Chapter 3

Magnetic Cores

Table of Contents

1. Introduction
2. Core Type and Shell Type Construction
3. Types of Core Materials
4. Eddy Currents and Insulation
5. Laminations
6. Annealing and Stress-Relief
7. Stacking Laminations and Polarity
8. Flux Crowding
9. Exciting Current
10. Tape Wound C, EE, and Toroidal Cores
11. Tape Toroidal Cores
12. Toroidal, Powder Core
13. Dimensional Outline for EI Laminations
14. Dimensional Outline for UI Laminations
15. Dimensional Outline for LL Laminations
16. Dimensional Outline for DU Laminations
17. Dimensional Outline for Three Phase Laminations
18. Dimensional Outline for Tape Wound C, EE, and Toroidal Cores
19. Dimensional Outline for EE and EI, Ferrite Cores
20. Dimensional Outline for EE and EI Planar, Ferrite Cores
21. Dimensional Outline for EC, Ferrite Cores
22. Dimensional Outline for ETD, Ferrite Cores
23. Dimensional Outline for ETD/(low profile), Ferrite Cores
24. Dimensional Outline for ER, Ferrite Cores
25. Dimensional Outline for EFD, Ferrite Cores
26. Dimensional Outline for EPC, Ferrite Cores
27. Dimensional Outline for PC, Ferrite Cores
28. Dimensional Outline for EP, Ferrite Cores
29. Dimensional Outline for PQ, Ferrite Cores
30. Dimensional Outline for PQ/(low profile), Ferrite Cores
31. Dimensional Outline for RM, Ferrite Cores
32. Dimensional Outline for RM/(low profile), Ferrite Cores

33. **Dimensional Outline for DS, Ferrite Cores**
34. **Dimensional Outline for UUR, Ferrite Cores**
35. **Dimensional Outline for UUS, Ferrite Cores**
36. **Dimensional Outline for Toroidal, Ferrite Cores**
37. **Dimensional Outline for Toroidal, MPP Powder Cores**
38. **Dimensional Outline for Toroidal, Iron Powder Cores**

Introduction

The key ingredient in a magnetic device is the magnetic field (flux) created when current is passed through a coiled wire. The ability to control (channel, predict, conduct), the magnetic field (flux) is critical to controlling the operation of the magnetic device.

The ability of a material to conduct magnetic flux is defined as permeability. A vacuum is defined as having a permeability of 1.0 and the permeability of all other materials is measured against this baseline. Most materials, such as air, paper, and wood are poor conductors of magnetic flux, in that they have low permeability. If wire is wound on a dowel, it exhibits a magnetic field exactly, as shown in Figure 3-1. There are a few materials, such as iron, nickel, cobalt, and their alloys that have high permeabilities, sometimes ranging into the hundreds of thousands. These materials and their alloys are used as the base materials for all core materials.

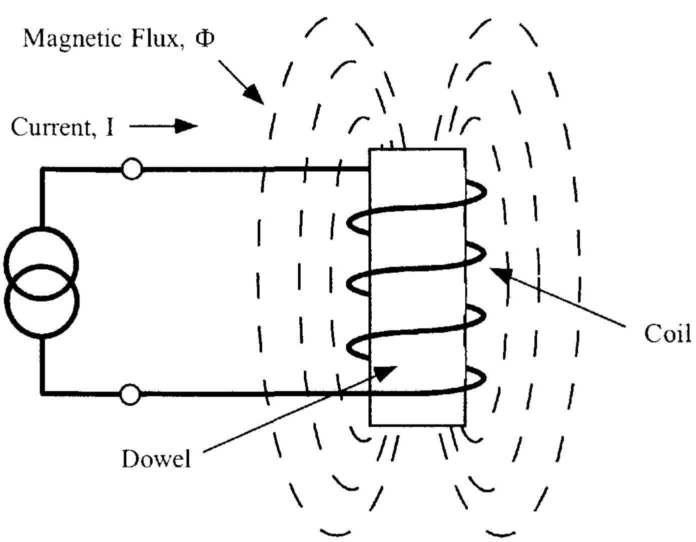


Figure 3-1. Air Core with an Intensified Magnetic Field.

The main purpose of the core is to contain the magnetic flux and create a well defined, predictable path for the flux. This flux path, and the mean distance covered by the flux within the magnetic material, is defined as the magnetic path length (MPL) (see Figure 3-2). The magnetic path length and permeability are vital keys in predicting the operation characteristic of a magnetic device. Selection of a core material and geometry are usually based on a compromise between conflicting requirements, such as size, weight, temperature rise, flux density, core loss, and operating frequency.

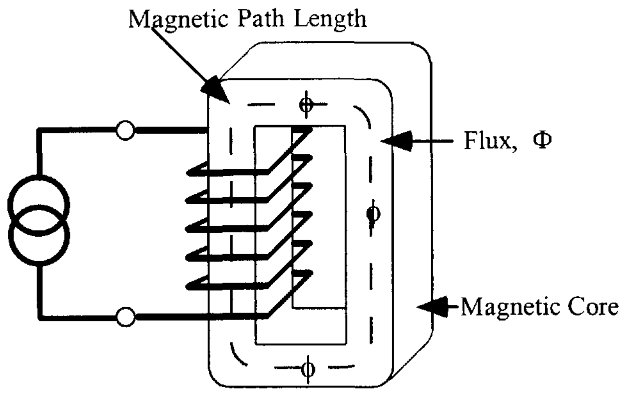


Figure 3-2. Magnetic Core Confines the Magnetic Field.

Core Type and Shell Type Construction

There are two types of construction for magnetic cores, core type and shell type. The shell type construction is shown in Figure 3-3 and the core type construction is shown in Figure 3-4. In the shell type of construction, shown in Figure 3-3, the core surrounds the coil. In the shell type of construction the magnetic fields are around the outside of the coil. The advantage of this configuration is that it requires only one coil. In the core type of construction, shown in Figure 3-4, the coils are outside of the core. A good example of this is a toroid, where the coil is wound on the outside of a core.

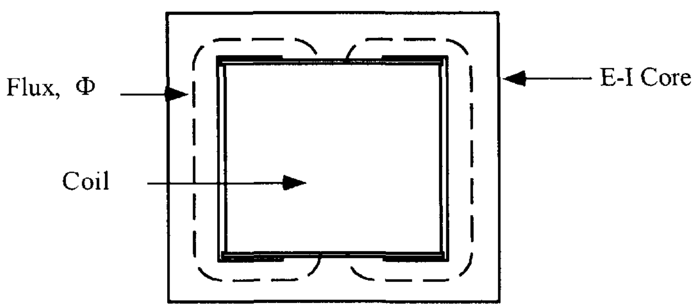


Figure 3-3. Shell Type Construction: the Core Surrounds the Coil.

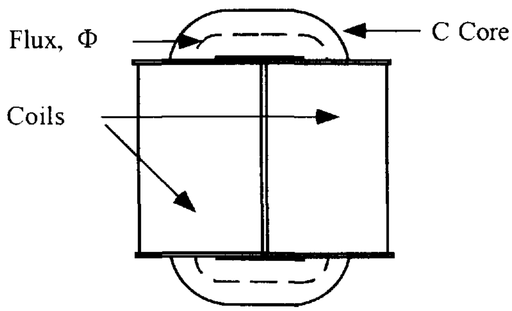


Figure 3-4. Core Type Construction the Coil Surrounds the Core.

Types of Core Materials

Magnetic cores are made of three basic materials. The first is the bulk metal, the second is the powdered materials, and the third is ferrite.

The bulk metals are processed from the furnace into ingots. Then, the material is put into a process of hot and cold rolling. The rolling process produces a sheet of material with a thickness ranging from 0.004 to 0.031 mils that can be punched into laminations. It can be further rolled to a thickness ranging from 0.002 to 0.000125 mils, then slit and wound into tape cores, such as C cores, E cores and toroids.

The powder cores, such as powder molypermalloy and powdered iron materials, are die-pressed into toroids, EE cores and slugs. Powder core processing starts at the ingot, then, goes through various steps of grinding until the powder is the right consistency for the required performance. Normally, powder cores are not machined after processing.

Ferrites are ceramic material of iron oxide, alloyed with oxides or carbonate of manganese, zinc, nickel, magnesium, or cobalt. Alloys are selected and mixed, based on the required permeability of the core.

Then, these mixtures are molded into the desired shape with pressure of approximately 150-200 tons per square inch and fired at temperatures above 2000 degrees F. After the parts are made, they are usually tumbled to remove burrs and sharp edges, which are characteristic of this process. Ferrites can be machined to almost any shape to meet the engineer's needs.

Eddy Currents and Insulation

Transformers operating at moderate frequency require the reduction of eddy current losses in the magnetic material. To reduce the eddy current losses to a reasonable value requires electrical steel to have adequate resistivity. Also, it needs to be rolled to a specific thickness, and it needs effective electrical insulation or coating of the magnetic material.

If an alternating voltage is applied to the primary winding, as shown in Figure 3-5, it will induce an alternating flux in the core. The alternating flux will, in turn, induce a voltage on the secondary winding. This alternating flux also induces a small alternating voltage in the core material. These voltages produce currents called eddy currents, which are proportional to the voltage. The magnitude of these eddy currents is also limited by the resistivity of the material. The alternating flux is proportional to the applied voltage. Doubling the applied voltage will double the eddy currents. This will raise the core loss by a factor of four. Eddy currents not only flow in the lamination itself, but could flow within the core as a unit, if the lamination is not properly stamped, and if the lamination is not adequately insulated, as shown in Figure 3-6.

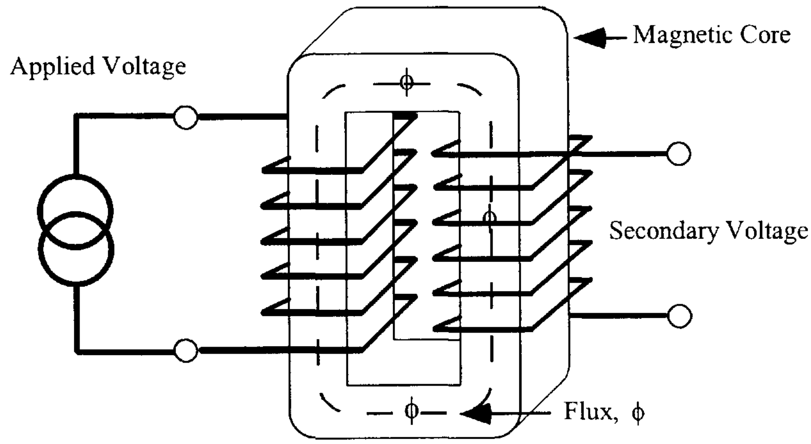


Figure 3-5. Applied Alternating Voltage Induces an Alternating Flux.

There are two eddy currents, as shown in Figure 3-6, I_a and I_b. The intralaminar eddy current, I_a, is governed by flux, per lamination and resistance of the lamination. It is, therefore, dependent on lamination width, thickness, and volume resistivity.

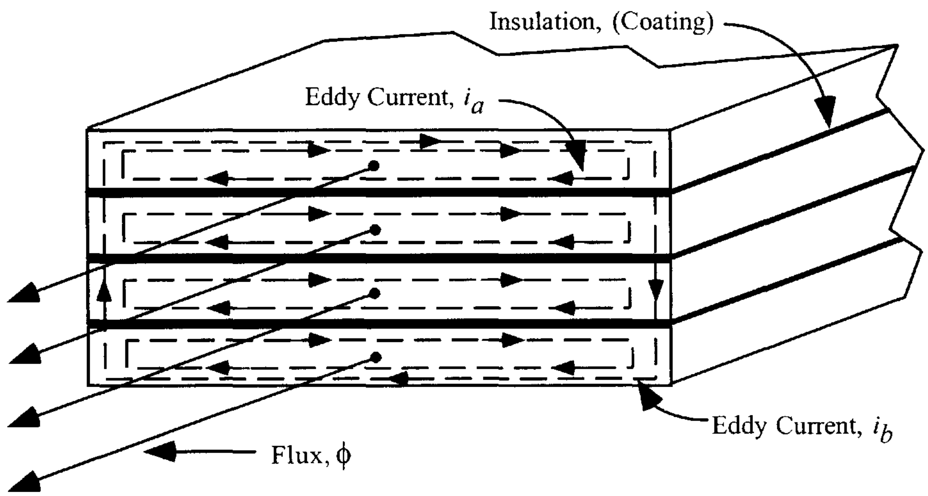


Figure 3-6. Using Insulation Between Laminations to Reduce Eddy Currents.

The interlaminar eddy current, I_b, is governed by total flux and resistance of the core stack. It is primarily dependent upon stack width and height, the number of laminations, and the surface insulation resistance, per lamination.

The magnetic materials used for tape cores and laminations are coated with an insulating material. The insulating coating is applied to reduce eddy currents. The American Iron and Steel Institute (AISI) have set up insulation standards for transformer steels used in different applications. High permeability nickel-iron cores are very strain sensitive. Manufacturers of these cores normally have their own proprietary, insulating material.

Laminations

Laminations are available in scores of different shapes and sizes. The punch press technology for fabricating laminations has been well developed. Most lamination sizes have been around forever. The most commonly used laminations are the EI, EE, FF, UI, LL, and the DU as shown in Figure 3-7. The laminations differ from each other by the location of the cut in the magnetic path length. This cut introduces an air gap, which results in the loss of permeability. To minimize the resulting air gap, the laminations are generally stacked in such a way the air gaps in each layer are staggered.

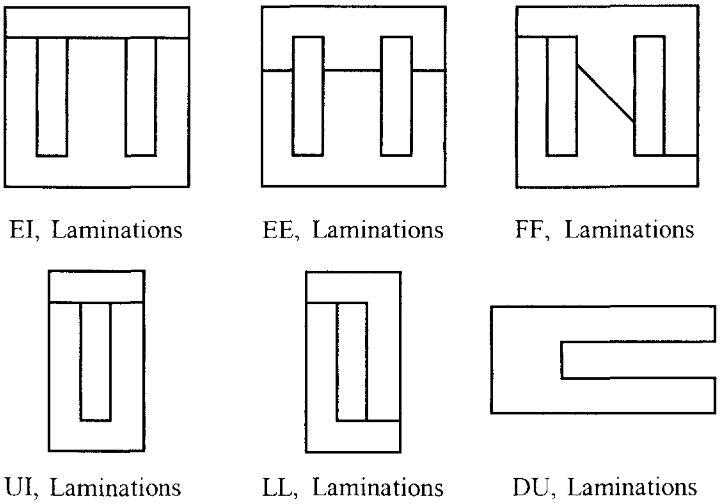


Figure 3-7. Commonly Used Lamination Shapes.

There are bobbins and brackets for almost all standard stacking dimensions. Most of the EI lamination is the scrapless. The name, scrapless, is derived from shapes that are punched with minimum waste, as shown in Figure 3-8.

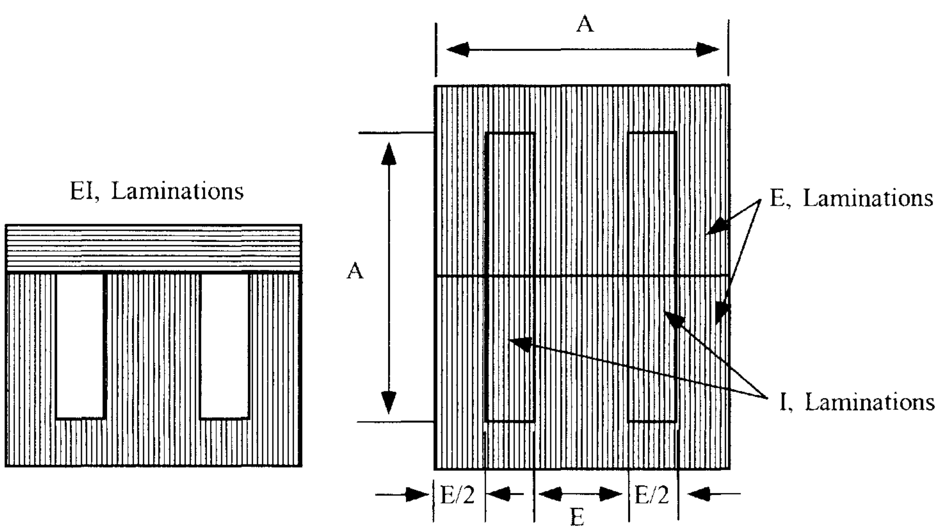


Figure 3-8. Typical, Scrapless EI Lamination.

