Magnetics inductor design tool - quick start guide

Once you have downloaded the tool (via https://www.mag-inc.com/Design/Design-Tools/Inductor-Design) double click the Excel file to open the design tool software. This tool is based on the Microsoft Excel application package, you will need Microsoft Excel 2007 or newer to use this tool. Once opened, you should see the Magnetics logo with a screenshot asking you to 'Enable content'.
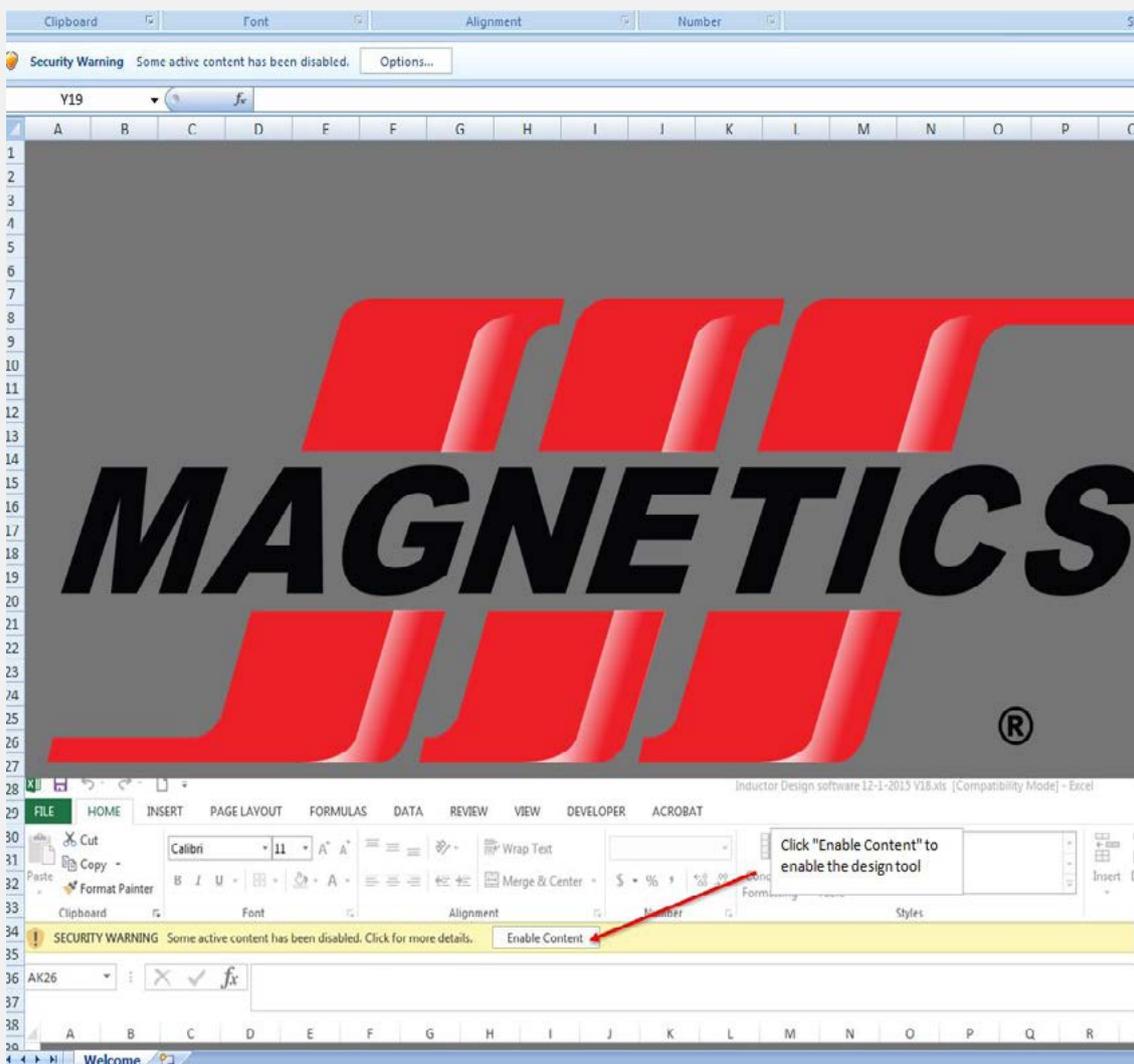
Between the formula bar and the formatting ribbon, you should see a security warning; "Some active content has been disabled", with an "Options" or "Enable Content" button next to it.
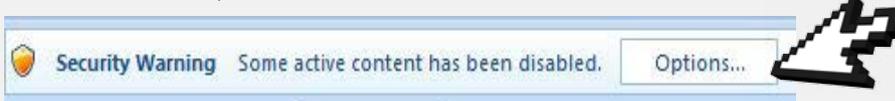
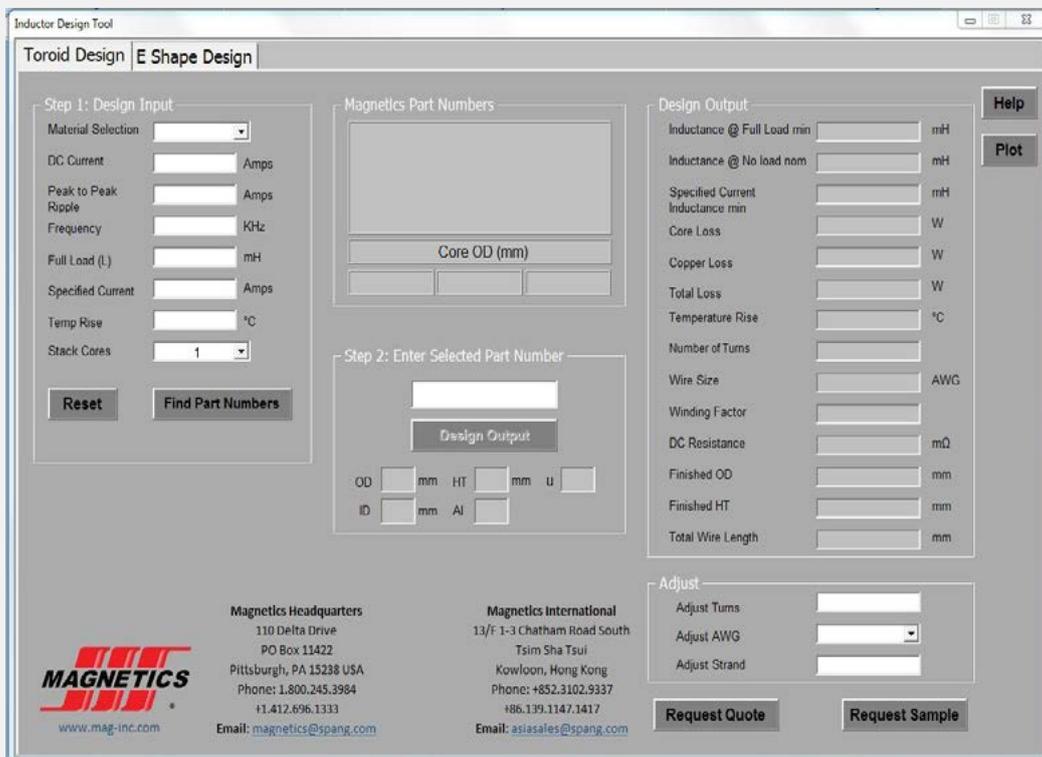
Click this and you should see a security alert window open (this will differ depending on the version of office you are using.

