 48b	17.22	1.87	10 S3U 48b	62.21	19.9
30 S3U 60a	19.27	2.35	10 S3U 60a	68.29	24.2
30 S3U 60b	29.15	3.55	10 S3U 60b	104.7	37.6
30 S3U 75a	34.89	4.70	10 S3U 75a	120.4	46.6
30 S3U 75b	55.82	7.51	10 S3U 75b	193.2	75.0
30 S3U 90a	55.27	8.03	10 S3U 90a	197.5	85.3
30 S3U 90b	92.74	13.47	10 S3U 90b	331.8	143
30 S3U 102a	78.33	11.90	10 S3U 102a	280.6	127
30 S3U 102b	126.70	19.24	10 S3U 102b	453.0	205
30 S3U 114a	103.66	16.35	10 S3U 114a	370.5	174
30 S3U 114b	170.01	26.82	10 S3U 114b	608.9	285
30 S3U 132a	153.60	25.36	10 S3U 132a	549.7	270
30 S3U 132b	245.40	40.52	10 S3U 132b	877.8	431
30 S3U 150a	217.87	37.29	10 S3U 150a	862.0	398
30 S3U 150b	327.91	56.13	10 S3U 150b	1177	599
30 S3U 168a	294.96	52.02	10 S3U 168a	1060	555
30 S3U 168b	477.29	84.17	10 S3U 168b	1715	898
30 S3U 180a	366.01	65.69	10 S3U 180a	1317	701
30 S3U 180b	457.51	82.11	10 S3U 180b	1647	877
30 S3U 180c	549.01	98.53	10 S3U 180c	1975	1052
30 S3U 210a	557.17	103.51	10 S3U 210a	2007	1104
30 S3U 210b	797.68	148.19	10 S3U 210b	2874	1581
30 S3U 210c	1038.19	192.87	10 S3U 210c	3740	2058

