ADVANCED TRANSPORTATION

Powertech

The Power of Trust. **The Future of Energy.**

ADVANCED TRANSPORTATION

Customer fueling at Powertech's 700 bar hydrogen station

Supporting the advancement of clean transportation technology through testing and development for fueling/charging infrastructure, vehicle systems/components, and codes/standards.

Hydrogen-fueled and electric vehicles rely on technology development and testing for the successful deployment of these advanced transportation options. The hydrogen fuel cell electric and natural gas vehicle industries require fueling stations and high-pressure gas systems and components that are safe, efficient, reliable, and user-friendly. Battery electric vehicles need communication and data management tools to optimize their charging and integration with the grid.

As a leader in the design and construction of hydrogen fueling stations, Powertech's Advanced Transportation–Infrastructure Department pioneered the design of turnkey, containerized hydrogen fueling station packages. This process streamlines station building by compiling and integrating the components at Powertech's facility, packaging them with control software, and testing the systems and components to deliver a safe and reliable plug-and-play system to the station site.

Since 1983, Powertech has also provided the technical expertise to support the complex and changing needs of the compressed gas industry. Our Advanced Transportation–Testing Department offers independent testing services for high-pressure components and systems used in alternate fuel vehicles and fueling infrastructure. The department's specialized laboratories conduct a comprehensive array of standard and custom design verification, performance, and qualification/certification testing of high-pressure gas cylinders, components, and fuel systems for the hydrogen and compressed natural gas industries.

Powertech's 30 years of experience with gas systems testing enables it to offer expert technical consultation to assist customers in designing tests, navigating certification or regulatory requirements, interpreting test results, and conducting failure analyses. Unique to the industry, Advanced Transportation engineers can also work with other in-house labs to provide an extended spectrum of services beyond the ordinary purview of component and system testing.

Powertech also has expertise in electric vehicle infrastructure deployment, and is supporting the development of solutions for vehicle-grid integration, including smart-charging, load management, distribution planning, and usage data collection and analysis via its evCloud aggregation platform.

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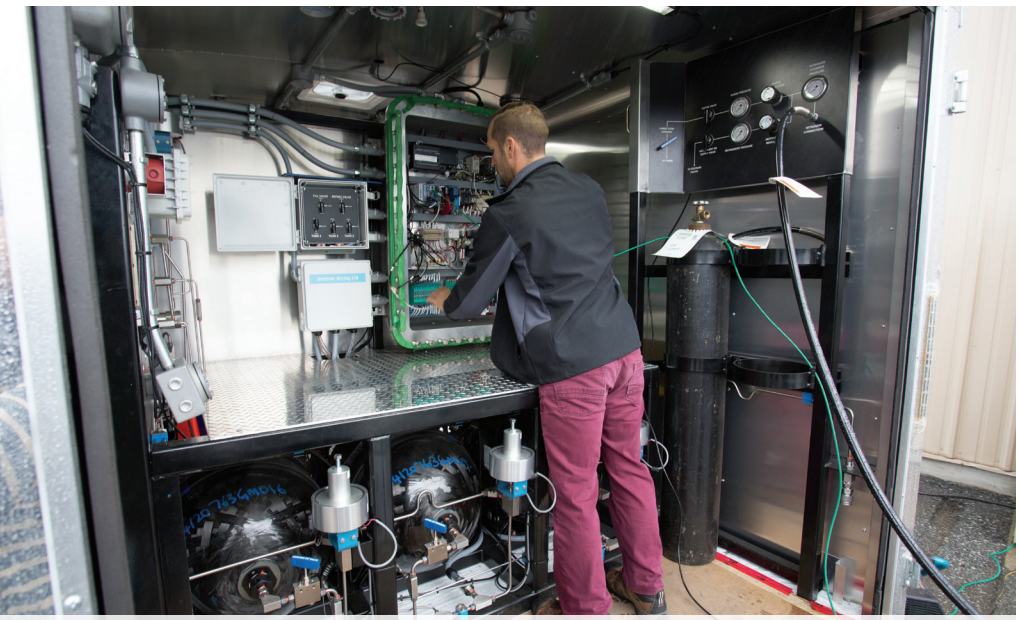
HYDROGEN INFRASTRUCTURE



Hydrogen Station Equipment Performance Device

Hawaii 700 bar fueling station

Hydrogen station fabrication

Powertech's Advanced Transportation–Infrastructure Department has the capabilities to offer services for hydrogen station design and construction.

