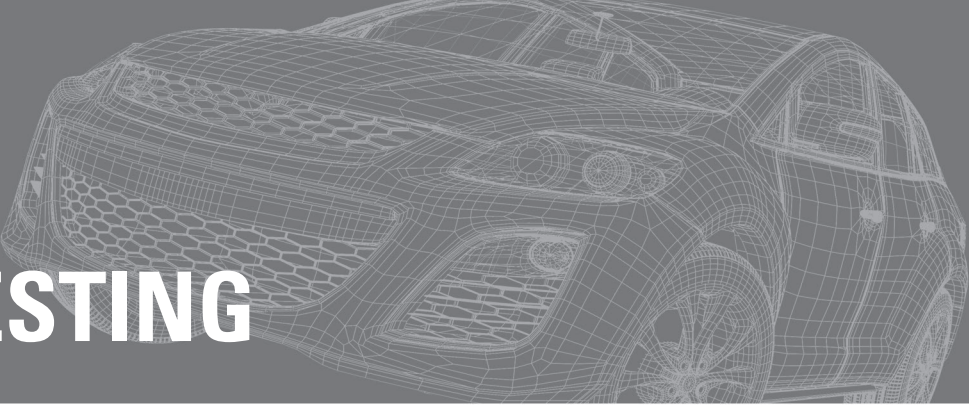




VEHICLE AND ENGINE TESTING SERVICES FOR RESEARCH, DEVELOPMENT AND CERTIFICATION

SGS ENVIRONMENTAL TESTING CENTER
A DIVISION OF SGS NORTH AMERICA, INC.





VEHICLE TESTING



The SGS Environmental Testing Center is equipped with a comprehensive array of laboratories serving the research, development and certification needs of our customers.

EXHAUST EMISSIONS CERTIFICATION

- Five chassis dynamometer emissions laboratories compliant with EPA standards
- Federal and supplemental vehicle emissions certification testing
- EPA CAP2000 and In-Use Verification Program (IUVF)
- Motorcycle and ATV Chassis Dynamometer

VEHICLE PROCUREMENT SERVICES

- Complete services for obtaining in-use vehicles for compliance testing
- Bulk mailing to candidates
- Candidate questionnaire and interview
- Random selections
- Test article history, maintenance and use
- Test article pickup and delivery
- Test article incoming and outgoing inspection including OBD
- Optional garage service or dealership visits

VEHICLE DEVELOPMENT

- Configuration of the five chassis dynamometer emissions labs to meet specific customer needs, including environmental testing, catalyst efficiency determination, custom drive cycles and test procedures, exhaust speciation
- Vehicle instrumentation, including exhaust sample ports, thermocouples, pressure transducers, data logging
- Mileage accumulation dynamometers in Jackson, Michigan (refer to specifications)
- Large cold soak room for cold start and sub-zero evaluation of products to -20°F (-29°C)
- Remote cold start facility located in Empire, Colorado at 8900 feet (2710 m) above sea level
- Certification and specialty fuels, in bulk tanks and drums

EVAPORATIVE EMISSIONS

- 4 Variable Temperature SHEDs available
- EPA and CARB procedures performed
- Point source running loss and fuel tank temp profile control
- On-board Refueling Vapor Recovery (ORVR)
- Large vehicle capable
- Canister loading and breakthrough (gravimetric or SHED)
- Customization and speciation for research and development

SPECIFICATIONS

ENGINE TEST CELL SPECIFICATIONS

ENGINE TEST CELL	DYNAMOMETER TYPE	MAX. SPEED (RPM)	PEAK ABSORBING TORQUE (CONTINUOUS)	RATED ABSORBING POWER (CONTINUOUS)
EW1	AC Electric Motoring/ Absorbing	4500	2668 lb-ft / 3617 Nm @ 0-1450 rpm	736hp / 549 kW @ 1450-4500 rpm
EW2	AC Electric Motoring/ Absorbing	4500	2668 lb-ft / 3617 Nm @ 0-1450 rpm	736hp / 549 kW @ 1450-4500 rpm
EW3	AC Electric Motoring/ Absorbing High Speed Low Inertia	9000	570 lb-ft / 772 Nm @ 0-4000 rpm	430hp / 320kW @ 4000-7000 rpm
EW4	AC Electric Motoring/ Absorbing	4500	2668 lb-ft / 3617 Nm @ 0-1450 rpm	736hp / 549 kW @ 1450-4500 rpm
EW5	AC Electric Motoring/ Absorbing High Speed Low Inertia	6700	412 lb-ft / 560 Nm @ 0-2000 rpm	156hp / 117 kW @ 2000-4400 rpm
OE1	AC Electric Motoring/ Absorbing	3600	2000 lb-ft / 2711 Nm @ 0-1500 rpm	600hp / 447kW @ 1500-3600 rpm
OE2	Eddy-Current Absorbing Only	6000	805 lb-ft / 1092 Nm @ 1000-1500 rpm	230hp / 172 kW @ 1500-5000 rpm

All Engine Test Cells feature CVS, dilute and two raw stream gas emissions analyzers, and PM sampler. Test Cells EW-1 to EW-5 are 40CFR Part 1065 compliant. All Engine Test Cells include altitude simulation and extreme combustion air temperatures.

