Primary and Secondary Standard Calibration Service
If it measures flow, we can calibrate it.

Among the world’s elite flow calibration facilities, Badger Meter Flow Dynamics primary and secondary standard calibration laboratories calibrate all flow meters from any manufacturer. Flow Dynamics primary standard calibration facility in Scottsdale, Arizona offers superior liquid and gas calibration uncertainties, as confirmed by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200668-0, Scope of Accreditation to ISO/IEC 17025:2005 and NIST Handbook 150.

The calibration results delivered by a primary standard facility are the highest achievable in the industry. These calibrations are sought after by test and measurement companies, as well as automotive and aircraft industry leaders. Secondary standards are used when flow ranges, pressures and hazardous gases cannot be met with primary standards. General industrial companies typically employ secondary standard calibrators, which use precision meters calibrated on primary standards to reduce cost, while meeting their accuracy requirements.

Thousands of customers in test and measurement, industrial process, custody transfer and aerospace/automotive industries trust Flow Dynamics to meet their precision calibration requirements. Flow Dynamics provides certified calibration data sheets, comprehensive meter historical data, annual reminders and a 10-day standard turnaround, with expedites upon request.

Meter types
- Cone meters
- Coriolis meters
- Electromagnetic flow meters
- Laminar flow elements
- Orifice plates
- Positive displacement meters
- Rotameters
- Sonic nozzles
- Target meters
- Thermal mass meters
- Turbine meters
- Ultrasonic meters
- Variable area meters
- Venturis
- Vortex-shedding devices

Other
- Master meter calibration
- OEM production calibrations
- Research and development flow meters
Why Calibrate?

It’s a fact: Flow meter performance will change over time. This typically happens due to a wide range of factors, such as an event that exceeds the meter’s over-range capability, unexpected particulates in the line, corrosion, or product buildup, a severe temperature event, lightning strikes, or using a new fluid with a viscosity that differs from the original calibration. Whatever the reason, calibration data exposes the unknown.

Flow meter users should calibrate to:

Maximize Revenue

Many flow meters are used in custody transfer applications where customers are charged for the amount of product delivered. A properly calibrated flow meter provides assurance that the supplier is collecting all the revenue that is due, while avoiding the risks associated with overcharging their customer.

Increase Production Yields

Timely flow meter calibration will help detect and adjust for instrument degradation over time and correct for meter output shifts. Calibration historical data can head off measurement errors to prevent batch over-dosing, wasted product, downtime, and delayed shipments.

Avoid Unscheduled Downtime

Routine calibration verifies that flow meters are performing as expected within the required tolerance. Historical calibration trend data provides valuable information on the performance of the meter over its lifecycle, making it easier to plan elective maintenance activities. The best practice is to define a calibration action plan to determine the flow meter variance and establish a regular calibration schedule. Early detection of potential problems allows the site to schedule needed maintenance before a measurement issue that necessitates unscheduled downtime occurs.
Why Calibrate?

Maintain Quality Certifications and/or Regulatory Compliance
Many ISO 9000 processes and authorities that oversee the sale of fluids require documented evidence of instrument calibration. Scheduled calibration helps users validate meter performance and provides historical records required by a quality system or a regulatory agency.

Publish the Best Performance Specifications
In research and development applications, engineers are not only proving designs but they are also working to provide the best performance specification possible for their products. This is especially important in products documenting fuel economy ratings to meet U.S. Environmental Protection Agency (EPA) regulations and/or aircraft engine efficiency specifications. With a dependable calibration solution, engineers can rely on flow meter data to publish the best product performance specifications.

Intralaboratory comparisons of four different Flow Dynamics calibrators (65, 300, 400, and 1200 gpm)
## Factors Affecting Meter Performance

