

# FLUXTROL



**ADVANCING** INDUCTION TECHNOLOGY



Robert Ruffini Fluxtrol President

Riccardo Ruffini Fluxtrol CEO



Worldwide Distribution Network

## A WORLD LEADER IN INDUCTION HEATING SOLUTIONS

Fluxtrol Incorporated®, a merger of Fluxtrol Manufacturing, and Centre for Induction Technology can partner with you to attain optimal induction heating solutions using our proprietary magnetic materials, scientific knowledge, engineering experience, and innovative solutions.

Fluxtrol Manufacturing was founded in 1981 by Robert S. Ruffini, inventor, entrepreneur, and induction heating enthusiast who specialized in the development and manufacture of soft magnetic composites for magnetic flux control in induction systems.

In 1993, he founded Centre for Induction Technology (CIT) for the purpose of education and promotion of induction technologies. As a visionary he had invited Professor Dr. Valentin Nemkov, one of the world's foremost experts in induction heating technique, to lead CIT's technical efforts: to provide innovative and practical solutions for much needed productivity, to develop and enhance

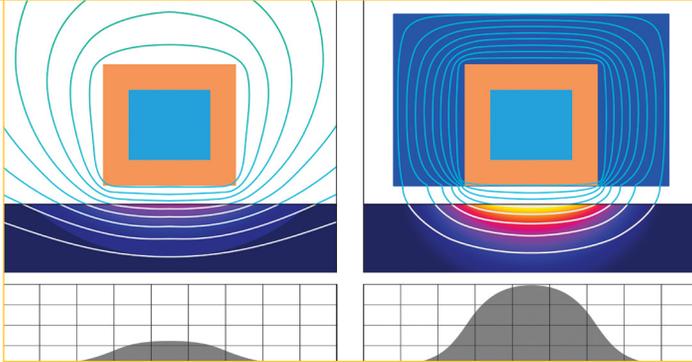
Fluxtrol's portfolio of products and educate user-professionals for the induction excellence for all concerned. Fluxtrol, Inc. and CIT have not only been advancing induction heating technologies for more than three decades, but also have become a world leader in the manufacture and supply of soft magnetic composites. Additionally, we provide a wide range of induction heating technology engineering services to a multitude of global industries.

We have a team of 20 induction heating experts including ten engineers with a wealth of real industry experience that service a global distribution network covering more than 50 countries. Our engineering team along with the combined efforts of our customer's specialists has brought forth many innovative solutions being used in thousands of applications ranging from automotive to aerospace, oil and gas, special metallurgy, biomedical and food industry.

*"Fluxtrol and CIT are bringing induction heating technology to new level through the practical use and understanding of this complicated process. It is due to their research in theoretical aspects and use of different magnetic flux concentrator products."*

— Hans Kristoffersen, Senior Researcher, Swerea | IVF

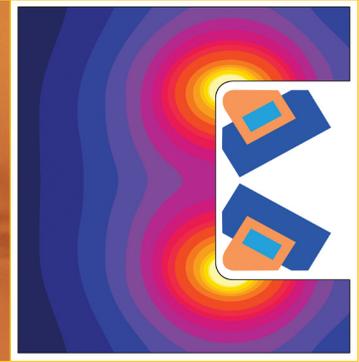
# Induction Heating Experts



Power Distribution Along Part Surface



Soft Magnetic Controllers



Crankshaft Hardening Simulation

## MAGNETIC FLUX CONTROL

Soft magnetic composites are the backbone of Fluxtrol. Substantial tests and validation efforts were employed to prove that our soft magnetic composites can not only compete with traditional materials such as SiFe laminations and ferrites, but in many cases they may exceed traditional material performance.

Our engineering experts have developed the theoretical aspects of magnetic flux control in induction heating systems and proved the material viability by means of computer simulation, laboratory tests, and practical implementation. All of these are easy to follow by customers professionals and are well documented in our Technical Library.

We continue to improve and diversify our soft magnetic composites, their installation technique, and advanced material protection methods in order to give induction heating community new materials, tools and methods for further progress in induction heating technology and equipment.

Benefits of optimal magnetic flux control include:

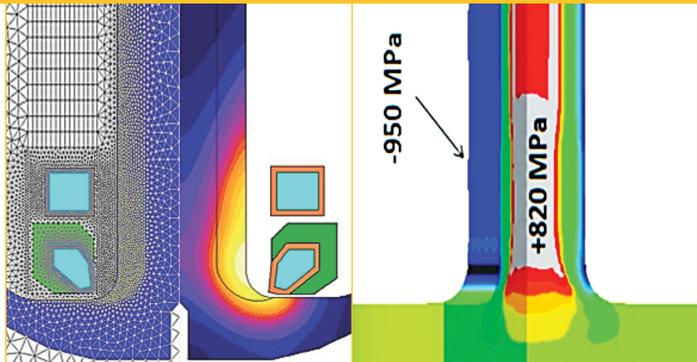
- Higher production rate
- Better component quality due to heat pattern control
- Energy saving due to improved efficiency
- Shielding of part areas from unintended heating
- Reduced coil current demand and equipment size

## CENTRE for INDUCTION TECHNOLOGY

We provide a wide range of engineering services: consulting, computer simulation, optimal design of induction coils and related processes, prototyping and validation, and finally, on-site setup, operating training and on-going technical support. Such technical support based on our vast and wide-ranging application experience is key and is one of our greatest strengths.