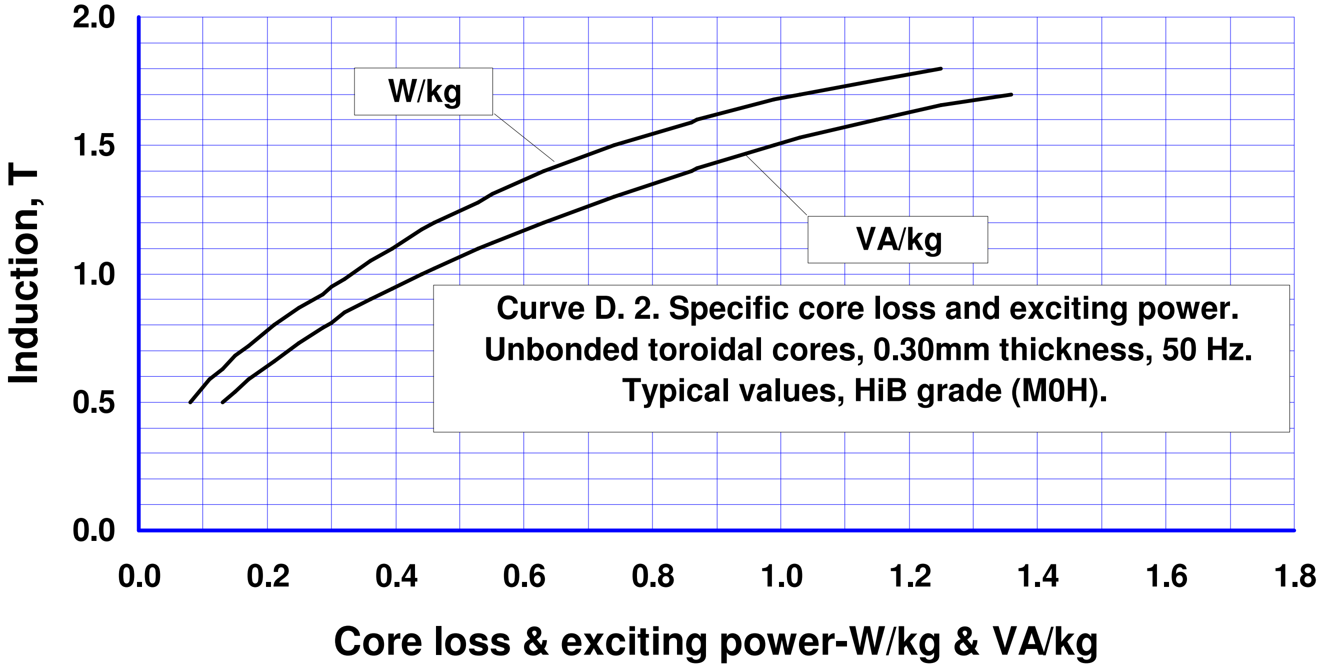
C.3 Toroids

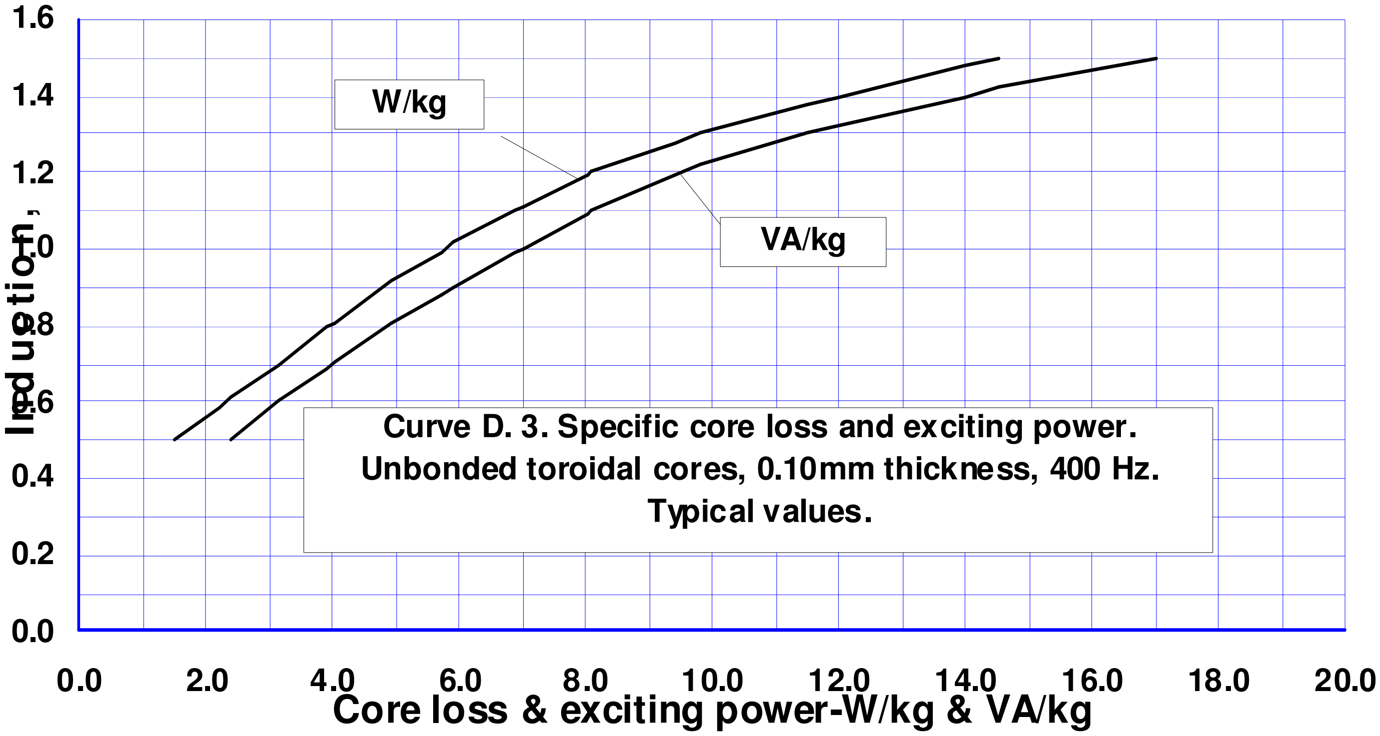
DIMENSIONS (mm)			LENGTH OF FLUX PATH L_m (mm)	EFFECTIVE CORE CROSS SECTION A_c, (mm^2)		NOMINAL WEIGHT W_t (gram)		WINDOW AREA (cm^2)
ID	OD	H	mean	0.30mm	0.10mm	0.30mm	0.10mm	A_w
30	50	13	126	123.5	119.6	119	115	7.1
30	50	16	126	152.0	147.2	146	141	7.1
30	50	20	126	190.0	184.0	183	177	7.1
40	50	16	141	76.0	73.6	82	80	12.6
40	50	20	141	95.0	92.0	103	99	12.6
40	50	25	141	118.8	115.0	128	124	12.6
40	50	30	141	142.5	138.0	154	149	12.6
40	60	16	157	152.0	147.2	183	177	12.6
40	60	20	157	190.0	184.0	228	221	12.6
40	60	25	157	237.5	230.0	285	276	12.6
40	60	30	157	285.0	276.0	342	332	12.6
40	70	20	173	285.0	276.0	377	365	12.6
40	70	25	173	356.3	345.0	471	456	12.6
40	70	30	173	427.5	414.0	565	547	12.6
40	70	35	173	498.8	483.0	659	638	12.6
40	70	38	173	541.5	524.4	715	693	12.6
40	75	30	181	498.8	483.0	689	667	12.6
40	75	35	181	581.9	563.5	804	778	12.6
40	75	38	181	631.8	611.8	873	845	12.6
40	85	30	196	641.3	621.0	963	932	12.6
40	75	45	181	748.1	724.5	1033	1001	12.6
40	85	35	196	748.1	724.5	1123	1088	12.6
40	85	38	196	812.3	786.6	1219	1181	12.6
40	85	45	196	961.9	931.5	1444	1399	12.6
45	75	30	188	427.5	414.0	616	597	15.9
45	75	35	188	498.8	483.0	719	696	15.9
45	75	38	188	541.5	524.4	780	756	15.9
45	75	45	188	641.3	621.0	924	895	15.9
45	95	30	220	712.5	690.0	1198	1160	15.9
45	95	35	220	831.3	805.0	1398	1354	15.9

