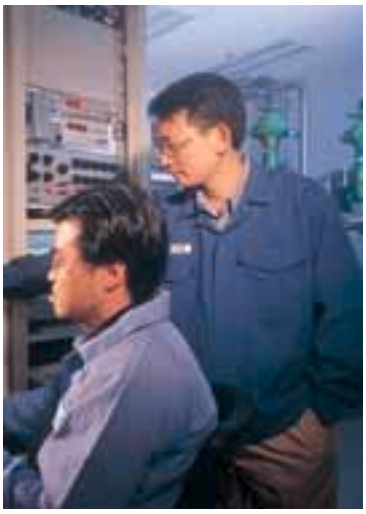
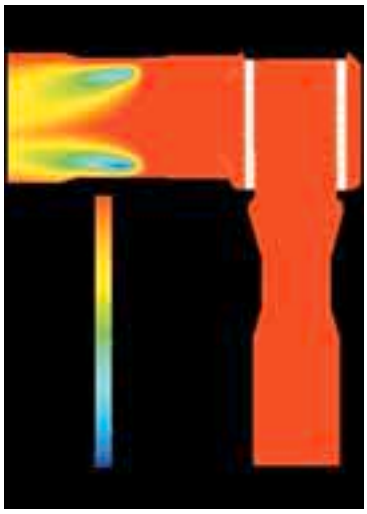
Research and Engineering

Laboratories and Competencies




FISHER®

EMERSON™
Process Management


FIELDVUE

Emerson's Fisher® Research and Engineering

Innovative Answers, Performance and Reliability

We use strong theoretical analyses and empirical data in developing application solutions and product designs. Our intellectual talent and facilities for research, analysis and testing are unmatched. Which means when you combine our lab capabilities with our experienced worldwide staff, the choice for control valves and instrumentation becomes clear: Emerson Process Management.

Emerson's Fisher® products provide innovative solutions to customer applications, set industry standards for performance and operate reliably. They can help you reduce costs by preventing unexpected downtime, excessive or unnecessary maintenance, or problems caused by using the wrong valve design.

Our mission in Emerson's Fisher Research and Engineering (R&E) revolves around:

Innovative Answers - implementing new ideas for solving difficult process problems

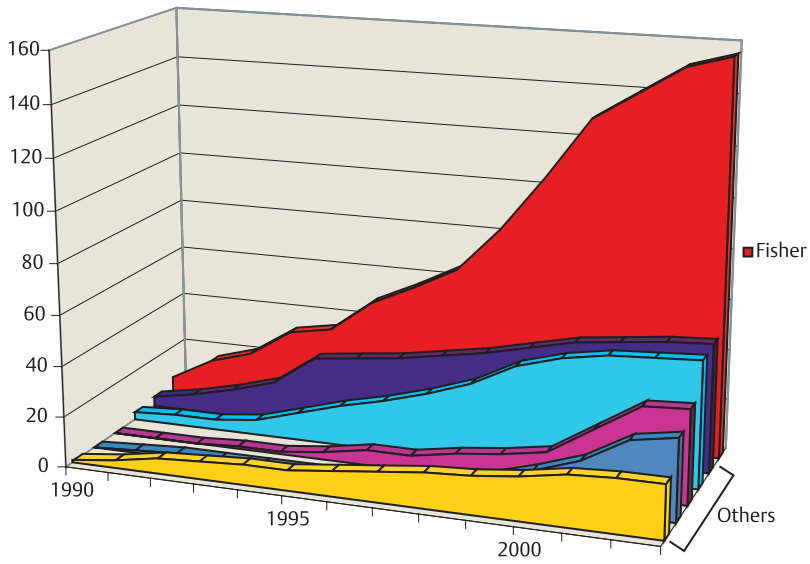
Performance - scrutinizing each component of a control valve and the control valve assembly as a system on its ability to ensure optimal control response, to minimize noise generation and to maximize capacity

Reliability - rigorous testing to ensure maximum cycle life, reliable performance at process extremes and accurate control valve sizing

We invite you to take this opportunity to learn about the people, facilities and methods that make Emerson's Fisher R&E the leader in the process control industry.

We have always been a leader in Research & Engineering. In the last ten years, Emerson's Fisher Valve Division has been issued over 150 unique patents, worldwide.