In the security alert window, select "Enable Content", then click OK.

This will launch the design tool window. You should now have the following:

Now you are ready to start the design process.

Firstly, you need to select your design shape by selecting between Toroid and E-Shape design tabs at the top of the window.

Now we are ready to find the suitable part numbers for your application. If you already know the part number(s), you can skip to the next step.

Enter your design criteria on the left hand side of the design tool, including your selected material, DC current, Frequency and Full Load. Once complete, click 'Find Part Numbers'. This will display part numbers in the central window:
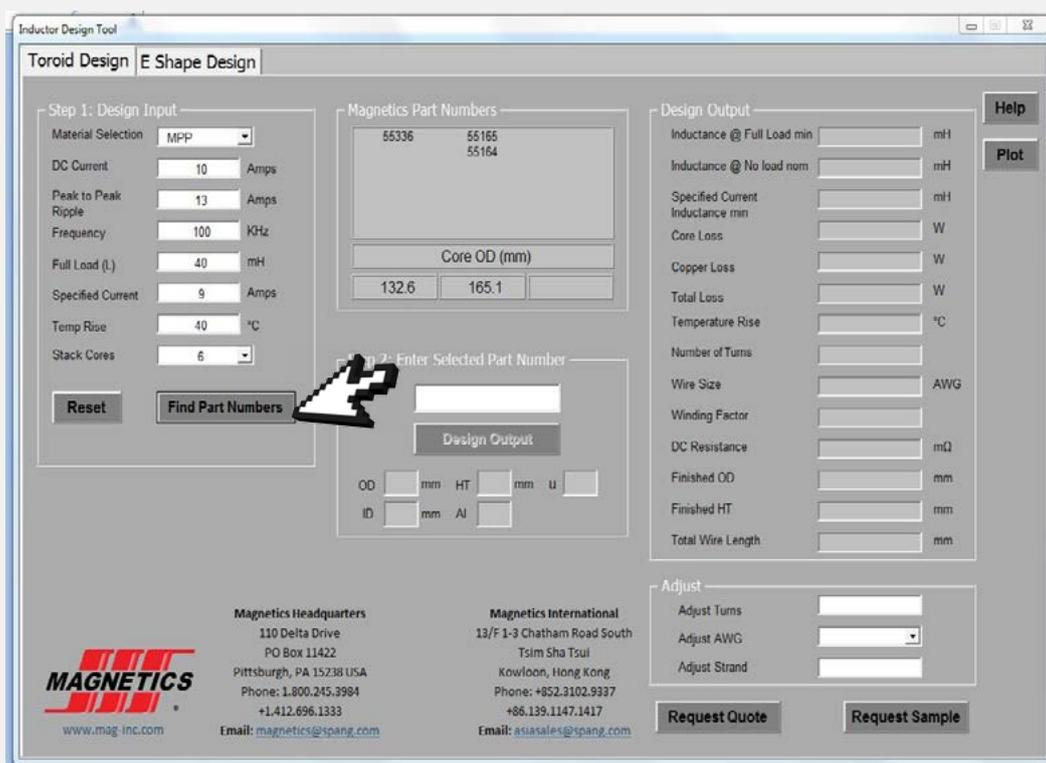

With part numbers available, enter one of these into the second stage of design software, directly below the part number window. If you already know or have part numbers available, you can enter these into the part number window.

If you enter a part number which is not recognised, the "Design Output" option will remain grey.

