

Powertech

A subsidiary of BC Hydro

Powertech Labs Inc.

12388 - 88th Avenue

Surrey, B.C. Canada

V3W 7R7

Phone 604 590 - 7500

Fax 604 590 - 5347

www.powertech.bc.ca

“Knowledge itself is power.”

Francis Bacon (1561-1626), founder of the scientific method

- Internationally recognized expertise in chemical, civil, mechanical, electrical, environmental, metallurgical, and materials sciences
- World class testing and analysis capability
- The largest High Voltage and High Power laboratories in Western North America

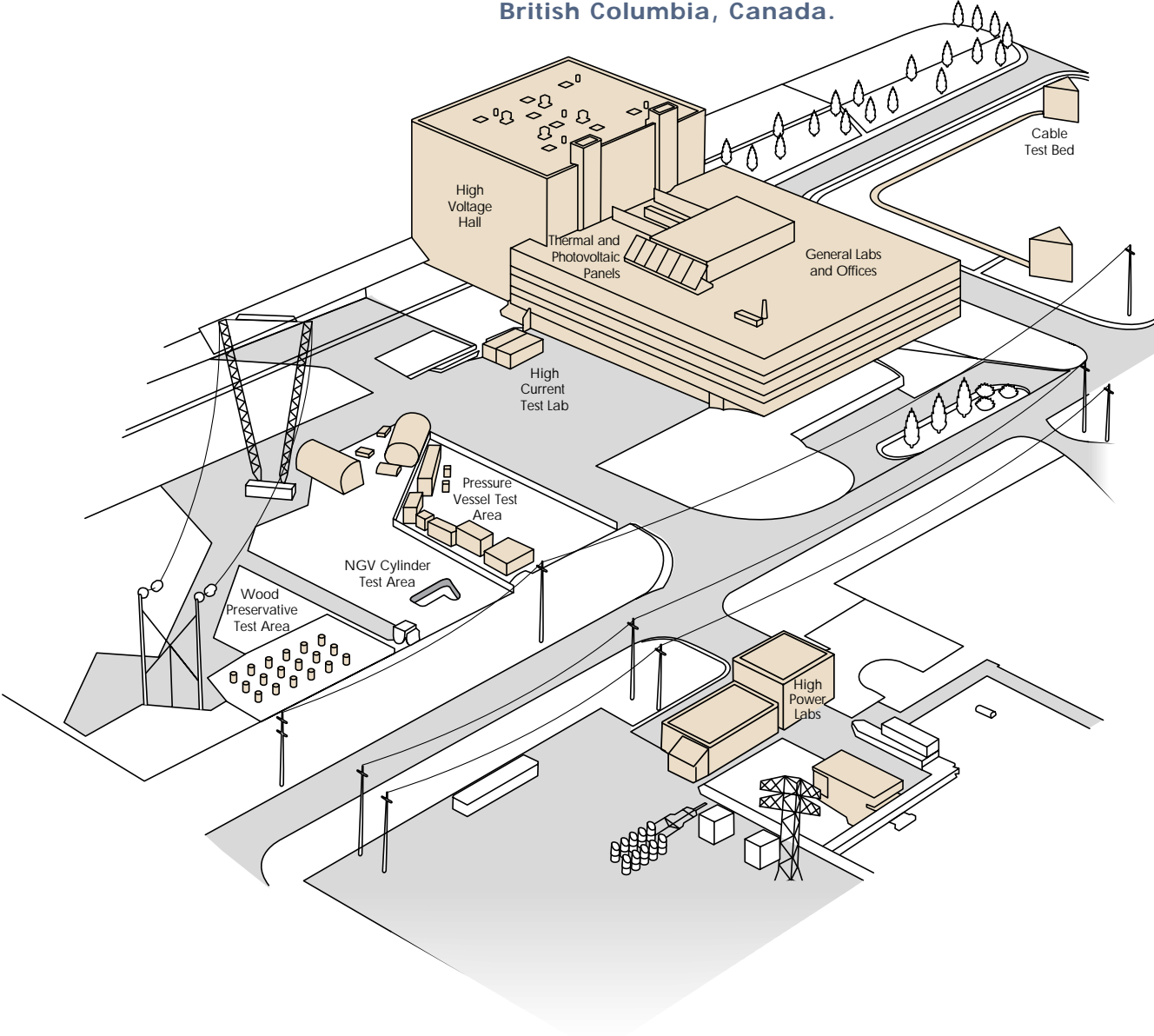
In a world growing steadily more complex and competitive, knowledge remains the key to success. Powertech has expert knowledge across a broad range of disciplines, world class facilities, and a proven ability to find practical, cost-effective solutions to even the most complex technical problems.

