REDUCING MEASUREMENT UNCERTAINTY IS OUR BUSINESS

Daniel is a global leader in providing fiscal flow and energy measurement products, systems and services to the oil and gas industry. The Daniel name is synonymous with quality products, industry expertise and innovative engineering.

With 80 years of experience in custody transfer and fiscal flow measurement, we understand that a small change in measurement accuracy can have a major impact on profitability. That’s why Daniel is committed to helping customers measure and understand oil and gas flows using intelligent meters, control all key metering parameters with predictive metering systems that detect potential system failures before they happen and sustain metering equipment with expert life-cycle services.

About the cover

Flow disturbances - The flow profile in a pipe can be impacted by bends, valves, headers, filters, or anything that impedes flow in the pipe. The disturbed flow profile is described by terms such as cross flow, asymmetry, and swirl, resulting in fluid measurement error.
Bringing technology and engineering together to create innovative solutions is deeply rooted in our heritage

Since its inception in the early 1930s when Paul Daniel invented the Daniel Senior™ Orifice Fitting, whose basic design still reigns at gas pipelines today, Daniel Measurement and Control continues to be a global and powerful force of innovation in the oil and gas industry.

Today, customers in more than 80 countries are entrusting their measurements to Daniel products, systems and services because they understand the ability of the Daniel brand to produce reliable, accurate and consistent measurement results.

About the photo
Inventor and company founder, Paul Daniel, with an early model of a Daniel Senior Orifice Fitting and his sky blue convertible Dodge, (Bakersfield, CA).
The key to accurate and reliable flow measurement

Good system design

When designing a measurement station it is important to understand the product to be measured, apply the correct equipment, and implement the appropriate volume correction calculations. The following considerations need to be addressed to minimize measurement uncertainty:

• What is the composition or fluid to be measured?
  • Crude oil
  • Light liquid hydrocarbon – condensate – natural gas liquids
  • Pure product
    • Propane
    • Butane
    • Refined product
• What is the minimum, maximum and normal flow rate?
• What is the operating pressure and temperature?
  • How does the operating pressure and temperature affect:
    • Density
    • Expansion/contraction characteristics
    • Viscosity
    • Vapor pressure
• What other operational factors affect proper measurement?
  • Basic sediment and water
  • Based on the answers to the previous questions, what is the best measuring device to handle the product?
  • What types of calculations will be implemented to correct the volume or mass measured at process conditions to the ‘standard conditions’?
  • How will accurate calibration or verification data be generated from the primary measuring device?

The right meter for the right application

The selection of the meter device depends upon the process conditions, the intended rangeability of the system and the fluid properties. For optimum performance, the meter must be capable of covering a wide flow range and maintain the required linearity.

A typical list of selection factors include the following:

• Is the measurement to be mass or volume?
• Is the measurement of liquid, gas, or vapor? Are there mixtures, or are they in combination with solids?
• Is the fluid corrosive, passive, clean, or dirty?
• What is the ratio of the maximum flow rate to the minimum flow rate?
• What are the operating temperatures and pressures?
• What pressure drop is permissible; that is, what is the energy consumption?
• What fluid properties must be considered? These include viscosity, density, compressibility, electrical conductivity, etc.
• What accuracy is needed?
• Is rate of flow or totalization required?
• What signal and display are required?
• What is the total cost of ownership?
• What maintenance is required and who has to do it?

Proper installation and maintenance

Attention to installation detail, piping requirements, and maintenance are critical to flow meter performance and to achieving accurate measurement.

Most properly installed meters require minimal maintenance. A few however may require routine service. The frequency of routine maintenance varies with process fluid, type of meter, and nature of the upset condition.

Flow meters are also subject to measurement errors associated with the effects of the installation configuration when the circumstances of the field installation differ significantly from those of the baseline calibration.

Installation errors are bias errors, not random errors. For this reason, special attention should be paid to minimizing measurement errors caused by installation effects.
Accurate flow calibration and proving  
Calibration provides confidence in a measurement and assurance that an instrument has the accuracy required to maintain a product or process within specifications.

