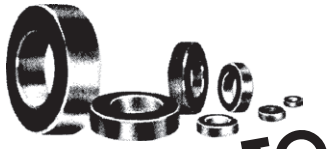

TOROID TURNS *

By Don Callow VK5AIL #75

(Amended 5 May 2004)

Often a circuit for a project specifies a toroid core, the number of turns of enamelled wire and its gauge.

If you want to use a different toroid and need to obtain the same inductance, e.g. for a tuned circuit, what you DO NOT do is to pick a core of different material and use the specified number of turns. The inductance depends greatly on the permeability of the material - so how do you estimate the number of turns ?

The accompanying TABLE OF EQUIVALENT TOROID TURNS may help. From it you can work out the number of turns of wire to be wound on your core, for some of the common sizes of toroids.

Example:
Specified - 20 turns on a Neosid 4327R/1/F25 core.
How many needed on a Philips 14 x 9 x 5 mm violet coloured substitute ?

■ Both cores are of ferrite material; the Philips is catalogue No. 4322-828-97180.

■ From the table, 63 turns on the Philips core are equivalent to 100 on the 4327R/1/F25, size 12.7 x 6.4 x 3.2 mm. So you need -

$$\frac{20}{100} \times 63 = 12.6 \text{ turns.}$$

■ As usual, it pays to wind extra turns on the core and later adjust them as necessary by removing the one or more excess turns. And in any case, the table gives only a rough guide.

■ So try starting with 14 or 15 turns on the Philips core.

It is quite easy to extend the table for other cores, as long as you know (or can work out) the Inductance Index A_l in uH per 100 turns. If the figure you have is in mH per 1,000 turns, just multiply it by 10 and you have the figure in uH per 100 turns.

The figure in the table is equal to

$$100 \times \sqrt{\frac{A_l \text{ of specified core}}{A_l \text{ of substitute core}}}$$

For details refer to the article TOROID TIMES which appeared in Lo-Key #11, September 1986. It was reprinted in the Club's Travelling Circuit Book No.1 (*No longer available - VK5AIL*), with the tables in an upgraded format. Table B - MATERIALS is reproduced here.

. o O o .

* Originally in Lo-Key #15 Sep '87; #46, #82

Note: Past issues of Lo-Key are available from the Club's Bits n Kits service.

TABLE B MATERIALS

BRAND	MIX ID	COLOUR CODE if coated	INITIAL PERMEABILITY μ_i	USEFUL FREQUENCY RANGES MHz	
				TUNED CIRCUITS	BROADBAND TRANSFORMERS
MATERIAL GROUP: IRON POWDER					
AMIDON	2 (E)	red	10	2 - 10	0.5 - 30
"	6 (SF	yellow	8	10 - 20 ? 90	2 - 50
MATERIAL GROUP: FERRITE					
AMIDON	43	(none)	850	0.01 - 1	1 - 50
"	61	(none)	125	0.2 - 10	10 - 200
NEOSID	F14	red	220	?	0.1 - 5
"	F25	(none)	50	?	1 - 50
PHILIPS FERROXCUBE	4C6	violet	100	?	0.1 - 50

NOTES:

* Iron powder has much better temperature stability than ferrite and is preferred for tuned circuits.

* Amidon Associates suggests you use larger sizes of iron powder cores for lower frequencies in the range and smaller sizes for the higher frequencies.

* High permeability gives high inductance or fewer turns for a given amount of inductance.