Cumulative Unique Patents Granted
to Global Process Control Suppliers of
Control Valves and Instrumentation



Innovative Answers

Emerson's Fisher R&E is known for its ability to implement new ideas in solving difficult process control problems for customers around the world. We create an environment with the necessary technical personnel, facilities and tools to provide innovative answers.

Simulation and Analysis Lab

Developing computer models of flow geometries

Early in product development, engineers use computational fluid dynamics (CFD) to visualize flow energy (see Figure 1), allowing them to change geometries and achieve expected performance levels.

Acoustics Lab

Analyzing noise sources so you won't need to

Our engineers have a broad understanding of all the sources of noise in a flow system. We test Fisher and non-Fisher control valves, valve trims, silencers, diffusers and spargers (see Figure 2). We even quantify noise levels from components in piping configurations other than the control valve, including tees, elbows, reducers and expansions to determine their contribution to overall noise levels.

Laser interferometry shadowgraphs (see Figure 3) are utilized to investigate flow phenomena and verify CFD models.

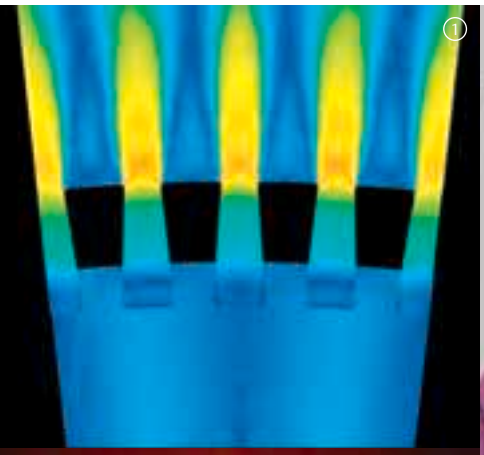
Our Brüel & Kjaer PULSE™ data acquisition system collects measurements simultaneously to analyze the propagation of noise. Figure 4 shows internal microphones and accelerometers measuring noise and pipewall vibration across an expansion.

A Case-In-Point

A R & E team took on the challenge of engineering a noise abatement technology that met the increasing noise reduction requirements of our customers. New process designs and stricter environmental laws pushed the limits of existing technologies.

Using CFD, computer models were made of different flow geometries that optimize pressure drop staging and recovery and minimize jet interactions. The team built sectional prototypes of the CFD models and then physically tested them by creating laser interferometry shadowgraphs. They were pleased to discover that the shadowgraphs and CFD model data agreed.

After optimization, the team constructed full-scale prototypes and gathered empirical noise data by flow testing. The acoustic performance was compared with customer requirements and nearest performing products. Emerson introduced the Fisher WhisperFlo® product line, and its performance has yet to be equaled.



PlantWeb® Dynamic Performance Labs

Bringing factory experts to you

The PlantWeb® Dynamic Performance Labs serve in the development of on-line, in-service predictive maintenance systems for control valves. The labs make extensive use of digital field devices, systems and software to conduct and document the dynamic performance of field instruments. The labs use HART® and FOUNDATION™ fieldbus communication protocol. DeltaV™ automation systems control the dynamic performance loops, flow lines and hot air test systems within our labs throughout the world.

We demonstrate our diagnostic capabilities in a dynamic flow loop environment in person or remotely wherever you have internet access (see Figure 5). You can participate in a performance evaluation on-line by causing a valve or instrument malfunction in the dynamic performance loop, and then allowing FIELDVUE® Instrumentation to detect, diagnose and recommend corrective action. We call this capability Performance Diagnostics (PD), an industry first.

Emerson is the undisputed leader in valve diagnostics. Our experts have programmed AMS ValveLink® software to detect and identify more than 200 fault conditions that can occur in control valves. PD can detect such problems as excessive friction, worn actuator or feedback linkages, dirty instrument air, actuator leaks and poor instrument calibration. ValveLink software queries sensor inputs onboard FIELDVUE Digital Valve Controllers and automatically interprets the data to identify root causes. It then recommends corrective action.

Instrument Development and Software Labs

Solutions, not just data

Ruggedness, reliability and performance are the foundations of Fisher traditional instrumentation. These foundations were the basis for the industry's first loop powered microprocessor-based instrument, the FIELDVUE Digital Valve Controller.

