SOLUTIONS FOR ELECTROMAGNETIC INTERFERENCE (EMI)

ACTIVE SYSTEMS
PASSIVE SYSTEMS
TECHNICAL SERVICES

BEYOND MEASURE.™

ETS·LINDGREN®
An ESCO Technologies Company

AN EXPERIENCED PARTNER YOU CAN TRUST.

WHERE EXPERTS DRIVE TECHNOLOGY

For over 75 years, wherever signals must be generated or interference regulated, ETS-Lindgren has cut across market sectors to create a track record of success making many aspects of modern life possible. Our products validate and set standards in research, development, production, and service in industries from Aerospace to Healthcare. We have designed and installed thousands of chambers and shielded systems worldwide and our workforce holds more than 100 patents in shielding, absorber, and related technologies.

As a division of the ESCO Technologies' (NYSE: ESE) portfolio, this worldwide partnership ensures ETS-Lindgren has robust financial backing and resources to invest in operational efficiencies, long-term industry research and development, as well as the best talent in the world.

ETS-Lindgren. Beyond Measure.

SOURCES OF AND SOLUTIONS FOR ELECTROMAGNETIC INTERFERENCE (EMI)

Low frequency Electromagnetic Interference (EMI) can impair the operation of sensitive equipment, resulting in poor performance, as well as inaccurate results and/or automated measurements. Typical sources of interference include:

- Moving ferrous objects, including elevators, forklifts, large steel doors, and vehicles (quasi-DC)
- Electrical sources, including transformers, power lines, HVAC systems, switch gear, and other tools (AC)
- Propulsion system sources, including trains, metro, subways, and trams (AC and quasi-DC)

As the leader in EMI shielding products and services, ETS-Lindgren has the expertise to solve your EMI problems. Our solutions include:

- Active Shielding Solutions
  - Magnetic Active Compensation System (MACS/D™)
- Passive Shielding Solutions
  - Series 83 Radio Frequency (RF) Shielding
  - Custom Engineered Passive Systems
  - Extremely Low Frequency (ELF) Magnetic Shielding
  - Light Emitting Diode (LED) Shielded Lighting
- Technical Service Solutions
  - Design and Installation
  - Surveys
  - Testing

Need more information? Please visit our website at www.ets-lindgren.com or contact your local ETS-Lindgren representative.

ACTIVE SHIELDING SOLUTIONS

Active Shielding is both a time and cost saving solution in mitigating electromagnetic interference in existing facilities. ETS-Lindgren's Active Shielding Solutions feature our Magnetic Active Compensation System (MACS/D) and Coil Systems.

MAGNETIC ACTIVE COMPENSATION SYSTEM (MACS/D)

MACS/D KEY FEATURES:

– High Performance, Reliable Concept in Environmental Shielding for Electron Microscope and Electron Beam Technology

– Remote Monitoring, Diagnostics, Troubleshooting, and Repair Capabilities via Network Enabled Digital Platform

– Individualized Installation

– Real-time Monitoring and Scrolling Display Shows 60 Seconds of Measured Magnetic Field History

– Data Logging Screen Provides More Detailed Output of System Status and Status History

- Over 300 Installations Worldwide

ETS-Lindgren's digital MACS/D provides cost-effective, maintenance-free attenuation of interfering magnetic fields for high resolution Electron Microscope (EM) instrumentation, wafer fabrication (lithography) equipment, and other charged-beam instrumentation. The MACS/D provides continuous field compensation and continuous field monitoring with higher compensation at the column with attenuation factors of 70 dB on average. In comparison, attenuation factors of competing systems are 40 dB on average. An upgraded switching amplifier increases the field compensation capability in each of the three axes by up to 50% as well as provides greater long-term stability.

The MACS/D now includes real-time monitoring and error display on the front panel for more detailed performance indicators. The MACS/D is also equipped with remote access over a network. This provides the benefit of VPN client support for remote diagnostics and troubleshooting, as well as facilitates software upgrades.

The MACS/D uses a traditional negative feedback loop and additional features to enhance performance. Along with the flexibility of the DSP based technology, the MACS/D provides superior compensation of higher order effects including gradients and magnet specific responses.

The MACS/D frequency-specific technology and fast DSP based, high-resolution universal architecture, provides for software and firmware flexibility so the MACS/D can easily be upgraded to the latest version, maximizing your long-term investment.