With the part number entered, click "Design Output" and the tool will provide the key design parameters required for your application, including dimensions, inductance, power loss and temperature rise. Any parameters significantly different to those in the design input will show in red font.
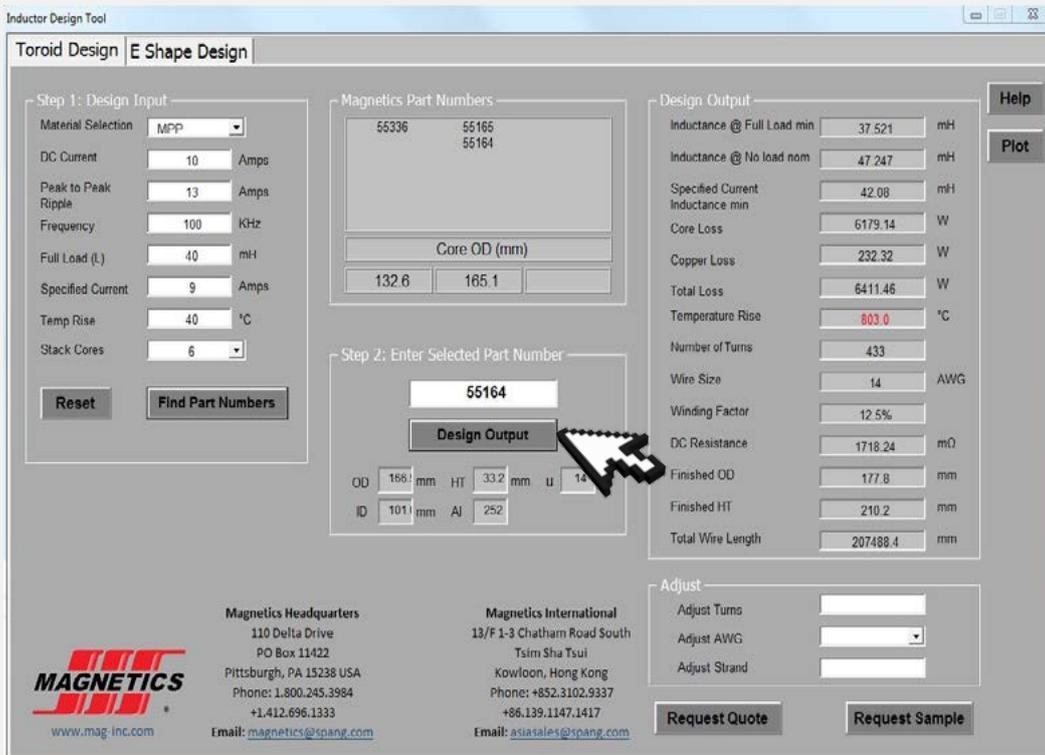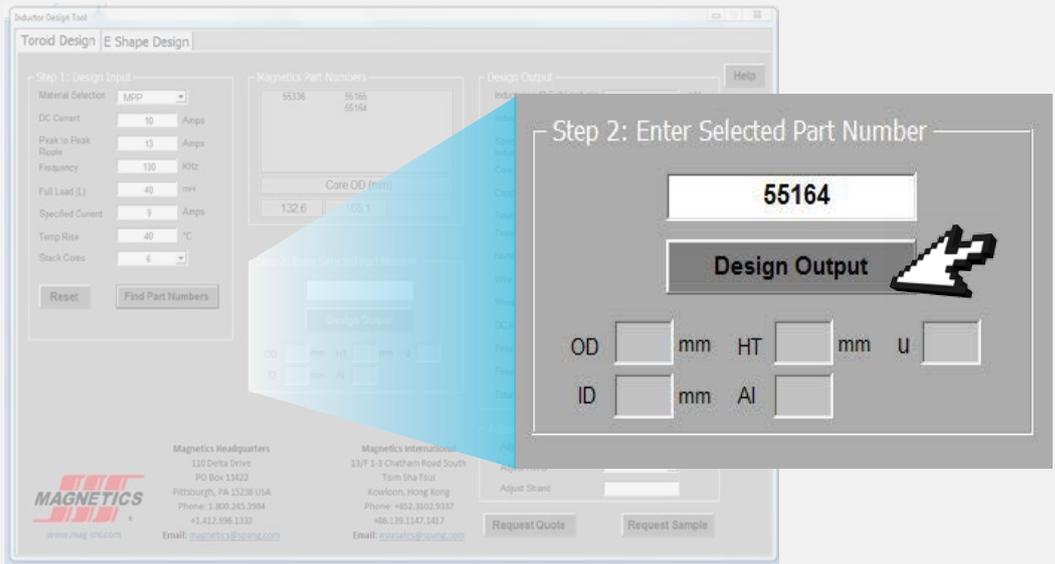
Below the Design Output, you can make adjustments to the design in terms of Turns, AWG and Strand. After making adjustments, click "Design Output" to apply any changes.
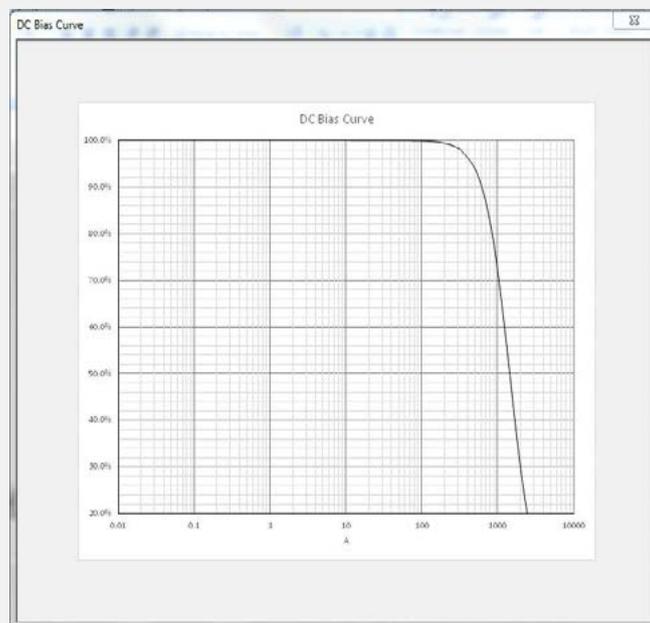