Annealing and Stress-Relief

One of the most important parameters in transformer steels is permeability. Any stress or strain of the magnetic materials will have an impact on the permeability. The resulting stress could cause higher magnetizing current, or a lower inductance. When the transformer is being assembled (in the stacking process) and a lamination is bent, (does not return to its original shape), that lamination has been stressed and should be replaced.

Some of the important magnetic properties are due to stress and strain after stamping, shearing and slitting. These properties that have been lost or seriously reduced, can be restored to the magnetic materials by annealing. Basically, stress relief is accomplished by heating (annealing) the magnetic material to prescribed temperature, (depending on the material), followed by cooling to room temperature. The entire annealing process is a delicate operation. The annealing must be done under controlled conditions of time, temperature and the ambient atmosphere that will avoid, even minute, adverse changes in the chemistry of the steel.

Stacking Laminations and Polarity

The edges of the magnetic material that have been stamped, sheared, or slit, will have a burr, as shown in Figure 3-9. The quality of the equipment will keep the burr to a minimum. This burr now gives the lamination a polarity. When a transformer is being stacked, the lamination build is normally sized by dimensions, or it just fills the bobbin.

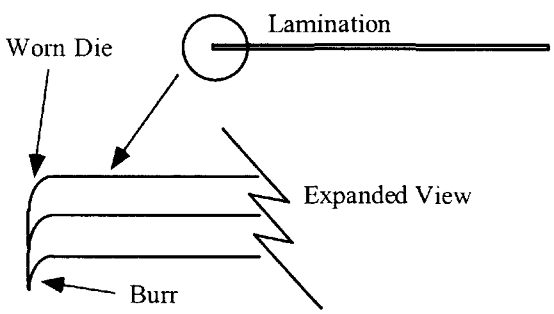


Figure 3-9. Expanded View, Showing Lamination Burr.

If the laminations are stacked correctly, all of the burred ends will be aligned. If the laminations are stacked randomly, such as the burr ends facing each other, then, the stacking factor would be affected. The stacking factor has a direct impact on the cross-section of the core. The end result would be less iron. This could lead to premature saturation, as increase in the magnetizing current, or a loss of inductance.

There are several methods used in stacking transformer laminations. The most common technique used in stacking laminations is the alternate method. The alternate method is where one set of laminations, such as an E and an I, are assembled. Then the laminations are reversed, as shown in Figure 3-10. This technique, used in stacking, provides the lowest air gap and the highest permeability. Another method for stacking laminations is to interleave two by two also shown in Figure 3-10. The second method of stacking would be in groups of two or more. This is done to cut assembly time. The loss in performance in stacking, other than one by one, is the increase in magnetizing current and a loss of permeability.

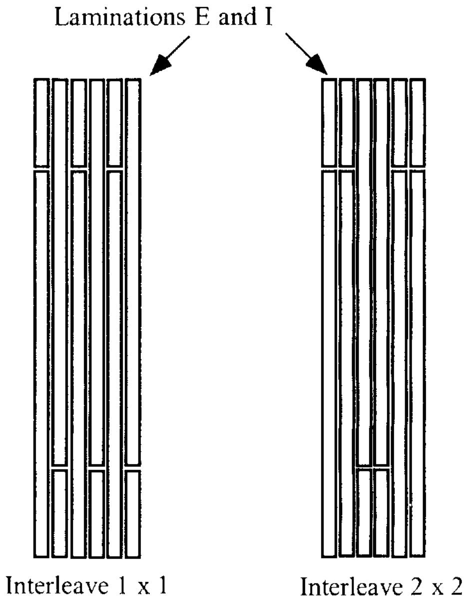


Figure 3-10. Methods for Stacking Laminations.

Flux Crowding

When laminations are stacked, as shown in Figure 3-11, there is flux crowding. This flux crowding is caused by the difference in spacing between the E, I, and the adjacent lamination. The adjacent lamination has a minimum air gap, which translates into a higher permeability.

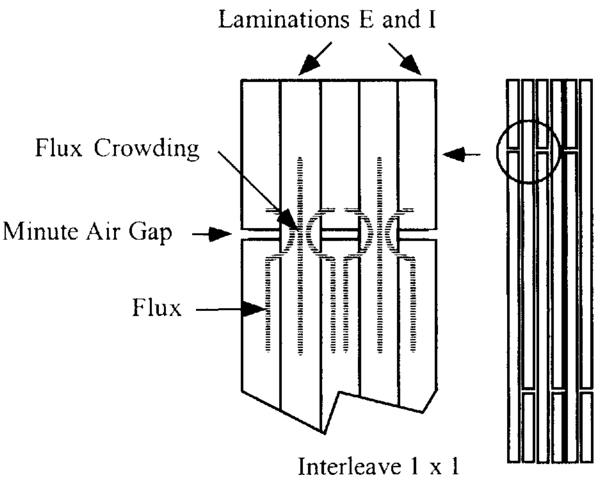


Figure 3-11. Flux Crowding when Lamination are Interleaved.

Exciting Current

The flux will skirt the low permeability, air gap and migrate into the adjacent lamination, causing flux crowding in that lamination. Eventually, this crowding will cause saturation in that portion of the lamination, and the excitation current will rise. After that portion of the lamination has saturated, the flux will migrate back to the lower permeability segment of the lamination from, where it left. This effect can be easily viewed by observing the B-H loops at low and high flux densities and comparing them with a toroidal core of the same material, with a minimum air gap, as shown in Figure 3-12. The B-H loop along with the magnetizing current I_m of a toroidal core, is shown in Figure 3-12A. The toroidal core, with its inherit minimum air gap, will have almost a square of current. Using the same material in lamination form will exhibit a B-H loop, and a magnetizing current, I_m, similar to Figure 3-12B operating at low flux densities. Increasing the excitation will cause premature saturation of the lamination, as seen by the non-linear, exciting current as shown in Figure 3-12C

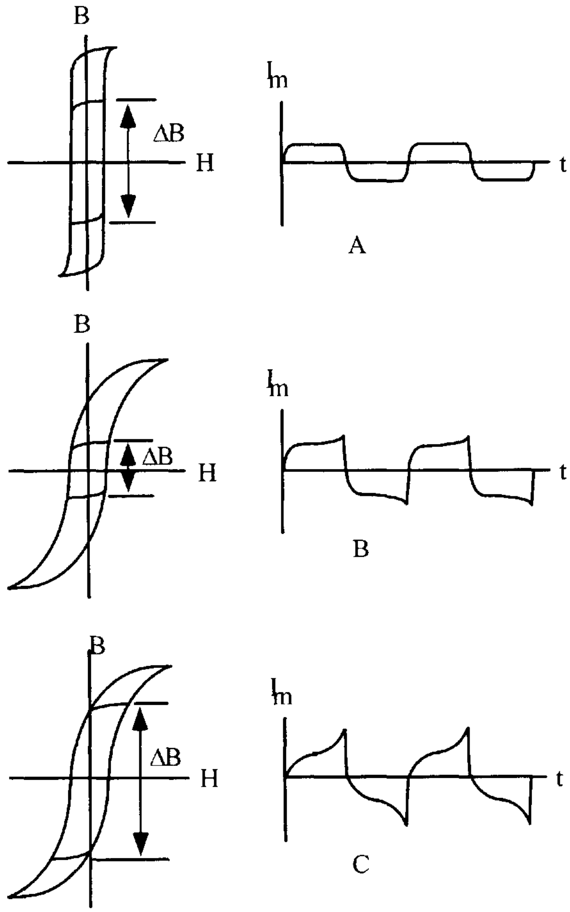


Figure 3-12. Comparing the Exciting Currents and Three B-H Loops.

Most finished transformers or inductors will have some sort of bracket, such as an L bracket, end bells, a channel bracket or maybe a bolt through the mounting holes to the chassis. When transformers are being assembled, there is a certain amount of attention that has to be used to get proper performance. The insulation material used to coat the lamination is normally very durable, but it can be scratched off and degrade the performance. When brackets are used in the transformer assembly, as shown in Figure 3-13 care must be taken on how the bolts and brackets are put together. The transformer assembly bolts, shown in Figure 3-13 should be the recommended size for the mounting hole and use all of the required hardware. This hardware should include the correct bolt size and length, and correct surface washer, lock washer and nut. Also, included in this hardware, should be fiber shoulder washers and proper sleeving to cover the bolt threads. If insulating hardware is not used, there is a good chance of a partial, shorted turn. The continuity for this partial turn can be created through the bolts and bracket, or the bolts, bracket, and the chassis. This partial shorted turn will downgrade the performance of the transformer.

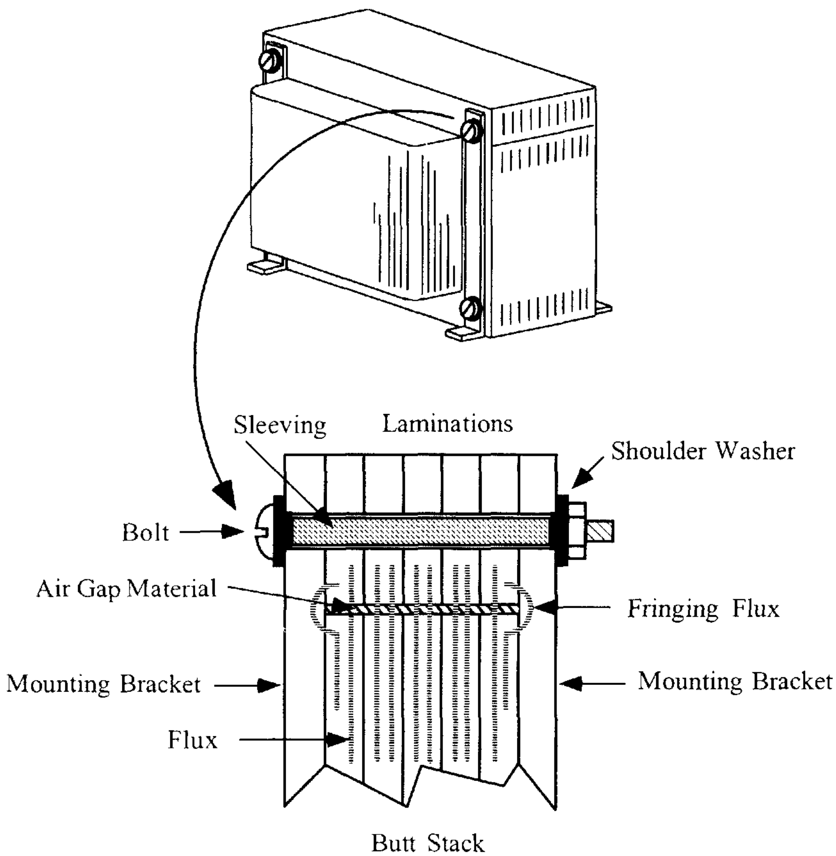


Figure 3-13. Lamination Mounting Hardware.

Tape Wound C, EE, and Toroidal Cores

Tape wound cores are constructed by winding around a mandrel, a magnetic material in the form of a preslit tape, as shown in Figure 3-14. This tape material comes in all of the iron alloys, plus the amorphous materials. The tape thickness varies from 0.0005 inch (0.0127 mm) to 0.012 inch (0.305 mm). The advantage of this type of construction is that the flux is parallel with the direction of rolling of the magnetic material. This provides the maximum utilization of flux with the minimum of magnetizing force. There are two disadvantages in this type of construction. When the core is cut in half, as shown in Figure 3-15, the mating surface has to be ground, lapped, and then, acid-etched. This is done to provide a smooth mating surface with the minimum of air gap and the maximum of permeability. The other disadvantage is when the cores are reassembled, the method used is normally done with a band and buckle, and this procedure requires a little skill to provide the right alignment and correct tension, as shown in Figure 3-16. The C cores are impregnated for strength, prior to being cut. The cut C core can be used in many configurations in the design of a magnetic component, as shown in Figure 3-17. The EE cores are constructed in the same way as C cores, but they have an additional overwind, as shown in Figure 3-18. The assembled, three phase transformer is shown in Figure 3-19.

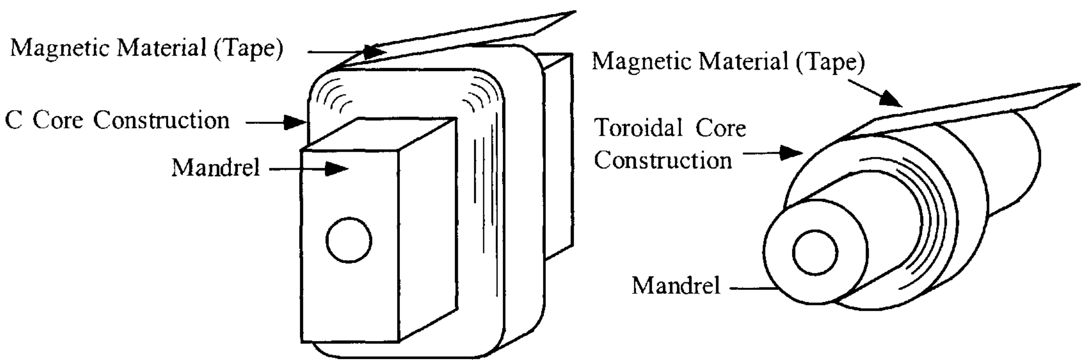


Figure 3-14. Tape Cores Being Wound on a Mandrel.

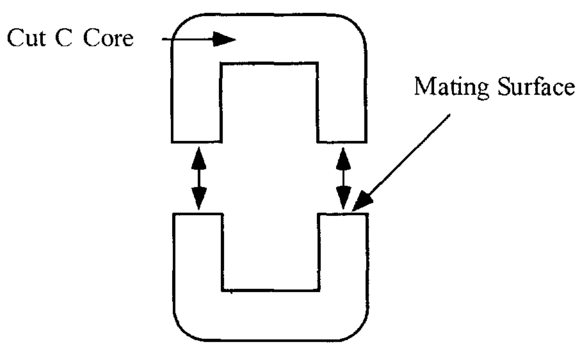


Figure 3-15. Two Halves of a Cut C Core.

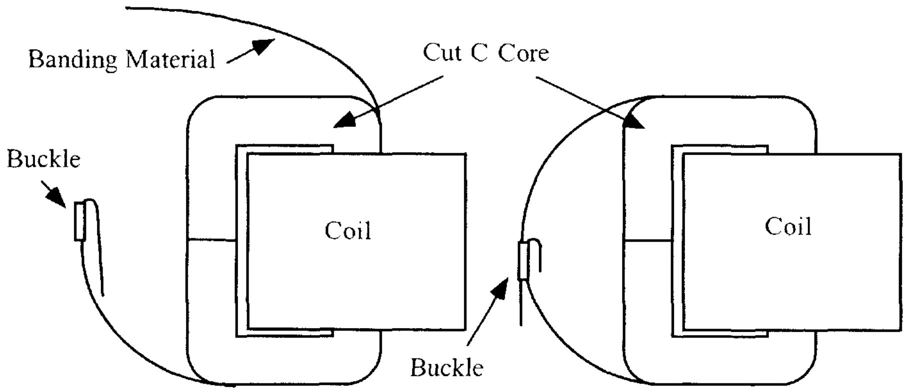


Figure 3-16. Banding the Cut C Core.