DIMENSIONS (mm)			LENGTH OF FLUX PATH L_m (mm)	EFFECTIVE CORE CROSS SECTION A_c, (mm^2)		NOMINAL WEIGHT W_t (gram)		WINDOW AREA (cm^2)
ID	OD	H	mean	0.30mm	0.10mm	0.30mm	0.10mm	A_w
45	95	38	220	902.5	874.0	1517	1470	15.9
45	95	45	220	1068.8	1035.0	1797	1740	15.9
50	80	45	204	641.3	621.0	1001	970	19.6
50	80	30	204	427.5	414.0	668	646	19.6
50	80	35	204	498.8	483.0	779	754	19.6
50	80	38	204	541.5	524.4	845	819	19.6
50	80	51	204	726.8	703.8	1134	1099	19.6
55	95	30	236	570.0	552.0	1027	995	23.7
55	95	35	236	665.0	644.0	1198	1160	23.7
55	95	38	236	722.0	699.2	1300	1260	23.7
55	95	45	236	855.0	828.0	1540	1492	23.7
55	95	51	236	969.0	938.4	1745	1690	23.7
60	100	30	251	570.0	552.0	1095	1061	28.3
60	100	35	251	665.0	644.0	1277	1238	28.3
60	100	38	251	722.0	699.2	1387	1343	28.3
60	100	45	251	855.0	828.0	1643	1591	28.3
60	110	38	267	902.5	874.0	1842	1784	28.3
60	100	51	251	969.0	938.4	1862	1803	28.3
60	110	45	267	1068.8	1035.0	2182	2113	28.3
60	120	38	283	1083.0	1048.8	2341	2267	28.3
60	110	51	267	1211.3	1173.0	2473	2395	28.6
60	120	45	283	1282.5	1242.0	2773	2685	28.3
60	120	51	283	1453.5	1407.6	3142	3043	28.3
70	120	38	298	902.3	874.0	2059	1995	38.5
70	120	45	298	1068.8	1035.0	2439	2362	38.5
70	120	51	298	1211.3	1173.0	2764	2677	38.5