Designing and Installing Stations
Powertech has the laboratory facilities and technical expertise to design and build turnkey hydrogen fueling stations, with flexible and customizable options such as hydrogen supply, storage cylinder type, dispenser type, and station size.

Mobile Fueling
New to Powertech's product line is the 70 MPa mobile fueler with pre-cooling. This standalone unit can be used where a full station is not available and is powered by a generator.

Station R&D
Powertech engineers can develop technology for future stations and station testing systems, such as the Hydrogen Station Equipment Performance Device (HySTEP), which was developed by Powertech's Advanced Transportation Department.

Codes and Standards Development
Through the participation of Powertech senior engineers in the activities of standards committees, Powertech is always engaged in the state-of-the-art and shaping the future direction of the industry.

Software Development
Powertech has the capability for developing control software for hydrogen stations and test systems, and has developed an advanced database for collecting fueling data from vehicles and stations. Powertech also has an in-house retail Point of Sale (POS) system, which can be used for credit card transactions at the dispenser.

Consulting Support Services
Powertech offers online support services for hydrogen stations using remote log-in capabilities.

EV INFRASTRUCTURE

Mobile DCFC demonstration

Customer fueling at Powertech's direct current fast charging (DCFC) station

Powertech's Advanced Transportation group supports the rapidly expanding EV market by providing engineering and consulting services to local and global clientele.

We are leading experts in all aspects of EV technologies, from infrastructure and smart grid integration, to fleet deployments and component testing. Powertech offers customized EV solutions including turnkey infrastructure deployments, consulting services, fleet management and optimization, data collection and analytics engineering services, and comprehensive electrical, mechanical, and environmental testing services.

Powertech's Advanced Transportation and Grid Modernization Groups come together to offer services and solutions to help OEMS, utilities, and partners in implementing EVs. Powertech's Grid Modernization team provides a live 25-kV distribution test system to assess, model and mitigate impacts of EV charging infrastructure; services to validate EV fleet integration, neighborhood storage, and demand response; and evaluation of EV impact on distribution systems and equipment.

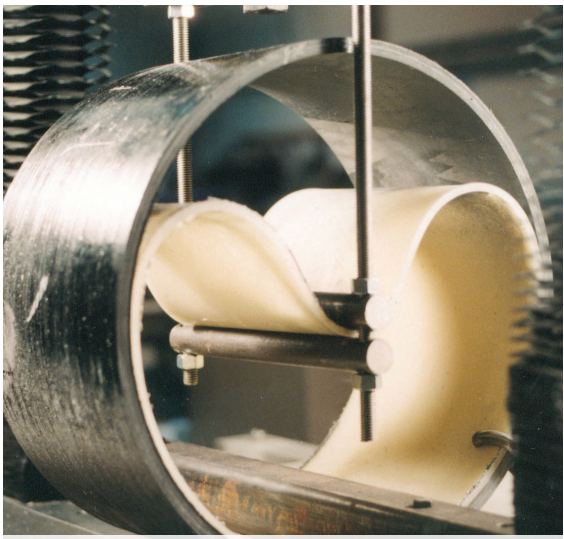
Our goals are to support our customers through effective EV adoption, while assessing, understanding, and mitigating impacts on utility distribution systems and neighborhood networks. Our services are designed to provide clean transportation solutions, to support our customers in promoting EV adoption, and to help the public and utilities make a seamless transition from gas to electric vehicles.

Level II EV chargers

Advanced
Transportation

HIGH-PRESSURE TESTING

Gunfire test



Type 4 liner flexibility test

Powertech's Advanced Transportation–Testing Department provides testing for high-pressure cylinders, components, and fuel systems.

Fuel Systems Testing
The Fuel Systems Testing Lab performs simulated hydrogen fueling tests, hydrogen gas pressure-cycling, static and dynamic hydrogen leakage testing, and drive cycle simulation.

