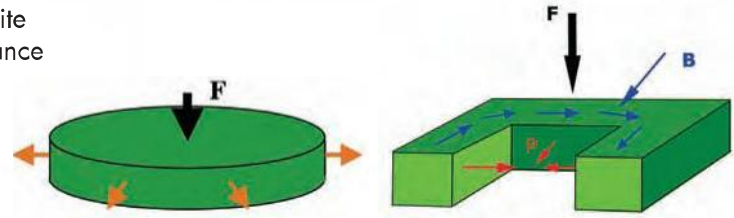


Fluxtrol Lamination Replacement Material (LRM)

Fluxtrol LRM utilizes the anisotropic nature of the magnetic composite material to maximize flux concentrator and induction coil performance

Optimal orientation of material in C-shaped concentrator provides high permeability, lower losses and:

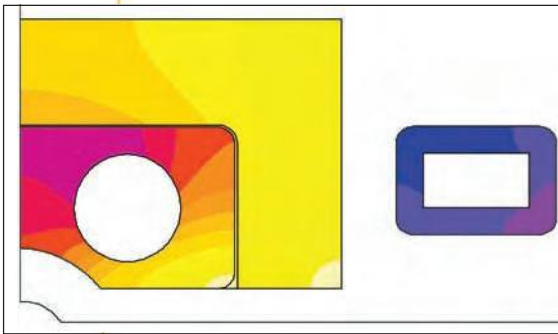
- Exists in all pressed MDMs
- Magnetic and thermal properties are higher in the direction perpendicular to pressing.
- Electrical strength is higher in direction of pressing



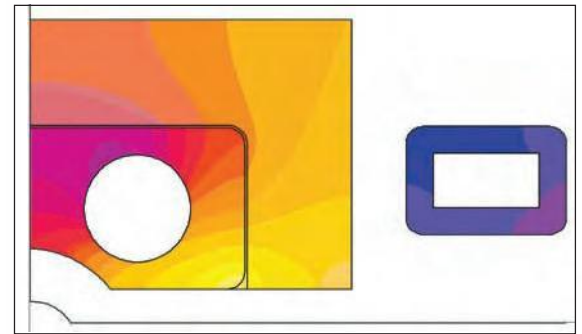
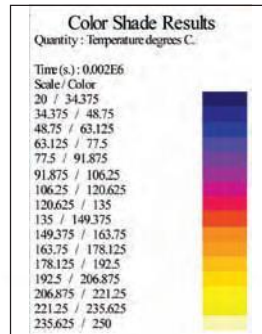
- B — Flux Density • P — Heat Transfer • F — Pressure Direction

Induction Coil Runs Cooler with Fluxtrol LRM

- Steady state temperature distribution in the pipe seam anneal induction coil with laminations
– Temperature scale 20° – 250° C



Laminations

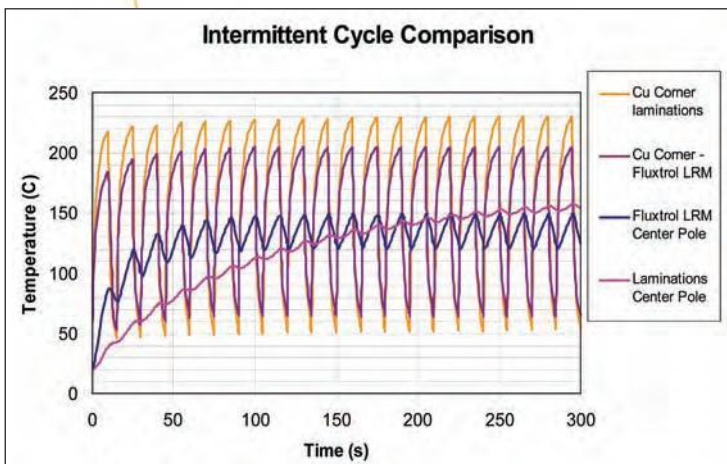


Fluxtrol LRM

- Steady state temperature distribution in the in pipe seam anneal induction coil with Fluxtrol LRM
– Temperature scale 20° – 250° C

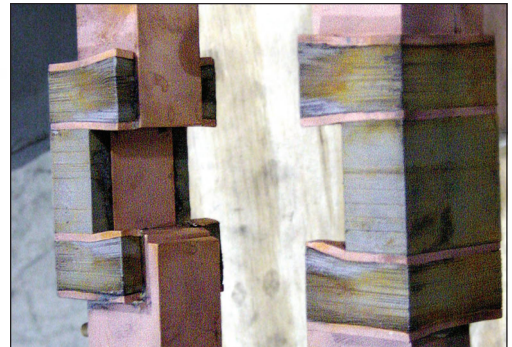
Temperature Evolution Curves in Critical Areas for Intermittent Heating