Using CIT's concept of Virtual Prototyping, we are able for a majority of cases to predict the performance of developed induction coils or systems effectively.

Our laboratory has induction heating power supplies ranging from 500 W to 50 kW with frequencies from 3 to 2000 kHz, and an array of magnetic and thermal measurement tools, including thermal imaging cameras. Additionally, Fluxtrol can support customers, from the design and manufacture of induction coils to development of new tooling to maximize induction process efficiency.



Induction Heating Simulation

Residual Stress Simulation



## RESEARCH & DEVELOPMENT

Research and Development is one of the core competencies of Fluxtrol and Centre for Induction Technology. The three cornerstones of our R&D are:

- Fundamental understanding of induction technique
- Use of the magnetic flux controllers (made of soft magnetic composites)
- Computer modeling and process simulation

In addition to creating solutions in traditional induction applications, we conduct research in Magnetic Nanoparticle Hyperthermia (MNH), stress and deformation control during induction heat treating, high frequency power transfer in industrial applications, crystal growth, and cold crucible melting. In order to maximize results, we form a complimentary team with a wide variety of resources, such as working cooperatively with universities, corporate research groups, government scientific groups from across the globe, and customers. By way of example, we have partnered with DANTE Solutions and Dana Corporation in a long-term study of structural transformations and formation of internal stresses during the induction heat treating of axle shafts.

## EDUCATION

We are dedicated to promoting the art and science of induction technology. This mission of education and “Advancing Induction Technology” comes in the form of personal training, conferences and seminars, as well as our special online Induction Heating Course.

The online “technical library” ([www.fluxtrol.com/technical-library](http://www.fluxtrol.com/technical-library)) has over a quarter of million views and downloads from all over the world and includes multiple video presentations, articles and technical papers prepared by our experts. Our new website contains substantial information about the theory and practice in induction technology and again we encourage all those who are interested to visit it.

In addition, CIT organizes courses for individuals and groups which can include specifically customized lectures and workshops, practical training in induction heating coil design and manufacturing, process set up, and more. Training courses in computer simulation include practical use of “Flux” (an electromagnetic and thermal finite element software) and engineering induction heating simulation program ELTA.

All of us at Fluxtrol and CIT take every opportunity to continue with learning and develop ourselves further through daily interactions with our valued customers and other partners, especially with regard to new applications and developments, technical requirements and regulations, problem solving and on-line/off-line troubleshooting methodologies.



## HI-TECH, HIGH SPEED AND HAZARDOUS ENVIRONMENT APPLICATIONS

Fluxtrol is actively working not only in traditional induction heating areas such as heat treating and melting, but also in many other areas, ranging from aerospace to biomedical. An excellent example of effective cooperative development is the innovative design of an inductive power transfer device for Tetra Pak's high-speed filling machines, that pack liquid food worldwide (International Patent WO 2006048441 A1).

Opposite is a list of the industries in which we are deeply involved, partnering with our clients in developing new processes and tools, as well as optimizing existing technologies.

### ■ Industries

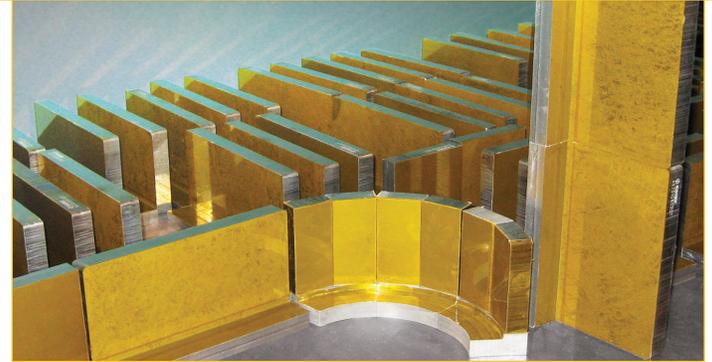
- Aerospace
- Automotive
- Machinery
- Tube and Pipe
- Oil & Gas
- Specialty Metallurgy
- Food Packaging
- Electronics
- Energy Generation
- Construction
- Biomedical

### ■ Technologies

- Heat Treating
- Mass Heating
- Special Melting
- Brazing & Soldering
- Sealing
- Inductive Plasma
- Shrink Fitting
- Tube Welding
- Die Heating
- Crystal Growth

*“Fluxtrol’s concentrators and design assistance helped Retech improve the performance of its cold crucible induction melting furnaces. The gains in efficiency have led to improved melting ability and product quality. This is very important for the advanced complex alloys being brought to market.”*

— Robert Haun, Director of New Product Development, Ukiah, USA.



