BLURRING THE LINES BETWEEN BREAKTHROUGH AND MIRACLES

Advancements in technology, science, and medicine have become so commonplace, it’s easy for consumers and medical team members alike to take them for granted. But you know what’s required to ensure the clarity, integrity, and detail of the images you capture – and what’s at stake if you don’t. For you, there’s only one partner you can trust. ETS-Lindgren.

As the world leader for MRI shielding solutions with over 30 years of experience, 10,000 installations and 25 patents under our tutelage, we design and install new MRI shielding facilities, retrofit existing facilities, and conduct site surveys to mitigate potential interference. As a result, you strengthen your reputation in the marketplace for medical expertise, your contribution to the patient care team and your value to the overall patient experience. In other words, with ETS-Lindgren, your image is safe with us.
WHERE PEOPLE DRIVE TECHNOLOGY

As much as we’re recognized for our technology, innovation, and engineering, ETS-Lindgren is very much a people company. Around the world and across the spectrum of healthcare, we bring an understanding that the most effective solutions begin with something far more basic than the products and technology we develop – a partnership between people.

From there, we get to know the complexities of your situation and how we can best work with you to resolve them. With end-to-end solutions, we continue to deliver ongoing value long after installations are complete, with training, service, and support.

CUSTOMIZED SOLUTIONS, OPTIMIZED FOR BUSINESS

In medicine, too often the cost of delivering patient care seems to be at odds with the profitability of your organization. With ETS-Lindgren, you reach the perfect balance with integrated medical shielding solutions that effectively address both with the ability to:

- More quickly and efficiently perform MRIs
- Engineer a safer, more comfortable environment for patients
- Minimize downtime and costs
- Enhance the productivity of staff
- Detect sooner, act faster
- Increase the quality, quantity, and precision of the scans performed
- Increase patient throughput
SHIELDING SOLUTIONS

Radio Frequency (RF) and magnetic interference from nearby office systems, electrical equipment, or even passing traffic, can degrade MRI image quality. With extensive capabilities in MRI shielding, ETS-Lindgren experts can select, install, and test the right RF shield for each situation, protecting your investment and letting you see results clearly. Using reliable construction methods such as copper shielding, integrated RF/magnetic shielding and silicon-based construction, ETS-Lindgren MRI shielding systems ensure long-term image quality.

Most MRI rooms only need RF shielding, but some may require magnetic shielding as well. ETS-Lindgren can perform an on-site survey to determine the type of shielding needed.
ETS-Lindgren’s MR-Cu Shield System is made of copper sheeting attached to a modular frame of fire-rated Laminated Veneer Lumber (LVL). The modules install quickly and can be easily adapted to the specific requirements of a particular room. Because the modules are structurally independent of the parent MRI room’s walls, they provide improved acoustic properties for the overall system and require no prior preparation from the customer.

**RF SHIELDED WALLS AND CEILINGS**

**MR-CU SHIELD SYSTEM**

ETS-Lindgren’s MR-Cu Shield System offers architectural flexibility and can be used in a variety of MRI suite configurations.
RF SHIELDED FLOORS

Like walls and ceilings, floors also require RF shielding. ETS-Lindgren offers two types of shielded flooring: Monolithic and Modular.

MONOLITHIC FLOORING

Our in-place Monolithic floor consists of structurally bonded materials that include a copper RF attenuator, dielectric material, and a moisture resistant barrier.

MODULAR FLOORING

Modular RF flooring uses a copper-clad wood core. A mechanical non-ferrous clamping system joins the panels together.
MAGNETIC AND RF SHIELDING

When the MRI room shares a common wall with an area including devices that may generate EMI interference, or one with equipment that is sensitive to strong magnetic fields, a separate magnetic shield can be constructed around the RF shield to contain the interference in both directions.