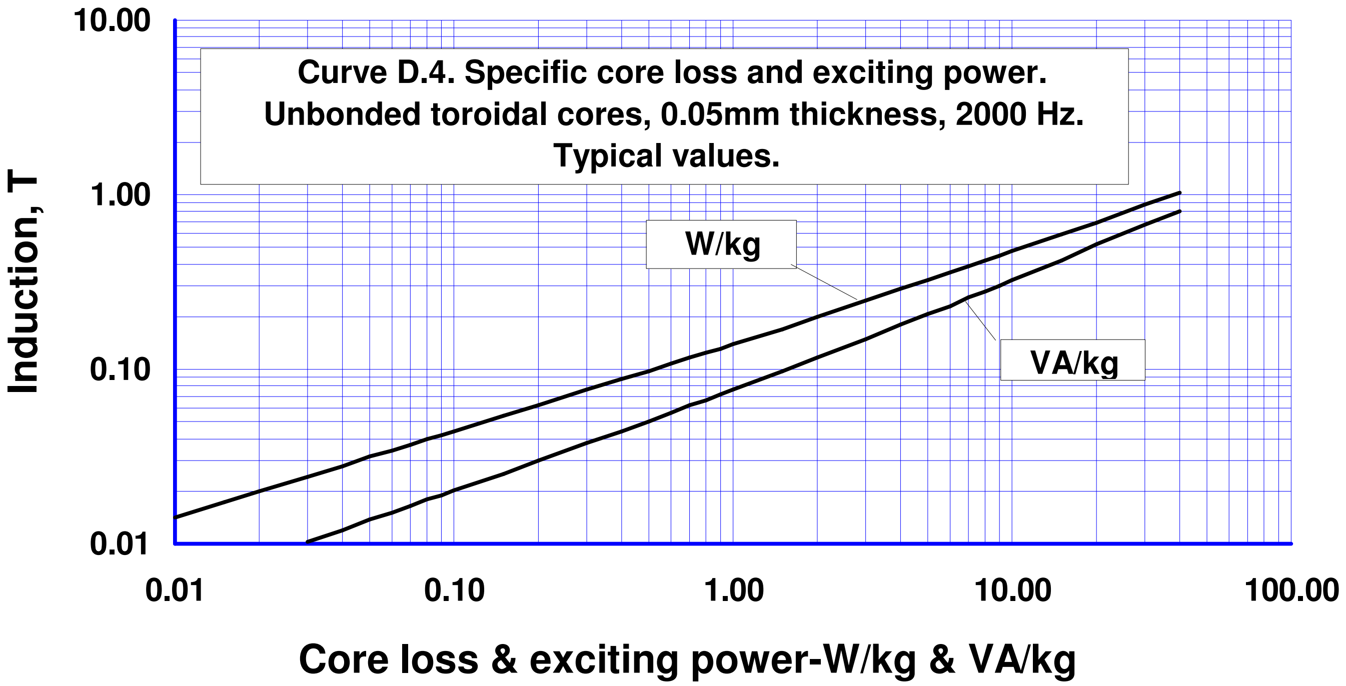
D.CURVES DATA



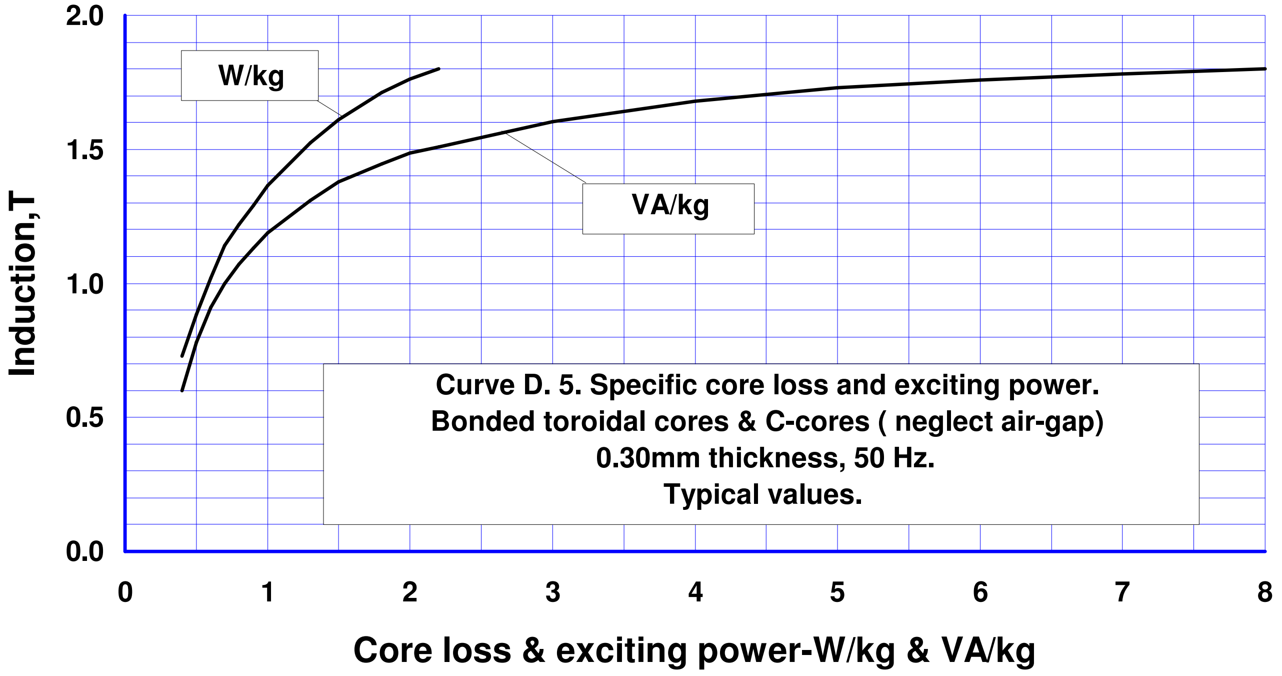




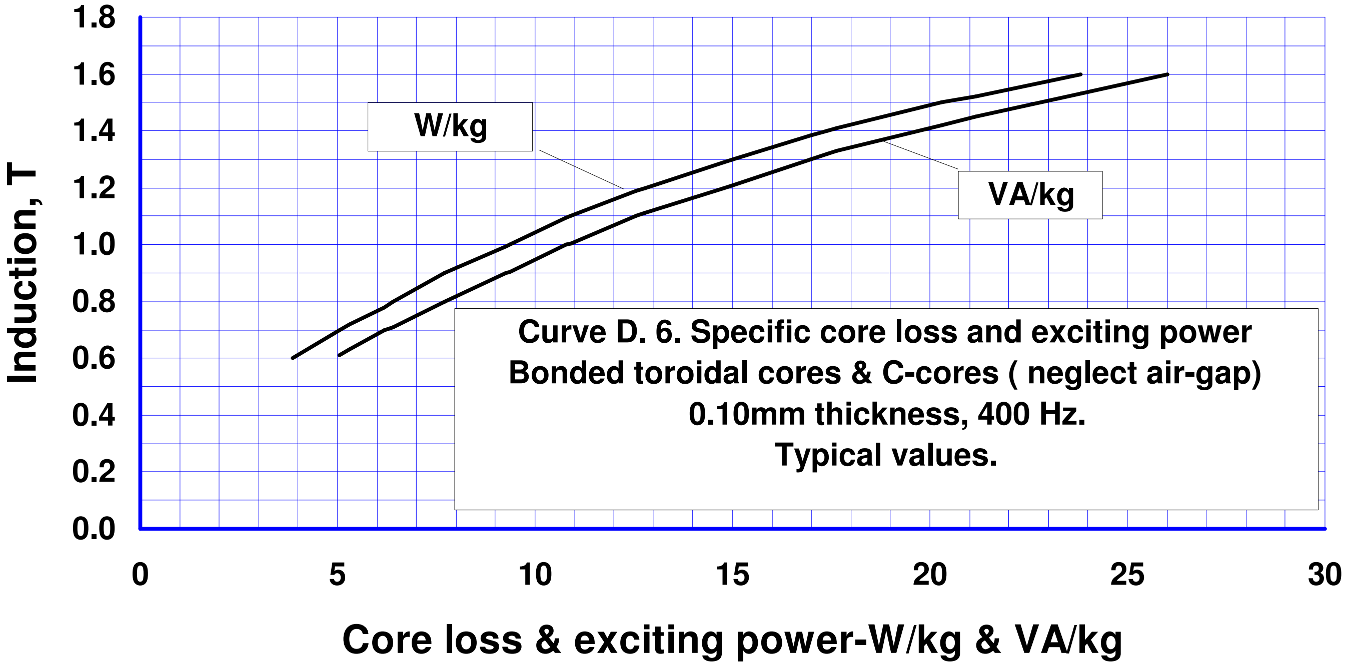
Curve D. 3. Specific core loss and exciting power. Unbonded toroidal cores, 0.10mm thickness, 400 Hz. Typical values.