<table>
<thead>
<tr>
<th>Flow Meter Type</th>
<th>Causes for Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamp-On Ultrasonic Flow Meter</td>
<td>• Transducer contact problems  • Electronic drift</td>
</tr>
<tr>
<td>Cone</td>
<td>• Cone abrasion or corrosion  • Differential pressure drift</td>
</tr>
<tr>
<td>Coriolis Meter</td>
<td>• Flow tube coating or abrasion  • Change in tube tensile strength  • Electronics</td>
</tr>
<tr>
<td>Electromagnetic Flow Meter</td>
<td>• Liner damage  • Electrode coating  • Electronics</td>
</tr>
<tr>
<td>Inline Ultrasonic Flow Meter</td>
<td>• Transducer corrosion  • Frequency change  • Electronics</td>
</tr>
<tr>
<td>Laminar Flow Element</td>
<td>• Particulate contamination  • Plate wear  • Electronics</td>
</tr>
<tr>
<td>Orifice Plate</td>
<td>• Abrasion on the leading or trailing edge of the orifice  • Differential pressure transmitter drift</td>
</tr>
<tr>
<td>Positive Displacement Meter</td>
<td>• Increased leakage of the piston or gear  • Particulate contamination</td>
</tr>
<tr>
<td>Rotameter</td>
<td>• Tube or ball erosion  • Scale movement  • Contamination</td>
</tr>
<tr>
<td>Sonic Nozzle</td>
<td>• Nozzle wear</td>
</tr>
<tr>
<td>Target Meter</td>
<td>• Target erosion  • Change in stress beam  • Electronics</td>
</tr>
<tr>
<td>Thermal Mass Meter</td>
<td>• Temperature sensor coating  • Sensor wear  • Electronics</td>
</tr>
<tr>
<td>Turbine Meter</td>
<td>• Bearing contamination  • Blade damage, bearing or blade wear  • Over-speed  • Electronics</td>
</tr>
<tr>
<td>Variable Area Meter</td>
<td>• Internal geometry erosion  • Scale movement  • Contamination</td>
</tr>
<tr>
<td>Venturi Meter</td>
<td>• Abrasion on the leading edge of the Venturi  • Differential pressure transmitter drift</td>
</tr>
<tr>
<td>Vortex-Shedding Device</td>
<td>• Bluff body wear  • Electronics</td>
</tr>
</tbody>
</table>
Rely on Flow Dynamics

Superior Credentials
The Flow Dynamics Scottsdale, Arizona calibration facility was the first independent flow lab to receive NVLAP (Lab Code 200668-0) accreditation. Calibrator uncertainties are verified and posted on a public NVLAP Accreditation Document. The NVLAP accreditation body also assesses conformity to ISO/IEC 17025, ANSI Z540 and the NIST 150 Handbook. With this accreditation, calibration service customers know that a third-party monitors the processes and the quality system, which safeguards your calibration results. This includes, monitoring primary calibration standards through an unbroken chain, which is traceable back to the U.S. National Institute of Standards and Technology (NIST).

The Flow Dynamics, Scottsdale, Arizona quality system is certified compliant to ISO 9001 and AS 9100, and audited by BSI Group America. These standards determine the technical competence of our calibration laboratory, providing you with reliable certified calibration results.

Comprehensive Documentation
Flow Dynamics furnishes a detailed report with every flow meter calibration and maintains complete calibration history information to support meter performance evaluations. Ten-point data graphs are available for all flow meter calibrations and additional data points are available upon request. Requested engineering units will be used on the certified calibration data sheet, which is returned with the calibrated flow meter.

Primary standard facility
- NVLAP (Code 200668-0) accredited
- NIST Handbook 150 compliant
- AS9100 and ISO 9001 BSI certificate of compliance
- ANSI/NCSL Z540 compliant
- ISO/IEC 17025 accredited
- NIST-traceable primary standards
- Uncertainties documented on scope of accreditation
- NIST round-robin interlaboratory testing participant
- Rigorous intralaboratory (internal) comparisons
Trusted Calibration Provider

Great Service
Flow Dynamics employs knowledgeable sales engineers, who strive for a seamless transition of transporting the customer’s meter to the calibration facility and then back to the installation site. If the flow meter was previously serviced at a Flow Dynamics facility, historical calibration information is on file and an order is all that’s needed to calibrate the meter the same way. If it’s a new calibration, no problem — sales engineers help guide the customer through the process!

Fast Turnaround
Flow Dynamics offers an annual calibration blanket order to eliminate unnecessary paperwork. However, quotes are still issued with each meter calibration to define technical details and help control costs. Standard delivery time is 10 business days; same-day calibrations are offered with an expedite fee.

- Superior calibration uncertainty
- Extensive fluid blending capability
- High accuracy viscosity measurement instruments
- Comprehensive and certified quality processes
- Leading flow calibrator manufacturer
- Proven solutions for:
  - Process control
  - Custody transfer
  - Test and measurement
  - Aerospace/automotive
  - Research and development
Complete Calibration Solution

Primary Standard Liquid and Gas Calibrations
Flow Dynamics offers liquid and gas calibration services, meeting both end user and original equipment manufacturer (OEM) production requirements. The blending of solvent and oil is used to simulate exact liquid viscosity, which is measured by highly accurate viscometers. Meters are calibrated on primary standards traceable to NIST, with published uncertainties, per NVLAP Lab Code 200668-0.