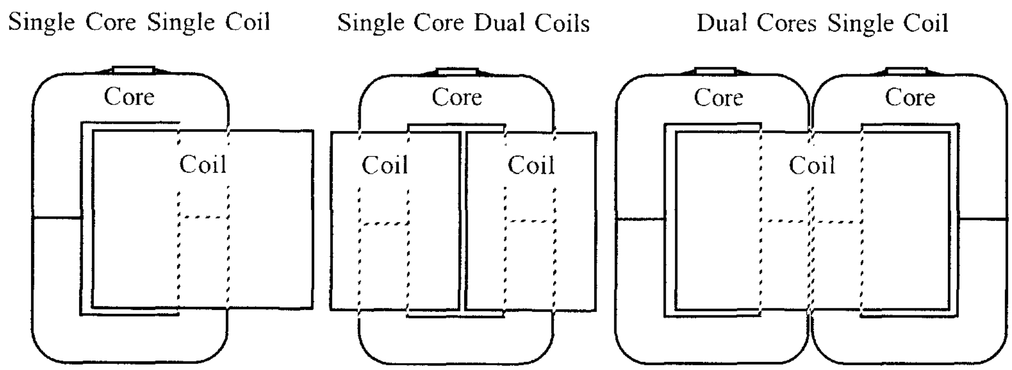


Figure 3-17. Three Different C Core Configurations.

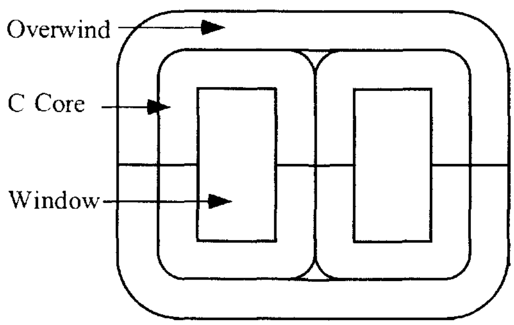


Figure 3-18. Three Phase Cut EE Core.

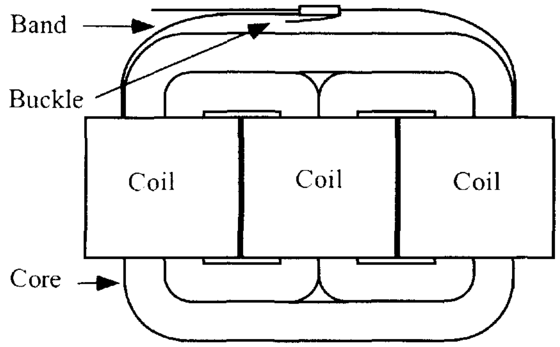


Figure 3-19. Typical, Assembled EE Cut Core.

Tape Toroidal Cores

Tape toroidal cores are constructed in the same way as tape C cores, by winding the magnetic material around a mandrel, in the form of a preslit tape. This tape material comes in all of the iron alloys, plus the amorphous materials. The tape thickness varies from 0.000125 inch (0.00318 mm) to 0.012 inch (0.305 mm). The tape toroid is normally offered in two configurations, cased and encapsulated as shown in Figure 3-20. The cased toroid offers superior electrical properties and stress protection against winding. The encapsulated cores are used when not all of the fine magnetic properties are important to the design, such as in power transformers.

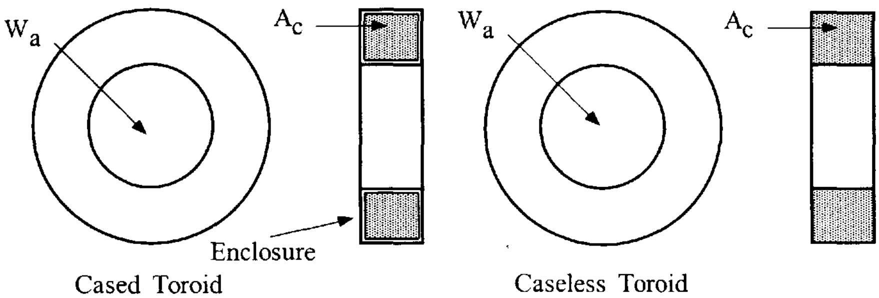


Figure 3-20. Outline of a Cased and a Caseless Toroidal Core.

Toroidal, Powder Core

Powder cores as shown in Figure 3-21 are very unique. They give the engineer another tool that speed the initial design. Powder cores have a built-in air gap. They come in a variety of materials and are very stable with time and temperature. The cores are manufactured with good engineering aids. Manufacturers provide catalogs for their cores that list, not only the size, but also permeability and Millihenrys per 1000 turns. The data is presented to the engineer in such a way that it takes the minimum amount of time to have a design that will function.

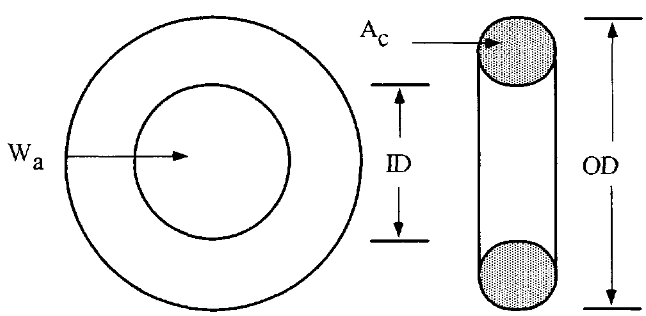


Figure 3-21. Outline of a Powder Toroidal Core.

Dimensional Outline for EI Laminations

Laminations are still one of the most widely-used cores in power conversion. The dimensional outline for EI laminations is shown in Figure 3-22. The assembled transformer is shown in Figure 3-23. A listing of common EI lamination sizes is shown in Table 3-1.

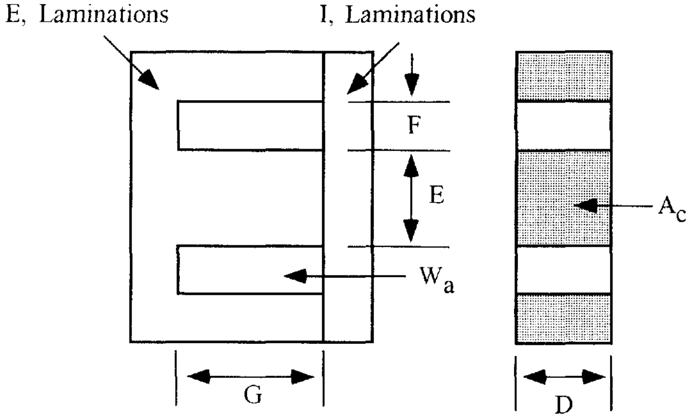


Figure 3-22. EI Lamination Outline.

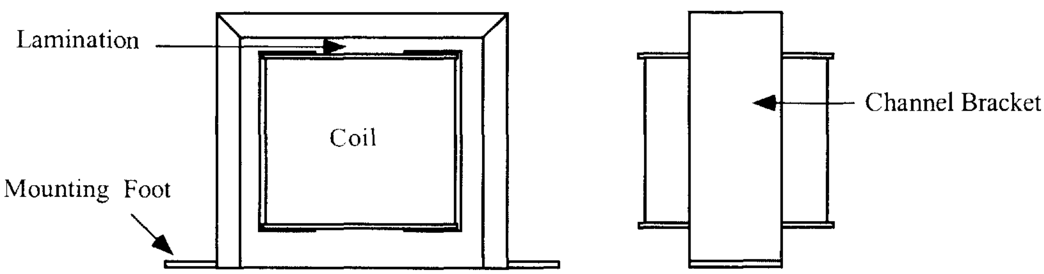


Figure 3-23. EI Lamination Assembled with Channel Bracket.

Table 3-1. Standard 14 mil EI Laminations.

EI, Laminations									
Part Number	D cm	E cm	F cm	G cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
EI-375	0.953	0.953	0.794	1.905	1.754	0.862	1.512	1.303	0.067
EI-021	1.270	1.270	0.794	2.064	1.075	1.523	1.638	2.510	0.188
EI-625	1.588	1.588	0.794	2.381	0.418	2.394	1.890	4.525	0.459
EI-750	1.905	1.905	0.953	2.857	0.790	3.448	2.723	9.384	1.153
EI-875	2.223	2.223	1.111	3.333	0.789	4.693	3.705	17.384	2.513
EI-100	2.540	2.540	1.270	3.810	0.790	6.129	4.839	29.656	4.927
EI-112	2.857	2.857	1.429	4.286	0.789	7.757	6.124	47.504	8.920
EI-125	3.175	3.175	1.588	4.763	0.789	9.577	7.560	72.404	15.162
EI-138	3.493	3.493	1.746	5.239	0.789	11.588	9.148	106.006	24.492
EI-150	3.810	3.810	1.905	5.715	0.789	13.790	10.887	150.136	37.579
EI-175	4.445	4.445	2.223	6.668	0.789	18.770	14.818	278.145	81.656
EI-225	5.715	5.715	2.858	8.573	0.789	31.028	24.496	760.064	288.936

Dimensional Outline for UI Laminations

The dimensional outline for UI laminations is shown in Figure 3-24. The assembled transformer is shown in Figure 3-25. A listing of common UI lamination sizes is shown in Table 3-2.

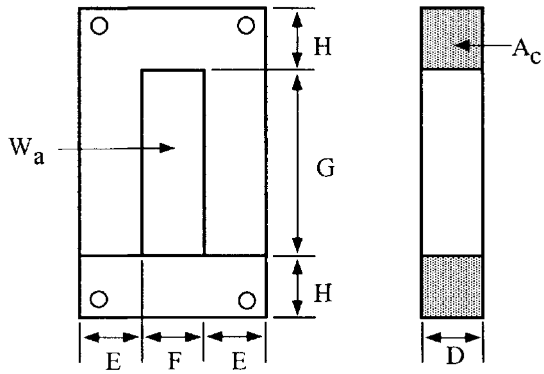


Figure 3-24. UI Lamination Outline.

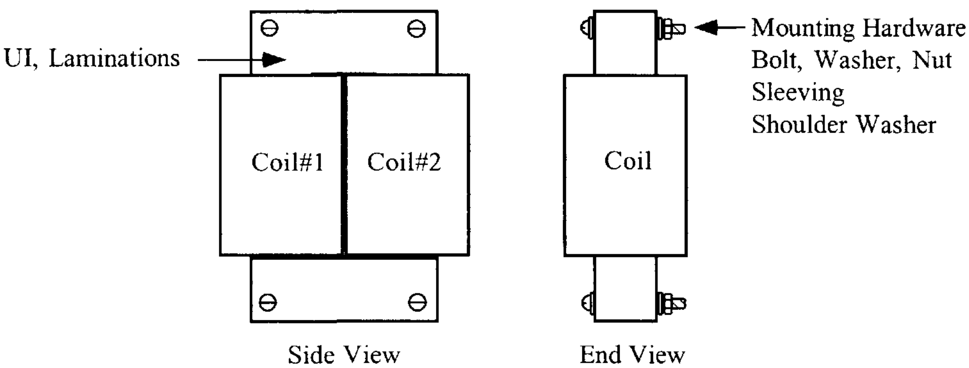


Figure 3-25. UI Lamination Assembled with Coils and Hardware.

Table 3-2. Standard 14 mil UI Laminations.

UI, Standard Laminations										
Part	D	E	F	G	H	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
50UI	1.270	1.270	1.270	3.810	1.270	3.159	1.532	4.839	7.414	0.592
60UI	1.429	1.429	2.223	5.398	1.429	6.187	1.939	11.996	23.263	1.839
75UI	1.905	1.905	1.905	5.715	1.905	3.157	3.448	10.887	37.534	4.614
100UI	2.540	2.540	2.540	7.620	2.540	3.158	6.129	19.355	118.626	19.709
125UI	3.175	3.175	3.175	9.525	3.175	3.158	9.577	30.242	289.614	60.647
150UI	3.810	3.810	3.810	11.430	3.810	3.158	13.790	43.548	600.544	150.318
180UI	4.572	4.572	4.572	11.430	4.572	2.632	19.858	52.258	1037.740	313.636
240UI	6.096	6.096	6.096	15.240	6.096	2.632	35.303	92.903	3279.770	1331.997

Dimensional Outline for LL Laminations

The dimensional outline for LL laminations is shown in Figure 3-26. The assembled transformer is shown in Figure 3-27. A listing of common lamination sizes is shown in Table 3-3.

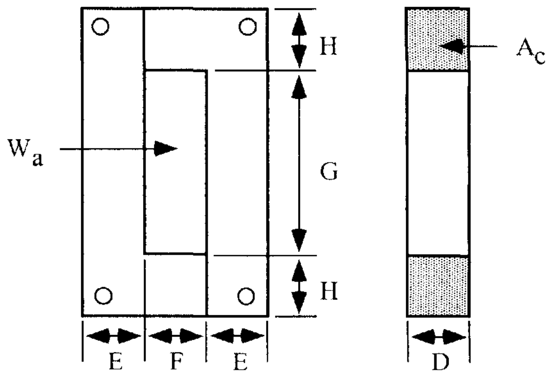


Figure 3-26. LL Lamination Outline.

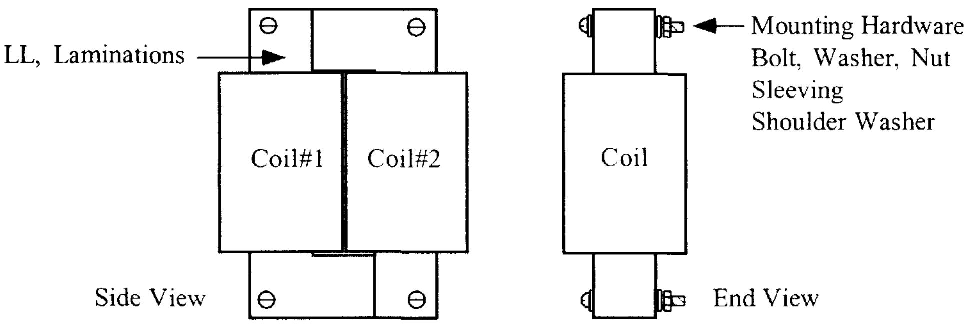


Figure 3-27. LL Lamination Assembled with Coils and Hardware.

Table 3-3. Standard 14 mil LL Laminations.

LL, Standard Laminations										
Part	D	E	F	G	H	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
141L	0.635	0.635	1.270	2.858	0.635	9.473	0.383	3.629	1.390	0.043
108L	1.031	1.031	0.874	3.334	1.111	2.884	1.010	2.913	2.943	0.201
250L	1.031	1.031	0.874	5.239	1.111	4.532	1.010	4.577	4.624	0.316
101L	1.111	1.111	1.588	2.858	1.111	3.867	1.173	4.536	5.322	0.340
7L	1.270	1.270	1.270	3.810	1.270	3.159	1.532	4.839	7.414	0.592
4L	1.270	1.270	1.905	3.810	1.270	4.737	1.532	7.258	11.121	0.785
104L	1.270	1.270	1.984	5.555	1.270	7.193	1.532	11.020	16.885	1.176
105L	1.270	1.270	1.905	6.826	1.270	8.488	1.532	13.004	19.925	1.407
102L	1.429	1.429	1.588	5.398	1.429	4.419	1.939	8.569	16.617	1.462
106L	1.429	1.429	2.223	5.398	1.429	6.187	1.939	11.996	23.263	1.839
107L	1.588	1.588	2.064	6.350	1.588	5.474	2.394	13.105	31.375	2.946

Dimensional Outline for DU Laminations

The dimensional outline for DU laminations is shown in Figure 3-28. The assembled transformer is shown in Figure 3-29. A listing of common DU laminations sizes is shown in Table 3-4.