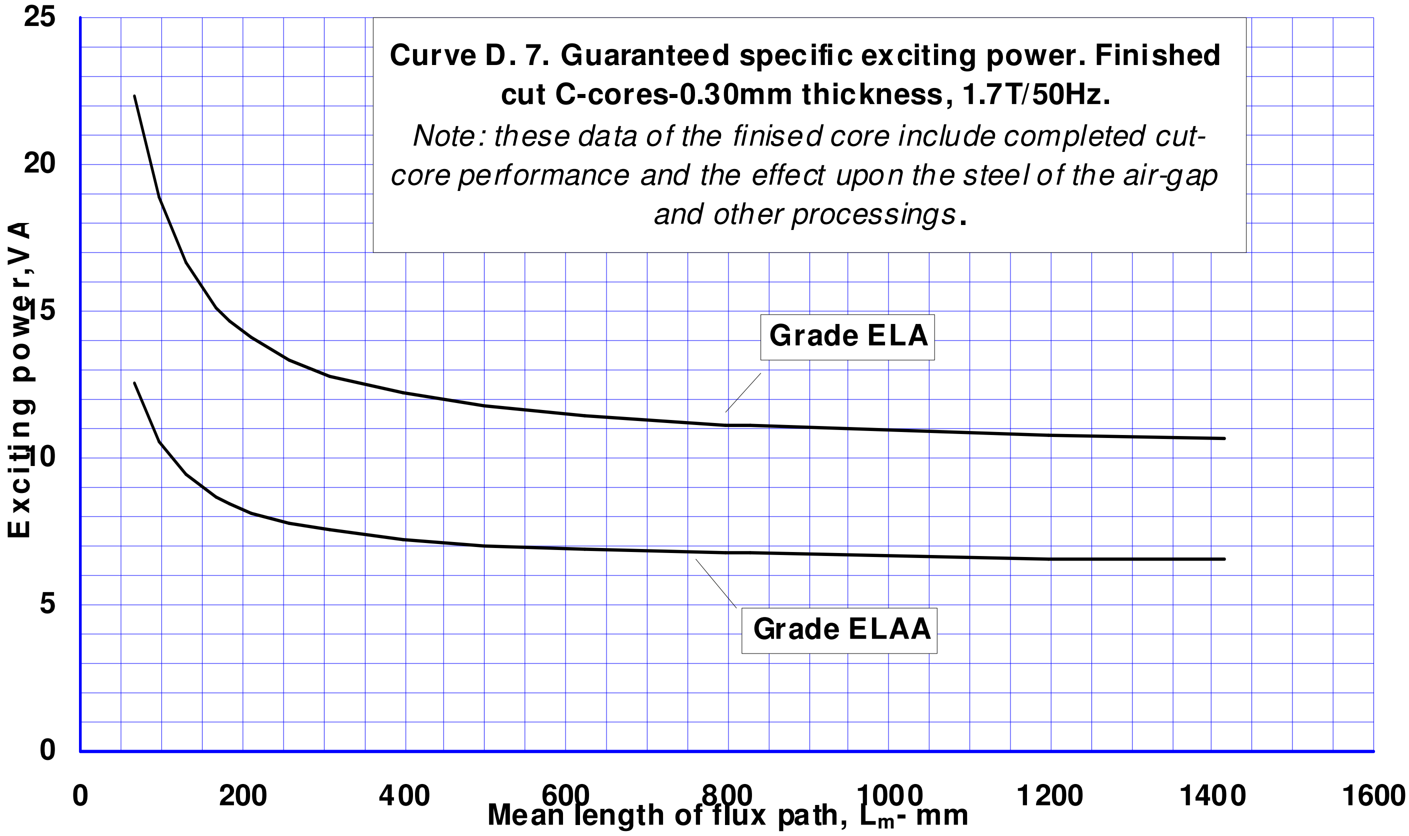
Curve D.4. Specific core loss and exciting power. Unbonded toroidal cores, 0.05mm thickness, 2000 Hz. Typical values.