The lab can also administer the expected service and localized fire testing required by the UN GTR No. 13, ECE R134, and SAE J2579 test standards.

The lab can develop custom test apparatuses to meet vehicle OEM internal performance or durability test procedures on high-pressure vehicle fuel systems. Tests include water spray, dust ingress, thermal shock, vibration resistance, mechanical shock or impact, electrical operation, and other specialized tests.

Cylinder Testing
Powertech has the capability to test high-pressure cylinders of all types to most EC/ECE, ANSI/CSA, KHK, ISO, SAE, and EN standards for all compressed hydrogen, natural gas, and industrial gas applications.

Cylinders include on-board vehicle (heavy and light duty), stationary storage, tube trailer, transportable, and portable cylinders. Powertech is also able to test to the new UN GTR No. 13, ECE R134, and SAE J2579 test specifications for hydrogen cylinder durability.

Component Testing
The Component Testing Lab tests high-pressure components, including solenoid valves, regulators, pressure-relief devices, check valves, manual valves, nozzle/receptacles, hoses, fittings, and sensors.

Testing is conducted to meet most EC/ECE, UN GTR, ANSI/CSA, KHK, and ISO standards for all compressed hydrogen, natural gas, and industrial gas applications.

The lab operates self-contained, hazardous-location-rated, and customizable test stations with a supply of high-pressure hydrogen (95 MPa), natural gas (25 MPa), and nitrogen available to perform tests, including operating cycle, durability/endurance cycle, hysteresis, internal and external leakage, and all other required tests in environments from -70°C to +170°C.

APPLICABLE STANDARDS

Bonfire test

Cylinder test

TEST OBJECTS	APPLICABLE STANDARDS
HIGH-PRESSURE CYLINDERS	ANSI NGV 2, CSA/ANSI HGV 2
	CSA B51 PART 2, CSA B339
	EC 79
	ECE R110, ECE R134
	EN 12245
	ISO/DIS 19881, ISO/DIS 19884, ISO 11439, ISO 11119, ISO 11515, ISO/TS 15869, ISO 9809
	KHK S0128, KHK RB9
	SAE J2579
	UN GTR NO. 13
	FMVSS 304
	DOT-CFFC, DOT-FRP2
HIGH-PRESSURE COMPONENTS	ANSI HPRD 1 , ANSI PRD 1, ANSI / CSA HGV 4.10, ANSI HGV 3.1/CSA 12.3, ANSI HGV 3.1
	EC 79
	ECE R110, ECE R134
	ISO/FDIS 19880-3, ISO/DIS 19880-5, ISO/DIS 19882, ISO/DIS 17268, ISO 15500
	UN GTR NO. 13
	CGA S1.1
FUEL SYSTEMS	ANSI HGV 4.9
	ECE R134
	SAE J2579, SAE J2601
	UN GTR NO. 13

Advanced Transportation

THE POWERTECH ADVANTAGE

Powertech Labs Inc. is one of the largest testing and research laboratories in North America, situated in beautiful British Columbia, Canada. Our 11-acre facility offers 15 different testing labs for a one-stop-shop approach to managing utility generation, transmission and distribution power systems.

Powertech is home to a broad range of scientists, engineers, and technical specialists, with capabilities in electrical testing, cable condition assessment, mechanical and materials engineering, software technologies, power system studies, chemical analysis, gas systems engineering, and smart utility services. These skilled researchers have decades of collective and real-world experience and often work in cross-departmental teams to investigate, diagnose and solve complex problems.

As an independent, third-party testing facility, we adhere to the **highest** laboratory **(ISO 17025)**, quality **(ISO 9001)** and environmental **(ISO 14001)** management standards. Many of our scientists and engineers chair or participate in various standards committees within their fields of expertise. Additionally we have the capabilities to derive and develop **non-standard testing** methods and setups required to test product prototypes and perform forensic analysis.

Outside of the utilities industry, Powertech provides routine **testing** capabilities, product **development**, research and **consulting** services to support an array of industrial-type operations, electrical equipment manufacturers and automotive original equipment manufacturers.

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