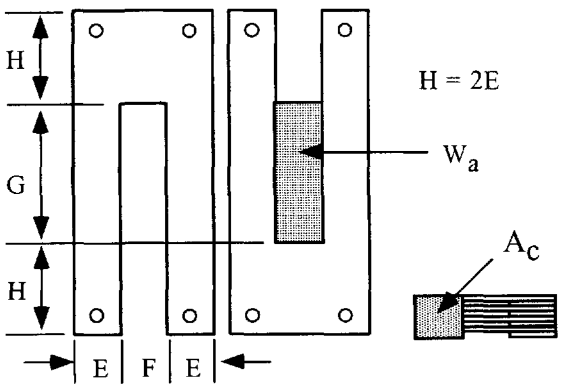


Figure 3-28. DU Lamination Outline.

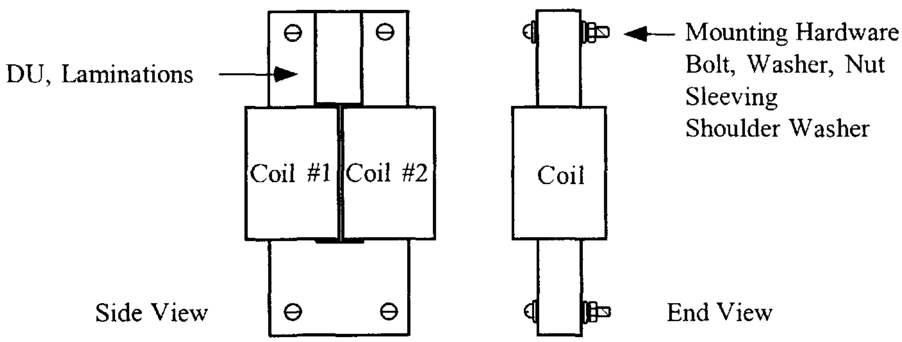


Figure 3-29. DU Lamination Assembled with Coils and Hardware.

Table 3-4. Standard 14 mil DU Laminations.

DU, Standard Laminations										
Part Number	D cm	E cm	F cm	G cm	H cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
DU-63	0.159	0.159	0.318	0.794	0.318	10.500	0.024	0.252	0.006	0.00003
DU-124	0.318	0.318	0.476	1.191	0.635	5.906	0.096	0.567	0.054	0.0009
DU-18	0.476	0.476	0.635	1.588	0.953	4.688	0.215	1.008	0.217	0.0057
DU-26	0.635	0.635	0.635	1.905	1.270	3.159	0.383	1.210	0.463	0.0180
DU-25	0.635	0.635	0.953	2.064	1.270	5.133	0.383	1.966	0.753	0.0260
DU-1	0.635	0.635	0.953	3.810	1.270	9.634	0.383	3.690	1.390	0.0479
DU-39	0.953	0.953	0.953	2.858	1.905	3.158	0.862	2.722	2.346	0.1416
DU-37	0.953	0.953	1.905	3.810	1.905	8.420	0.862	7.258	6.256	0.2992
DU-50	1.270	1.270	2.540	5.080	2.540	8.422	1.532	12.903	19.771	1.2524
DU-75	1.905	1.905	3.810	7.620	3.810	8.420	3.448	29.032	100.091	9.7136
DU-1125	2.858	2.858	5.715	11.430	5.715	8.421	7.757	65.322	506.709	74.8302
DU-125	3.175	3.175	3.175	9.525	3.175	3.158	9.577	30.242	289.614	60.6474

Dimensional Outline for Three Phase Laminations

The dimensional outline for three phase laminations is shown in Figure 3-30. The assembled transformer is shown in Figure 3-31. A listing of common three phase laminations sizes is shown in Table 3-5.

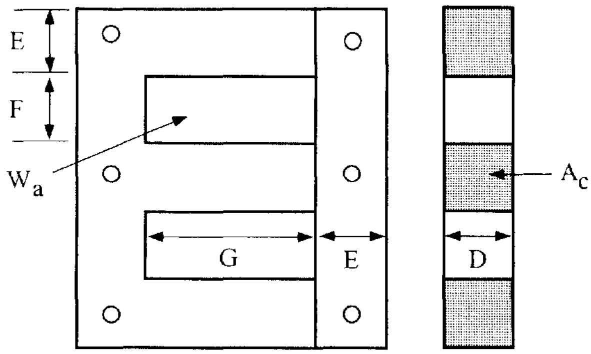


Figure 3-30. EI Three Phase Laminations Outline.

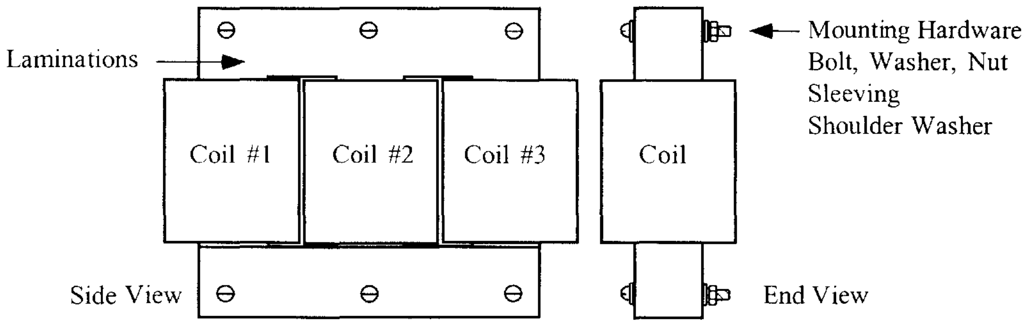


Figure 3-31. Three Phase Lamination Assembled with Coils and Hardware.

Table 3-5. Standard 14 mil EI Three Phase Laminations.

3Phase, Standard Laminations									
Part Number	D cm	E cm	F cm	G cm	W_a / $2A_c$	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
25EI	0.635	0.635	0.871	2.858	3.251	0.383	2.490	1.430	0.051
375EI	0.953	0.953	1.270	3.175	2.339	0.862	4.032	5.213	0.289
50EI	1.270	1.270	1.588	3.493	1.810	1.532	5.544	12.743	0.955
562EI	1.427	1.427	1.588	5.398	2.213	1.936	8.569	24.881	2.187
625EI	1.588	1.588	1.984	5.634	2.334	2.394	11.176	40.135	3.816
875EI	2.223	2.223	2.779	6.111	1.809	4.693	16.982	119.531	16.187
100EI	2.540	2.540	3.810	7.620	2.368	6.129	29.032	266.908	39.067
120EI	3.048	3.048	3.048	7.620	1.316	8.826	23.226	307.479	61.727
150EI	3.810	3.810	3.810	9.525	1.316	13.790	36.290	750.680	187.898
180EI	4.572	4.572	4.572	11.430	1.316	19.858	52.258	1556.609	470.453
240EI	6.096	6.096	6.096	15.240	1.316	35.303	92.903	4919.656	1997.995
360EI	9.144	9.144	9.144	22.860	1.316	79.432	209.032	24905.750	15174.600

Dimensional Outline for Tape Wound C, EE, and Toroidal Cores

The dimensional outline for C cores is shown in Figure 3-32. The dimensional outline for EE cores is shown in Figure 3-33. The dimensional outline for C cores is shown in Figure 3-34.

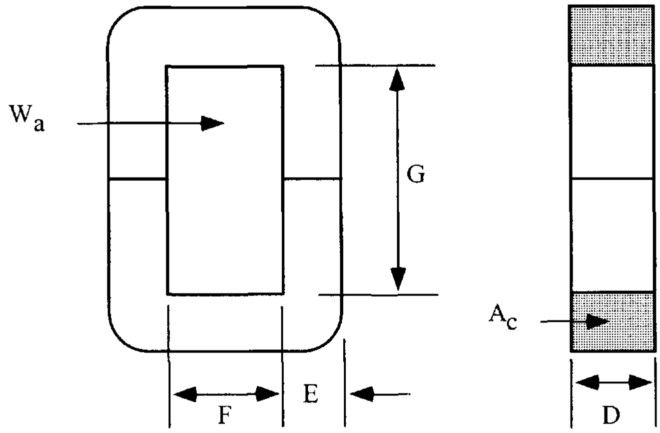


Figure 3-32. Tape C Core Dimensional Outline.

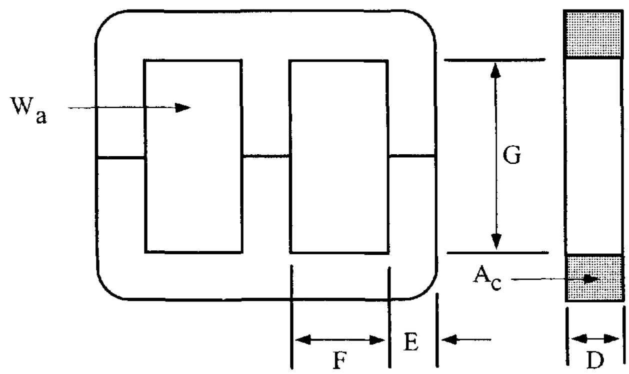


Figure 3-33. Tape EE Core Dimensional Outline.

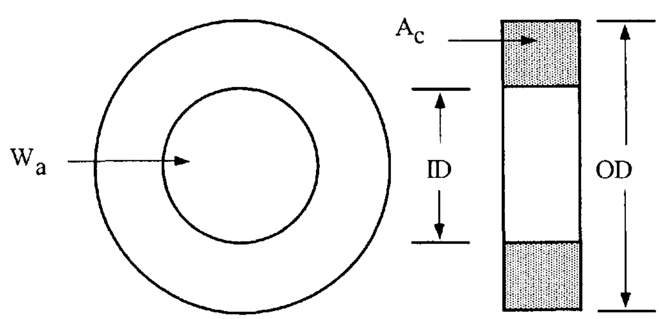


Figure 3-34. Tape Toroidal Core Dimensional Outline.

Dimensional Outline for EE and EI, Ferrite Cores

The dimensional outline for EE and EI ferrite cores is shown in Figure 3-35. A listing of common lamination sizes is shown in Table 3-6.

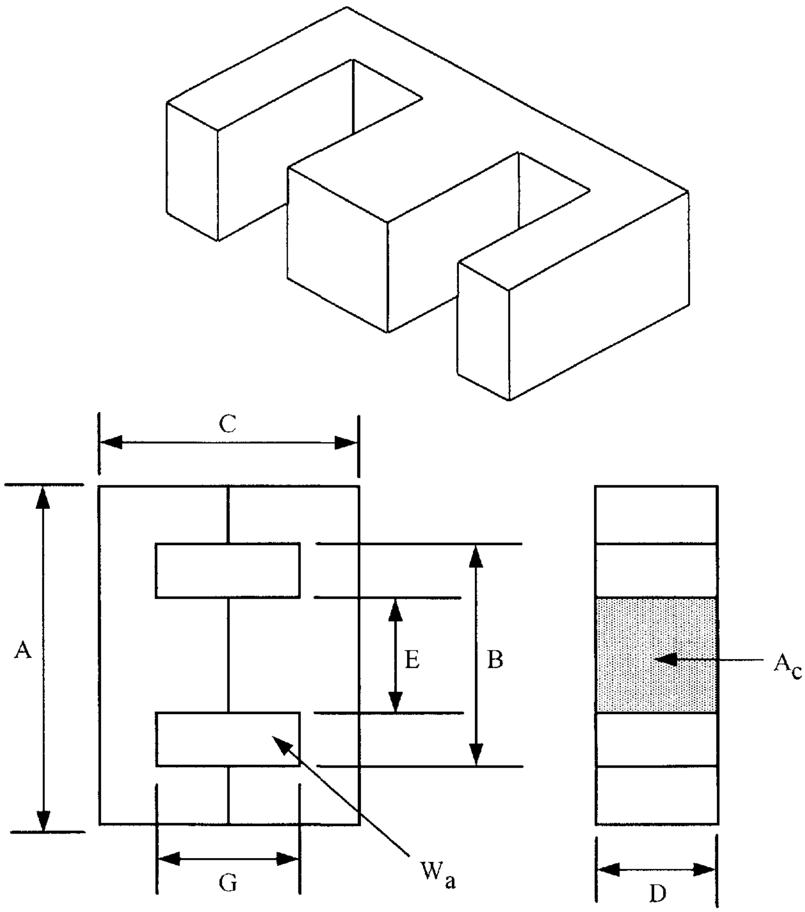


Figure 3-35. Dimension Outline for EE, EI Ferrite Cores.

Table 3-6. Standard EE Ferrite Cores.

EE, Ferrite Cores (Magnetics)											
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	W_a / A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
EE-187	1.930	1.392	1.620	0.478	0.478	1.108	2.223	0.228	0.506	0.115	0.0028
EE-2425	2.515	1.880	1.906	0.653	0.610	1.250	2.062	0.385	0.794	0.306	0.0095
EE-375	3.454	2.527	2.820	0.935	0.932	1.930	1.832	0.840	1.539	1.293	0.0654
EE-21	4.087	2.832	3.300	1.252	1.252	2.080	1.081	1.520	1.643	2.498	0.1875
EE-625	4.712	3.162	3.940	1.567	1.567	2.420	0.806	2.390	1.930	4.613	0.4700
EE-75	5.657	3.810	4.720	1.880	1.880	2.420	0.669	3.490	2.335	8.150	1.0195

Dimensional Outline for EE and EI Planar, Ferrite Cores

The dimensional outline for EE and EI planar ferrite cores is shown in Figure 3-36. A listing of EE, EI planar cores are shown in Table 3-7.

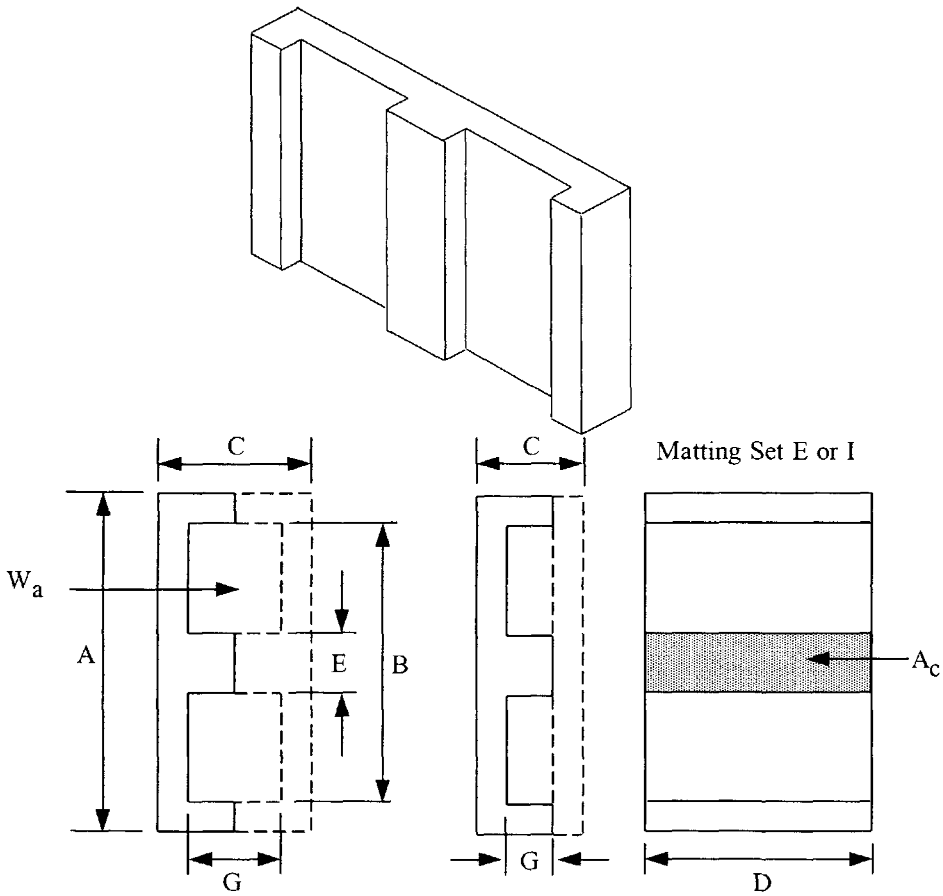


Figure 3-36. Dimension Outline for EE, EI Planar Ferrite Cores.