Automated test systems in our labs verify instrument hardware, firmware and Windows®-based software applications. Customers are able to solve difficult problems using advanced electronic technologies enabled with integrated software solutions.

Utilizing AMS ValveLink software, an engineer performs device diagnostics (see Figure 6) while the control valve assembly is on-line and in service.

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Performance

Our engineers design valves, actuators and positioners as systems with performance in mind. They ensure the valve assembly: 1) is capable of reacting to small control steps; 2) achieves setpoint quickly when changes are made; and 3) enables the right process gain.

Cryogenic Testing Lab

Testing at actual service temperatures

Control valves intended for cryogenic service undergo extensive testing for proof of operability and tight shutoff capability. The cryogenic valve area (see Figure 7) allows the cold testing of valves in any of four cryogenic test tanks and includes a dedicated 6,000 gallon (27,276 liter) liquid nitrogen supply tank, digital temperature measurement equipment and a mass spectrometer for leakage detection.

Dynamic Performance Labs

Testing products the way customers use them

We use open- and closed-loop dynamic analyses in determining how a control valve assembly will perform when in service. Our investment in five operating dynamic performance loops around the world is unequaled. We use these loops to improve Fisher product designs and compare them to other offerings.

In combination with the Fisher FIELDVUE Digital Valve Controller, a high-thrust actuator provides high-speed and stable valve response (see Figure 8).

A Case-In-Point

Grounded in more than 20 years of steam conditioning experience, our engineers developed the Fisher Design TBX valve to give optimized performance for demanding steam applications.

The TBX valve features a flow up configuration to provide increased operating stability and ease of maintenance. It incorporates Emerson's low noise Fisher Whisper Trim® valve technology within a simplified trim configuration that accommodates rapid changes in temperature (e.g., as experienced during a turbine trip.)

TBX steam conditioning valves work with FIELDVUE Digital Valve Controllers to deliver fast stroking speeds with tight process control. Predictive diagnostics enable improved reliability and maintenance efficiency. Further cost savings, increased plant availability, and enhanced safety and environmental compliance are achieved when the Fisher digital valves are integrated into the PlantWeb architecture.

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Materials Lab

Matching material performance to customer needs

A fully-equipped materials lab ensures that products perform to expectation. Emerson materials engineers investigate the properties and application limits of metallics and nonmetallics with many tools and techniques, including: dynamic mechanic analysis, Fourier transform infrared spectrometry, scanning electron microscope (SEM), electron dispersion spectrometry (EDS), tribology, Falex® ring and block tester, universal tester for tensile and compression loading, and an array of special hardness testers.

By performing accelerated corrosion tests, we determine whether coatings and paints will perform in severe environments such as off-shore platforms.

