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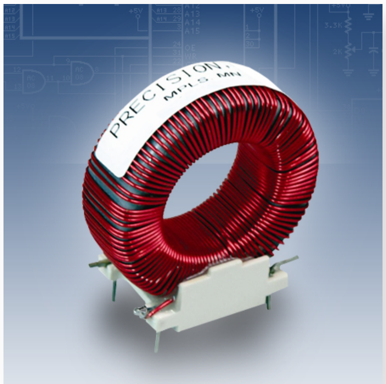

Power Factor Correction (PFC) Magnetics Checklist

In recent years, power factor correction (PFC) has been gaining momentum. While the U.S. does not have any existing regulatory requirements, in Europe, the employment of PFC in power supplies is necessary to meet the European EN61000-3-2 regulatory standard. As the U.S. government continues to emphasize energy conservation and efficiency, the domestic need for PFC is on horizon. While many design considerations exist for a PFC circuit, the design of PFCmagnetics hinge upon a few key parameters. Precision Inc. has created a checklist to demystify these parameters and ensure that key design considerations are addressed.

Design Checklist

#	Parameters	Considerations
1	**Power level in Watts** • Output of the PFC • Do not fail to include the efficiency of the downstream DC/DC converter when deter mining the required PFC output power.	Lacking better information, assume 85% efficiency for the DC/DC.
2	**Input voltage range** • Usually 85-265VAC	85-265V input range includes worst-case for a label rating of 100-240V
3	**Input frequency range** • Usually 50-60 Hz	Some applications require 400 Hz. This doesn't usually affect the magnetics appreciably but it does have some implications for the control method.
4	**Operating frequency** • Fixed or variable	Fixed frequency operation is only available in Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode (DCM) operation. Boundary Conduction Mode (BCM)) is variablefrequency.
5	**Output voltage** • Fixed, usually 390VDC or tracking	Tracking output voltage may offer some advantage at low mains voltages, but it requires a wider inputrange on the DC/DC. If this method is chosen, verify that the efficiency of the DC/DC does not degrade at low input.
6	**Conducted EMI requirements** • Class A or Class B	EMI requirements will mostly affect the design of the input filter. Normally, at least one common-modeinductor will be required.
7	**Topology** • Single-switch boost • Two-phase interleaved boost	Two-switch interleaved topology may result in smallerindividual components, but there will be more of them and statistical reliability should be considered. Also the choice of controllers is not as great.

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8	**Operating mode** • Continuous inductor current • Boundary-mode • Discontinuous inductor current	Discontinuous and boundary mode control both produce high ripple current in the inductor (2x the average current) which increases the inductor loss and also the conducted EMI. But at low power levels (usually under 100W), these items are manageable and the control method is simple and robust. The inductor usually requires a sense winding for zero-current detection. At high power levels, CCM is the only realistic choice.
9	**Stray field from the PFC inductor**	Many PFCs are used in applications where the maximum rated power output is not continuously required. This may allow some relaxation of the thermal requirements on the inductor.
10	**Auxiliary output requirements** • Voltage • Number of aux windings • Isolation	In some crowded applications, the stray field from the inductor may cause a problem. Toroids are not always the best solution in this regard, and some ferrite shapes can be considered (potcore, RM core).
11	**Average vs. maximum output power**	CCM PFCs can very effectively use an auxiliary winding of a few turns to generate a surprisingly stable DC voltage for operatin the controller after startup. Also, it is relatively easy to make the aux winding comply withSELV requirements so a secondary-sidecontrol voltage can be provided.
12	**Physical size constraints and mounting considerations**	Size can be partly driven by (9) above. Also, when calculating the inductance, it is important to understand that it is OK for the value to swing downward as much as 50% at maximum current. This is why materials other than ferrite are usually chosen. Ferrite saturates abruptly where powderediron, Kool Mu, MPP and related materials do not.
13	**Temperature rise constraints** • Usually the magnetics are not the issue	The inductor in a well-designed PFC is not usually a major loss item. Also, allowing a fair amount of swing may vallow a smaller core which will have less core loss.
14	**Cost objective**	Cost is driven mostly by choice of core material and mounting hardware

The checklist above presents a list of parameters generally applicable to most PFC applications. Contact Precision Inc. for custom requirements specific to the desired application.