# Inductor Core Selection Procedure

Only two parameters of the design application must be known to select a core for a current-limited inductor; inductance required with DC bias and the DC current. Use the following procedure to determine the core size and number of turns.

1. Compute the product of $LI^2$ where:
   L = inductance required with DC bias (mH)
   I = DC current (A)

2. Locate the $LI^2$ value on the Core Selector Chart (page 20, 21 & 22). Follow this coordinate to the intersection with the first core size that lies above the diagonal permeability line. This is the smallest core size that can be used.

3. The permeability line is sectioned into standard available core permeabilities. Selecting the permeability indicated will tend to be the best trade-off between $A_L$ and DC bias.

4. Inductance, core size, and permeability are now known. Calculate the number of turns by using the following procedure:

   (a) The inductance factor ($A_L$ in $nH/T^2$) for the core is obtained from the core data sheet. Determine the minimum $A_L$ by using the worst case negative tolerance (generally -8%). With this information, calculate the number of turns needed to obtain the required inductance from:

   $$N = \sqrt{\frac{L\,10^3}{A_L}}$$

   Where L is required inductance (µH)

   (b) Calculate the bias in A·T/cm from:

   $$H = \frac{NI}{l_e}$$

   (c) From the Permeability vs. DC Bias curves (pages 26 through 28), determine the rolloff percentage of initial permeability for the previously calculated bias level. Curve fit equations shown in the catalog can simplify this step. They are also available to use on Magnetics website: http://www.mag-inc.com/design/design-guides/Curve-Fit-Equation-Tool

   (d) Multiply the required inductance by the percentage rolloff to find the inductance with bias current applied.

   (e) Increase the number of turns by dividing the initial number of turns (from step 4(a)) by the percentage rolloff. This will yield an inductance close to the required value after steps 4 (b), (c) and (d) are repeated.

   (f) Iterate steps 4 (b), (c) and (d) if needed to adjust turns up or down until the biased inductance is satisfactorily close to the target.

5. Choose a suitable wire size using the Wire Table (page 23). Duty cycles below 100% allow smaller wire sizes and lower winding factors, but do not allow smaller core sizes.

6. Design Checks

   (a) **Winding Factor**. See p.13 for notes on checking the coil design.

   (b) **Copper Losses**. See p.13 for notes on calculating conductor resistance and losses.

   (c) **Core Losses**. See p.14 for notes on calculating AC core losses. If AC losses result in too much heating or low efficiency, then the inductor may be loss-limited rather than current-limited. Design alternatives for this case include using a larger core or a lower permeability core to reduce the AC flux density; or using a lower loss material such as MPP in place of Kool Mµ, or High Flux in place of XFLUX.

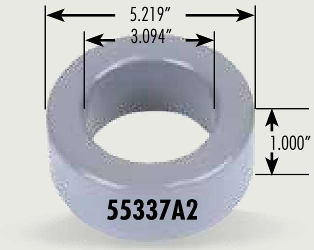
   (d) **Temperature Rise**. Dissipation of the heat generated by conductor and core losses is influenced by many factors. This means there is no simple way to predict temperature rise (△T) precisely. But the following equation is known to give a useful approximation for a component in still air. Surface areas for cores wound to 40% fill are given with the core data in this catalog.

   $$\Delta T\,(^\circ C) = \left(\frac{\text{Total Losses (mW)}}{\text{Component Surface Area (cm}^2\text{)}}\right)^{0.833}$$

# 132.6 mm OD



| Core Dimensions | OD(max) | ID(min) | HT(max) |
|---|---|---|---|
| Before Finish (nominal) | 132.6 mm/5.219 in | 78.60 mm/3.094 in | 25.4 mm/1.000 in |
| After Finish (limits) | 134.0 mm/5.274 in | 77.19 mm/3.039 in | 26.8 mm/1.055 in |




| Permeability (μ) | $A_L$ ± 8% | Part Number | | | |
|---|---|---|---|---|---|
| | | MPP | High Flux | Kool Mμ® | XFLUX® |
| 14 | 37 | 55336 | 58336 | - | - |
| 26 | 68 | 55337 | 58337 | 77337 | - |
| 40 | 105 | - | - | 77338 | - |
| 60 | 158 | 55339 | 58339 | 77339 | - |
| 125 | 329 | 55340 | 58340 | - | - |

| Physical Characteristics | |
|---|---|
| Window Area | 4,710 mm² |
| Cross Section | 678 mm² |
| Path Length | 324 mm |
| Volume | 220,000 mm³ |
| Weight- MPP* | 1,700 g |
| Weight- High Flux* | 1,500 g |
| Weight- Kool Mμ* | 1,200 g |
| Weight - XFLUX | - |
| Area Product | 3,190,000 mm⁴ |

*26μ, see page 25

| Winding Turn Length ** Reference General Winding Data pages* | |
|---|---|
| Winding Factor | Length/Turn (mm) |
| 0% | 110 |
| 20% | 130 |
| 25% | 135 |
| 30% | 139 |
| 35% | 145 |
| 40% | 150 |
| 45% | 156 |
| 50% | 162 |
| 60% | 173 |
| 70% | 187 |

| Wound Coil Dimensions | | |
|---|---|---|
| 40% Winding Factor | OD | 146 mm |
| | HT | 50.7 mm |
| Completely Full Window | Max OD | 179 mm |
| | Max HT | 78.8 mm |

| Surface Area | |
|---|---|
| Unwound Core | 36,000 mm² |
| 40% Winding Factor | 65,000 mm² |

### Kool Mμ $A_L$ vs. DC Bias