As the research and technology arm of BC Hydro (the third largest electric utility in Canada) for almost two decades, Powertech developed the wide-ranging technical expertise now offered to industry at large.

Internationally recognized engineering expertise. Superb technical facilities.

**Over 11 acres of indoor and outdoor
test facilities located near Vancouver,**

British Columbia, Canada.





SERVICES

Powertech's problem solving expertise spans 7 areas of service to our clients.

FIELD TESTING SERVICES

Powertech engineers and specialists are well experienced in performing generator, transmission, substation and distribution equipment field tests. Advanced techniques and apparatus are employed with data capture and plotting software to provide state-of-the-art reports on plant performance, condition and diagnostics.



TECHNICAL UNITS

Each of Powertech's 5 Technical Units focuses on a specific discipline. Together the units pool their expertise and specialized equipment to provide a total solution to problems, from diagnosis through testing and recommendations.



High Voltage Lab

One of three power engineering labs.

Solutions to technical problems.

The optimum solutions –

the ones that deal with every aspect of the problem

– require a pooling of knowledge.

Structured for Optimum

Solutions

Powertech has five distinct technical units, each of which focuses on developing and applying research, technology, and innovative testing in a particular area of expertise. What sets Powertech apart is our ability to combine expertise from the different business units to provide the optimum solution to complex problems. For example, dealing with a malfunction of a power transformer could require

pooling knowledge from electrical, chemical, and materials engineering.

Powertech has the required knowledge in each area and the ability to make it all work together.

Powertech's in-house expertise is complemented by ongoing cooperation with universities and major international research institutes to provide clients with the most appropriate technical solutions.

Serving the World

Powertech's full range of services are used by clients around the world, including utilities, manufacturers, regulatory agencies, industrial customers, and consulting engineers. Our experts help them assess and improve the performance, efficiency, safety, reliability, and environmental impact of structures, systems, equipment and components.

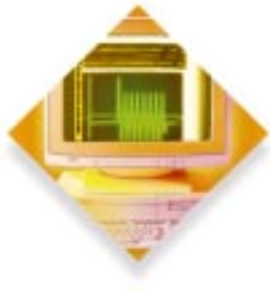


Sample of transformer oil being removed by client for delivery to Powertech to test for PCB content.

Monitoring of the static electricity in plastic pipe caused by the flow of natural gas. Voltages can be sufficient to cause pipe failure.

At Powertech, we understand that the best solutions are the ones that save you time and money. Our various services are designed to enhance the performance of your business by helping you minimize downtime and maximize the reliability and service life of your energy systems and equipment.

POWER SYSTEM PERFORMANCE



Powertech combines advanced computer simulation techniques with field measurement capabilities to fully assess and enhance power system performance.

Consumers of electric power demand reliable, high-quality electricity supply from utilities at low cost. This requires the ability to properly design power systems and the associated controls, and assess system performance under a wide variety of conditions — a formidable task considering the complexity of modern power systems and the continually changing environment in which they operate.

Powertech combines advanced computer simulation techniques with field measurement capabilities to fully assess and enhance power system performance. As leaders in analytical tools and techniques, we can perform a variety of simulations required for system planning and operation. Field measurements are conducted for commissioning of equipment,

diagnosing system problems, derivation of analytical models, and verification of simulation results. Whether designing a major system expansion or optimizing the performance of existing facilities, Powertech delivers.

Areas of expertise include:

- systems planning and operating studies
- stability assessment, control and enhancement
- HVDC and Flexible AC transmission Systems (FACTS) assessment
- harmonics and power quality analysis
- field measurements including switching surges and load response
- system protection
- generator field testing and model development



Voltage divider being erected for staged fault testing in a substation. Data is used to evaluate circuit breaker performance.

Graphical results of a power quality study carried out for residential, commercial, and industrial end users.

