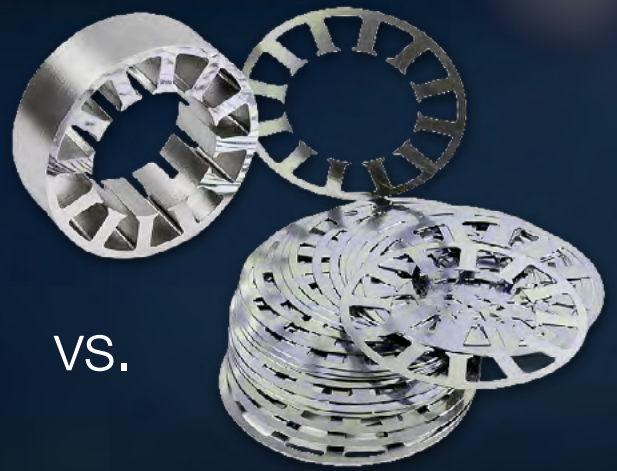




VS.



Application note

Somaloy® 700 7P vs Lamination datasheets: Data measured on real components

When choosing the core material for an electric machine, data sheet comparisons is a logical first step. However, when comparing Soft Magnetic Composites with Laminated steel sheets, simply comparing data sheets can be misleading.

Lamination data sheets are typically measured on single, ideal sheets under perfect conditions.

In reality, laminations in machine cores undergo cutting, punching, stacking etc. – processes that introduce stress and distortion, significantly increasing losses and reducing permeability. The losses can be 30-100% higher than data sheet values^{1,2}.

By contrast, **SMC (Soft Magnetic Composite) data sheets are based on small, pressed and cured components**, which closely represent real-world performance for typical applications. However, SMC also has limitations: very tall or complex geometries can

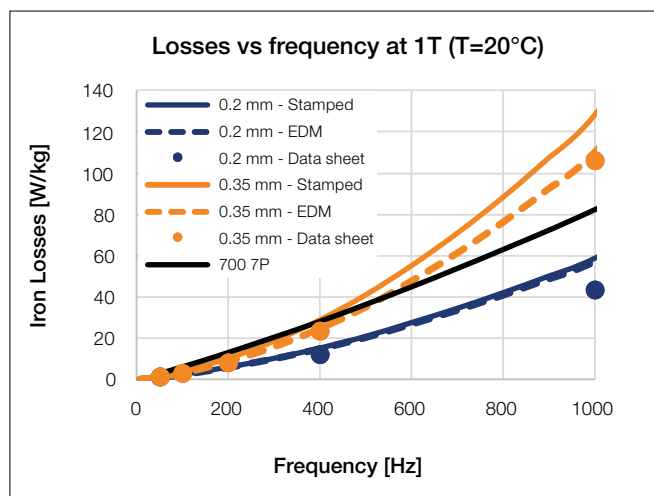
lead to density variations, affecting magnetic properties, but often in predictable ways. **To understand the effect of different densities, review the material data sheets by scanning the QR code at the bottom of the next page.**

A study at Newcastle University³ provides a clear example of this issue. It compared laminations and SMC using identical toroidal rings (55/45/5 mm) – the same geometry used for Somaloy datasheet testing. Results show that laminations are highly sensitive to manufacturing, with losses compared in the graph below. The cross-over frequency, above which Somaloy 700 7P has lower losses than 0.35 mm laminations, dropped from 600 Hz to 380 Hz when comparing with a stamped and stacked ring instead of data sheet values.

Furthermore, simulation softwares try to incorporate this in their models, but the study shows that the performance drop due to manufacturing was very much underestimated, with measured losses at 1T being 16% to 71% higher than simulated values.

Beyond the more real-world values on the data sheets, **SMC offers unique advantages:**

- **3D magnetic properties** enable innovative designs like axial flux machines, where flux paths are not confined to a single plane.
- **Superior thermal conductivity in all directions** supports efficient cooling, critical for high-power-density applications.



Measured losses vs JMAG-Simulated losses

Magnetic flux density	0.5 T	1.0 T	1.5 T
0.2 mm - Stamped	24.90%	27.20%	24.20%
0.2 mm - Mechanical	23.10%	23.70%	19.20%
0.35 mm - Stamped	45.40%	36.50%	16.50%
0.35 mm - Mechanical	20.80%	15.90%	3.30%
0.5 mm - Stamped	87.00%	71.40%	26.60%
0.5 mm - Mechanical	55.10%	50.80%	19.60%
Somaloy 700HR 3P	3.30%	2.00%	-1.90%
Somaloy 700HR 5P	2.10%	2.20%	-4.30%
Somaloy 130i 5P	0.40%	0.60%	-2.00%

Sources

1. **Analysis of Iron Losses in Electrical Machines**, 2022, Emma Johansson, PhD Thesis, Chalmers
2. **Measurement and Modeling of Iron Losses in Electrical Machines**, 2022, Krings et al, KTH
3. D. Gumbleton-Wood, G. J. Atkinson and L. Sjöberg, **Electromagnetic Properties of Soft Magnetic Composites and Electrical Steels at High Frequencies Considering Material Manufacturing Techniques**, 2019 *IEEE International Electric Machines & Drives Conference (IEMDC)*, San Diego, CA, USA, 2019, pp. 2027-2034, doi: 10.1109/IEMDC.2019.8785071



Scan the QR code for more information about Somaloy 7P, or email us at SMCsupport@hoganäs.com