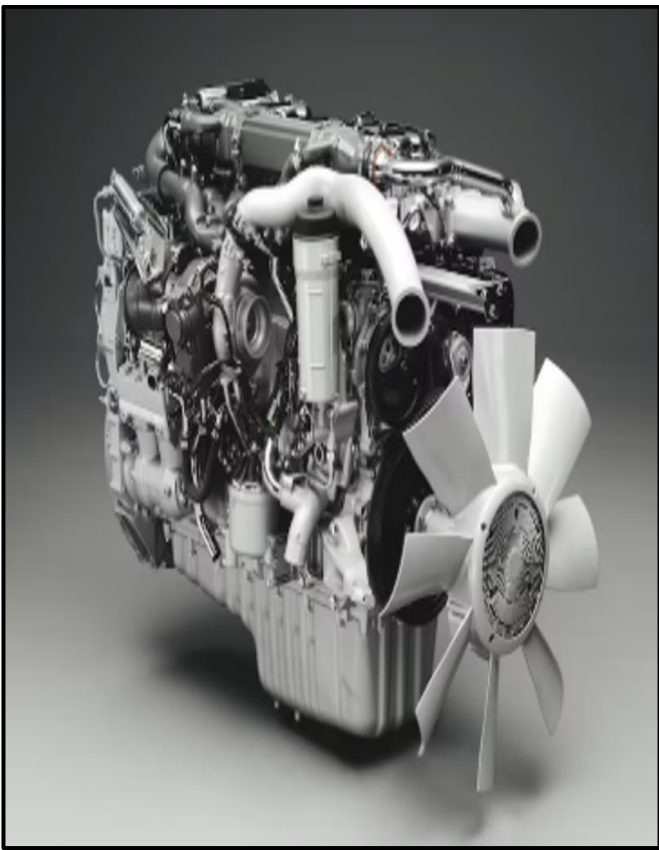


**POWERTRAIN
TEST LAB
(Engine & E-Motor
testing)**





Powertrain Department

- Capable of certification/ development of Medium & Heavy-Duty Vehicle's engine with GVW above 3.5 ton, off road engines (tractors, CEV, power tillers) and Gensets as per National/ International standards.
- Power testing for 2W/3W/4W engines, along with electric motor (up to 300 kW), is performed within the department.
- Offers **customer-specific testing solutions** such as endurance projects, deterioration factor (DF) testing, overspeed testing, high-altitude testing, cold chamber testing and thermal shock testing.
- Supports comprehensive **DVP (Design Validation Plan) testing for all types of electric motors & engines.**

Capabilities:

- ❑ **Transient Dynamometers:** 11 Nos, rating (25kW-800kW) having capability of emission testing as per BS VI/EURO VI, TREM/CEV-IV/V, Gensets CPCB IV+, e-motor testing.
- ❑ **Eddy current Dynamometers:** 08 Nos, rating (35kW-550kW) having capability of emission testing (TREM IIIA/Bharat Stage CEV III/Genset) testing, durability.
- ❑ **Full flow dilution system:** 02 Nos of Transient test bed (500kW & 220kW) capable of measuring gaseous emissions using full flow dilution system.
- ❑ **E-Motor facility:** Battery Emulator of rating up to 300kW equipped with Power Analyser, for testing of EV/ Hybrid Vehicle e-motors .
- ❑ Particle Mass and Number measurement (PN₂₃) using partial flow dilution system.
- ❑ Emission Analyser for gaseous emission measurement (including high altitude option) and FTIR for NH₃ measurement.
- ❑ Opacimeter and Smoke meter for measuring smoke and opacity, including high altitude option.

Specific Capabilities / USPs

- ❑ High Altitude Simulation: Low Pressure/Temperature (540 mbar & -28°C) Engine combustion intake system for simulation of High-altitude (up to 5000 m) testing for Engines.
- ❑ Engine Combustion Analysis via AVL INDICOM.
- ❑ ETAS hardware and INCA tools for ECU calibration, diagnostics, data logging and analysis.
- ❑ Dual stream analyzers for emission measurement. (CO, CO₂, THC, CH₄, NO_x)
- ❑ Transient soot measurement in engines via AVL Micro Soot device.
- ❑ Thermal Shock facility (20°C to 120°C) and Oil Conditioning unit (70°C to 140°C).
- ❑ Cold chamber facility with temperature control up to -30°C to facilitate cold startability trials.