Once you are happy with the parameters / output, click 'Plot' to see a graph of the core's properties and performance.

You can adjust your design as many times as you like. After making changes, click "Design Output" to apply these before clicking "Plot" to see your performance graph.

Once you are happy with your design, samples can be requested or parts ordered from Acal BFi by contacting your local office or dedicated sales contact. (See next page)

consult. design. integrate.

Appendix 1 - terms and definitions

The Design Tool software requires users to enter a Material Selection, DC Current, Full Load and Number of Stack Cores to provide accurate Magnetics Part Number suggestions. It is recommended to provide as much data as possible during the Design Input stage to provide the most accurate part numbers.

Design Inputs

Material Selection: (required)

Choose from up to five Magnetics materials, including Kool Mu, XFlux, High Flux, MPP and 75 Series.

DC Current: (required)

The effective DC current in Amps flowing through the inductor. This is often simply the maximum output current that the inductor must support. For line frequency AC plus High frequency ripple enter the RMS value of the line frequency and add the high frequency ripple into the peak-to-peak ripple.

Peak to Peak Ripple:

The high frequency 'ripple' current in Amps, peak to peak, that is superimposed on the DC current. This contributes to core losses in inductor designs. Relatively aggressive designs (for example, ripple currents that are 25% or more compared to the DC current) can have high core losses and large temperature rises.

Frequency:

Switching frequency of the SMPS converter. This defines the frequency of the AC ripple current and allows the design package to accurately estimate core losses.

Full Load L: (required)

The inductance (in milli Henries) that must be maintained by the inductor at maximum steady state load current. This value is perhaps the most crucial for the design, and is usually specified as a minimum.
Note: When entering this value, please use a leading 0 when entering micro henries; example 300 microhenries is entered as 0.3 or 0.30 or 0.300.

Specified Current:

The value of current for which you will like to know the value of inductance at that current. Often Peak current plus maximum AC ripple. It can be any current value that is of interest.

Temperature Rise:

Maximum allowable temperature rise (in degrees °C) for the final, wound design.
Note: If the desired temperature rise has been exceeded, the Temperature rise font in the output will turn red.

Stack cores:

It can be beneficial for a designer to stack cores. This increases the core area while maintaining the path length. Therefore the inductance is increased for the same size of OD of the core.