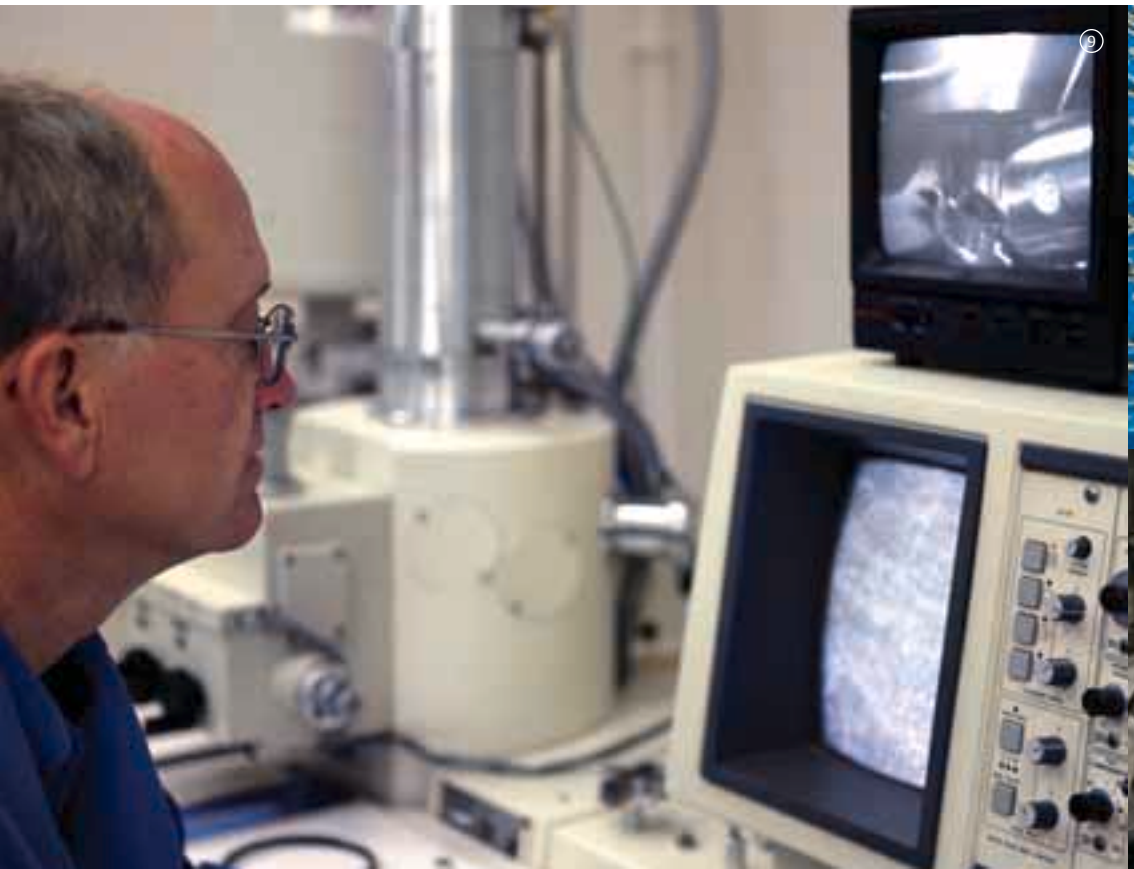
The SEM (see Figure 9) and EDS can image fracture surfaces to reveal the root cause of materials failures. We use forensic analysis to help our customers determine the optimum materials for their processes.

Emerson tests new materials for use in process control products. For example, our materials experts are actively involved in NACE and have qualified numerous new materials per MR0175 requirements for sour applications. The microstructure of a duplex stainless steel is shown in Figure 10.

High-Temperature Steam Lab

Performance at actual power plant temperatures

We test valve seals and trim in high temperature steam to 1,000°F (538°C) at 1,500 psi (103 bar). This capability has verified the performance improvement of a patent pending Bore Seal™ trim (see Figure 11) for steam applications.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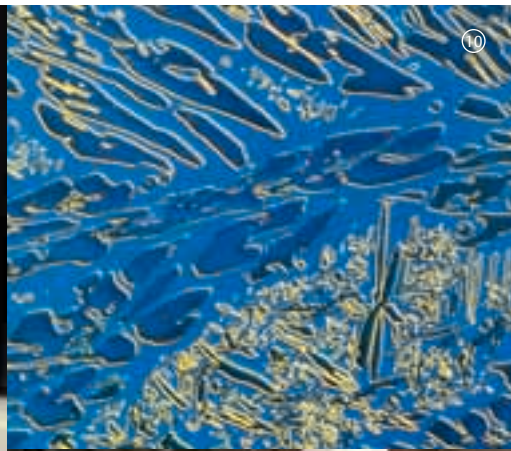
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Reliability

Emerson conducts rigorous analyses and testing utilizing a broad range of capabilities to gain maximum reliability of our products.

Computer analysis tools include: computational fluid dynamics, magnetic field modeling, thermal analysis, finite element analysis, flow system analysis, dynamic simulation and modeling, electronic simulation and solidification modeling.

Mechanical testing evaluates cycle life, performance at temperature extremes, flow capacity, vibration sensitivity and materials performance.

To ensure Fisher products withstand the demanding requirements of various applications, we utilize a variety of tools and techniques: electrodynamic vibration systems, cryogenic test tanks, environmental chambers, elevated temperature tests, experimental stress analysis, salt spray corrosion chamber, high-pressure autoclave and H_2S corrosion cells.

Flow Labs

Sizing coefficients that are real

After building a product prototype, Emerson's new product design team works with test engineers to develop a comprehensive test plan.