EQUIPMENT PERFORMANCE



Powertech operates one of the best equipped and most technologically advanced electrical and natural gas equipment testing facilities in North America.

Powertech operates one of the best equipped and most technologically advanced electrical and natural gas equipment testing facilities in North America. We evaluate equipment for manufacturers and utilities throughout the world and perform certification testing to national and international standards.

Our facilities include:

- a 3.2 MV-240 KJ High Voltage Lab
- a three-phase 1500 MVA High Power Lab
- a 10,000 A High Current Lab
- a mechanical lab with a 25 metre test bed
- an environmental test chamber with controlled temperature and humidity

We perform development testing, acceptance testing, failure analysis, and accelerated ageing testing. Electrical equipment evaluated includes switchgear, cables, insulators, machine insulation, stator bars, transformers, surge arresters, circuit breakers, connectors, conductors, buswork, lighting products, and large motors and drives.

Natural gas transmission and distribution equipment evaluated includes pipelines, storage vessels, liquefied natural gas system components, fireplaces, and refuelling hoses.



Powertech's High Power Lab provides 3-phase testing of equipment and devices to 1500 MVA.

NGV cylinder being readied for ultrasonic inspection.

CONDITION ASSESSMENT



Powertech is an industry leader in machine condition monitoring (MCM).

In order to make critical maintenance and repair decisions that will extend the life of equipment and structures, their condition must be assessed continually or at intervals. Powertech has extensive expertise in this area.

We are an industry leader in machine condition monitoring (MCM). This technology uses sophisticated software for remote monitoring of plant and equipment to determine maintenance requirements and potential failure conditions.

Powertech offers a range of nondestructive evaluation services. We diagnose vibration, which is a traditional indicator of machinery distress, identifying the causes of malfunctions and recommending corrective measures.

We evaluate cable insulation, analyze insulating fluids, and measure generator corona discharge to assess the condition of power equipment.

Powertech has developed a non-invasive technique for assessing the condition of transformer paper from oil analysis.

We apply fracture mechanics to fitness-for-purpose evaluation of cracked or aged components of turbines, generators, penstocks, breakers, steam pipes, gas pipes, and steam chests.

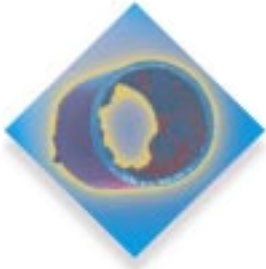
Condition assessment is also critical for large structures. Powertech performs life assessment studies for earth, concrete, and steel structures, identifies potential problems and recommends remedial measures.



Turbine dismantled for service. Condition monitoring systems alert plant personnel to developing problems in equipment.

Powertech has designed a device to measure the gassing tendency of insulating oil. This procedure determines suitability for use in 500 kV equipment.

MAINTENANCE ENGINEERING



Powertech is a leader in overlay technology for the cavitation protection of hydraulic turbines.

Without regular inspection and maintenance, plant and equipment would rapidly deteriorate and have to be replaced at great cost. Powertech provides sophisticated technology critical to life extension of plant and equipment.

Our nondestructive testing experts look for cracks and other defects that are early warning signs of equipment failure.

Procedures are specified for the weld repair of cracks on electrical generating equipment and on a variety of pressure vessels. Brazing techniques are provided for high current contacts. Powertech is a leader in overlay technology for the cavitation protection of hydraulic turbines.

Powertech experts can help extend the service life of structures and get maximum value for maintenance dollars. We select appropriate repair materials or protective coating systems, and recommend application procedures and maintenance schedules. We also design corrosion protection systems with sacrificial anodes and impressed current schemes.

Powertech analyzes fluids and lubricants to detect decomposition products and diagnose machine wear, schedule maintenance, and lengthen intervals between lubricant replacement. We help to apply new technologies to rejuvenate cables and cable accessories.

Sophisticated machine condition monitoring (MCM) software is being developed at Powertech for inspection of plant and equipment.



Arc gouge technique developed at Powertech to rapidly remove a cavitated surface for weld preparation.

Acoustic emission safety testing of fiberglass booms. Instrumentation listens for the sound of rupturing fibers.