MAGNETIC SHIELDING

Magnetic shields are utilized for either containing the internal room generated MRI gauss lines or to prevent outside interferences, such as moving metals, elevators, electrical rooms, etc. We can develop a solution for these energies, which generally utilize M36 silicon steel.

SERIES 81 SHIELDING

Series 81 panels are made with an appropriate shielding material, bonded to both sides of a wood core.
RF SHIELDED ROOM ACCESSORIES

As an industry expert in healthcare shielding, ETS-Lindgren offers a variety of MRI suite accessories to enhance or certify the complete system.

MAGNETIC ACTIVE CANCELLATION SYSTEMS (MACS/D™)

Often, MRI systems (or other medical devices) may require more protection from magnetic interference that is not possible with passive shielding alone. ETS-Lindgren’s Magnetic Active Cancellation System (MACS/D) is an active system with real-time magnetic field compensation for AC/DC magnetic field fluctuation, allowing for higher quality images. In some instances, potential sites that were previously rejected because of high magnetic fields have become usable after a MACS/D system was installed.

MACS/D units are small in size, self-contained, and are easily installed. They require no maintenance or adjustments after installation, under normal operating conditions. MACS/D systems are designed for 24 hour, continuous operation.

Image Quality Before Activation of MACS/D Unit.

Image Quality During Activation of MACS/D Unit.
ETS-Lindgren electrical power and signal line filters prevent the transmission of conducted RF noise.

Waveguide air vents are used to stop RF noise while allowing for airflow.

**ELECTRICAL POWER AND SIGNAL LINE FILTERING**

ETS-Lindgren medical filters prevent RF interference from being conducted along electrical power and signal lines to connected medical equipment. ETS-Lindgren has an extensive selection of filters to block RF interference.

**EMI/RFI SHIELDED WAVEGUIDE AIR VENTS**

Waveguide air vents allow the free-flow of air into a shielded room for ventilation and prevent electromagnetic interference from entering the room where the waveguides are installed.
RF SHIELDED SWING DOORS

ETS-Lindgren's Shielded Swing Doors are designed to provide excellent, reliable performance while remaining easy-to-operate in a swing open/close configuration.

EVO™ MRI DOOR

ETS-Lindgren's EVO Doors are designed to provide reliable, easy-to-open access and low maintenance service for use in a rigorous MRI environment. EVO Doors have the industry’s highest STC rating of 44 with a reduction of 49 dB at the frequencies of concern. All doors in the EVO Series can be customized to meet the specific needs or concerns of every installation. Please contact ETS-Lindgren for additional information.

Standard Features
• Easy-open, lever-style handle
• Concealed seals
• Inherent acoustic properties
• Low-profile ADA compliant threshold
• Easy clean threshold

Options Available on Some Models
• RF shielded window
• Safe Intravenous Port (SIVP) feedthrough (see page 11 for information)
• Automatic open/close
• Blow-out doors
• Mag-lock
• Key pad

The EVO Door can be customized to create a unique solution for your MRI suite.
SAFE INTRAVENTHIOUS PORT (SIVP) FOR EVO MRI DOORS

ETS-Lindgren’s Safe IV Port (SIVP) provides safe and easy passage of intravenous (IV) lines into an MRI room, without compromising the RF shield. Designed exclusively for EVO Shielded Doors, the SIVP allows infusion pumps and other medical equipment to safely remain outside of the MRI room, while remaining fully connected to the patient.

In the past, performing an MRI on a patient with IV lines was adverse for the MRI environment. The IV lines would need to be disconnected from the patient and reconnected via other means, or force the facility to leave IV’s disconnected during the MRI scanning period. Alternatively, to keep infusion pumps or medical equipment safely outside of the MRI room, connected IV lines were passed through the MRI door. This option also posed serious problems, as the RF seal of the door was either breached or left in an open condition, leaving the MRI room vulnerable to EMI (electromagnetic interference), thus causing poor image quality.