To determine the appropriate calibration scope, decisions need to be made regarding the variables to be measured and the desired accuracy based on the application standpoint and upon the capabilities of the device being calibrated.

Flow measurement devices are generally calibrated by three methods:
- Wet calibration using actual fluid flow
- Dry calibration using flow simulation by electronic or mechanical means
- Measurement check of physical dimensions and use of empirical tables relating flow rate to these dimensions

Advanced real-time diagnostics  
Smart measurement devices with predictive intelligence deliver advanced diagnostic information from the field, report current device health and in turn reduce measurement uncertainty and streamline maintenance efforts.

A prescribed meter re-calibration scheme does not always ensure accurate measurement. Using real-time advanced diagnostics to monitor the meter’s performance is the right way to ensure proper and accurate operation.

Advanced velocity-based diagnostics ensure the dynamics of the metering system remain within control limits.

Smart system-wide control  
An effective metering system should provide users with a dashboard that shows how changes in one device are going to affect the whole production cycle.

Being able to monitor and control all key metering parameters, proving and sampling—all from one location—is key to greater operating efficiency, optimal throughput and accurate measurement.

A smart and automated control solution will put you in control of your metering system and lets you:
- View any aspect of your system, down to a specific device
- Compare different meter streams based on temperature, pressure, flow meter factors and repeatability
- View proving sequence flow charts, measurement uncertainty reports and online calculations for timely detection of measurement variability

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Crude Oil and Gas

Production
- Offshore
  - Crude oil
  - Wellhead
  - Gas-oil separation
  - Storage and transportation
  - Gas recovery
  - Gas treatment
  - Storage and transportation
- Onshore
  - Wellhead
  - Flowline gas-oil separation
  - Gathering line storage

Transportation
- FPSO
- Gas transmission
- Gas processing
- Underground storage
- Gas distribution

Petroleum

Refining
- Process control
- Storage
- Transfer to marketing terminal
- Truck and railcar loading

Marketing and Distribution
- Loading, unloading and batching for trucks, railcars and ships
- Blending capabilities
- Aircraft fueling operations
- Biofuels terminals

Refined Product

Transportation
- Tank trucks
- Railcars
- Pipeline
- Marine

Key Products
- Ultrasonic Flow Meters
- Turbine Flow Meters
- Differential Pressure Flow Meters
- Liquid Metering Systems
- Gas Metering Systems
- Prover Systems
- DanPac Control System

Key Products
- Ultrasonic Flow Meters
- Turbine Flow Meters
- Control Valves
- Marketing Terminal Systems
- Prover Systems
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Ultrasonic Flow Meters

SeniorSonic 3414 4-Path Gas Ultrasonic Flow Meter
Designed for natural gas custody transfer applications requiring high accuracy and low maintenance.
- Four-path chordal design reduces susceptibility to meter fouling.
- Cross-flow compensation with 3-Axis measurement paths
- Modular advanced diagnostics package
- Excellent performance in sour gas applications
- Available sizes: 100 mm to 1067 mm (4 in to 42 in)

JuniorSonic 3411 1-Path and 3412 2-Path Gas Ultrasonic Flow Meters
Ideal for natural gas non-custody transfer applications such as check metering, pipeline balance, storage measurement, production or wet gas.
- Tolerant of wet gas
- Two-path design for measurement redundancy
- Flow calibrated accuracy: ±0.5% of reading relative to lab
- Available line sizes: 100 mm to 1067 mm (4 in to 42 in)

Transducers for Gas Ultrasonic Flow Meters
Engineered for reliable performance under demanding conditions, including wet, rich and/or dirty gas. T-20 Series Transducers serve most standard gas measurement applications while T-32 Transducers are designed for low pressure applications and can only be used with the SeniorSonic 3414 meter.
- Superior electrical connection maximizes meter uptime
- Higher tolerance of H₂S and other corrosive fluids for increased durability
- External transformer allows extended service without process interruption

Ultrasonic meters in offshore gas measurement
Total weight of facilities can be a challenge on offshore structures, especially on floating spars or tension leg platforms. This is an area where the implementation of ultrasonic measurement systems offers distinct advantages.
Because ultrasonic meters have greater overall throughput capacity than the same size orifice meters, significant savings in weight, footprint and cost may be realized when designing and implementing new measurement systems on offshore structures. The associated reduction in required isolation valves, piping headers and other things, contributes to the overall weight, space and cost savings as well.