Current Density:

The software assumes a value of 500 Amps/cm^2. The density (in Amps per square centimeter) of current in the windings. This value is used to correctly size the wire gauge used in the design. Note that for very high current levels, stranded conductors are recommended to make use of all of the copper due to the skin effect that occurs at higher frequencies and also to reduce losses.

Selected Part Number:

Wound Core Dimensions

The dimensions of the wound core, in mm.

For toroids, OD is the outside diameter of the component and HT is the wound core's height.

For E-core and U-Core designs, OD is the back wall dimension of the core set, HT is the height of the wound bobbin.

ID – is the inside diameter in a toroid

AI – is the inductance factor, units for it are nH/T^2

μ – is the permeability

In all cases, these dimensions should represent 'worst case' values, as they are based on the maximum dimensions of the selected core.
Note that not all E- and U-Core sizes have bobbins offered. In these cases, the winding area is computed as 90% of the area defined by the minimum core window dimensions.

consult. design. integrate.

Design Outputs

Inductance at Full Load min:

The actual inductance (at maximum output current) that the inductor design will produce, expressed in mH if the core is at the minimum core Al value typically -8% of nominal..

Inductance at No Load nom:

The inductance of the wound core of nominal AL value with no load (output) current, expressed in mH. In designs where the core has been selected from the website or catalog (as opposed to being chosen by the design program), this value may not meet the required inductance

Specified Current Inductance Min:

The actual inductance (at Specified Current) that the inductor design will produce, expressed in mH if the core is at the minimum core Al value typically -8% of nominal

Core Loss:

Total losses generated by the core material.
Note: Often designs can be made more efficient by switching to a low loss material such as Kool Mμ or MPP or by selecting a slightly larger core.

Copper Loss:

Copper losses generated in the windings. This value is a combination of the I^2 R losses and the estimated AC losses.

Total Losses:

Combined losses through both Core and Copper.

Temperature Rise:

The temperature of the inductor (in °C), taking into account full copper and core losses. Larger sized cores tend to be able to support much higher losses with lower temperature rises than smaller ones, as they have a larger amount of surface area with which to dissipate the accumulated heat.
Note: If the temperature rise is higher than that specified in the Temperature Rise input field then this field will show a red font color as a warning.

Number of Turns:

The number of turns of wire that must be wound on the core to obtain the desired inductance at full load.

Wire Size:

The American Wire Gauge (AWG) wire size recommended by the design program. The software chooses a single strand that will carry the current. Adjust this as necessary to lower losses, take into account skin effect and use multiple strands of wire for higher frequencies.

Winding Factor:

The percentage of winding area (ID of toroids, Bobbin window area for E-cores and U-Cores) occupied by wire. This is calculated by multiplying the turns by the wire area and dividing by the winding area. Winding factors of up to 0.5 are typical for toroidal designs, while bobbin-wound (E-core and U-Core) designs can see typical winding factors of up to 0.8.

Note: This value assumes wire coated with insulation. If you are using magnet wire with a very thin coating a lower winding factor will be achieved.

DC Resistance of Winding:

The resistance (in Ohms) of the winding. DCR is used to calculate copper losses in the inductor.

Finished OD:

The outside diameter of the inductor including winding. It is expressed in mm.

Finished HT:

The height of the inductor including the winding.

Total Wire Length:

The length of wire needed to apply all the turns required by the design

Adjust

Adjust turns:

This field helps to adjust the inductance value by changing the number of turns of the design. The software will change the output parameters according to the value on this field.

Adjust AWG:

Changing this value the user can adjust the section of the wire used in the design. The software will change DC resistance and copper losses accordingly.

Adjust strand:

This field allow to modify the number of strands used to make the turns. The software will change DC resistance and copper losses accordingly.