Table 3-7. Standard EE, EI Planar Ferrite Cores.

EE&EI/LP, Ferrite Cores (Magnetics)											
Part	A	B	C	D	E	G	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
41805-EI	1.800	1.370	0.598	1.000	0.398	0.188	0.227	0.401	0.091	0.036639	0.001240
41805-EE	1.800	1.370	0.796	1.000	0.398	0.367	0.456	0.401	0.183	0.073277	0.002484
42216-EI	2.160	1.610	0.826	1.590	0.508	0.297	0.203	0.806	0.164	0.131899	0.006507
42216-EE	2.160	1.610	1.144	1.590	0.508	0.594	0.406	0.806	0.327	0.263799	0.013014
43208-EI	3.175	2.450	0.908	2.032	0.635	0.318	0.224	1.290	0.289	0.372275	0.021846
43208-EE	3.175	2.450	1.270	2.032	0.635	0.636	0.447	1.290	0.577	0.744549	0.043692
43618-EI	3.556	2.720	0.635	1.780	0.762	0.241	0.175	1.350	0.236	0.318518	0.019618
43618-EE	3.556	2.720	1.270	1.780	0.762	0.482	0.350	1.350	0.472	0.637035	0.039235

Dimensional Outline for EC, Ferrite Cores

The dimensional outline for EC ferrite cores is shown in Figure 3-37. A listing of EC cores is shown in Table 3-8.

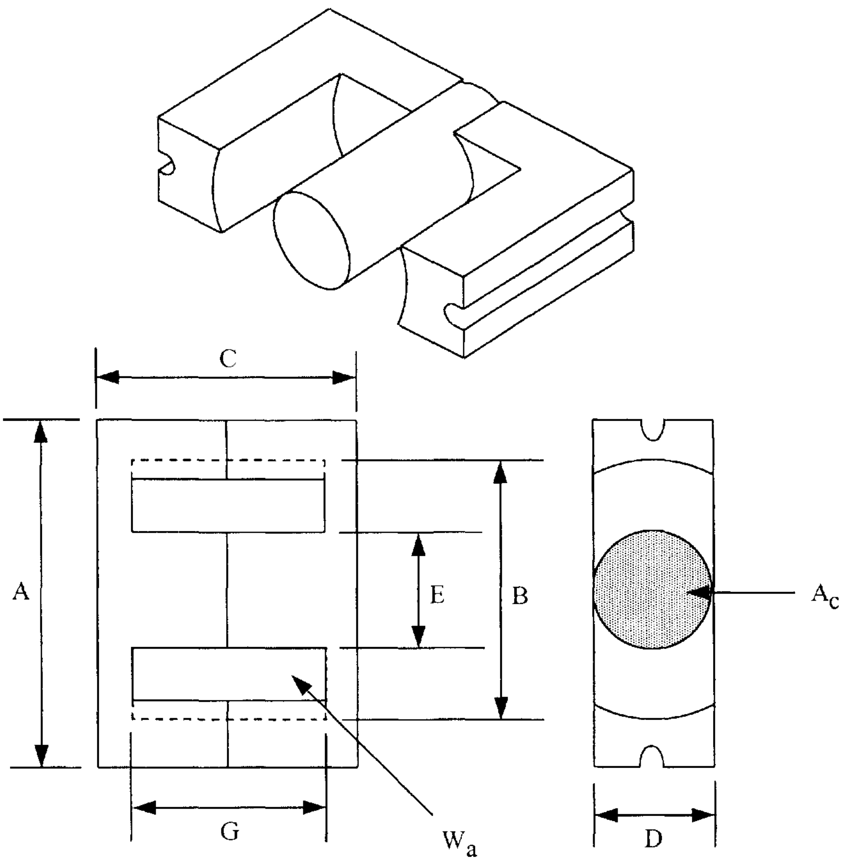


Figure 3-37. Dimension Outline for EC Ferrite Cores.

Table 3-8. Standard EC Ferrite Cores.

EC, Ferrite Cores												
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	H cm	W_a / A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
EC-35	3.450	2.270	3.460	0.950	0.950	2.380	NA	2.220	0.710	1.580	1.119	0.051
EC-41	4.060	2.705	3.901	1.161	1.161	2.697	NA	1.960	1.060	2.080	2.208	0.125
EC-52	5.220	3.302	4.841	1.340	1.340	3.099	NA	2.160	1.410	3.040	4.286	0.267
EC-70	7.000	4,45	6.900	1.683	1.683	4.465	NA	2.970	2.110	6.280	13.246	0.966

Dimensional Outline for ETD, Ferrite Cores

The dimensional outline for ETD ferrite cores is shown in Figure 3-38. A listing of ETD cores is shown in Table 3-9.

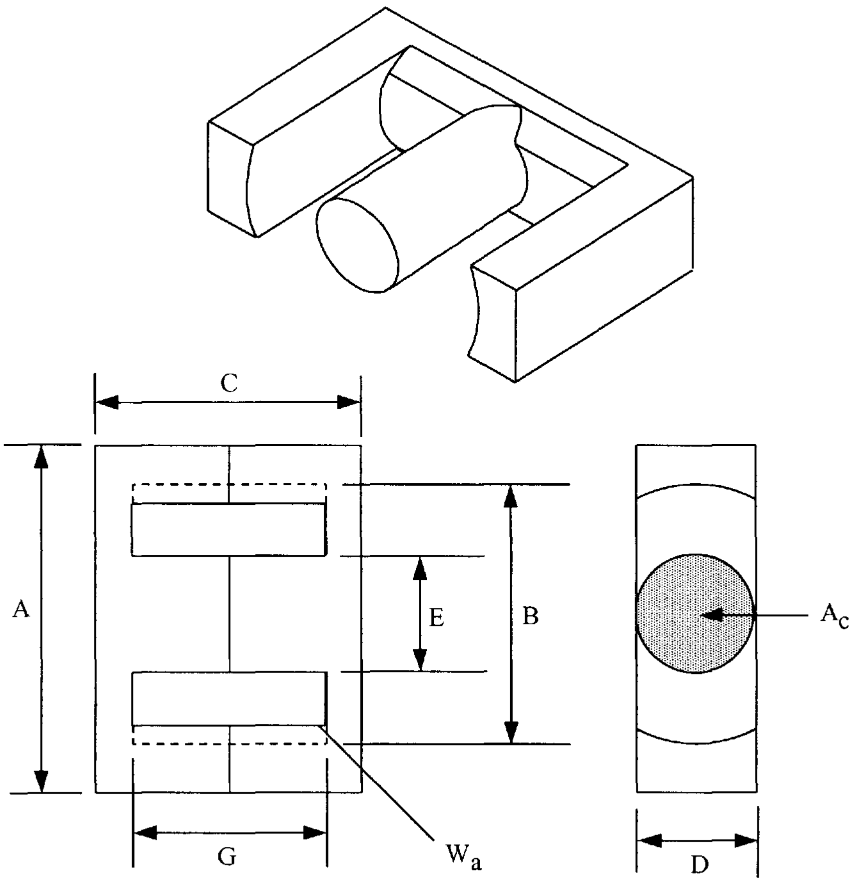


Figure 3-38. Dimension Outline for ETD Ferrite Cores.

Table 3-9. Standard ETD Ferrite Cores.

ETD, Ferrite Cores										
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	$\frac{W_a}{A_c}$	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
ETD-29	2.980	2.270	3.360	0.980	0.980	2.200	1.910	0.761	1.452	1.1050	0.0536
ETD-34	3.500	2.560	3.460	1.110	1.110	2.420	1.925	0.974	1.875	1.8270	0.0994
ETD-39	4.000	2.930	3.960	1.280	1.280	2.920	2.052	1.252	2.569	3.2171	0.1925
ETD-44	4.500	3.250	4.460	1.520	1.520	3.300	1.742	1.742	3.036	5.2890	0.3897
ETD-49	4.980	3.610	4.940	1.670	1.670	3.620	1.767	2.110	3.729	7.8673	0.6383
ETD-54	5.450	4.120	5.520	1.890	1.890	4.040	1.609	2.800	4.505	12.6129	1.2106
ETD-59	5.980	4.470	6.200	2.165	2.165	4.400	1.382	3.677	5.082	18.6860	2.1347

Dimensional Outline for ETD/(low profile), Ferrite Cores

The ETD/lp cores offer a low profile to be used with printed circuit board (PCB) designs. The dimensional outline for ETD/lp ferrite cores is shown in Figure 3-39. A listing of ETD/lp cores is shown in Table 3-10.

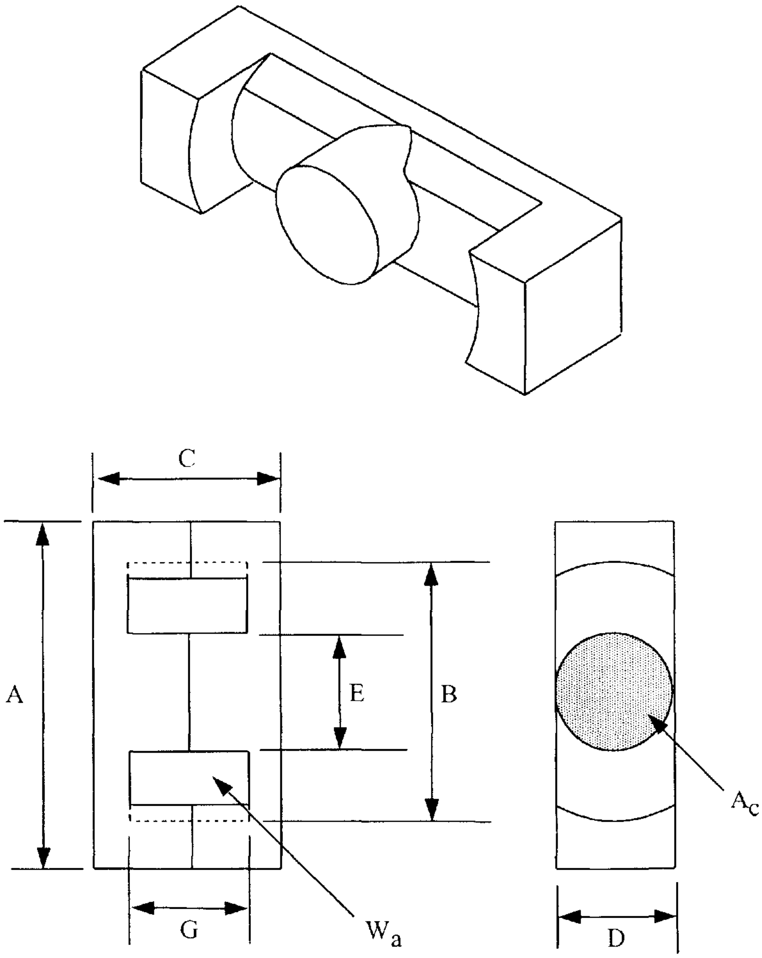


Figure 3-39. Dimension Outline for ETD/lp Ferrite Cores.

Table 3-10. Standard ETD/lp Ferrite Cores.

ETD/lp, Ferrite Cores											
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	W_a / A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
ETD34(lp)	3.421	2.631	1.804	1.080	1.080	0.762	0.609	0.970	0.591	0.5732	0.0310
ETD39(lp)	3.909	3.010	1.798	1.250	1.250	0.762	0.559	1.200	0.671	0.8047	0.0461
ETD44(lp)	4.399	3.330	1.920	1.481	1.481	0.762	0.407	1.730	0.704	1.2187	0.0894
ETD49(lp)	4.869	3.701	2.082	1.631	1.631	0.762	0.374	2.110	0.789	1.6640	0.1353

Dimensional Outline for ER, Ferrite Cores

SMD

The dimensional outline for ER ferrite cores is shown in Figure 3-40. A listing of ER ferrite cores is shown in Table 3-11.

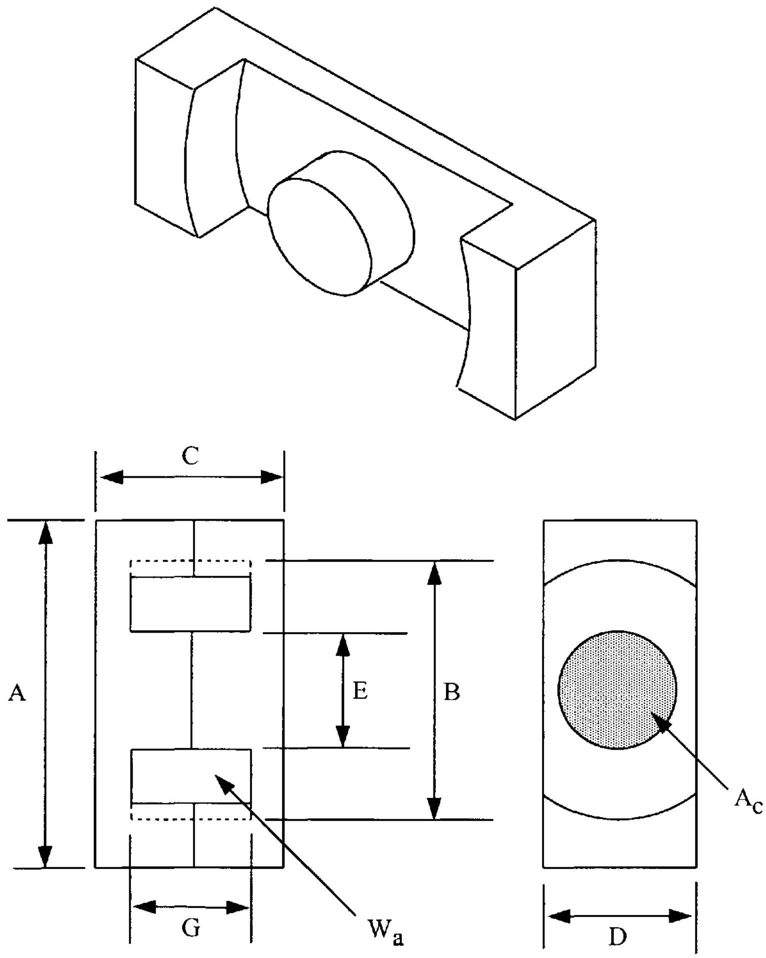


Figure 3-40. Dimension Outline for ER Ferrite Cores.

Table 3-11. Standard ER Ferrite Cores.