VEHICLE TEST SITE SPECIFICATIONS

VEHICLE LAB	DYNAMOMETER	ABSORBING POWER (HP/KW)	AIR TEMPERATURE RANGE (°F/°C)	EMISSION SAMPLING
Site 1	AC Electric Single 48" Roll	200/149	-20 to 110°F -29 to 43°C	5 Streams + Bag Gas & Diesel CVS
Site 2	AC Electric All-Wheel Drive Two Independent 48" Rolls	350/261 front 450/336 rear	0 to 110°F -18 to 43°C	5 Streams + Bag Gas & Diesel CVS
Site 3	AC Electric Single 48" Roll	200/149	50 to 110°F 10 to 43°C	4 Streams + Bag Gas CVS
Site 4	AC Electric Single 48" Roll	200/149	0 to 110°F -18 to 43°C	3 Streams + Bag Gas CVS Running Loss
Site 5	AC Electric Single 48" Roll	200/149	68 to 86°F 20 to 30°C	3 Streams + Bag Gas CVS

VEHICLE MILEAGE ACCUMULATION DYNAMOMETER SPECIFICATIONS (JACKSON, MICHIGAN)

FEATURES	TYPICAL USES
■ 7 Mileage Accumulation Dynamometers	■ Rapid non-road mileage accumulation
■ Eddy Current absorbing, Single 40" Roll	■ Catalyst aging
■ Driverless, automated throttle and braking	■ Exhaust emissions deterioration
■ Road load model, programmable drive cycles	■ Fuels effects
■ Road speed modulated frontal cooling fans	■ Lube evaluations
■ Data acquisition, comprehensive alarms and safeties	■ Diesel Particulate Filter regeneration studies
■ OBD interface	■ Transmission and driveline aging
■ Individual video recording of vehicles	■ Front wheel drive and rear wheel drive
■ Secured facility	■ Cost effective, low risk alternative to drivers

ENGINE TESTING

The facility contains seven high-feature test cells and can test engines rated from 8kW to 549kW. The test cells can accommodate diesel, gasoline, and gaseous fueled engines.

EXTREME TESTING

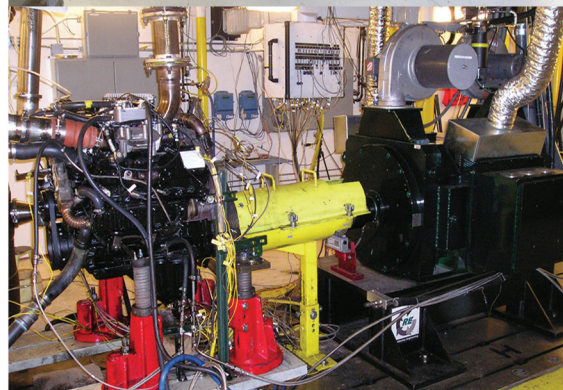
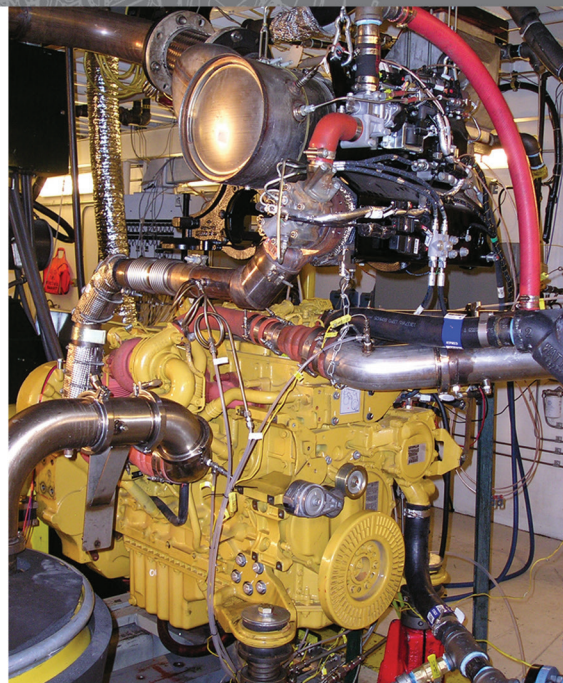
- All Test Cells feature SGS-ETC's patented Balancing Altitude Simulation Equipment (BASE™), proven capable of testing engines from 0 to 12000+ feet (3660+ m) elevation above sea level for both steady state and transient engine operating conditions
- Combustion air temperatures may be set from 14 to 130°F (-10 to 54°C) over the range of simulated altitudes
- Realistic intercooler efficiency is assured by employing air-to-liquid laboratory intercoolers, isolated cooling circuit designs and coolant flow meters with closed loop controllers