Details / Brief Specifications of Test Facilities:

❑ Transient Dynamometers:

- **ETC-02:** 26.9kW@4000-9000rpm and 65Nm@4000rpm
- **ETC-03:** 441kW@1427-3300rpm and 2950Nm@1427rpm
- **ETC-04:** 462kW@1645-3180rpm and 2680Nm@1645rpm
- **ETC-05:** 304kW@1661-3600rpm and 1750Nm@1661rpm
- **ETC-06:** 500kW@1591-3025rpm and 3000Nm@1591rpm
- **ETC-07:** 220kW@ 2250-4500rpm and 934Nm@2250rpm
- **ETC-08:** 210kW@ 4600-10000rpm and 380Nm@4600rpm
- **ETC-10:** 160kW@3659-10262rpm and 415Nm@3659rpm
- **ETC-11:** 830kW@1500-2670rpm and 5200Nm@1550rpm
- **ETC-12:** 498kW@1613-3410rpm and 2950Nm@1613rpm
- **ETC-21:** 400kW@2101-4902rpm and 1930Nm@2101rpm



❑ Eddy Current Dynamometers:

- **ETC-01:** 250kW@2000-6000rpm and 1200Nm@1000-2000rpm
- **ETC-09:** 160kW@4500-1000rpm and 400Nm@2000-4500rpm
- **ETC-13:** 250kW@2000-6000rpm and 1200Nm@1000-2000rpm
- **ETC-15:** 35kW@5000-10000rpm and 95Nm@2500-5500rpm
- **ETC-16:** 150kW@2800-8000rpm and 500Nm@1800-2800rpm
- **ETC-17:** 250kW@2000-6000rpm and 1200Nm@1000-2000rpm
- **ETC-18:** 80kW@4800-9000rpm and 160Nm@2000-4800rpm
- **ETC-20:** 290kW@1500-9000rpm and 2000Nm@1500rpm



❑ Emission Analyzer: (CO, CO2, THC, CH4, NOx, O2)

- Compliance: EURO VI/ 40 CFR 1065/ Stage V
- MEXA ONE/ MEXA 7500 DEGR/ AMA i60 (Dual Line with EGR)
- MEXA 7200D (CVS)
- MEXA 7100/7400 (Raw)

❑ Particulate Measurement System: AVL SPC 478

- Compliance: ISO 8178/16183 and CFR 1065
- Sampling line: 3 (70mm and 47mm)
- Typical flow: 0.8-2.0 g/s
- Flow accuracy: $G_p \leq 5\%/pt$, $q \leq 15$
- Flow Controllability range, $q \leq 120$
- Exhaust pipe pressure: $Amb \pm 1.2kPa$



❑ Particulate number Measurement System: AVL APC 489

- Compliance: UNECE R49/R96
- PN size: up to 23 nm
- PNC measurement range: 0...10,000 p/cm³
- Altitude: up to 2000 m

❑ Ammonia Measurement System: AVL FTIR i60

- Compliance: UNECE R49/R96
- Spectral Range: 650-4000 cm⁻¹
- Spectral Resolution: 0.5 m⁻¹
- Sample working Pressure: min. 90 kPa
- Noise: $\leq 1\%$ of full scale



❑ **Fuel Flow Meters with conditioning unit: AVL 735/753C, Horiba, CP Engineering**

- Type: Coriolis
- Range up to 300 kg/hr
- Measurement uncertainty: $\leq 0.12\%$
- Fuel feed pressure = up to 5bar

❑ **Battery Emulator Unit: Unico**

- Capacity: 300kW (150kW+150kW)
- Voltage Output: 1000V DC
- Maximum output current per unit: $\pm 450A$

❑ **Opacity Measurement System: AVL 439**

- Measurement range: 0 ...100 % or $k = 0 \dots 10 \text{ m}^{-1}$
- Measurement value resolution: 0.1 % opacity or 0.0025 m^{-1}
- Exhaust gas temperature 0... 600° C
- Exhaust gas pressure -100 mbar + 400 mbar

❑ **Smoke Measurement System: AVL 415S**

- Measurement range: 0 ... 10 FSN
- Soot Concentration: 0 ... 32000 mg/m^3
- Resolution: 0.001 FSN / 0.01 mg/m^3 / 0.01 %
- Exhaust gas backpressure, with Special Sampling Option 415S: -200 mbar up to +750 mbar total pressure relative to ambient

❑ **Conditioned Air Handling System: AVL, CP Engineering**

- Temperature: 15 to 30°C
- Humidity: 7 to 20 g/kg
- Max. flow up to 5000kg/hr
- Altitude simulation up to 2000m