ER, Ferrite Cores (Philips)											
Part	A	B	C	D	E	G	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
ER 9.5	0.950	0.750	0.490	0.500	0.350	0.320	0.842	0.0760	0.0640	0.00486	0.000054
ER 11	1.100	0.870	0.500	0.600	0.425	0.300	0.526	0.1270	0.0668	0.00848	0.000136
ER 35	3.500	2.615	4.140	1.140	1.130	2.950	2.470	1.0700	2.1904	2.34370	0.137777
ER 42	4.200	3.005	4.480	1.560	1.550	3.090	1.159	1.9400	2.2480	4.36107	0.371338
ER 48	4.800	3.800	4.220	2.100	1.800	2.940	1.153	2.5500	2.9400	7.49700	0.662096
ER 54	5.350	4.065	3.660	1.795	1.790	2.220	1.010	2.5000	2.5253	6.31313	0.556146

Dimensional Outline for EFD, Ferrite Cores

SMD

The EFD cores (**E**conomic **F**lat **D**esign) offer a significant advance in power transformer circuit miniaturization. The dimensional outline for EFD ferrite cores is shown in Figure 3-41. A listing of EFD cores is shown in Table 3-12.

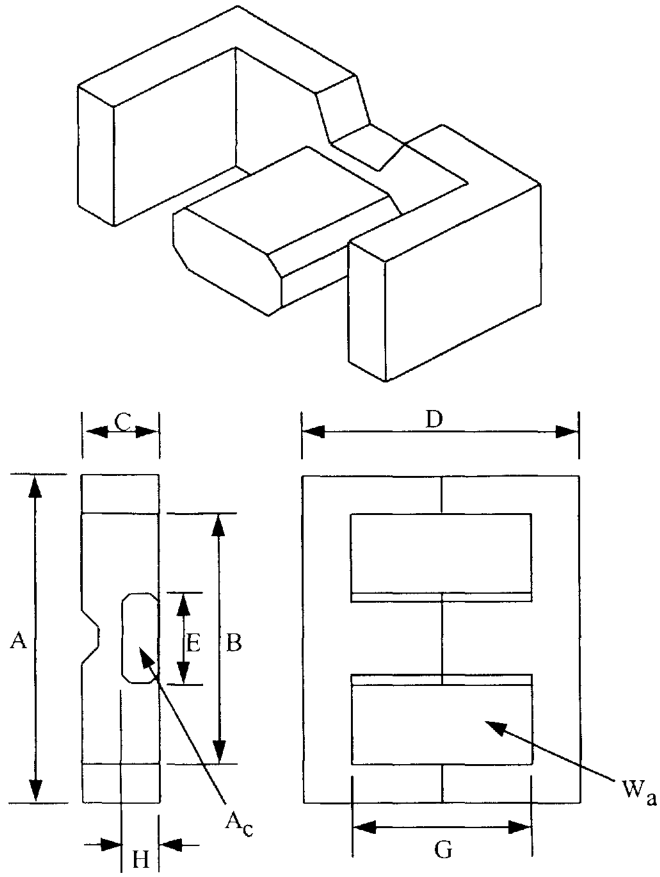


Figure 3-41. Dimension Outline for EFD Ferrite Cores.

Table 3-12. Standard EFD Ferrite Cores.

EFD, Ferrite Cores												
Part	A	B	C	D	E	G	H	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
EFD-10	1.050	0.765	0.270	1.040	0.455	0.750	0.145	1.610	0.072	0.116	0.00836	0.00013
EFD-15	1.500	1.100	0.465	1.500	0.530	1.100	0.240	2.090	0.150	0.314	0.04702	0.00105
EFD-20	2.000	1.540	0.665	2.000	0.890	1.540	0.360	1.610	0.310	0.501	0.15515	0.00506
EFD-25	2.500	1.870	0.910	2.500	1.140	1.860	0.520	1.170	0.580	0.679	0.39376	0.01911
EFD-30	3.000	2.240	0.910	3.000	1.460	2.240	0.490	1.266	0.690	0.874	0.60278	0.03047

Dimensional Outline for EPC, Ferrite Cores

SMD

The dimensional outline for EPC ferrite cores is shown in Figure 3-42. A listing of ECP cores is shown in Table 3-13.

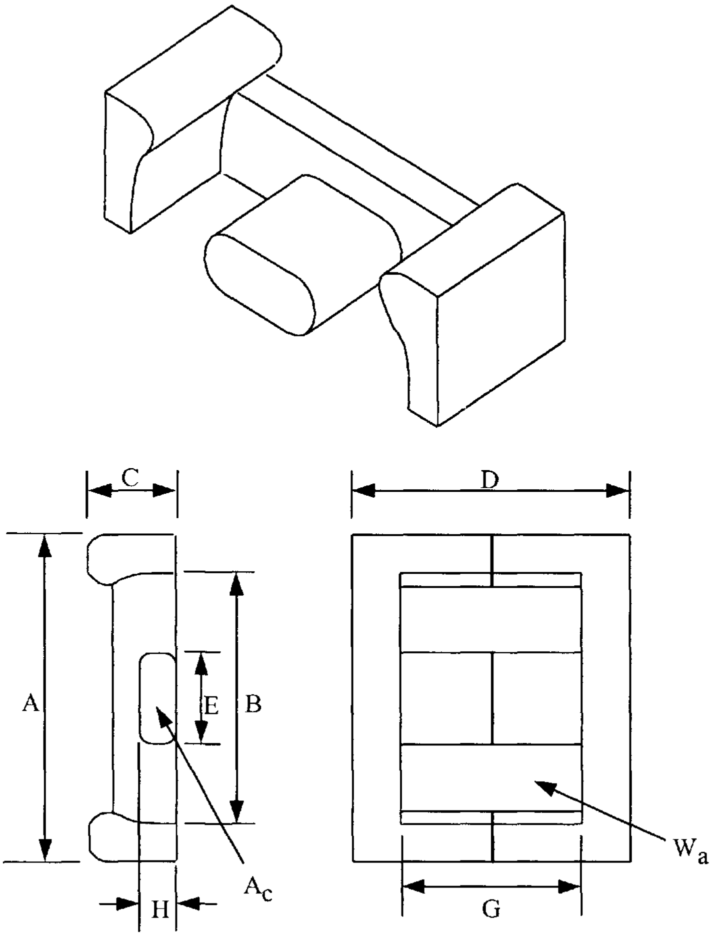


Figure 3-42. Dimension Outline for EPC Ferrite Cores.

Table 3-13. Standard EPC Ferrite Cores.

EPC, Ferrite Cores (TDK)												
Part	A	B	C	D	E	G	H	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
EPC-10	1.020	0.760	0.340	0.810	0.500	0.530	0.190	0.734	0.0939	0.0689	0.006470	0.000128
EPC-13	1.325	1.050	0.460	1.320	0.560	0.900	0.205	1.765	0.1250	0.2205	0.027562	0.000549
EPC-17	1.760	1.430	0.600	1.710	0.770	1.210	0.280	1.751	0.2280	0.3993	0.091040	0.002428
EPC-19	1.910	1.580	0.600	1.950	0.850	1.450	0.250	2.334	0.2270	0.5293	0.120140	0.002981
EPC-25	2.510	2.080	0.800	2.500	1.150	1.800	0.400	1.804	0.4640	0.8370	0.388368	0.014533
EPC-27	2.710	2.160	0.800	3.200	1.300	2.400	0.400	1.890	0.5460	1.0320	0.563472	0.024036
EPC-30	3.010	2.360	0.800	3.500	1.500	2.600	0.400	1.832	0.6100	1.1180	0.681980	0.030015

Dimensional Outline for PC, Ferrite Cores

The dimensional outline for PC ferrite cores is shown in Figure 3-43. A listing of PC cores is shown in Table 3-14.

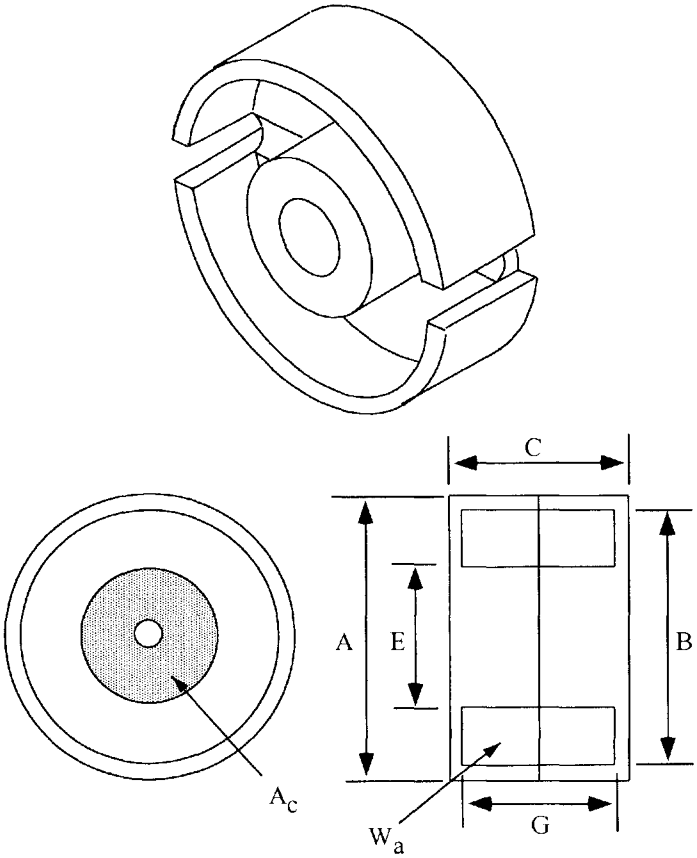


Figure 3-43. Dimension Outline for PC Ferrite Cores.

Table 3-14. Standard PC Ferrite Cores.

PC, Ferrite Cores (Magnetics)										
Part Number	A cm	B cm	C cm	E cm	G cm	$\frac{W_a}{A_c}$	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
PC-40905	0.914	0.749	0.562	0.388	0.361	0.650	0.100	0.065	0.00652	0.000134
PC-41408	1.400	1.160	0.848	0.599	0.559	0.631	0.249	0.157	0.03904	0.001331
PC-41811	1.800	1.498	1.067	0.759	0.720	0.697	0.429	0.299	0.11413	0.005287
PC-42213	2.160	1.790	1.340	0.940	0.920	0.612	0.639	0.391	0.24985	0.014360
PC-42616	2.550	2.121	1.610	1.148	1.102	0.576	0.931	0.536	0.49913	0.035114
PC-43019	3.000	2.500	1.880	1.350	1.300	0.549	1.360	0.747	1.01660	0.088001
PC-43622	3.560	2.990	2.200	1.610	1.460	0.498	2.020	1.007	2.03495	0.220347
PC-44229	4.240	3.560	2.960	1.770	2.040	0.686	2.660	1.826	4.85663	0.600289

Dimensional Outline for EP, Ferrite Cores

The EP ferrite cores are typically used in transformer applications. The shape of the assembly is almost cubical, allowing high package densities on the PCB. The dimensional outline for EP ferrite cores is shown in Figure 3-44. A listing of EP cores is shown in Table 3-15.

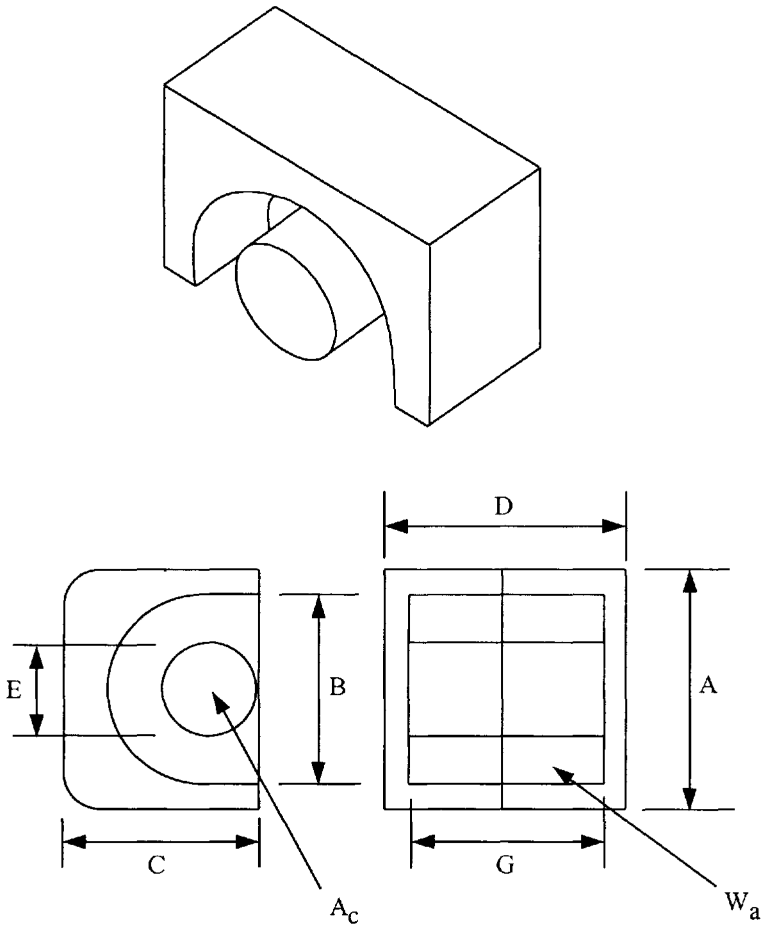


Figure 3-44. Dimension Outline for EP Ferrite Cores.

Table 3-15. Standard EP Ferrite Cores.

EP, Ferrite Cores											
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
EP-7	0.940	0.720	0.650	0.750	0.340	0.500	0.987	0.1080	0.1066	0.01151	0.00027
EP-10	1.150	0.940	0.760	1.020	0.330	0.740	1.997	0.1130	0.2257	0.02550	0.00053
EP-13	1.280	0.970	0.900	1.300	0.450	0.900	1.344	0.1950	0.2622	0.05112	0.00165
EP-17	1.800	1.200	1.100	1.680	0.570	1.140	1.066	0.3370	0.3591	0.12101	0.00540
EP-20	2.400	1.650	1.500	2.140	0.880	1.440	0.704	0.7870	0.5544	0.43631	0.03261

Dimensional Outline for PQ, Ferrite Cores

The PQ ferrite cores (**P**ower **Q**uality) feature round center legs with rather small cross-sections. The dimensional outline for PQ ferrite cores is shown in Figure 3-45. A listing of PQ cores is shown in Table 3-16.

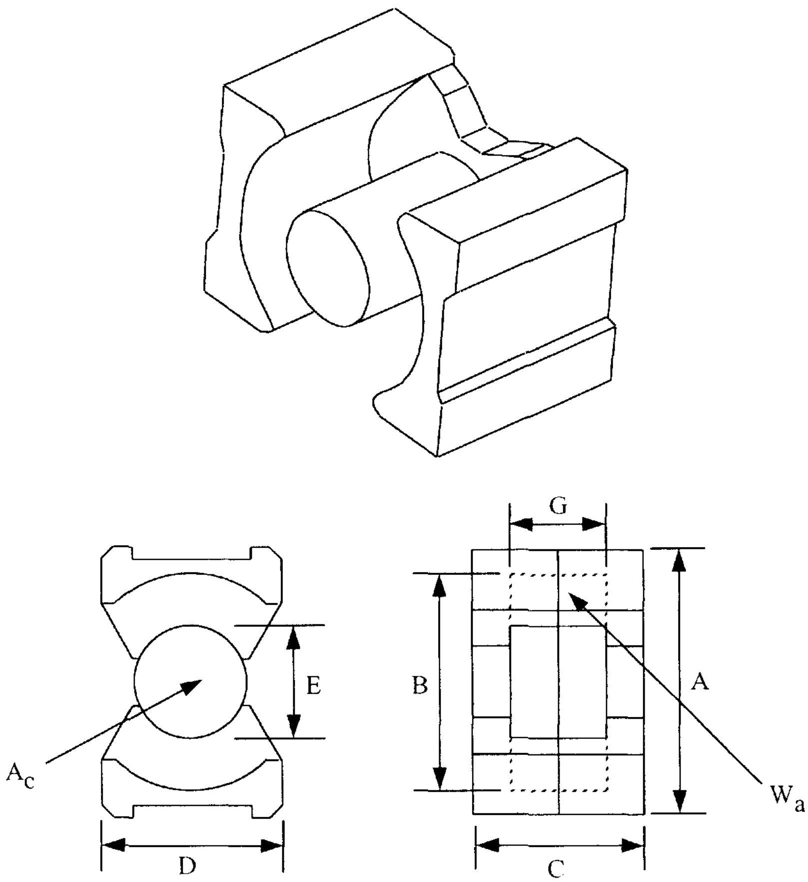


Figure 3-45. Dimension Outline for PQ Ferrite Cores.