With the SIVP accessory installed, medical equipment can remain safely outside of the MRI room, the RF shield remains in tact, and image quality is not compromised.
RF SHIELDED SLIDING DOORS

Shielded Sliding Doors (SSD) provide excellent, reliable performance in a sliding open/close configuration.

SSD MRI DOOR

ETS-Lindgren’s SSD was developed for the special requirements of multi-room, intraoperative suites. One of the door’s key features is a pneumatically actuated sealing mechanism that provides trouble-free operation and minimal maintenance.

Standard Features
• Single leaf sliding
• Reverse on contact sensors
• Expansion seal for acoustic and hygienic management
• ADA compliant door threshold
• Emergency overrides

Options Include
• Double leaf sliding
• Approaching object, bidirectional motion sensors
• Door positioning indicators
• Lead shielding up to 6 mm (.25 in)

Shielded Sliding Doors are available in single door configuration as standard or double door configuration as optional.
CLEARSHIELD™ RF SHIELDED WINDOWS

WINDOW WALL

The Clearshield Window Wall’s RF attenuating properties block RF interference while providing clear views of the surrounding landscape and sky, giving your room an open, airy feeling. Please note: The Window Wall must be mated to an exterior wall window or skylight.

Standard Features

• Large size 122 cm x 152 cm (48 in x 60 in) (Maximum single panel size. Panels can be combined to form larger structures.)
• 100 dB attenuation @ 150 MHz
• Suitable for 3T MRI
• STC 40 acoustic rating
• Functions as a wall, skylight or observation window
• Can be removed/replaced for magnet egress

The Window Wall lets light in while keeping RF noise out.
OBSERVATION WINDOW

ETS-Lindgren’s observation windows provide a combination of clear viewing with high RF attenuation levels. You can see perfectly, yet the transmission of RF interference is attenuated to industry standards.

Standard Features
- Large size 122 cm x 183 cm (48 in x 72 in)
  (Maximum single panel size. Panels can be combined to form larger viewing areas.)
- 100 dB attenuation @ 150 MHz
- Suitable for 3T MRI

Observation windows allow for patient viewing without compromising shield integrity.
RF SHIELDED LIGHTING SOLUTIONS

At ETS-Lindgren, we realize patient experience is an important aspect to your facility’s design. That’s why we continue to invest our resources into developing lighting solutions designed specifically for the MRI and medical environment. From low-profile lighting that fits easily in older, lower ceiling MRI facilities, to innovative graphic display lighting, ambient rope lights and strip lighting, as well as dimmers, drivers, and controllers – ETS-Lindgren enables you to create environments that keep your patients at the center of all you do.

ETS-Lindgren has a wide selection of MRI lighting products. For a complete listing visit our website at www.ets-lindgren.com or contact your local ETS-Lindgren representative.
Med-Vizion Graphic Display Panel Systems bring the aesthetics of nature into windowless MRI rooms.

RF SHIELDED LIGHTING SOLUTIONS

MED-VIZION™ GRAPHIC DISPLAY PANEL SYSTEMS

From whole ceiling and entire wall displays to single and multiple panels, Med-Vizion Graphic Display Panel (GDP) Systems dramatically transform any environment. This system is easily installed and creates a calming environment for patients and staff by illuminating photographic scenes with a natural, uniform light. These panels utilize special diffraction technology, allowing even illumination from edge-mounted LEDs.

Our new low-profile wall mounted units are a nominal 2.5 cm (1 in) in depth and can be surface mounted in a few hours or less. Ceiling units are easily installed in the most commonly used ceiling configurations. Med-Vizion GDP Systems are suitable for 3T MRIs.
RGB AMBIENT ROPE LIGHTS PLUS CONTROLLER

Designed for flexibility, mood, aesthetics, and patient comfort, RGB Ambient Rope Lights can be fabricated to any length and installed to any shape or pattern. Color and brightness can be adjusted with the dimmer/controller.

