

CVS-7000



- [Overview](#)
- [Specifications](#)

Overview

Applications

Mass emissions and particulate sampling for:

- Light/medium-duty vehicles
- Heavy-duty truck and bus engines
- Small utility to large off-road engines
- Gasoline, diesel, and alternative fuels
- Certification, R&D, audit
- SULEV, ULEV, LEV, TLEV and higher emissions
- Hybrid Vehicles

Typical Light-Duty Uses:

- EPA FTP, HWFET, and SFTP
- ECE 15+EUDC (NEDC)
- JC08
- JAPAN 10/15
- Related regulations for other countries

Typical Heavy-Duty Uses:

- EPA FTP
- NTE
- NRTC
- ELR
- ETC
- ECE Regulation 49
- ISO 8178
- JE05

Principle

Light-Duty Gasoline/Alternative Fuels Testing

Exhaust flows into the mixing tee where it is diluted with ambient air to prevent water condensation. Sample of ambient air is sent to the Bag Sampling Unit for storage in bags.

- From the mixing tee, diluted exhaust sample enters the Exhaust Sampling Unit, which measures dilute-exhaust flow rate and volume.
- Sample of the dilute exhaust - extracted proportionally before the critical flow venturi - proceeds to the Bag Sampling Unit for storage in sample bags.
- Emission analyzers measure concentrations of THC, CO, CO₂, NO_x, and CH₄ in bags.

The mass of HC, CO, NO_x, CO₂, CH₄ is calculated from Gas Concentration in the Bag, Gas Density, and Total CVS Volume.

DIESEL DILUTION METHODS:

1. Single-Dilution Method

Exhaust enters a primary dilution tunnel where it is mixed with ambient air. Tunnel is sized to assure complete mixing and cooling of the sample to 125°F (51.7°C) or less. From the primary tunnel, samples are extracted and sent to:

- Dilution sampler (DLS). Collects particulate samples on filters - one for each test phase. Filters are weighed at end of test.
- Oven with Heated FID and CLD analyzers. Measures and continuously integrates THC and NO_x concentrations.
- Optional auxiliary sampling devices.

Bulk-stream sample proceeds into Exhaust Sampling Unit, which measures flow-rate and volume. Sample is extracted before bulk-stream venturi and sent to Bag Sampling Unit (BSU) for storage in sample bags, later analyzed for CO and CO₂.

2. Double-Dilution Method (Typical for Heavy Duty Diesel or Light Duty Diesel Applications)

Exhaust enters a primary dilution tunnel where it is mixed with ambient air. Tunnel is sized to assure complete mixing and cooling of the sample to 375°F (191°C) or less. Samples are extracted from primary tunnel and sent to:

- Oven with Heated FID and CLD analyzers. Measures and continuously integrates THC and NO_x concentrations.
- Heated Particulate Filter Unit or Secondary dilution tunnel. Mixes extracted sample with dilution air and cools it to 125°F (51.7°C). Small sample proceeds to Dilution Sampler (DLS) for particulate sampling on filters - one for each test phase. Filters are weighed at end of test.
- Optional auxiliary sampling devices

Bulk-stream sample proceeds into Exhaust Sampling Unit, which measures flow-rate and volume. Sample is extracted before bulk-stream venturi and sent to Bag Sampling Unit (BSU) for storage in sample bags, later analyzed for CO and CO₂.

Features

CVS-7000 general-purpose dilution and sampling system for bag mass emissions and particulate analysis. Modular components - mixing tee, tunnel, exhaust sampling unit, bag sampling unit, particulate sampler, and main control unit - provide flexibility to support:

- **Configurations for all engine sizes, applications, and fuels**
from mopeds to mini-buses, small utility to heavy-duty engines, SULEV to higher-emission vehicles. Includes configurations for gasoline, diesel, and alternative fuels.
- **Wide range of flow rates**
from 1 m³/min (35 SCFM) to 200 m³/min (7000 SCFM) depending on engine size and application.
- **Single, selectable, or scalable flow rates**
Choice of critical-flow-venturi technique (CFV) or subsonic-venturi technique (SAO) assures flexibility in flow rate control and measurement.
- **Advanced bag sampling techniques**
Supports up to 12 bags. Enhanced systems offer variety of techniques to prevent water condensation, minimize HC out-gassing, reduce HC hang-up, and allow a lower dilution ratio. Dedicated lines and bags allow separation of gasoline and diesel samples - or separation of "clean" and "dirty" samples for ULEV/SULEV testing.
- **Basic and enhanced dilution strategies**
Basic mixing tees and tunnels accommodate routine exhaust-dilution requirements. Enhanced systems offer a variety of techniques to prevent water condensation, purify dilution air, control tailpipe pressure, and improve resolution of CVS measurements.
- **Direct measurement of dilution air volume**
Installed in the mixing tee, an SAO can measure dilution-air volume to allow calculation of tailpipe volume for modal tests.
- **Installation in test cells with limited space**
Modular design allows installation where space is available - in the test cell, in the control room, and/or on a mezzanine. The Main Control Unit - also used by the MEXA-7000 analytical system - provides comprehensive data displays, alarms, calibration functions, and data logging.

Features

- Proven track record with over 900 units installed and operational worldwide.
- Complies with worldwide statutory regulations.
- Modular components can be configured and customized for any application and floor plan.
- Standard models meet basic testing needs and include large number of options for demanding applications.
- Integrates seamlessly with the MEXA-7000 to sample and analyze vehicle emissions.
- Main Control Unit provides easy operation and maximum functionality. Simultaneously controls the CVS-7000 and MEXA-7000.
- Worldwide service network assures excellent support.

Modular in design, all models include:

- Remote Mixing Tee (RMT) - dilutes and mixes exhaust gas with filtered ambient air. Provides a probe for collecting background air in bags. (Mixing tee can be alternatively integrated into Exhaust Sampler Unit.)
- Exhaust Sampling Unit (ESU) - measures the flow rate and volume of diluted exhaust and provides probe(s) for sample collection.
- Bag Sampling Unit (BSU) - fills, reads, and evacuates sample and ambient bags.
- Turbocompressor - draws diluted exhaust sample through the system.
- Main Control Unit (MCU) - provides measurements, calibrations, displays, alarms, data logging, host computer interface, and other functions.

Systems for diesel testing also include:

- Dilution Tunnel (DLT) - dilutes, mixes, and cools diesel-exhaust gas. Provides probes for Hot THC, Hot NOx (heavy duty), particulate matter, and optional auxiliary sampling devices.
- Dilution Sampler (DLS) - collects samples of particulate matter on filters.
- Heated Particulate Filter Unit (HF-47) Optional-- temperature-controlled, heated particulate filter enclosure with particle pre-classifier.

Models can be configured for any engine size, application, and fuel by specifying features of each module (see Specifications).

Related SAE Papers

Click on paper's identification number to order:

"The Control of TP Pressure in Emissions Sampling Systems."

[SAE Paper 1999-01-0152](#)

"Proportional Ambient Sampling: A CVS Improvement for ULEV and Lean Engine Operation."

[SAE Paper 1999-01-0154](#)

"Predicting and Preventing Water Condensation in Sampled Vehicle Exhaust"

SAE Paper 980404

"Numerical Analysis of Mass Emission Measurement Systems for Low Emission Vehicles Emission Measurement and Testing Methods (Part A&B)"

[SAE Paper 1999-01-0150](#)

Manufactured by HORIBA