Secondary Standard Water Calibrations
NIST traceable water calibration services are available for industrial meters requiring K Factor or 3-point calibrations. This provides a low-cost calibration, which meets the needs of ±0.5 percent meters.
Complete Calibration Solution

Research and Development Testing
The Flow Dynamics calibration lab is also available to support research and development projects. Without the restriction that comes from reliance on a single metering technology, the facility can provide reliable data to help determine the performance of products or components.

Onsite Calibrations
Flow Dynamics can use secondary standard master meters, installed in existing piping, to perform onsite flow meter calibrations. This enables the meter to be calibrated using the actual process fluid, without removal from the process piping, eliminating system variables that are sometimes difficult to reproduce in the calibration lab.

Calibrator Certifications
NVLAP Accredited Calibration Certificates for COX 311 Series (time-weigh calibrators) and third-party positive displacement calibrators are also available. Flow Dynamics engineers collect data using primary standards to generate a report containing all the equations used in developing the uncertainty statement.

Hazardous Fluid Correlation
To meet hazardous gas requirements, Flow Dynamics provides gas substitution and simulation using proven mathematical correlation.
Liquid Calibration Capabilities

Liquid – Primary Standard Calibration Capability

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>0.003…1,500 gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>0.60…1,000 centistokes</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.034% of reading</td>
</tr>
</tbody>
</table>

Liquid Industrial – Secondary Standard

Water Calibration Capability

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>1.0…5,000 gpm (12&quot; meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>1 centistoke</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.25% of reading</td>
</tr>
</tbody>
</table>

Liquid Field Calibration – Secondary Standard Capability

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>0.25…1,500 gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>Based on customer’s fluid</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.15% of reading</td>
</tr>
</tbody>
</table>

- Primary standard liquid calibrators
- Primary standard gas calibrators
- Sonic nozzle banks
- Industrial secondary standard liquid calibrators
- Industrial secondary standard gas calibrators
- Certified data sheets
- Historical data retention
- Ball bearing replacement
## Gas Calibration Capabilities

### Gas – Primary Standard Calibration Capability

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>0.00035…1,500 SCFM Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>Partial vacuum to 450 PSIA</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.20% of reading</td>
</tr>
</tbody>
</table>

### Gas – Secondary Standard Capability

<table>
<thead>
<tr>
<th>Sonic Nozzles</th>
<th>Gas correlations for toxic gases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recommended for Helium, Nitrogen, Argon, Hydrogen, Methane, etc.</td>
</tr>
<tr>
<td>Flow Range</td>
<td>0.10…400 SCFM</td>
</tr>
<tr>
<td>Pressure</td>
<td>200 PSIA max.</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.35% of reading</td>
</tr>
</tbody>
</table>

**NOTE:** Pressure varies, depending on flow rate. The higher the flow, the lower the pressure capability.

### Gas Field Calibration – Secondary Standard Capability

<table>
<thead>
<tr>
<th>Sonic Nozzles</th>
<th>Customer supplied air or gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Range</td>
<td>0.10…1,000 SCFM</td>
</tr>
<tr>
<td>Pressure</td>
<td>Based on customer’s line pressure</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>±0.35% of reading</td>
</tr>
</tbody>
</table>

**NOTE:** The secondary standard uncertainties may vary depending on the master meter used. The exact uncertainty will be established at the time of order when the flow rate and fluid are known.
Flow Dynamics Calibration Facilities

Scottsdale, Arizona, USA
The Flow Dynamics facility in Scottsdale, Arizona is a 32,000 square-foot calibration laboratory that was specially designed to accommodate precision flow calibration equipment. Equipped with numerous primary standard liquid and gas displacement flow calibrators, the facility can calibrate in a wide variety of liquid viscosities and gas densities. No other laboratory offers a more complete liquid and gas calibration solution for today’s flow meter user.

15555 North 79th Place
Scottsdale, AZ 85260
United States of America

Racine, Wisconsin, USA
The facility in Racine, Wisconsin, offers NIST traceable calibrations for industrial flow meters up to 12 inch or 5,000 gpm and has 22 test stands (secondary standards) for gas and liquid to serve the industrial markets.

8635 Washington Avenue
Racine, WI 53406
United States of America

Tokyo, Japan
Established to meet the growing need for primary standard flow calibration services in the Asia-Pacific region, the NTK-COX calibration lab provides hydrocarbon calibrations from 0.04 to 1514 LPM. All liquid primary standard flow calibrators at the site are manufactured and calibrated by Flow Dynamics NVLAP (Lab Code 200668-0) and have accredited certified data sheets and uncertainty documents.

417-1 Shimoongata
Hachioji-City, Tokyo 192-0154
Japan

Note: NVLAP accreditation applies only to the Badger Meter Flow Dynamics calibration Lab, located in Scottsdale AZ.

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