

**Boeing, St. Louis Selects  
ETS-Lindgren for Custom All-Welded  
Chamber Installation**

Boeing, the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft combined, contracted with ETS-Lindgren for a customized RF shielded semi-anechoic chamber and control room at its facility in St. Louis, Missouri.

ETS-Lindgren provided two freestanding, self-supporting, fully welded RF shielded enclosures constructed of solid steel panels. Anechoic treatment of the chamber included 100% coverage of all wall and ceiling surfaces to provide an ideal test environment over the frequency range of 10 kHz to 40 GHz, without the use of ferrite tile.

The chambers were designed primarily to perform MIL-STD-461 E/F Electro-magnetic Interference (EMI) testing. Secondary objectives of the design were to perform RTCA DO-160D/E EMI testing and to provide a facility to operate and integrate RF transmitters in a shielded environment. The chambers may also be used for conducted emissions, conducted immunity, radiated emissions and radiated immunity testing.

**All-Welded Chamber Expertise**

ETS-Lindgren excels in the design, manufacture and installation of welded RF shielded enclosures. The company is highly-valued for its 30+ years of experience in designing and building large high-performance chambers. This non-paralleled industry experience was instrumental in the successful execution of the project.



*Boeing, St. Louis, Missouri*

*Key all-welded chamber features include:*

- Freestanding structural framework that conforms to the Uniform Building Code (IBC) and the latest American Institute of Steel Construction (AISC) standards.
- A single layer of high-grade hot rolled steel sheet material in sizes designed to minimize seam footage and ensure the highest shielding performance.
- No mechanical seams that can result in high maintenance and serious loss of shielding effectiveness. The MIG-welded seams are unaffected by corrosion, oxidation and mechanical expansion brought about by temperature and humidity changes.
- Primed exterior chamber walls and ceiling surfaces as well as interior control room walls and ceiling for protection against rust and corrosion.

**Chamber and Control Room  
Technical Features**

- Semi-Anechoic Chamber is 20 ft wide x 28 ft long x 12 ft high (6 m x 9 m x 4 m), nominal interior shield dimensions.
- Control Room is 20 ft wide x 20 ft long x 12 ft high (6 m x 6 m x 4 m), nominal interior shield dimensions.
- Pneumatic RF shielded sliding doors provided include two each at 8 ft x 8 ft (2.4 m x 2.4 m) and one each at 4 ft x 8 ft (1.2 m x 2.4 m). The doors are fully automatic with push button entry/egress operation and are integrated with the Very Early Smoke Detection and Alarm (VESDA) air sampling fire system.
- Door package includes absorber plugs, interlock switch and door maintenance kit.
- Specialty Copper Work Benches: A metallic test bench/table - 4 ft wide x 18 ft long x 3 ft high (1.2 m x 5.5 m x .90 m) for the chamber and 4 ft wide x 8 ft long x 3 ft high (1.2 m x 2.4 m x .90 m) for the control room - includes ground studs spaced equally every 300 mm along the test bench wall. Copper braided ground-

ing straps are provided for connecting the test bench to the grounding studs on the back wall. Additional grounding straps for the chamber sidewalls enhance Boeing's secondary objective of DO-160D/E testing without degrading the performance for the primary purpose MIL-STD testing. The bench surfaces are constructed of .125 mm (minimum) thick copper that conforms to C110 ASTM-B152 (C11000) as required. Support provided is a minimum of 290 gm/cm<sup>2</sup> point load and an evenly distributed load of 170 kg/m<sup>2</sup> over its entire surface.

- Ground isolation achieves a minimum of 20,000 ohms of isolation from earth ground as well as from building ground. The chamber is furnished with a single ground stud located adjacent to the power line filters.
- Electrical grounding is achieved in accordance with the National Electric Code by connecting the chamber to the chamber complex's dedicated driven ground rod network, designed and provided by Boeing's Facilities Engineering.
- ETS-Lindgren Model 4340-03 digital CCTV system including camera, PC and monitor, tripod and required cabling.
- Floor treatment consists of 3 mm thick dielectric floor underlay and 6 mm polyethylene water and moisture repellent vapor barrier finished with a 3 mm vinyl floor tile.

**Anechoic Absorber Treatment**

Anechoic treatment of the chamber includes 100% coverage of all wall and ceiling surfaces in addition to removable absorber sufficient to cover half of the chamber floor. Chamber performance is achieved by using high-performance EMC-24PCL, a 24 in. (60 cm) pyramidal microwave absorber specifically designed for MIL-STD testing applications.

*Key absorber features include:*

- Designed to provide an ideal MIL-STD-461E/F test environment over the frequency range of 10 kHz to 40 GHz as required, without the use of ferrite tile.
- Specialty connector panel with absorber includes a removable "box" protruding into the chamber at the location of the panel.
- RF power handling of 200 V/m capability (0.1 Watt/in<sup>2</sup> power density) continuous wave.
- Material composition is high performance combustion limiting polyurethane made from urethane foam impregnated with a dielectrically matched conductive carbon.

**About ETS-Lindgren**

ETS-Lindgren is an international manufacturer of components and systems that measure, shield, and control electromagnetic and acoustic energy. The company's products are used for electromagnetic compatibility (EMC), microwave and wireless testing, electromagnetic field (EMF) measurement, radio frequency (RF) personal safety monitoring, magnetic resonance imaging (MRI), and control of acoustic environments.

Headquartered in Cedar Park, Texas, ETS-Lindgren has manufacturing facilities in North America, Europe and Asia. The company is a wholly owned subsidiary of ESCO Technologies, a leading supplier of engineered products for growing industrial and commercial markets. ESCO is a New York Stock Exchange listed company (symbol ESE) with headquarters in St. Louis, Missouri. Additional information about ETS-Lindgren is available at [www.ets-lindgren.com](http://www.ets-lindgren.com). Additional information about ESCO and its subsidiaries is available at [www.escotechnologies.com](http://www.escotechnologies.com).

**CHAMBER PERFORMANCE**

MAGNETIC FIELD	<ul style="list-style-type: none"> <li>■ 1 kHz ≥ 20 dB increasing to ≥ 60 dB at 10 kHz</li> <li>■ ≥ 60 dB at 10 kHz increasing to ≥ 100 dB from 1 MHz to 40 GHz</li> </ul>
ELECTRIC FIELD	<ul style="list-style-type: none"> <li>■ 120 dB from 1 kHz to 50 MHz</li> </ul>
PLANE WAVE THROUGH MICROWAVE	<ul style="list-style-type: none"> <li>■ 120 dB from 50 kHz to 18 GHz</li> <li>■ 100 dB from 1 MHz to 40 GHz</li> </ul>

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