TYPICAL ENGINE TEST CELL USES

- Exhaust emissions certification tests, compliant with 40CFR Part 1065 and ISO8178 standards
- "Not-to-Exceed" performance and emissions testing at extreme environmental conditions
- Engine mapping and emission control system development
- Electronic control system calibration, with customer working on site, remotely off site, or using SGS-ETC calibration engineers
- Prototype engine development
- Engine component evaluations
- Aftertreatment component evaluations
- Verification of retrofit systems for state programs
- Competitive benchmarking
- Fuel blends and additive studies

INSTRUMENTS FOR DEVELOPMENT AND EXHAUST SPECIATION

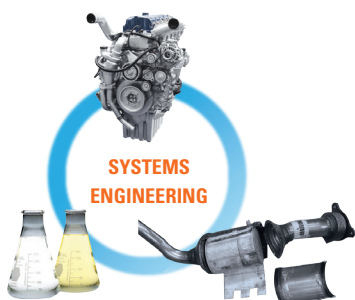
- A&D Combustion Analysis Systems (CAS)
- Combustion noise meters
- Euro 6 compliant particle number sampling with rotating disk diluter
- Particle size distribution
- Microsoot sensors, smoke meters, opacity meters
- Innova 3433 photoacoustic analyzer for SHED speciation
- NMOG speciation cart (DNPH cartridges, impingers, bags)
- Fourier Transform Infrared Analyzer (FTIR)
- Laser absorption spectrometer for NH₃ and N₂O
- Fuel flow meters and coolant flow meters



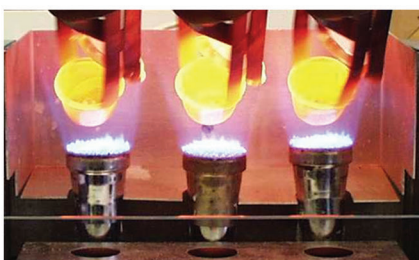
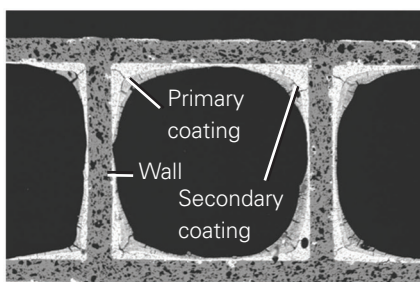
ENGINEERING SERVICES

SGS Environmental Testing Center offers experienced engineers to assist customers with research and development, including:

- Electronic control system calibration
- Calibration for high altitude and extreme temperatures
- Vehicle cold start and driveability assessment
- Design of Experiments
- Data analysis and statistical analysis
- Advanced experimental methods
- Exhaust and evaporative emissions expertise
- Fuel, engine and aftertreatment system interactions
- Management of complex projects



An in-depth understanding of engine, aftertreatment and fuel interaction is required for development of next generation powertrains. SGS offers comprehensive analytical laboratories to assist customers in characterizing catalysts, particulate filters and test fuels.



FUEL AND OIL PROPERTIES AND CHEMISTRY: SGS OIL, GAS & CHEMICALS, DEER PARK, TEXAS

Comprehensive ASTM methods of interest to developers:

- Octane and cetane rating engines
- Distillation
- Aromatics
- C, H, O, S, N analysis
- Hydrocarbon speciation
- Cloud point and pour point
- And hundreds more....

CATALYST AND PARTICULATE FILTER CHARACTERIZATION: SGS MINERALS SERVICES, LAKEFIELD, ONTARIO, CANADA

Independent assessment of substrate, coating quality and formulation:

- Optical and electronic imaging instrumentation
- Quality assessment of precious metal coating by SEM and backscatter imaging
- Recovery and analysis of coated ceramic and metal substrates
- Analysis of precious metals, base metals and rare earth elements

Quality ↑

Emissions ↑

Brand protection ↑

Reliability ↑ Quality ↑

↑ **Safety**

↑ **Productivity**

↑ Speed to market

↑ Safety ↑ End of life



YOUR TEST AND DEVELOPMENT RESOURCE

The SGS Environmental Testing Center has over 30 years of experience providing comprehensive vehicle and engine emission, fuel consumption, evaporative determination, and performance testing services. The 80,000 square foot laboratory is on a five acre secure site located in Aurora, Colorado. The laboratory is less than 20 minutes from the Denver International Airport and less than an hour drive from the world's foremost high altitude natural proving grounds, the Rocky Mountains. The facility has a comprehensive security system and video surveillance, and can address additional customer requirements to protect confidentiality.

The laboratory is used by automobile and engine manufacturers, suppliers, the petrol chemical industry, the research community and government agencies. Our customers use the laboratory to test new products, perform research and development, and certify compliance with federal and state emissions regulations. Our core business is the advancement of test technology and methods to enable the development of next-generation powertrains. We offer vehicle procurement, engineering services, control system calibration, data analysis and project management to meet specific customer needs. We also have one of the greatest capacities

in the world for testing powertrains under extreme altitude and temperature conditions.

The SGS Environmental Testing Center is an accredited laboratory in compliance with ISO 14001:2004 environmental management, and ISO 17025:2005 quality management for performing vehicle and engine emissions tests. American Association for Laboratory Accreditation Certificate Number 1975-01.



1975-01



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WHEN YOU NEED TO BE SURE

SGS