Every Fisher valve design undergoes thorough and extensive flow testing (see Figure 12) to determine sizing coefficients, stem force or hydrodynamic torque requirements, and to investigate actual flow performance.

We operate 17 flow lines size 2 to 16-inch (51 to 406 mm) at a maximum nominal pressure of 400 psi (28 bar) using our low-pressure systems and a maximum nominal pressure of 2,500 psi (172 bar) using our high-pressure system.

The flow lines handle 14,000,000 scfh (396,436 cubic meters per hour) of air flow and 17,500 gpm (66,245 lpm) of water flow. Our flow labs utilize both steady state and blowdown test methodologies.

Cycle Life Lab

Verifying product life meets expectations

Fisher products are subjected to humidity and temperature extremes in environmental chambers to verify their reliable operation (see Figure 13).

Emerson develops and tests valve packing systems (see Figure 14) with exceptional cycle life that allow our customers to meet and exceed EPA regulations for fugitive emissions of volatile organic compounds.

We cycle test bearings and seals at elevated temperatures in a hot air system (see Figure 15) to ensure their performance and reliability. Our proven composite rotary valve bearings and seals are patented technologies.

Experimental Stress Lab

Safety and code compliance

Experimental stress analysis (see Figure 16) and finite element analysis make certain the pressure boundaries for Fisher products are within accepted factors of safety.

Vibration Lab

Ensuring performance in extreme conditions

Using two electrodynamic vibration systems (see Figure 17), we measure the ability of a product to withstand vibration extremes. Shaker tables produce 1,500 (6,672 newtons) and 4,500 pounds (20,017 newtons) of force.

A Case-In-Point

In 1987, Emerson began a R&E program on valve packing. The team found that while conventional packing could usually meet the strict U.S. EPA limits for stem leakage when initially installed, it often failed to meet those requirements over an extended period of valve operation.

So the team went back to basic packing principles. Combining basic research with empirical studies, they confirmed and quantified the basic design principles for valve packing. The application of these principles by our engineers resulted in Fisher ENVIRO-SEAL® packing systems for both sliding-stem and rotary valves in all types of service. ENVIRO-SEAL today stands as the system of choice worldwide, for both extended service life and stringent emission control.


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Our People and Facilities

Our Fisher R&E groups have attracted engineers with B.S., M.S. and Ph.D. degrees from universities all over the world. Their expertise lies in mechanical, electrical, electronics, mechatronics, computer, acoustic and materials engineering. You may have seen their articles published in key industry publications and process control handbooks (see Figure 18).

Our engineers are active participants in the development of national and international industry standards.

Emerson's Fisher R&E capabilities extend worldwide with engineers and labs in the North America, Europe and Asia (see Figures 19, 20 and 21). Emerson has the technical expertise around the world to provide our customers the products and support they require to be competitive in today's business environment.

Emerson's Fisher R&E labs are open for customer tours on a pre-arranged basis. Inquire with your Emerson sales contact.

A Case-In-Point

Emerson engineers in North America began searching for a tool that could improve communication with Asian and European counterparts. Phone conversations yielded misunderstandings. Faxes and e-mail correspondence didn't show enough detail.

R&E was given the opportunity to beta test one vendor's collaboration software. With it, they created a virtual space where global teams had access to the same CAD solid models, finite element analyses and other visual tools. During these collaboration sessions, individuals presented designs, voiced concerns, manipulated and modified designs, and reached solutions.

The beta test was successful, and R&E invested in the infrastructure. We have in place one common database and a file server system for global connectivity. The sun never sets on Emerson's Fisher Research & Engineering.