Table 3-16. Standard PQ Ferrite Cores.

PQ, Ferrite Cores										
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	W_a / A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
PQ20/16	2.050	1.800	1.620	1.400	0.880	1.030	0.764	0.620	0.474	0.294	0.0167
PQ20/20	2.050	1.800	2.020	1.400	0.880	1.430	1.061	0.620	0.658	0.408	0.0232
PQ26/20	2.650	2.250	2.015	1.900	1.200	1.150	0.507	1.190	0.604	0.717	0.0161
PQ26/25	2.650	2.250	2.475	1.900	1.200	1.610	0.724	1.180	0.854	0.997	0.0855
PQ32/20	3.200	2.750	2.055	2.200	1.345	1.150	0.475	1.700	0.808	1.373	0.1401
PQ32/30	3.200	2.750	3.035	2.200	1.245	2.130	0.930	1.610	1.496	2.409	0.2327
PQ35/35	3.510	3.200	3.475	2.600	1.435	2.500	1.126	1.960	2.206	4.324	0.4511
PQ40/40	4.050	3.700	3.975	2.800	1.490	2.950	1.622	2.010	3.260	6.552	0.6281
PQ50/50	5.000	4.400	4.995	3.200	2.000	3.610	1.321	3.280	4.332	14.210	1.8123

Dimensional Outline for PQ/(low profile), Ferrite Cores

The PQ/lp cores are a cut down version of the standard PQ cores. The PQ/lp cores have a substantially reduced total height. The dimensional outline for PQ/lp ferrite cores is shown in Figure 3-46. A listing of PQ/lp cores is shown in Table 3-17.

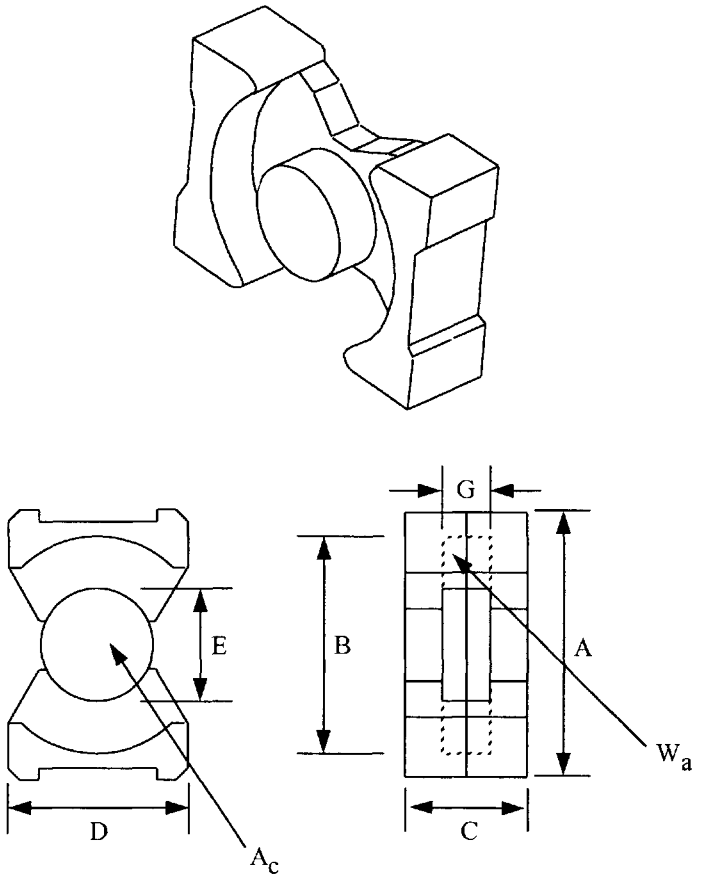


Figure 3-46. Dimension Outline for PQ Ferrite Cores.

Table 3-17. Standard PQ Ferrite Cores.

PQ/lp, Ferrite Cores (Ferrite International)											
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	$\frac{W_a}{A_c}$	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
PQ20/20/lp	2.125	1.801	2.702	1.400	0.884	1.524	1.127	0.620	0.699	0.433	0.024
PQ26/20/lp	2.724	2.250	3.260	1.900	1.199	1.524	0.673	1.190	0.801	0.953	0.080
PQ32/20/lp	3.302	2.751	3.342	2.200	1.348	1.524	0.629	1.700	1.069	1.817	0.185
PQ35/35/lp	3.612	3.200	3.474	2.601	1.435	1.524	0.686	1.960	1.345	2.636	0.275
PQ40/40/lp	4.148	3.701	3.566	2.799	1.491	1.524	0.838	2.010	1.684	3.385	0.324

Dimensional Outline for RM, Ferrite Cores

The RM cores (**R**ectangular **M**odular) were developed for high printed circuit board (PCB) packing densities. The dimensional outline for RM ferrite cores is shown in Figure 3-47. A listing of RM cores is shown in Table 3-18.

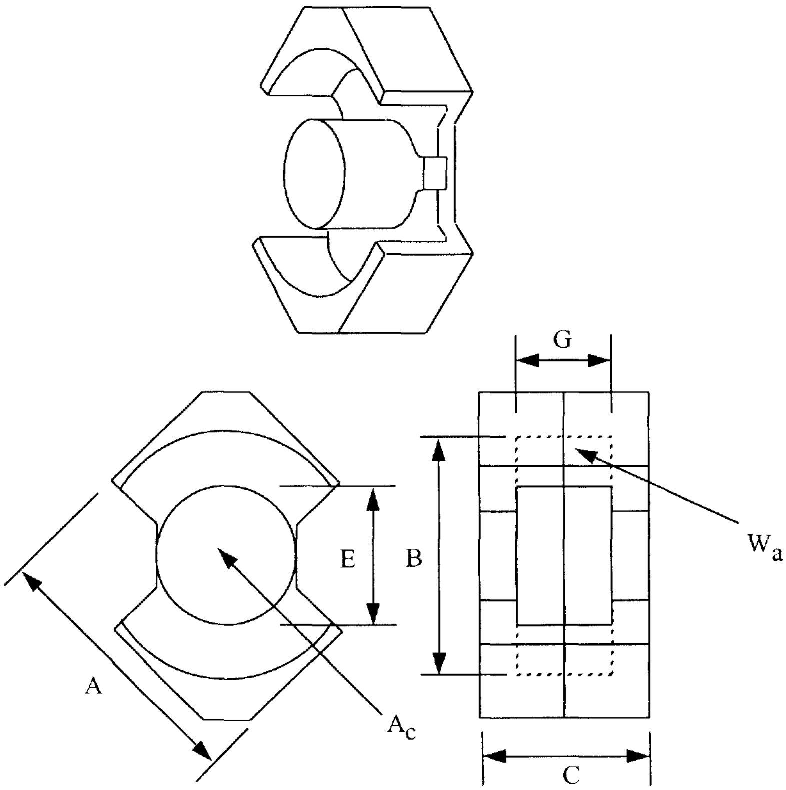


Figure 3-47. Dimension Outline for RM Ferrite Cores.

Table 3-18. Standard RM Ferrite Cores.

RM, Ferrite Cores												
Part	A	B	C	D	E	G	H	$\frac{W_a}{A_c}$	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	cm		cm^2	cm^2	cm^4	cm^5
RM-4	0.963	0.815	1.04	NA	0.38	0.72	NA	1.12	0.14	0.157	0.0219	0.0006
RM-5	1.205	1.04	1.04	NA	0.48	0.65	NA	0.768	0.237	0.182	0.0431	0.0016
RM-6	1.44	1.265	1.24	NA	0.63	0.82	NA	0.71	0.366	0.26	0.0953	0.0044
RM-7	1.685	1.508	1.34	NA	0.71	0.865	NA	0.75	0.46	0.345	0.159	0.00802
RM-8	1.935	1.73	1.64	NA	0.84	1.1	NA	0.76	0.64	0.489	0.313	0.01911
RM-10	2.415	2.165	1.86	NA	1.07	1.27	NA	0.71	0.98	0.695	0.681	0.05098
RM-12	2.925	2.55	2.35	NA	1.26	1.71	NA	0.788	1.4	1.103	1.544	0.139
RM-14	3.42	2.95	2.88	NA	1.47	2.11	NA	0.874	1.78	1.556	2.77	0.2744

Dimensional Outline for RM/(low profile), Ferrite Cores

SMD

The RM/lp ferrite cores are a cut down version of the standard RM cores. The dimensional outline for RM/lp ferrite cores is shown in Figure 3-48. A listing of RM/lp cores is shown in Table 3-19.

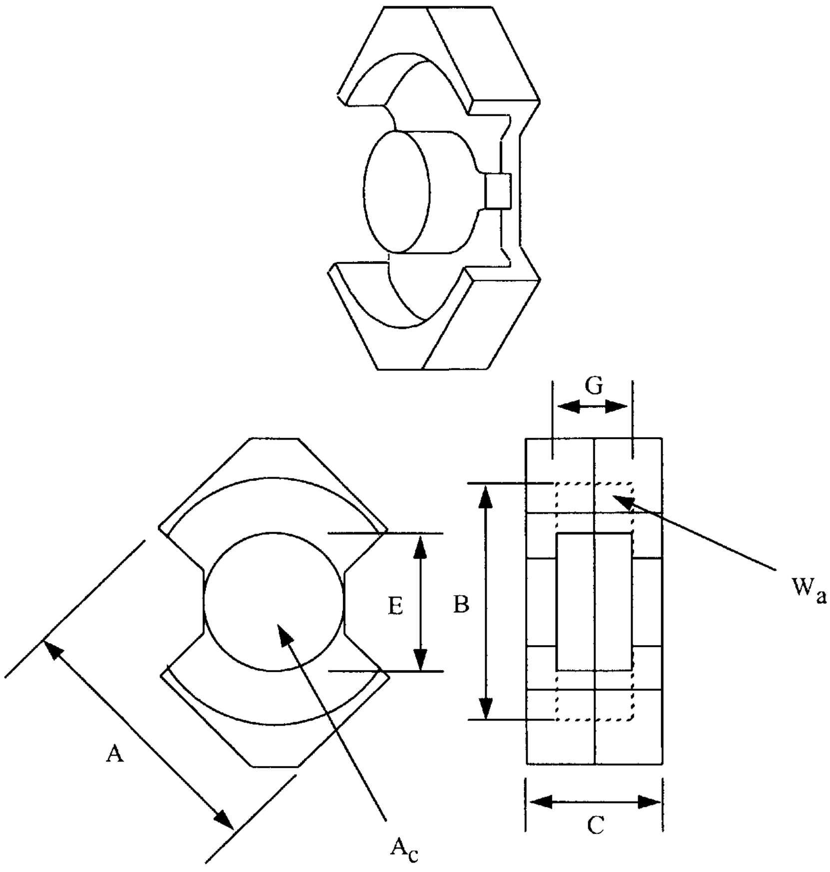


Figure 3-48. Dimension Outline for RM/lp Ferrite Cores.

Table 3-19. Standard RM/lp Ferrite Cores.

RM/lp, Ferrite Cores (Ferrite International)										
Part	A	B	C	D	E	G	W_a	A_c	W_a	A_p	K_g
Number	cm	cm	cm	cm	cm	cm	A_c	cm^2	cm^2	cm^4	cm^5
PQ20/20/lp	2.126	1.801	2.702	1.400	0.884	1.524	1.127	0.620	0.699	0.43323	0.02412
PQ26/20/lp	2.725	2.250	3.260	1.900	1.199	1.524	0.673	1.190	0.801	0.95303	0.08022
PQ32/20/lp	3.302	2.751	3.342	2.200	1.348	1.524	0.629	1.700	1.069	1.81744	0.18514
PQ35/35/lp	3.612	3.200	3.474	2.601	1.435	1.524	0.686	1.960	1.345	2.63606	0.27494
PQ40/40/lp	4.148	3.701	3.566	2.799	1.491	1.524	0.838	2.010	1.684	3.38488	0.32431

Dimensional Outline for DS, Ferrite Cores

The DS ferrite cores are similar to standard Pot Cores. These cores have a large opening to bring out many strands of wire, which is convenient for high power and multiple outputs. The dimensional outline for DS ferrite cores is shown in Figure 3-49. A listing of DS cores is shown in Table 3-20.

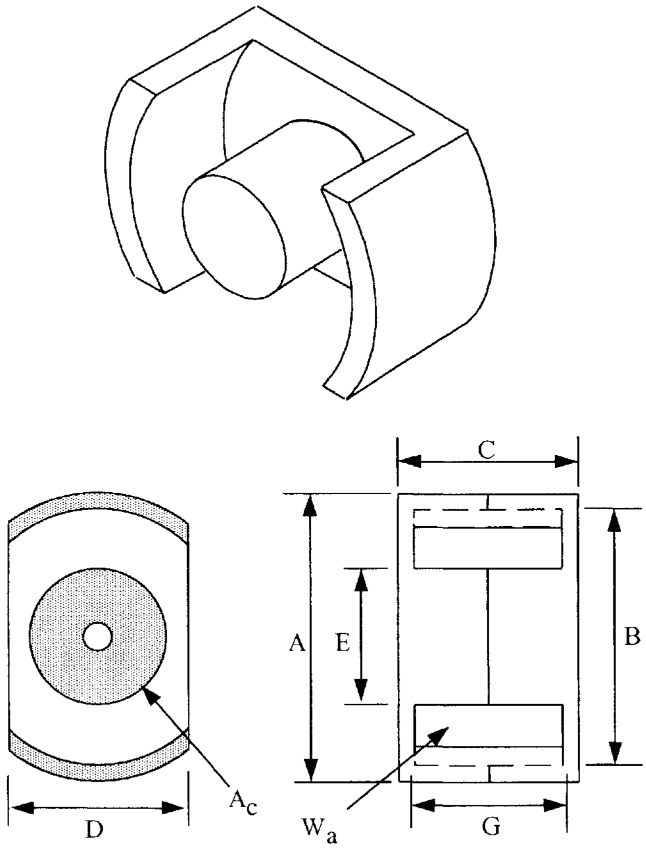


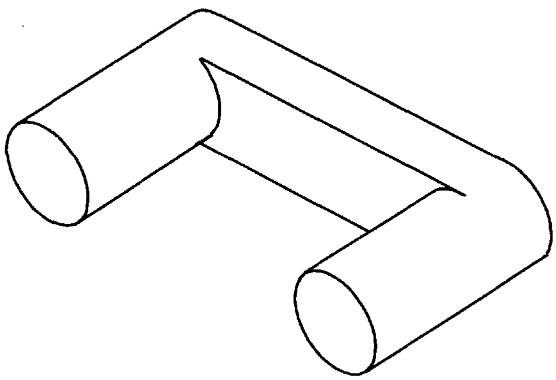
Figure 3-49. Dimension Outline for DS Ferrite Cores.

Table 3-20. Standard DS Ferrite Cores.

