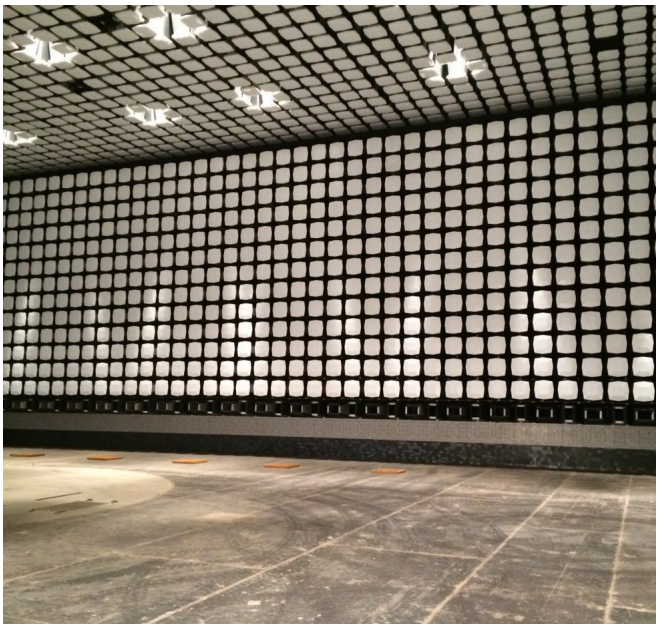
CASE STUDY NATRiP - MANESAR, INDIA



The National Automotive Testing and R&D Infrastructure Project (NATRiP) is the largest and one of the most significant initiatives in the automotive industry in India, representing a unique collaboration between the Government of India, a number of State Governments, and the Indian Automotive Industry. NATRiP is responsible for a new state-of-the-art testing, validation, and R&D project created to support the rapidly growing automotive industry in India.

NATRiP selected ETS-Lindgren, a world leader in the design and installation of automotive EMC test chambers, to provide this one-of-a-kind test facility. With numerous automotive EMC test chambers provided to notable companies such as General Motors (GM), Ford Motor Company, Honda, and Chrysler, to name just a few of its prominent automotive customers, ETS-Lindgren's proven expertise encouraged a successful partnership.

The NATRiP project includes two major automotive EMC test facilities near the automotive manufacturing hubs in India. One is located in Manesar (near Gurgaon, National Capital Region) and the other is located in Orgadam, on the outskirts of Chennai. Both facilities have one large 10 m chamber for full vehicle testing with an 11m diameter chassis dynamometer turntable for testing of large and small vehicles. The Chennai facility also has a smaller EMC test chamber with a 6 m diameter chassis dynamometer turntable for testing motorcycles, three wheeled vehicles and automotive components.

Chamber Technical Specifications GARC (Chennai)

This facility houses six chambers with the following dimensions (shown as length x width x height):

- 10 Meter Chamber for Whole Vehicle Testing, 30 m (98 ft) x 20 m (66 ft) x 10 m (33 ft)
- Whole Vehicle Control Room, 10 m (33 ft) x 6 m (20 ft) x 3 m (10 ft)
- Two/Three Wheeler Semi-automatic Chamber,19 m (62 ft) x 12 m (39 ft) x 8 m (26 ft)
- Two/Three Wheeler Control Room,10 m (33 ft) x 4 m (13 ft) x 3 m (10 ft)
- Amplifier Rooms, Two Rooms, Each 4 m (13 ft) x 4 m (13 ft) x 3 m (10 ft)

Chamber Technical Specifications iCAT (Manesar)

This facility houses five chambers with the following dimensions (shown as length x width x height):

- 10 Meter Chamber for Whole Vehicle Testing, 30 m (98 ft) x 20 m (66 ft) x 10 m (33 ft)
- Whole Vehicle Control Room, 8 m (26 ft) x 4 m (13 ft) x 3 m (10 ft)
- Component Semi-automatic Chamber, 8 m (26 ft) x 7 m (23 ft) x 6 m (20 ft)
- Component Control Room, 6 m (20 ft) x 4 m (13 ft) x 3 m (10 ft)

Amplifier Rooms, Two Rooms, Each 7 m (23 ft) x 3 m (10 ft)x 3 m (10 ft)

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RF Shielded Chassis Dynamometer Pit Rooms

An RF shielded dynamometer pit room is located underground in each facility basement below the ten-meter chamber. The rooms are lined (floor and walls) with welded steel.

Full Vehicle Chassis Dynamometer System

A four wheel full vehicle chassis dynamometer turntable was installed in each ten-meter chamber capable of a maximum axle load in the track area of 9,000 kg (19,842 lb); maximum turntable load is 19,000 kg (41,888 lb) total.

Entire Facility Technical Features

- Capable of performing EMC tests on vehicles from two wheelers up to Heavy Commercial Vehicles (HCV). CISPR 16-1-4: Site VSWR (SVSWR) testing from 1 GHz to 18 GHz at 3 m (10 ft) range, with a test volume of 2 m (7 ft) diameter.
- CISPR 25 Ed 3: Better than 6 dB between 70 MHz and 2500 MHz.
- Constructed of ETS-Lindgren Series 101™ pan-shield type lightweight, modular shielding panels. ISPR 25 Ed 4 (Draft): 150 kHz to 1 GHz, Long Wire compliant.
- Absorber treatment includes ETS-Lindgren PS-1250 and PS-600 FerroSorb™ hybrid polystyrene EMC absorber material capable of handling a field strength of 200 V/m continuous in the entire frequency band and 600 V/m from 1.2 to 1.4 GHz and from 2.7 to 3.1 GHz.
- ETS-Lindgren provided its automatic sliding doors for EUT access and semi-automatic swing-type doors for personnel access to the chambers, control rooms and amplifier rooms. The fully automatic sliding door is designed to meet the highest shielding requirements with push button entry/egress.
- CCTV and intercom systems include ETS-Lindgren Model 4340 Digital CCTV color system.
- Fire detection includes a Very Early Smoke Detection and Alarm (VESDA) system with aspirating smoke detectors.

Compliance and Test Standards

- Indian Automotive Industry Standard AIS - 004/1999
- MIL-STD-461E
- SAE J1113-22, SAE J1113-25
- CISPR 25, CISPR12
- SAE J551-11, SAE J551-12
- SAE J551-17, SAE J551-15

In addition, the chambers meet the applicable ISO automotive EMC standards as well as the OEM standards of Ford, GM, PSA (Peugeot - Citroën), BMW, Fiat, Chrysler, Honda, Mitsubishi and Mercedes-Benz.

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, wireless, and magnetic resonance imaging (MRI) testing, electromagnetic field (EMF) measurement, radio frequency (RF) personal safety monitoring, 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. Additional information about ESCO and its subsidiaries is available at www.escotechnologies.com.