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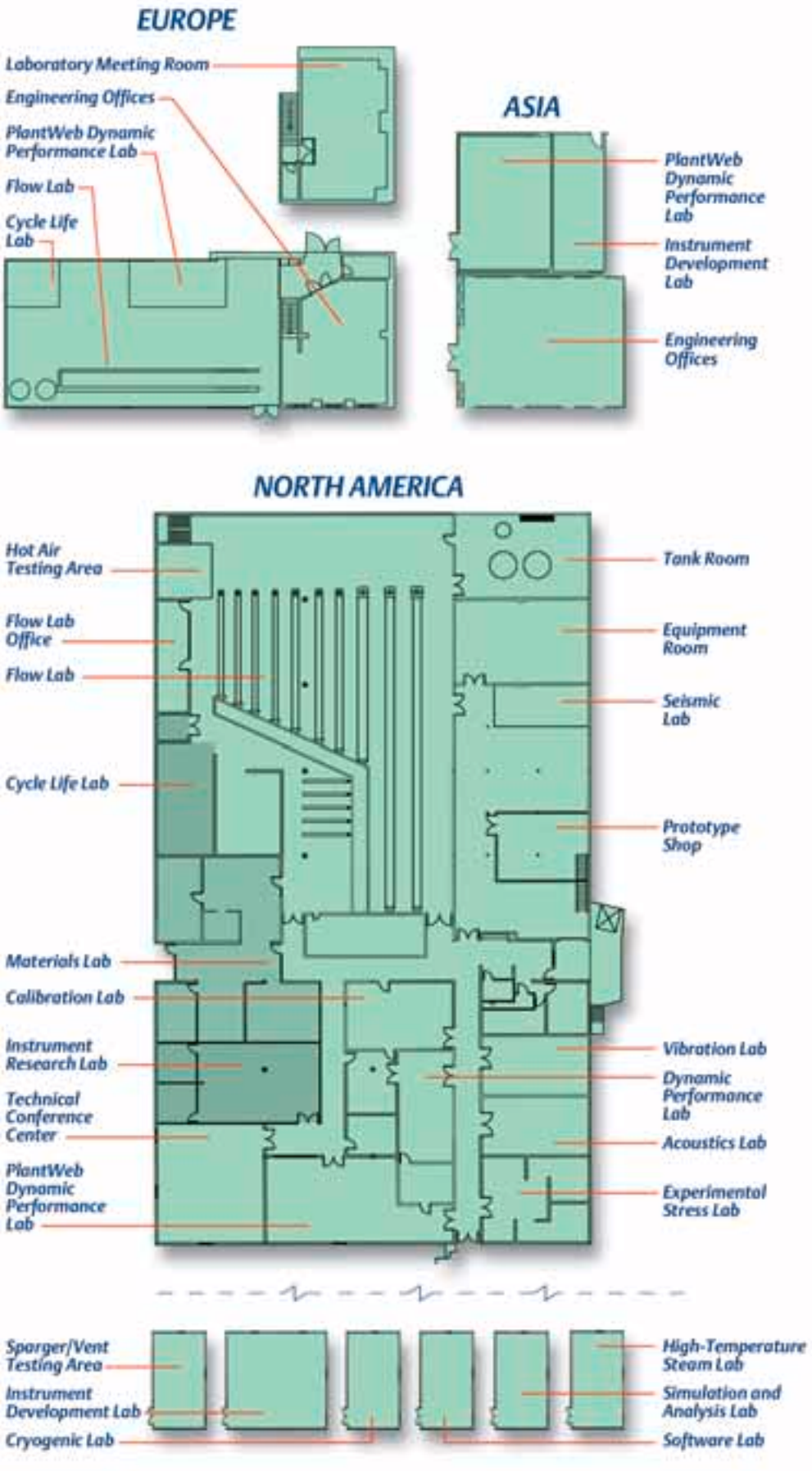
EUROPE
Laboratory Meeting Room
Engineering Offices
PlantWeb Dynamic Performance Lab
Flow Lab
Cycle Life Lab
ASIA
PlantWeb Dynamic Performance Lab
Instrument Development Lab
Engineering Offices
NORTH AMERICA
Hot Air Testing Area
Flow Lab Office
Flow Lab
Cycle Life Lab
Materials Lab
Calibration Lab
Instrument Research Lab
Technical Conference Center
PlantWeb Dynamic Performance Lab
Tank Room
Equipment Room
Seismic Lab
Prototype Shop
Vibration Lab
Dynamic Performance Lab
Acoustics Lab
Experimental Stress Lab
Sparger/Vent Testing Area
Instrument Development Lab
Cryogenic Lab
High-Temperature Steam Lab
Simulation and Analysis Lab
Software Lab




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D351083X012 MP79-CD116 Printed in U.S.A. / 8M AQ / 9-03