Image Quality Before Activation of MACS/D Unit (Magnification 50,000 X)

Image Quality During Activation of MACS/D Unit (Magnification 50,000 X)

MACS/D PRODUCT FEATURES

WEB APPLICATION PROGRAMMING INTERFACE (API)

The web API is defined specifically for MACS/D remote and local management pages. The embedded web service (server) allows user access via the web API and the Machine Control Computer (MCC) to review system settings and performance data. Current web pages are developmental and conform to HTML5 and CSS, which may be modified with basic editing tools.

LINUX-BASED MACHINE CONTROL COMPUTER

The remote internet access over VPN client (requires VPN server) coupled with Layered User Access (LUA) provides maximum network security. This allows for the ability to remotely monitor, troubleshoot, repair, diagnose, and update firmware/software.

INCREASED POWER

The MACS/D has significantly more powerful coil drivers resulting in up to 50% more field compensation capability in each of the three axes, typically >30uT peak. The switching amplifier allows for maximum long-term amplifier reliability.

FRONT PANEL

The front panel LCD displays real-time monitoring, system performance, and warning/error messages.

STRAIGHTFORWARD CALIBRATION

Complex calibration situations require only minor adjustments on the software, which are stored in non-volatile memory.

PASSIVE SHIELDING SOLUTIONS

Passive Shielding is ideal in mitigating electromagnetic interference in new or renovated facilities. ETS-Lindgren's Passive Shielding Solutions include Series 83 Radio Frequency (RF) Shielding, Extremely Low Magnetic (ELF) Shielding, Custom Engineered Passive Systems, and Light Emitting Diode (LED) shielded lighting.

SERIES 83 RF SHIELDING FEATURES:
– Conductive Material Lining
– 100 dB Insertion Loss from 14 kHz to 1 GHz
– Flexible Shielding Solution
– 25 dB Low Frequency (50/60 Hz) AC Magnetic Field Attenuation

SERIES 83 RF SHIELDED SYSTEM

ETS-Lindgren's Series 83 RF Shielded System can be customized to meet a variety of unique requirements. Since the Series 83 RF Shielding can meet specific customer requirements and provides performance over a wide frequency band, it is a truly flexible shielding solution.

SERIES 83 RF SHIELDING FEATURES

CONSTRUCTION

Series 83 RF Shielding is made of G60 grade, 11-gauge galvanized steel. It offers the advantages of high shielding performance, durability, and ideal electrical continuity and magnetic reluctance. Each panel section provides excellent resilience to moisture-induced warping and enhanced structural strength that lend to its robust design.

PERFORMANCE

Series 83 RF Shielding has a conductive material lining, on either side of an engineered wood core, which is used for attenuating EMI/RFI signals. Typical performance of Series 83 RF Shielding as measured in accordance with IEEE 299/MIL-STD-285 is 100 dB from 14 kHz to 1 GHz. Additionally, the specialized construction of the Series 83 RF Shielding also provides excellent low frequency AC magnetic field attenuation characteristics of 25 dB at 50/60 Hz.

CUSTOM ENGINEERED PASSIVE SHIELDING

ETS-Lindgren understands that one size does not always fit all. ETS-Lindgren's Extremely Low Frequency (ELF) products can be tailored to fit a customer's specific performance requirements.

ELF SHIELDING FEATURES

CONSTRUCTION

ETS-Lindgren provides standard and custom shielding construction to meet customer requirements. Shielding construction may feature a customized combination of materials, including aluminum, electrical steel, low carbon steel, and high permalloy material in conjunction with special construction methodologies to achieve the desired performance.

PERFORMANCE

ELF shielding uses an assortment of shielding materials to achieve a specified performance. Utilizing customer driven performance requirements, ETS-Lindgren will develop a design using various shielding materials and construction methods to achieve the desired results. This includes sub Hertz magnetic (H-field) attenuation of 10s of dB to high frequency plane wave attenuation exceeding 100 dB.

ELF SHIELDING FEATURES:

- Custom Engineering and Design
- Designs Providing Attenuation for Frequencies > 0.01 Hz
- Flexible Shielding Solution
- Performance Designed to Meet Customer Requirements

PASSIVE SHIELDING SOLUTIONS (CONT.)

LIGHT EMITTING DIODE (LED) RF SHIELDED LIGHTING

ETS-Lindgren's LED lighting combines the latest LED technology and RF shielding to provide bright, RF noise-free, and low heat illumination. Our LED shielded lighting achieves brightness equal to incandescent lighting while using less energy over a longer product life span.