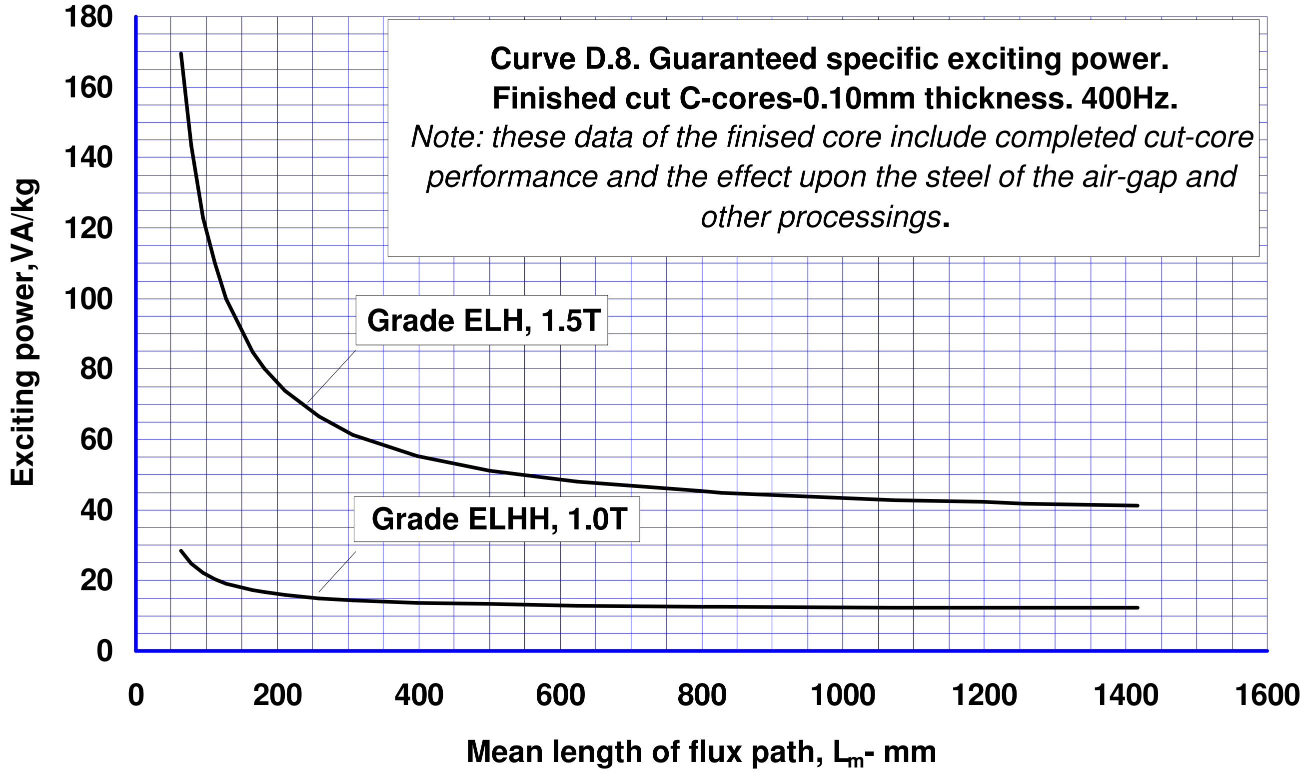


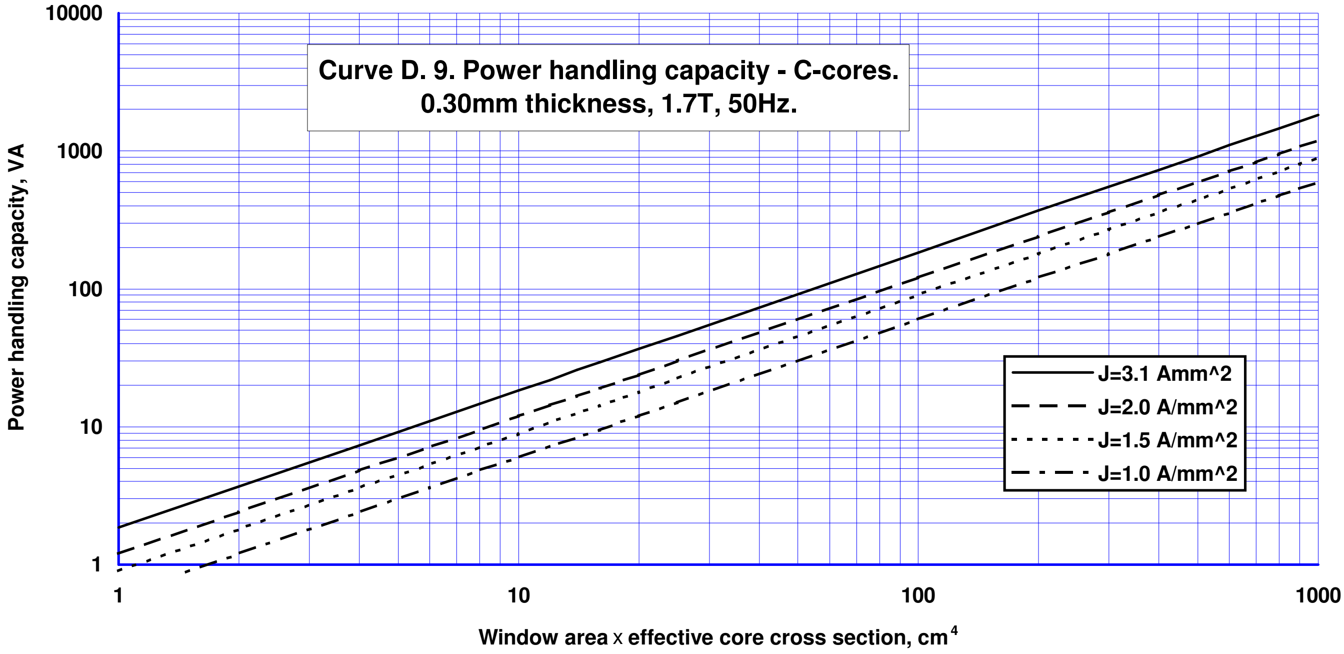
Curve D. 5. Specific core loss and exciting power.
Bonded toroidal cores & C-cores (neglect air-gap)
0.30mm thickness, 50 Hz.
Typical values.