MATERIALS TECHNOLOGY



Powertech's expertise in materials identification, characterization, specification, and failure analysis covers virtually any material in any application.

Powertech's expertise in materials identification, characterization, specification, and failure analysis covers virtually any material in any application, from massive concrete dam repairs to qualification testing of rubber formulations used in linemen's safety gloves.

We use fracture mechanics and stress analysis to evaluate the condition of steel, aluminum, composites, glass, plastics, rubber, concrete, wood, glass, ceramics, and fiberglass. Flammability and toxicity of materials are also tested.

Equipment and facilities include an environmental chamber, mechanical, chemical and electrical test equipment, and a metallurgical laboratory with a scanning electron microscope using image analysis.

We also investigate alternative materials for applications in which cost or environmental concerns are critical, such as the use of composite utility poles and crossarms or self-lubricating bushings.



Measuring the physical force used by linemen to close a fuse (pressure on the porcelain can cause it to break).

Failed electrical contact.

ENVIRONMENTAL SERVICES



Powertech performs product life cycle assessments and recommends acceptable materials and components.

Most industries are looking for ways to minimize the environmental impact of their plants and systems and maximize resource conservation and sustainability. Powertech helps by identifying trace elements in air, water, and soils and by evaluating appropriate technologies for disposal and remediation.

Powertech has also provided consultation for a commercial full scale treatment plant to purify PCB contaminated transformer oils.

We assist in reducing the amount of industrial waste by evaluating and specifying alternative structural materials and environmentally friendly lubricants and coolants. Powertech performs product life cycle assessments and recommends acceptable materials and components. We give expert advice on options for reuse and recycling of materials.

Energy efficient products are evaluated by Powertech for manufacturers and users. Research into new energy efficient electrotechnologies is in progress.



Powertech designed a treatment plant to purify PCB contaminated transformer oil.

Core sample being taken from a lodgepole pine pole for pentachlorophenol analysis.

ALTERNATE ENERGY TECHNOLOGIES



Powertech is recognized for its expertise in on-board storage systems for natural gas in vehicles.

Powertech studies and evaluates alternative options for the generation of electricity, such as wave energy, fuel cells, or photovoltaic systems.

We assess the safety, reliability, and economic viability of alternative fuels for transportation. Powertech is recognized worldwide for its expertise in on-board storage systems for natural gas in vehicles. Evaluation of refuelling stations for natural gas

vehicles is offered as well. We have also conducted studies on the storage of hydrogen as a vehicular fuel for regulatory agencies and the developers of hydrogen vehicles.



Monitoring the temperature and internal pressure of a compressed natural gas steel cylinder during fire testing.



SERVICES

Power System Performance

- Power System Analysis
- Power System Planning
- Power System Diagnostics
- Power Quality Assessment and Enhancement
- Field Testing
- Monitoring and Control Instrumentation

Equipment Performance

- Power Equipment Evaluation
 - High Power Lab Tests
 - High Voltage Lab Tests
 - High Current Lab Tests
 - Insulation Analysis
 - Utilization of Electric Energy
 - Mechanical Testing
- Evaluation of Other Equipment

Condition Assessment

- Nondestructive Testing
- Condition Survey of Structures
- Stress Analysis
- Metallurgical Services
- Vibration Monitoring
- Machine Condition Monitoring
- Insulating Fluid Analysis
- Cable Evaluation

Maintenance Engineering

- Equipment
 - Fuel, Lubricants and Coolants Analysis
 - Cables and Insulating Fluid Analysis
 - Corrosion, Cavitation and Welding Technologies
- Structures
 - Protective Coatings Technology
 - Corrosion Management
 - Concrete Repair Technology
 - Modal Analysis
 - Life Cycle Cost Management