❑ **High Altitude Conditioned Air Handling System: CP**

- Pressure: 540 to 1020 mbar sea level to 5000m
- Humidity: 6~20 gm / Kg of air
- Capacity: 2500 Kg/hr @ 1000 mbar, 1800 Kg/ hr @ 540 mbar

❑ **Blowby Meter: AVL 442 and AVL 442S**

- Range up to 150kg/hr and 300 kg/hr

❑ **Air Mass Flow meters: ABB, AVL and FEV**

- Type: hot film anemometer, ultrasonic
- Range: 400, 720, 1000, 1200, 2400, 3000, 4000 kg/hr

❑ **Micro soot Sensor: AVL 489**

- Soot Concentration < 50 mg/m^3
- Dilution ratio: 2-10
- Resoultion $\leq 0.01 \text{ mg}/\text{m}^3$

❑ **CNG/PNG Mass flow meters: Rheonik, Emerson**

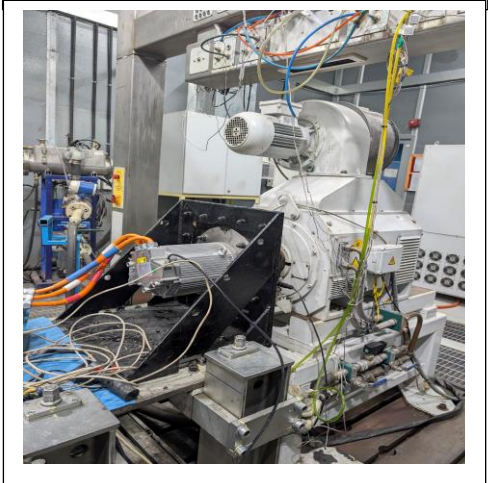
- Type: Coriolis
- Range: 36 kg/hr to 150kg/hr

❑ **Oil Conditioning Unit: AVL CONSYS LUBE**

- Capacity: 6litres
- Control range: 70-140°C

❑ **Coolant Conditioning units: AVL, Yantrashilpa, Gvision**

❑ **Intercooler unit up to 850 kW: Yantrashilpa, Gvision**



Key Projects Executed:

- Study of in-use Diesel Genset for effectiveness of Retrofitting Exhaust Treatment Devices with Central Pollution Control Board (CPCB).
- Deployment of alternate Fuel Technologies on Marine Engines for fishing vessels with Dept. of Fisheries.
- Performance Evaluation of Engine oil on Genset and Tractor Diesel engines in collaboration with IOCL.
- Efficiency testing of chain and belt drive (new and used) for e-motor on transient Dynamometer at varying loads.
- Development and performance evaluation of off-road engines for High Altitude conditions (up to 5000 m and -20 °C).
- Development, Performance and emission testing of Alternate CNG-fueled, Bio diesel tractor engines.
- After-treatment system development & validation for various manufacturers for Automotive and Non-road applications.

Standards / Regulations (National & International):

- AIS 137 Part 4:** Standard for testing of M & N Category vehicles engine, GVW > 3500 kg (BS-VI).
- AIS 137 Part 5:** Standard for Power testing of IC Engines and Electric Drive Trains for Categories L, M and N.
- AIS 137 Part 7:** Standard for testing of Agricultural Tractors, CEVs & Combine Harvesters for Bharat Stage (CEV/TREM) - IV & Bharat Stage (CEV/TREM) – V.
- CPCB IV+:** Standard for emission compliance of Genset engines (up to 800 kW).
- PCLS/12/2021-22:** Standard for testing RECD for in use Genset engines (up to 800 kW).
- AIS- 041:** Test Standard for E-motor Power Test.
- IS 8122, IS 12036, IS 14599, IS 9935.**
- UNECE R24, R49, R85, R96.**

Compliance / Lab Accreditations / Recognitions:

- "Type Approval" under 126A of the CMVR under MoRTH (Dept. of Road Transport and Highways).
- "Type Approval" for Gensets under Central Pollution Control Board (CPCB) for Emission Testing
- Export Homologation with Vehicle Testing Agency (VCA-UK)
- ISO/IEC 17025: 2017 with Scope

• Electrical

• Mechanical



• Chemical

- Integrated Management System (IMS):



Correlation & Benchmarking:

- ❑ Correlation and Benchmarking with various Engine manufacturers for Automotive and Non-Road engines for Quality Assurance.
- ❑ Internal Benchmarking is done to maintain consistency and quality of test data with Master engine on quarterly basis.

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