LED SHIELDED LIGHTING FEATURES:
– Ideal for Shielded Chamber/Room Usage
– Suitable for New and Retrofit Construction
– High Power LED
– Reduced Energy Consumption
– No Audible Noise, No Flickering During Operation
– Options for Shielded or Remotely Located AC/DC Power Supplies Reduce Potential for EM Interference from Light Fixtures

LED SHIELDED LIGHTING FEATURES

PRODUCT DESIGN

All ETS-Lindgren LED shielded lights are designed for installation into both new construction and existing construction. Additionally, the LED lights are RF shielded, thus they do not introduce additional RF noise into the environment.

PERFORMANCE

A low-cost, maintenance-free lighting solution, our LED shielded lighting has a longer life in comparison to incandescent and fluorescent lighting. With no audible noise or flickering, ETS-Lindgren's LED shielded lighting illuminates your environment with bright light while remaining energy efficient.

SERVICE SOLUTIONS

Throughout your project's life cycle, ETS-Lindgren's dedicated experts are committed to the success of our customers. ETS-Lindgren understands how downtime can impact our customers' development, production, and testing schedules. We also understand how critical it is that your results be consistent, repeatable, and reliable. Let ETS-Lindgren assist in making your project a success.

ETS-Lindgren employs more than 800 professionals at locations in the Americas, Europe, the Middle East, and Asia. In addition, we have a global network of independent representatives and distributors. Our customers benefit with local service and support from specialists who are backed by the global resources of ETS-Lindgren.

DESIGN AND INSTALLATION

ETS-Lindgren has in-house experts that can design and install integrated shielding systems and oversee project management. These specialized services include the ability to plan and design magnetic and RF shielding throughout all phases of the architectural design process, including EMI and Finite Element Analysis (FEA) Modeling as well as Building Information Modeling (BIM) capabilities.

Gain better insight and predictability of the physical facility – before it is built – with Building Information Modeling (BIM) from ETS-Lindgren. Our certified BIM experts can design a virtual model, allowing our customers to visualize a completed project before it begins. This results in a reduction of construction delays, rework, and unnecessary expenses. It not only provides 3D representations of the architecture, but also the mechanical, electrical, and plumbing. It's a great collaborative tool that delivers the confidence and ultimate results you deserve to protect your investment.

DESIGN AND INSTALLATION SERVICES:

- Design and Installation of Magnetic Shielding
- Design and Installation of RF Shielding
- EMI Modeling
- Static Magnetic Modeling
- Building Information Modeling (BIM)
- Design Drawing Packages
- Construction Specifications

SERVICE SOLUTIONS (CONT.)

SURVEYS

SURVEYING SERVICES:
– Magnetic Field Surveys
– Vibration Surveys
– Acoustic Surveys

The Medical, Government, Industrial, and Test & Measurement industries all require surveying services to verify facilities meet the environmental requirements for a variety of applications. For example, sensitive medical and research imaging equipment, such as electron microscopes, require surveys for preliminary site planning.

When magnetic field interference is suspected as a potential problem, the environment is surveyed utilizing magnetometers and the latest data acquisition equipment to identify the source. ETS-Lindgren offers a wide variety of magnetic field surveys including:

- Magnetic Field Surveys
  - AC Magnetic Fields
  - DC Magnetic Fields
  - Quasi-DC Magnetic Fields
  - Detailed Facility Mapping
  - Time Studies
  - Source Identification

Vibration transmitted by common sources, such as mechanical systems, facility equipment, foot traffic, and vehicular traffic, can propagate through a facility adversely impacting sensitive instrumentation. Our Services Team can help plan your facility by performing vibration surveys including:

- Vibration Surveys
  - Transient Vibrations
  - Steady State Vibrations
  - Source Identification
  - Mitigation Strategies

Once our technicians identify the source of interference, ETS-Lindgren's Services Team can develop a plan to mitigate the problem.

TESTING SERVICES

As the expert in Radio Frequency (RF) and Magnetic Shielding, ETS-Lindgren is also the leader in RF shielding test services. Our experienced technicians are available to perform testing and measurement of existing shield systems to determine RF and magnetic shielding effectiveness to all the latest standards, troubleshoot RF leaks, and repair damages. ETS-Lindgren offers Shielded Room Verification testing of trouble-prone areas, such as:

- Shielded Room Verification
  - Shield Seams Testing
  - Electrical and Mechanical Service Penetrations
  - Equipment Panels
  - Doors
  - Windows

Should it be determined that there are issues with shielding integrity, ETS-Lindgren can assist by troubleshooting, identifying the root cause, and providing repair solutions.

TESTING SERVICES:

– RF Shielded Room Verification
– Magnetic Shielding Verification
– RF and Magnetic Shielding Commissioning Testing
– Troubleshooting Shielding Integrity Leaks
– Pre-Testing for Shielding Upgrades

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