RGB AMBIENT STRIP LIGHTS PLUS CONTROLLER

Create a calming, restful environment with the RGB Ambient Strip Light System. These lights are easy to install and use a programmed, multi-color visual experience to calm and soothe. Choose between DMX dimming control, high-end, wall-mount with iPad control, or remote iPad control.

ACCENT STRIP LIGHTS PLUS CONTROLLER

Long-lasting, comfortable white light delivers low-temperature lighting that is ideal for illuminating MRI rooms and suites. Slide dimmer controls provide easy adjustment between higher-light needs or low-light ambience.

Ambient lighting creates a restful, calming aesthetic in a multitude of medical environment applications.
The Med-Vizion LED Sheet Lamp Recessed Troffer provides an efficient, uniform illumination in a variety of sizes.

The Med-Vision ZXR LED Down Light saves energy and costs less to maintain than traditional lighting.

MED-VIZION ZXR LED DOWN LIGHTING

Med-Vizion ZXR LED Down Lighting uses the latest LED technology for MRI compatible lighting with brightness equal to incandescent lighting, but consumes less power and lasts longer. Med-Vizion lamps include all necessary mounting hardware and trim rings. All down light fixtures are outfitted with external drivers and a dimmer switch assembly that supports up to 15 ZXR LED Down Lights. This dimmable down light meets magnet OEM standards and conformance guidelines.

MED-VIZION LED SHEET LAMP RECESSED TROFFER

Ideal to replace standard fluorescent fixtures with an efficient, no glare, uniform luminance across the lighting panel, the Med-Vizion LED Sheet Lamp Recessed Troffer consists of an LED lighting guide plate and built-in dimmable LEDs. The thin profile makes this ideal for low clearance ceiling spaces, as it is only as thick as the ceiling grid.
SAFETY SOLUTIONS

Buying, installing, and upgrading an MRI room is an expensive investment. An important part of the process is the shielding required to ensure patient and staff safety. In addition to being the leader in RF Shielding and RF Shielding products and accessories, ETS-Lindgren is also the leader in safety solutions for MRI. Our solutions are designed to protect your staff, patients, and facility from potential or adverse events. But, we don’t stop there. ETS-Lindgren also provides MRI Safety Training to provide further confidence that all of your valuable assets are safe.
SuiteSentry Entryway Systems are available for either out-swinging or in-swinging doors. In-swinging door option shown.

FERROMAGNETIC DETECTION

SUITESENTRY™ ENTRYWAY FERROMAGNETIC DETECTION SYSTEMS (FMDS)

SuiteSentry Entryway Systems offer the industry’s most advanced ferromagnetic detection for your entire MRI suite. SuiteSentry Entryways are specifically designed to give your technologists full control of both inside and outside the MRI room, per the American College of Radiology (ACR) and The Joint Commission’s requirement of ‘control of Zone IV at all times’. The SuiteSentry Entryway gives an alert on an approach of ferromagnetic materials into Zone IV, before reaching the threshold. The systems’ highly-visual warning lights can be seen from both inside and outside the MRI room. The greater the threat, the further away the warning is activated. There is also an audio alarm, which is activated only upon reaching the threshold. In facilities with out-swinging MRI doors, the unit is mounted on the inside part of the door frame while in-swinging doors the system is installed on the outside.

The optional ferromagnetic incident log manager (FILM) uniquely aids in complying with The Joint Commission standards and as a tool to assist with your internal root cause analysis. The FILM provides a continuous and automatic visual record of potential and actual projectile incidents, as well as a visual record after the incident.
FERROMAGNETIC DETECTION (CONTINUED)

SUITESENTRY SINGLE SCREENER FERROMAGNETIC DETECTOR

The SuiteSentry Single Screener is designed to instantly pinpoint the location of a ferromagnetic object without an invasive pat-down required. For installation in the controlled, pre-screening zone of MRI suites, the SuiteSentry Single Screener is the highest sensitivity, full-body patient and personnel scanner available.