## SOFT MAGNETIC COMPOSITES

Our unique magnetic materials are made of electrically insulated iron powders and high temperature organic binders using a proprietary manufacturing technology.

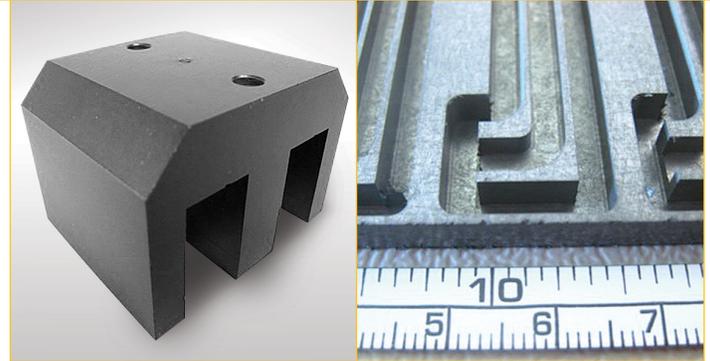
Our diverse family of products have been designed for the entire range of frequencies used in induction heating (up to 3000 kHz and even higher). Fluxtrol and Ferrotron materials have low anisotropy, excellent machinability and a unique combination of magnetic, electrical, and good mechanical strength properties with high thermal conductivity which allow our materials to handle high thermal loads. Formable SMC Alphaform LF & MF were developed on the basis of magnetic particles with a thermal-curing epoxy binder

and may be used for quick and efficient installation to induction heating coils with low tolerances.

Our materials effectively work in different challenging environments, from a vacuum to the down holes of oil and gas wells. With various protective coatings, our materials satisfy strict requirements of clean rooms, aseptic chambers, and other sterile environments. These materials are being used in special NMR and high-frequency power transfer systems.

Fluxtrol welcomes collaboration with customers or research groups for the production of custom materials and advancement of new ideas and specialized applications.

Properties	Units	— Machinable —				— Formable —	
		 FLUXTROL 100	 FLUXTROL A	 FLUXTROL 50	 FERROTRON 559H	 ALPHAFORM LF	 ALPHAFORM MF
Density $\pm 2\%$	g/cm <sup>3</sup>	6.8	6.6	6.1	5.9	4.1	4.0
Maximum Permeability	None	130	120	55	18	13	10
Saturation Flux Density	Gs	18,000	16,000	15,000	10,000	10,000	9,000
Operating Frequency Range	kHz	up to 50	up to 50	10–1000	10–3000	1–80	10–1000
Temperature Resistance	Centigrade	225 Long Term 300 Short Term	250 300	250 300	250 300	225 300	225 300
Thermal Conductivity	W/cm °C	0.23	0.2	0.06	0.04	0.02	0.02
Resistivity	kOhmcm	12.5	0.5	0.5	>15	>15	>15



## MAGNETIC FLUX CONTROLLERS

**FLUXTROL 100** [New]  
Low to Medium Frequency Soft Magnetic Composite  
[Frequency Range: up to 50 kHz]

FLUXTROL 100 has been created to replace FLUXTROL A. It has lower anisotropy and better thermal conductivity. FLUXTROL 100 has good machinability and mechanical properties. It is an optimal material for heavy loaded applications.

**FLUXTROL A**  
Low to Medium Frequency Soft Magnetic Composite  
[Frequency Range: up to 50 kHz]

**FLUXTROL 50**  
Medium to High Frequency Soft Magnetic Composite  
[Frequency Range: 10 – 1000 kHz]

**FERROTRON 559H**  
High Frequency Soft Magnetic Composite  
[Frequency Range: 10 – 3000 kHz]

*“Fluxtrol’s magnetic flux concentrators exceeded our expectations in the manufacturing of suspension components. They not only helped us lower our induction heating costs, but also improved our part quality.”*

— Predi Medina, Process Engineer TRW Canada Ltd.

Magnetic flux control, i.e., modification of the magnetic field distribution and intensity may be accomplished by variation of shape and positioning of the induction heating coil turns or by using Fluxtrol, Ferrotron and Alphaform SMCs to provide accurate heat pattern control, improve parameters of induction coils and performance of the entire installation. Each grade of our Fluxtrol SMC materials has its own distinctive properties that are the most beneficial to certain application conditions, process type, induction heating coil design, frequency, and power levels. Advantages of our magnetic flux controlling materials:

- Availability for the whole frequency range
- Outstanding mechanical properties
- Easy to machine & apply
- Good thermal properties
- Simple in-field adjustment
- Can be used for quenchant delivery
- Can work as structural components
- Wide range of sizes

Please feel free to contact Fluxtrol today for more information about which of our magnetic flux controllers will work best to optimize the performance of your induction heating system(s) in various induction heating applications.



## ADVANCING INDUCTION TECHNOLOGY

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### OUR NETWORK OF DISTRIBUTORS