- Maximum copper temperature with Fluxtrol LRM is 20° C less than with Laminations, temperature variation span is 35° C lower



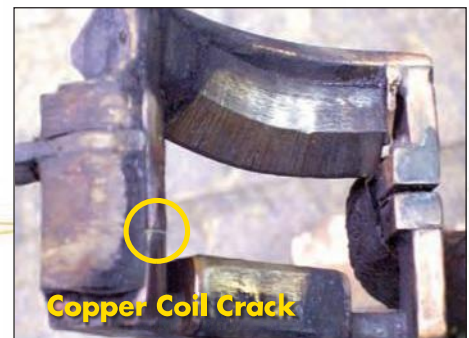
Typical Failure Mode of Laminations

- Image illustrates overheating in a three dimensional field

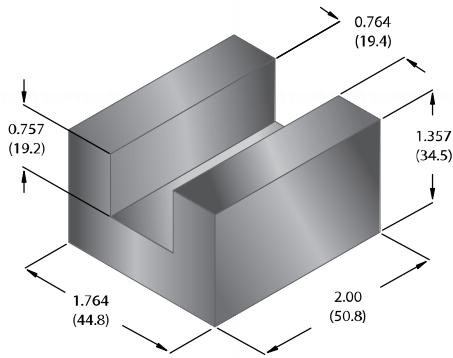
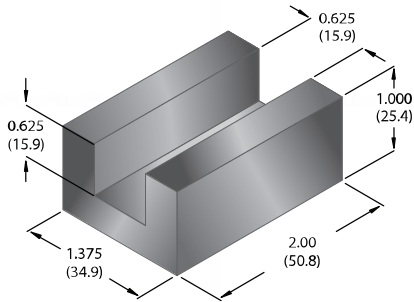
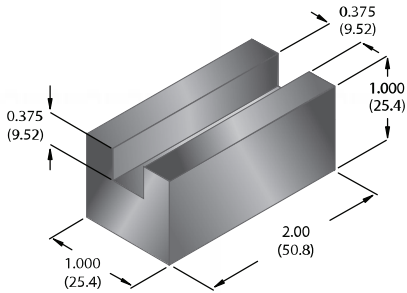


Crankshaft Coil Failure

- Copper failure due to thermal ratcheting

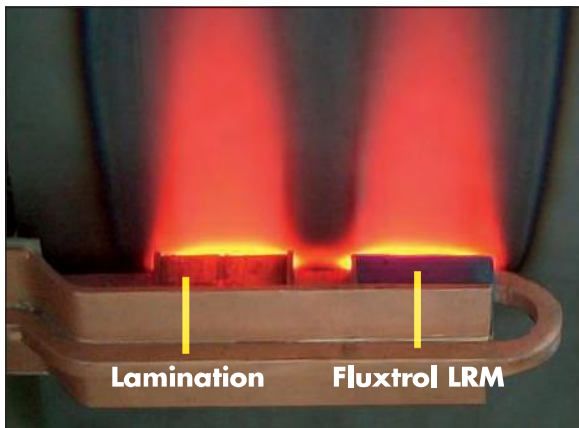


Standard Lamination Replacement Sizes



Comparison of Laminates versus Fluxtrol LRM

- Fluxtrol LRM (right) has equivalent heating to laminations (left)

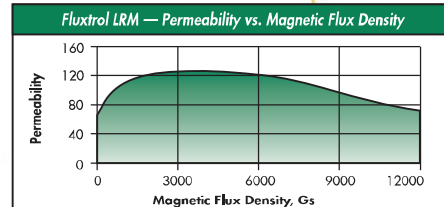
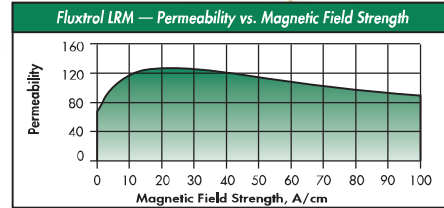
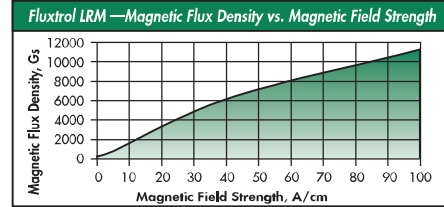


Fluxtrol Material Properties

FLUXTROL LRM

Ideal for low and medium frequency applications (.05–30kHz). Highest magnetic permeability in the Fluxtrol family of soft magnetic materials. Material has excellent mechanical strength, thermal conductivity and good machinability.