TECHGATE® MRI SAFETY BARRIER

TechGate MRI Safety Barrier provides an LED lit, on-demand barrier to entry for the MRI suite. In the event of emergency, a proprietary hinged break-away arm allows for rapid access. For easy installation, the TechGate is powered by a standard wall outlet.

All SuiteSentry Systems are designed to provide optimum ferromagnetic detection based on each facility’s environment and procedures.

TechGate protects your patients, staff, and equipment by restricting unscreened individuals access to the MRI room.
The Oxygen Monitoring System (OMS) uses zirconium oxygen sensor cell technology and provides stable readings in areas where temperature and humidity levels are changing.

**HIGH PERFORMANCE MRI PATIENT SCREENER**

The High Performance MRI Patient Screener combines high sensitivity ferromagnetic metal detection with immunity to non-ferromagnetic metals. This portable screener has three analysis modes that are selectable via the easy-to-use keyboard interface. By using all three modes, the MRI suite staff can obtain an indication of any metals used inside the patient and of their magnetic susceptibility. For optimum operating conditions when using the screener, the patient should lie on a metal-free bed. Together, with written and verbal questionnaires, the staff will have a clear picture of the risk situation and be able to make the most appropriate decisions for optimal patient and facility care.

**OMS™ OXYGEN DEFICIENCY MONITOR**

The OMS Oxygen Deficiency Monitor is a compact, sample draw, gas monitoring system that continuously monitors areas where gases may be used or stored. If the level of oxygen in the room or storage area falls below a safe limit, the OMS can be set to alarm both locally and at a remote monitoring station.

High Performance MRI Patient Screeners are especially useful when patients are non-ambulatory and may be transported in wheelchairs or gurneys.
SERVICE SOLUTIONS FOR MRI

Uptime is more than a measure of days, hours, and minutes. It provides the means to quickly and accurately make diagnoses and deliver treatment. It allows departments to function at optimum efficiency. It enables organizations to recover operating costs and capital expenditures more reliably by maximizing throughput. Above all, it elevates the patient experience to a level that demonstrates your commitment to putting them first.

Whether you’re building from the ground up, replacing or upgrading existing facilities, or seeking immediate remedy to a problem, our end-to-end service capabilities enable you to access the expertise you need, when you need it, with:

• Site Planning and Design
• Engineering and Consulting
• Maintenance and Repair
• Education and Training
Our in-house engineering and design capabilities allow us to provide you with the best solutions for your facility.

SITE PLANNING AND DESIGN

Optimum utilization of space and resources are critical aspects of site planning and design. So is protecting the integrity of your MRI artifacts. As one of the world’s leading MRI shielding experts, ETS-Lindgren can provide critical recommendations to your internal team, architect, and contractors that:

- Ensure site location and design parameters protect the magnet and your overall MRI investment
- Reduce artifact issues and maximize uptime with superior shielding product selection
- Identify and mitigate potential problems with outside noise, vibration, EMI, and other environmental factors that can compromise image integrity
- Maximize space utilization and increase the amount of usable space in facilities where square footage is at a premium
- Test and measure to ensure reliability of recommendations
BUILDING INFORMATION MODELING (BIM)

Gain better insight and predictability of the physical facility – before it is built – with Building Information Modeling (BIM) from ETS-Lindgren. It not only provides 3-D representations of the architecture, but also the mechanical, electrical, and plumbing. So, you’re able to see how our recommendations about the RF shielded enclosure will interface with the overall building. It’s a great collaborative tool that delivers the results you’re looking for, including:

- Lower expense and risk
- Fewer construction delays and rework
- Decrease in on-site problems