Originally in Lo-Key #11 Sep 1986; redrawn 7Apl1995 - VK5AIL

TABLE OF EQUIVALENT TOROID TURNS

VK5AIL 12Jul87; Amd 4Apl95; 1Dec95

SPECIFIED TOROID					SUBSTITUTE TOROID																	
					IRON POWDER						FERRITE										14.0 x 9.0 x 5.0	9.0 x 6.0 x 3.0
					AMIDON						AMIDON						NEOSID						PHILIPS	
					T-68-2	T-50-2	T-37-2	T-68-6	T-50-6	T-37-6	FT-50B-43	FT-50A-43	FT-50-43	FT-37-43	FT-50-61	FT-37-61	43 27R/1/F25	43 27R/2/F25	43 27R/3/F25	43 27R/1/F14	43 27R/2/F14	43 27R/3/F14	4322-020-97180	4322-020-97170
	IRON POWDER	AMIDON	T-68-2	17.5 x 9.4 x 4.8	100	108	119	110	119	138	<	10	10	12	29	32	57	40	33	27	19	16	36	48
			T-50-2	12.7 x 7.7 x 4.8	93	100	111	102	111	128	<	<	10	11	27	30	53	37	30	25	18	15	33	45
			T-37-2	9.5 x 5.2 x 3.3	84	90	100	92	100	115	<	<	<	10	24	27	48	34	28	23	16	13	30	41
			T-68-6	17.5 x 9.4 x 4.8	91	98	108	100	108	125	<	<	<	11	26	29	52	37	30	25	17	14	33	44
			T-50-6	12.7 x 7.7 x 4.8	84	90	100	92	100	115	<	<	<	10	24	27	48	34	28	23	16	13	30	41
			T-37-6	9.5 x 5.2 x 3.3	73	78	87	80	87	100	<	<	<	<	21	23	41	29	24	20	14	11	26	35
	FERRITE	AMIDON	FT-50B-43	12.7 x 7.9 x 12.7	>	>	>	>	>	>	100	141	148	165	409	454	807	571	465	385	272	222	508	685
			FT-50A-43	12.7 x 7.9 x 6.4	>	>	>	>	>	>	71	100	104	116	290	321	571	404	329	272	192	157	360	484
			FT-50-43	12.7 x 7.1 x 4.8	958	>	>	>	>	>	68	96	100	112	277	308	547	387	315	261	184	150	344	464
			FT-37-43	9.5 x 4.7 x 3.2	858	926	>	945	>	>	61	86	90	100	249	276	490	346	282	234	165	135	309	416
			FT-50-61	12.7 x 7.1 x 4.8	345	373	412	380	412	476	24	35	36	40	100	111	197	139	113	94	66	54	124	167
			FT-37-61	9.5 x 4.7 x 3.2	311	336	372	343	372	429	22	31	33	36	90	100	178	126	102	85	60	49	112	151
		NEOSID	4327R/1/F25	12.7 x 6.4 x 3.2	175	189	209	193	209	242	12	18	18	20	51	56	100	71	58	48	34	27	63	85
			4327R/2/F25	12.7 x 6.4 x 6.4	248	267	296	273	296	342	18	25	26	29	72	80	141	100	81	67	48	39	89	120
			4327R/3/F25	12.7 x 6.4 x 9.5	304	328	363	335	363	420	22	30	32	35	88	98	174	123	100	83	59	48	109	147
			4327R/1/F14	12.7 x 6.4 x 3.2	368	396	439	405	439	507	26	37	38	43	106	118	210	148	121	100	71	58	132	178
			4327R/2/F14	12.7 x 6.4 x 6.4	520	561	620	572	620	716	37	52	54	61	150	167	297	210	171	141	100	81	187	252
			4327R/3/F14	12.7 x 6.4 x 9.5	638	688	762	703	762	879	45	64	67	74	185	205	364	257	210	174	123	100	229	309

NOTES

 # The figures in the table are number of turns to be wound on SUBSTITUTE toroid for each 100 turns on SPECIFIED toroid.

 # > means that the figure is equal or greater than 1000 i.e. Substitute core needs at least 10 times number of turns on Specified core.

 # < means that the figure is < 10 i.e. Substitute core needs less than 1/10th number of turns on Specified core.

 # No figures are shown in these two situations because substitution is probably not practical.

 # The dimensions given are outer diameter x inner diameter x height, all in mm.

 # Philips ferrite cores are shown only as Substitutes because I have not seen them specified in circuits.

 # Ferrite is NOT recommended for tuned circuits mainly because of poor temperature stability. Amidon iron powder mix #6 is very stable, with a temperature coefficient for inductance of about 1/300th of that for ferrite mix #43 !

Example: Neosid 4327R/3/F25 choke SPECIFIED with 12 turns. Use Philips 14 mm 4322-020-97180 SUBSTITUTE. Wind 12 x (109/100) = 13 turns