DS, Ferrite Cores (Magnetics)											
Part Number	A cm	B cm	C cm	D cm	E cm	G cm	W_a / A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
DS-42311	2.286	1.793	1.108	1.540	0.990	0.726	0.568	0.512	0.291	0.14920	0.00674
DS-42318	2.286	1.793	1.800	1.540	0.990	1.386	0.960	0.580	0.557	0.32275	0.01624
DS-42316	2.550	2.121	1.610	1.709	1.148	1.102	0.696	0.770	0.536	0.41281	0.02402
DS-42319	3.000	2.500	1.880	1.709	1.351	1.300	0.638	1.170	0.747	0.87381	0.06506
DS-42322	3.561	2.985	2.170	2.385	1.610	1.458	0.672	1.490	1.002	1.49354	0.11942
DS-42329	4.240	3.561	2.960	2.840	1.770	2.042	0.875	2.090	1.828	3.82179	0.37109

Dimensional Outline for UUR, Ferrite Cores

The UUR ferrite cores feature round legs with rather small cross sections. The round legs allow easy winding with either wire or foil. U cores are used for power, pulse and high-voltage transformers. The dimensional outline for UUR ferrite cores is shown in Figure 3-50. A listing of UUR cores is shown in Table 3-21.



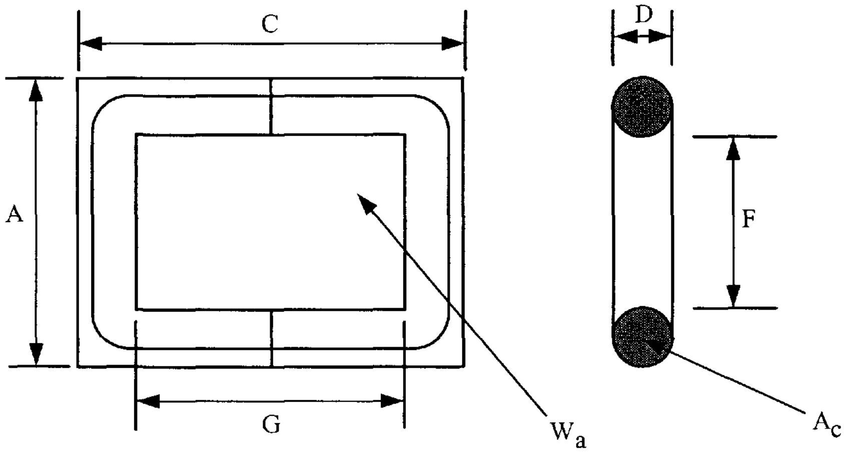


Figure 3-50. Dimension Outline for UUR Ferrite Cores.

Table 3-21. Standard UUR Ferrite Cores.

UUR, Ferrite Cores (Magnetics)										
Part Number	A cm	C cm	D cm	F cm	G cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
UUR-44121	4.196	4.120	1.170	1.910	2.180	4.215	0.988	4.164	4.114	0.202
UUR-44119	4.196	4.180	1.170	1.910	2.680	5.619	0.911	5.119	4.663	0.211
UUR-44125	4.196	5.080	1.170	1.910	3.140	6.070	0.988	5.997	5.925	0.291
UUR-44130	4.196	6.100	1.170	1.910	4.160	8.043	0.988	7.946	7.850	0.386

Dimensional Outline for UUS, Ferrite Cores

The UUS ferrite cores feature square or rectangular legs. U cores are used for power, pulse and high-voltage transformers. The dimensional outline for UUS ferrite cores is shown in Figure 3-51. A listing of UUS cores is shown in Table 3-22.

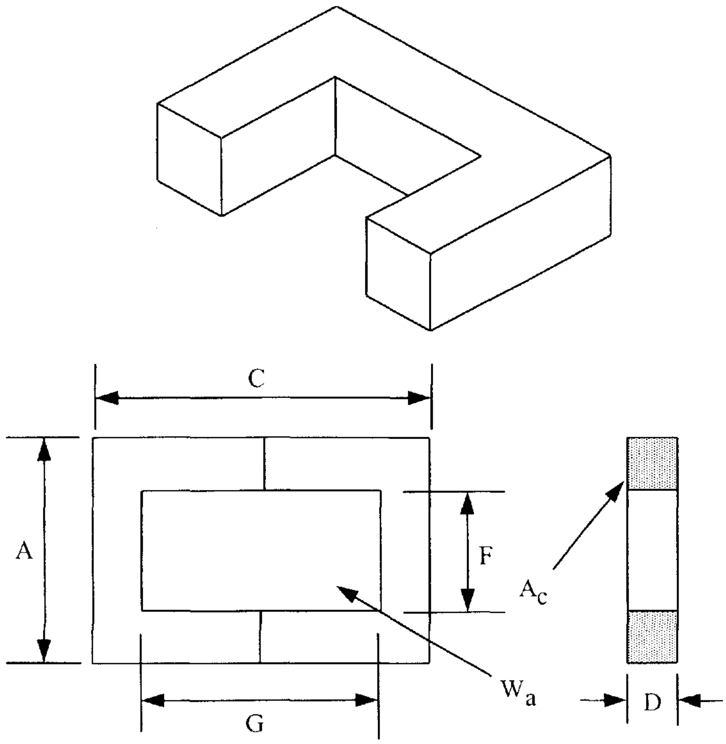


Figure 3-51. Dimension Outline for UUS Ferrite Cores.

Table 3-22. Standard UUS Ferrite Cores.

UUS, Ferrite Cores (Philips)										
Part Number	A cm	C cm	D cm	F cm	G cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
UUS-10	1.000	1.640	0.290	0.435	1.000	5.179	0.084	0.435	0.0365	0.000549
UUS-20	2.080	3.120	0.750	0.640	1.660	1.896	0.560	1.062	0.5949	0.030612
UUS-25	2.480	3.920	1.270	0.840	2.280	1.841	1.040	1.915	1.9918	0.135668
UUS-30	3.130	5.060	1.600	1.050	2.980	1.943	1.610	3.129	5.0377	0.430427
UUS-67	6.730	5.400	1.430	3.880	2.540	4.831	2.040	9.855	20.1046	1.321661
UUS-93	9.300	15.200	4.800	3.620	9.600	7.757	4.480	34.752	155.6889	12.808331

Dimensional Outline for Toroidal, Ferrite Cores

The toroidal ferrite core has the best possible shape from the magnetic point of view. The magnetic flux path is completely enclosed within the magnetic structure. The toroidal structure fully exploits the capabilities of a ferrite material. The dimensional outline for toroidal ferrite cores is shown in Figure 3-52. A listing of toroidal cores is shown in Table 3-23.

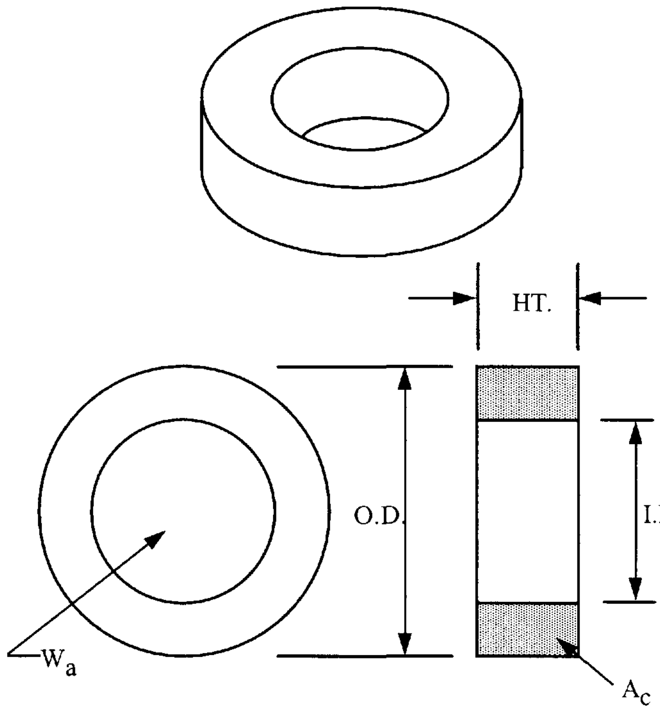


Figure 3-52. Dimension Outline for Toroidal Ferrite Cores.

Table 3-23. Standard Toroidal Ferrite Cores.

Toroidal, Ferrite Cores (Magnetics)								
Part Number	OD cm	ID cm	HT cm	$\frac{W_a}{A_c}$	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5
TC-40705	0.762	0.318	0.478	0.806	0.098	0.079	0.007783	0.000222
TC-41206	1.270	0.516	0.635	0.946	0.221	0.209	0.046215	0.002011
TC-42206	2.210	1.370	0.635	5.896	0.250	1.474	0.368528	0.013237
TC-42908	2.900	1.900	0.749	7.919	0.358	2.835	1.015032	0.041312
TC-43806	3.810	1.900	0.635	4.974	0.570	2.835	1.616112	0.090668
TC-43610	3.600	2.300	1.000	6.616	0.628	4.155	2.609185	0.146301
TC-43813	3.810	1.900	1.270	2.465	1.150	2.835	3.260577	0.295249
TC-48613	8.570	5.550	1.270	12.937	1.870	24.192	45.239426	3.807278

Dimensional Outline for Toroidal, MPP Powder Cores

The dimensional outline for toroidal MPP powder cores is shown in Figure 3-53. A listing of toroidal cores is shown in Table 3-24.

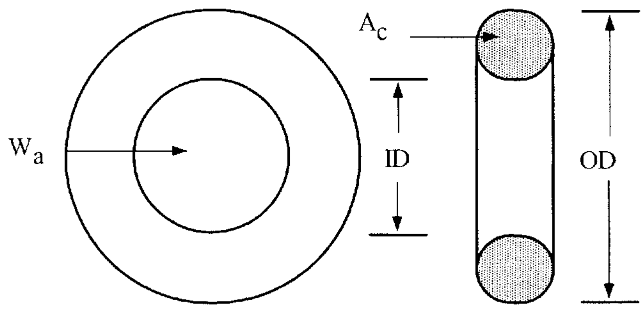


Figure 3-53. Dimension Outline for Toroidal Powder Cores.

Table 3-24. A Small List of Standard Toroidal MPP Powder Cores.

MPP Powder Cores, Magnetics 60 mu (coated)										
Part Number	OD cm	ID cm	HT cm	MPL cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5	AL mh/1000N
55021	0.699	0.229	0.343	1.36	0.877	0.047	0.041	0.001930	0.000040	24
55281	1.029	0.427	0.381	2.18	1.900	0.075	0.143	0.010746	0.000252	25
55291	1.029	0.427	0.457	2.18	1.512	0.095	0.143	0.013504	0.000357	32
55041	1.080	0.457	0.457	2.38	1.640	0.100	0.164	0.016400	0.000432	32
55131	1.190	0.589	0.472	2.69	3.013	0.091	0.273	0.024734	0.000603	26
55051	1.346	0.699	0.551	3.12	3.360	0.114	0.383	0.043662	0.001225	27
55121	1.740	0.953	0.711	4.11	3.714	0.192	0.713	0.136896	0.004787	35
55381	1.803	0.902	0.711	4.14	2.750	0.232	0.638	0.148016	0.006030	43
55848	2.110	1.207	0.711	5.09	5.044	0.226	1.140	0.257640	0.009730	32
55059	2.350	1.339	0.838	5.67	4.260	0.331	1.410	0.466710	0.020153	43
55351	2.430	1.377	0.970	5.88	3.840	0.388	1.490	0.578120	0.028639	51
55894	2.770	1.410	1.199	6.35	2.385	0.654	1.560	1.020240	0.070381	75
55071	3.380	1.930	1.161	8.15	4.360	0.672	2.930	1.968960	0.124886	61
55586	3.520	2.260	0.983	8.95	8.833	0.454	4.010	1.820540	0.087356	38
55076	3.670	2.150	1.128	8.98	5.369	0.678	3.640	2.467920	0.154082	56
55083	4.070	2.330	1.537	9.84	3.983	1.072	4.270	4.577440	0.389064	81
55439	4.760	2.330	1.892	10.74	2.146	1.990	4.270	8.497300	1.034038	135
55090	4.760	2.790	1.613	11.63	4.560	1.340	6.110	8.187400	0.717932	86
55716	5.170	3.090	1.435	12.73	5.995	1.251	7.500	9.382500	0.762526	73
55110	5.800	3.470	1.486	14.300	6.565	1.444	9.480	13.689120	1.212742	75

Dimensional Outline for Toroidal, Iron Powder Cores

The dimensional outline for toroidal iron powder cores is shown in Figure 3-54. A listing of toroidal cores is shown in Table 3-25.

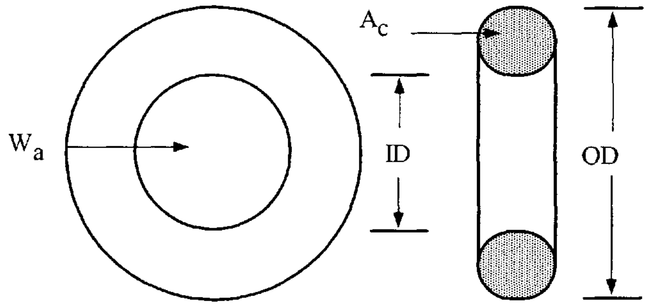


Figure 3-54. Dimension Outline for Toroidal Iron Powder Cores.

Table 3-25. A Small List of Standard Toroidal Iron Powder Cores.

Iron Powder Cores, Micrometals 75 mu (coated)										
Part Number	OD cm	ID cm	HT cm	MPL cm	W_a/A_c	A_c cm^2	W_a cm^2	A_p cm^4	K_g cm^5	AL mh/1000N
T20-26	0.508	0.224	0.178	1.15	1.713	0.023	0.039	0.000906	0.000014	18.5
T25-26	0.648	0.305	0.244	1.50	1.974	0.037	0.073	0.002702	0.000053	24.5
T26-26	0.673	0.267	0.483	1.47	0.622	0.090	0.056	0.005037	0.000154	57
T30-26	0.780	0.384	0.325	1.84	1.929	0.060	0.116	0.006945	0.000158	33.5
T37-26	0.953	0.521	0.325	2.31	3.329	0.064	0.213	0.013637	0.000308	28.5
T38-26	0.953	0.445	0.483	2.18	1.364	0.114	0.155	0.017721	0.000572	49
T44-26	1.120	0.582	0.404	2.68	2.686	0.099	0.266	0.026324	0.000760	37
T50-26	1.270	0.770	0.483	3.19	4.156	0.112	0.465	0.052128	0.002174	33
T60-26	1.520	0.853	0.594	3.74	3.054	0.187	0.571	0.106809	0.003938	50
T68-26	1.750	0.940	0.483	4.23	3.875	0.179	0.694	0.124159	0.007187	43.5
T80-26	2.020	1.260	0.635	5.14	5.395	0.231	1.246	0.287887	0.010389	46
T94-26	2.390	1.420	0.792	5.97	4.373	0.362	1.583	0.573000	0.016164	60
T90-26	2.290	1.400	0.953	5.78	3.895	0.395	1.539	0.607747	0.030827	70
T106-26	2.690	1.450	1.110	6.49	2.504	0.659	1.650	1.087655	0.113914	93
T130-26	3.300	1.980	1.110	8.28	4.409	0.698	3.078	2.148105	0.141056	81
T132-26	3.300	1.780	1.110	7.96	3.090	0.805	2.487	2.002191	0.151249	103
T131-26	3.300	1.630	1.110	7.72	2.357	0.885	2.086	1.845815	0.152983	116
T141-26	3.590	2.240	1.050	9.14	5.844	0.674	3.939	2.654762	0.164023	75
T150-26	3.840	2.150	1.110	9.38	4.091	0.887	3.629	3.218624	0.246891	96
T175-26	4.450	2.720	1.650	11.200	4.334	1.340	5.808	7.782377	0.715820	105