BIM allows our customers to visualize the completed project before it begins. BIM also provides a better understanding on how the shielded room interfaces with the host building and the Mechanical, Electrical, and Plumbing (MEP) facilities. This promotes an efficient workflow for the architectural design team, the general contractor, and MEP specialists. Our customers benefit with reduced construction delays, rework, and unnecessary expense. Because BIM provides a high level representation of the shielded room, it becomes a key tool for effectively designing the parent building and MEP facilities. BIM provides the immediate benefit of 3-D visualization for spatial coordination and clash detection which prevents building systems from interfering with each other during construction.
A typical BIM project starts with a meeting to establish a schedule for coordinating all of the project elements. Then, a 3-D BIM model of the shielded room is prepared to integrate the host building architecture and MEP models. Our design software is compatible for direct importation into Navisworks®, we can provide native files with an .nwc file extension. To assure a good flow of communication, we participate in all scheduled virtual coordination reviews. In most cases, these can be conducted online. We also collaborate with all participants in the life cycle of the project, sharing information as relates to the design and integration of the shielded room to the host building. In the event a sub-contractor does not have BIM capability, we have the ability to seamlessly integrate their 2-D CAD data.

All proprietary shielding models and families are created by our own ETS-Lindgren Autodesk Certified Professional design team, supervised by a Director of Project Engineering & BIM Technologies.
ENGINEERING AND CONSULTING

At ETS-Lindgren, we test, we measure, and we develop. Our expertise enables us to provide testing and surveys that are critical to meeting key requirements for ISO-9000 annual or bi-annual testing, ACR-MRI insurance underwriting tenets, as well as:

RF (RADIO FREQUENCY) TESTING

RF testing includes measurements of existing shield systems. Trouble areas such as shield seams, electrical and mechanical service penetrations, equipment panels, and doors/windows are tested for RF integrity loss.

EMI TESTING

When Electromagnetic Interference (EMI) is suspected as the problem, the environment is scanned electronically to identify the source. Our team then determines the appropriate actions required to contain, eliminate, or lessen the effects.

DC MAGNETIC TESTING

Strong magnetic fields can have adverse effects on sensitive instrumentation. Our engineering team can identify magnetic sources and provide solutions including containment shielding and field cancellation (MACS/D).
ENGINEERING AND CONSULTING (CONTINUED)

ACOUSTIC ANALYSIS
Acoustic analysis includes measurements to determine noise sources, whether airborne or structurally transmitted. Solutions can include source elimination, isolation, and soundproofing of existing structures.

VIBRATION ANALYSIS
Noise can result from vibrations transmitted by structural members over long distances. A site analysis by our engineering team can determine the source and implement isolation measures.
MAINTENANCE AND MODIFICATIONS

MRI represents a significant investment. Making sure yours performs with minimal downtime and continues to function longer is critical to patient care and the bottom line. With ETS-Lindgren maintenance and repair services, your image is safe with us.

MAINTENANCE SERVICES

Periodic maintenance pays for itself by reducing downtime and unexpected expenses. Our experienced service crews can visit your facility on a scheduled basis to prevent problems before they start, by servicing your MRI shield system.

FACILITY UPGRADES

An aging facility, new equipment, or an increasingly RF noisy environment can dictate the need to install new or additional shielding. Our engineers can survey your facility to determine the right amount of work that needs to be completed.

SHIELDED ROOM RELOCATION

Whether it’s across your facility or across town, ETS-Lindgren can assist in relocating your shielded room as quickly and efficiently as possible.
TRAINING AND EDUCATION

In an industry that’s more than three decades old, ETS-Lindgren boasts a technical team with an average tenure of more than 20 years. We do all we can to share our knowledge and experience with our clients, including MRI safety training for clients, partners, and others. From basic ergonomic issues associated with daily routines in the MRI chamber, to identifying and mitigating safety issues surrounding working with today’s powerful magnets, to best practices and even knowing when there’s a problem and what to do about it – ETS-Lindgren service personnel provides the technical training to:

- Reduce the number of workplace incidents
- Protect patients
- Lower risk of infection
- Improve process and throughput

Our Training and Educational programs are designed to help make your staff more effective and efficient and give your patients a better overall experience.
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