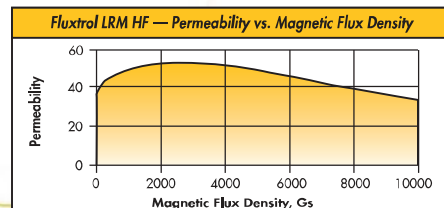
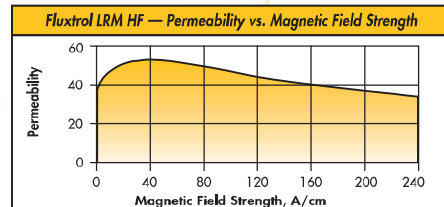
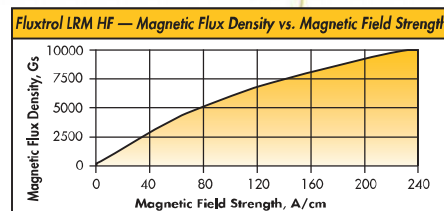
Properties	Units	Fluxtrol LRM
Density ± 2%	g/cm ³	6.6
Operating Frequency Range	kHz	.05–30
Initial Permeability		63
Maximum Permeability		120
Saturation Flux Density	Tesla	1.6
Temperature Resistance	Centigrade	250 Long Term 300 Short Term
Resistivity	kOhmcm	0.5
Thermal Conductivity	W/cm C	0.2

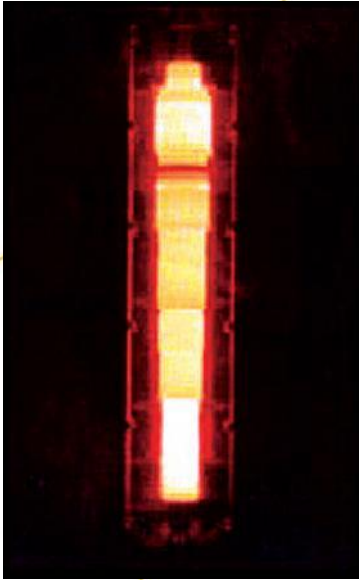


FLUXTROL LRM – High Frequency

Excellent performance over a wide range of frequencies (10-1000kHz). Ideal magnetic permeability for low and medium frequency applications, yet offers the highest permeability in the Fluxtrol family of soft magnetic materials in high frequency applications. Material has excellent mechanical strength, machinability and good thermal conductivity.

Properties	Units	Fluxtrol LRM HF
Density ± 2%	g/cm ³	6.1
Operating Frequency Range	kHz	10-1000
Major Frequency Range	kHz	10-500
Initial Permeability		36
Maximum Permeability		55
Saturation Flux Density	Tesla	1.5
Temperature Resistance	Centigrade	250 Long Term 300 Short Term
Resistivity	kOhmcm	10.0
Thermal Conductivity	W/cm C	0.1





Application **Success Report**

- Application Area: Case Hardening by Rotating Shaft in Static Position
- Component Description: Automotive Drive System Shaft w/Multiple Diameters
- Original Concentrator Type: Laminations
- Problem: Short Coil Life Due to Lamination Failure
- Failure Mode: Corrosion, Overheating of Laminations

Application **Equipment Specifics**

- Coil Design: Single Shot Coil – CNC Machined from Solid
- Available Power: 600kW – 480kW Actual in Use
- Available Frequency: 3-10 kHz – 9kHz Actual in Use
- Heating Time: 5.1 Seconds
- Quenching Time: 8 Seconds
- Total Cycle Time: 15 Seconds

Result **Documentation**

Customer was experiencing unsatisfactory life (150,000 cycles) of single shot coil with laminations being used as concentrators. Fluxtrol was given the opportunity to improve life of coil as long as there were no changes to coil or settings other than direct replacement of laminations with Fluxtrol LRM material.

Laminations were removed and replaced with Fluxtrol LRM material and coil was put back into production environment. Coil life has more than doubled with coil still running and exceeding 300,000 cycles. No other changes were necessary in set up and customer is now looking for additional applications where they can replace laminations with Fluxtrol LRM materials to extend up time.

Fluxtrol LRM Application Methods

- Thermally conductive two part epoxy is recommended.

In addition, the following mechanical fasteners may be employed.

- Secured by copper tabs
- Brass studs with washers and nuts
- Drawn together with flexible bands
- Trapped in place with non-conductive materials

Fluxtrol LRM is **Designed for:**

- Axle Bar coils
- Crankshaft coils
- Stem coils
- Spindle & Bearing coils
- Seam Anneal coils
- Specialty Melting coils

Fluxtrol LRM is Aggressively Priced to Replace Laminations!



1388 Atlantic Boulevard
Auburn Hills, MI 48326 USA

P: 1.248.393.2000
1.800.224.5522 USA
F: 1.248.393.0277

www.fluxtrol.com
sales@fluxtrol.com