Materials Technology

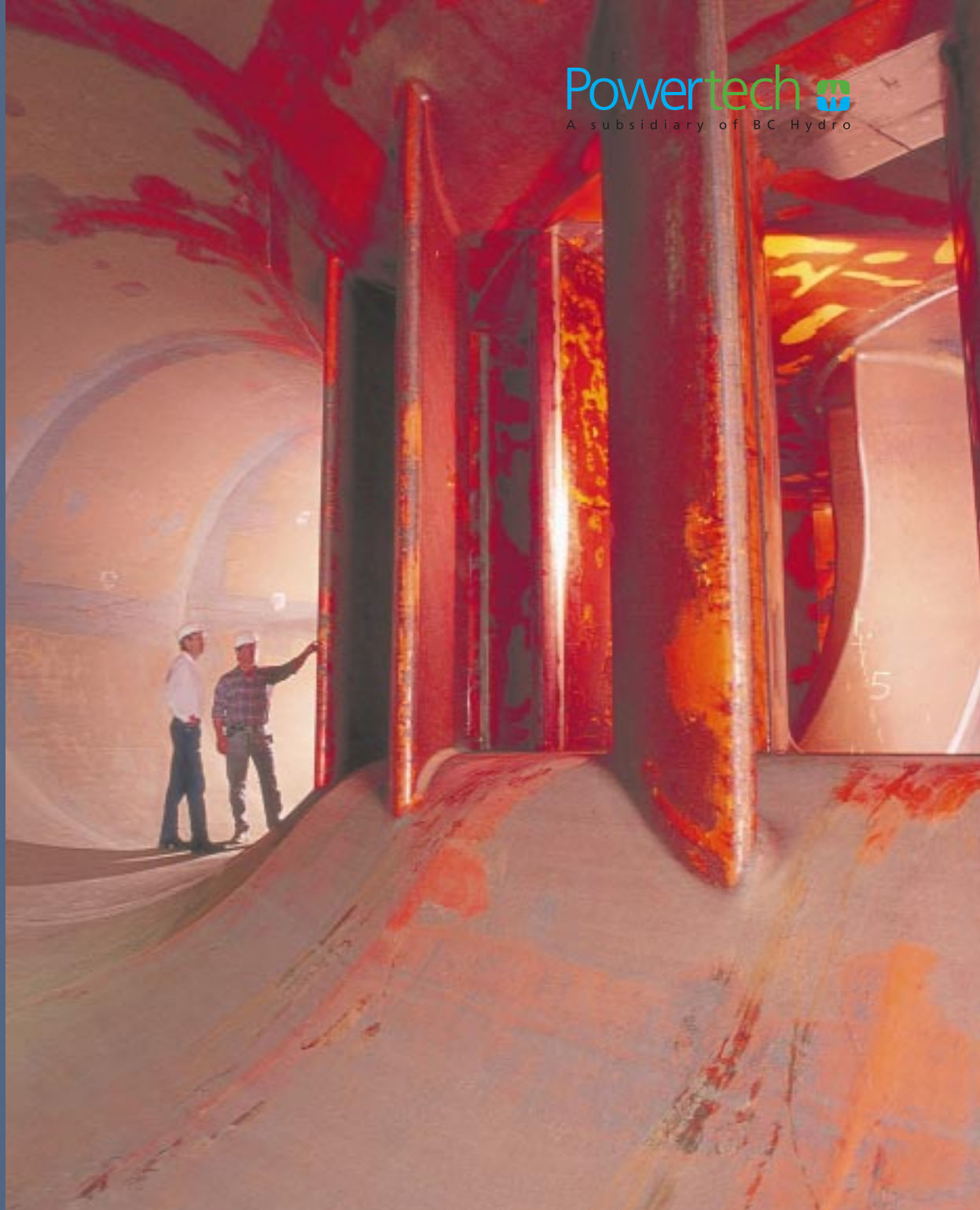
- Civil Engineering Materials Analysis
- Materials Chemistry and Plastics Analysis
- Glass, Ceramics, Fiberglass Analysis
- Mechanical Testing Services

Environmental Services

- Environmental Analytical Services
- Environmental Impact Studies
- Abatement Strategies for Toxic Substances
- Waste Management
- Life Cycle Assessment
- Application Studies for New Electrotechnologies

Alternate Energy Technologies

- Alternate Energy Sources for Utility Application
- Natural Gas for Vehicles
- Pressure Vessel and Cylinder Development



**Scrollcase dried out for inspection
of turbine condition**



For further information on
how Powertech can help
resolve your technical
challenges, please contact:

Powertech Labs Inc.
12388 - 88th Avenue
Surrey, B.C. Canada
V3W 7R7

Phone 604 590 - 7500
Fax 604 590 - 5347
www.powertech.bc.ca