When you make these adjustments, repress the "Design Output" button to recalculate with the new values.

consult. design. integrate.

acal | bfi

European leader in advanced technology solutions

www.acalbfi.com

Acal BFi Belgium
Lozenberg 4
1932 Zaventem
Belgium

Tel: +32 (0)2 720 5983
Fax: +32 (0)2 725 1014
Email: sales-be@acalbfi.be
Web: www.acalbfi.be

Acal BFi Nordic AB (Denmark)
Jernbanegade 23 B
DK-4000 Roskilde
Denmark

Tel: +45 70 26 22 25
Fax: +45 70 26 22 21
Email: info@acalbfi.dk
Web: www.acalbfi.se

Acal BFi Nordic AB (Finland)
Teknobulevardi 3-5
FI-01530 Vantaa
Finland

Tel: +358 207 969 770
Fax: +358 207 969 771
Email: info@acalbfi.fi
Web: www.acalbfi.se

Acal BFi France SAS
4 Allée du Cantal
Z.l. La Petite Montagne Sud
CE 1834 - Lisses
91018 EVRY Cedex, France

Tel: +33 (0)1 60 79 59 00
Fax: +33 (0)1 60 79 89 01
Email: sales-fr@acalbfi.fr
Web: www.acalbfi.fr

Acal BFi Germany GmbH
Assar-Gabrielsson-Straße 1
63128 Dietzenbach
Germany

Tel: +49 (0)6074 4098 0
Fax: +49 (0)6074 4098 110
Email: sales-de@acalbfi.de
Web: www.acalbfi.de

Acal BFi Germany GmbH
Oppelner Straße 5
82194 Gröbenzell
Germany

Tel: +49 (0)8142 6520 0
Fax: +49 (0)8142 6520 190
Email: sales-de@acalbfi.de
Web: www.acalbfi.de

Acal BFi Italy SRL
Via Cascina Venina n.20/A
20090 Assago (Ml)
Milan
Italy

Tel: +39 02 53583.1
Fax: +39 02 53583201
Email: sales-it@acalbfi.it
Web: www.acalbfi.it

Acal BFi Italy SRL
Via Alessandro de Stefani 60
00137 Roma
Italy

Tel: +39 06 86894259
Fax: +39 06 86895354
Email: sales-it@acalbfi.it
Web: www.acalbfi.it

Acal BFi Netherlands BV
Luchthavenweg 53
5657 EA Eindhoven
The Netherlands

Tel: +31 (0)40 250 7400
Fax: +31 (0)40 250 7409
Email: sales-nl@acalbfi.nl
Web: www.acalbfi.nl

Acal BFi Nordic AB (Norway)
Gigstadsvei 24
3511 Hönefoss
Norway

Tel: +47 (0)32 16 2060
Fax: +47 (0)32 16 2069
Email: info@acalbfi.no
Web: www.acalbfi.se

Acal BFi Nordic AB (Sweden)
Rissneleden 138
SE-17457 Sundbyberg
Sweden

Tel: +46 (0) 8 5465 6500
Fax: +46 (0) 8 5465 6565
Email: info@acalbfi.se
Web: www.acalbfi.se

Acal BFi Nordic AB (Sweden)
Fålhagsleden 59
Box 3002
SE-750 03 Uppsala
Sweden

Tel: +46 (0)18 56 58 30
Fax: +46 (0)18 69 66 66
Email: info@acalbfi.se
Web: www.acalbfi.se

Acal BFi UK Limited
3 The Business Centre
Molly Millars Lane
Wokingham
Berkshire, RG41 2EY
UK

Tel: +44 (0)1189 788 878
Fax: +44 (0)1189 776 095
Email: sales-uk@acalbfi.co.uk
Web: www.acalbfi.co.uk

Acal BFi UK Limited
Challenge House
Sherwood Drive
Bletchley, Milton Keynes
Buckinghamshire, MK3 6DP
UK

Tel: +44 (0)1189 788 878
Fax: +44 (0)1189 776 095
Email: sales-uk@acalbfi.co.uk
Web: www.acalbfi.co.uk