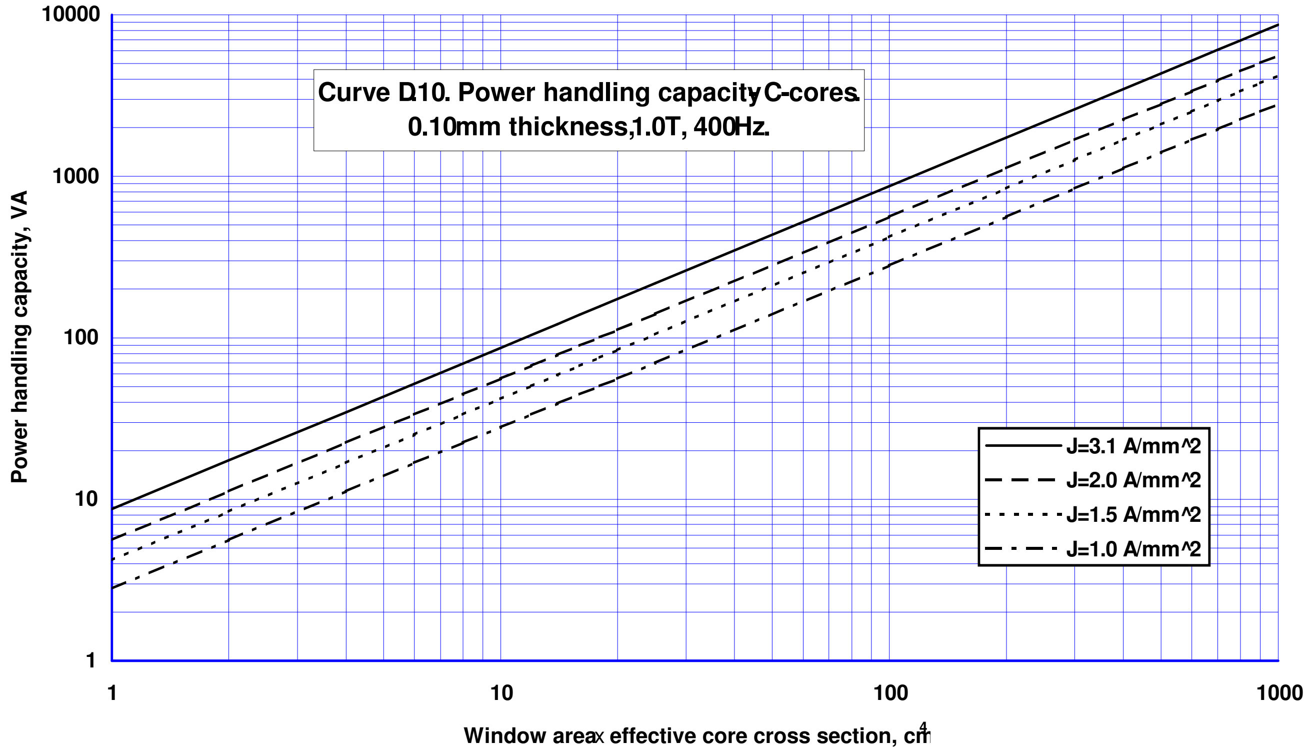


Curve D. 6. Specific core loss and exciting power
Bonded toroidal cores & C-cores (neglect air-gap)
0.10mm thickness, 400 Hz.
Typical values.


Curve D. 7. Guaranteed specific exciting power. Finished cut C-cores-0.30mm thickness, 1.7T/50Hz.
Note: these data of the finised core include completed cut-core performance and the effect upon the steel of the air-gap and other processings.
Grade ELA
Grade ELAA
Exciting power, VA
Mean length of flux path, Lm- mm
0
5
10
15
20
25
0
200
400
600
800
1000
1200
1400
1600


Curve D.8. Guaranteed specific exciting power. Finished cut C-cores-0.10mm thickness. 400Hz.
Note: these data of the finised core include completed cut-core performance and the effect upon the steel of the air-gap and other processings.
Grade ELH, 1.5T
Grade ELHH, 1.0T
Exciting power,VA/kg
Mean length of flux path, Lm- mm
0
20
40
60
80
100
120
140
160
180
0
200
400
600
800
1000
1200
1400
1600


Curve D. 9. Power handling capacity - C-cores.
0.30mm thickness, 1.7T, 50Hz.
Power handling capacity, VA
10000
1000
100
10
1
1
10
100
1000
Window area x effective core cross section, cm4
J=3.1 Amm^2
J=2.0 A/mm^2
J=1.5 A/mm^2
J=1.0 A/mm^2


Curve D.10. Power handling capacity C-cores.
0.10mm thickness, 1.0T, 400Hz.
Power handling capacity, VA
10000
1000
100
10
1
1
10
100
1000
Window area x effective core cross section, cm4
J=3.1 A/mm^2
J=2.0 A/mm^2
J=1.5 A/mm^2
J=1.0 A/mm^2