EMPOWERS YOUR STAFF WITH EASY ACCESS TO EXPERT FLOW ANALYSIS
The advanced operation and predictive intelligence package of Daniel ultrasonic meters allows users access to real-time diagnostics to detect flow disturbances that may affect measurement, address maintenance alarms before they lead to failure and provide an intuitive view of meter health.
Your operators can finally take control of your flow measurement with easy access to expert flow analysis and suggested corrective actions allowing them to work predictively, instead of reactively.

TAKING CONTROL WITH PREDICTIVE INTELLIGENCE
This mark identifies a core component of Emerson's PlantWeb digital plant architecture...a device, instrument or software designed with best-in-class intelligence to help you extract the right data for optimized measurement, control and safety.
PlantWeb incorporates high-speed communications networks, Emerson's wide portfolio of intelligent field devices, asset management software, and bus (O) technologies for more efficient plant operations and maintenance savings.

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Daniel gas measurement products are used around the world in a variety of critical gas measurement applications. Correctly installed in onboard and offshore production facilities, compressor stations, processing facilities and city gates, these products are also useful for onshore and offshore production applications. Commonly installed in a variety of critical gas measurement applications around the world in a Daniel gas measurement product applications.

**Differential Pressure Flow Technology**

**Senior™ Dual-Chamber Orifice Fitting**
The standard in natural gas flow measurement, Daniel Senior Orifice Fitting reigns as the most widely used dual-chamber device. It saves time and money by providing a fast and simple method of changing orifice plates, under pressure without flow interruption.

- Easy plate replacement without downstream piping
- Field repairable
- Available sizes: 50 mm to 1220 mm (2 in to 48 in)
- Special trim available

**Differential Pressure Orifice Flange Union**
Provides accurate and economical differential measurement with little to no maintenance. It serves as a simple device for securely holding an orifice plate in a line.

- Adheres to strict AGA and API stringent tolerances
-关系表 to a temporary orifice flanges are made to conform to the standard raised face dimensions in accordance with the ANSI B16.5 Flange Piping Code for all pressure ranges
- Available sizes: 25 mm to 305 mm (1 in to 12 in)

**Orifice Plate Holder**
Daniel’s concentrically aligned orifice plate carrier reduces measurement uncertainty using a three point positioning system.

- Corner tabs are precision ground to hold orifice plate in the proper horizontal position
- Hinged seal ring design provides metal to metal contact for edgewise alignment
- The fitting’s yoke and the spring loaded button located at the top of the orifice plate carrier ensure a tight vertical positioning of the plate when the slide valve is closed

**Junior™ Single Chamber Orifice Fitting**
Offer fast, simple and reliable measurement at large meter stations. The single-chamber fitting is engineered to make plate changing quick and easy at installations where live movement from flange spooling is undesirable.

- Pack and configuration ensure fast plate changing
- Available sizes: 250 mm to 1000 mm (10 in to 42 in)

**Meter Tubes**
Accurate and dependable Daniel meter tubes adhere to the highest quality standards and are made by experienced code qualified welders.

- Reduces flow turbulence, ensuring consistent measurement accuracy
- Ideal addition to any Daniel differential pressure meter
- Offer special trim available upon request

**Daniel Differential Pressure Orifice Plates**
Daniel offers Universal, DVS and Paddle Type plates in a wide variety of line and orifice sizes.

- Each plate validated on a Coordinate Measurement Machine (CMM) to ensure high accuracy
- Wide regulatory acceptance
- Low cost and ease of installation
- Available sizes: 12 mm to 1504 mm (½ in to 60 in)

**Simplex™ Single Chamber Orifice Fitting**
Always quick and economical to install and replacement of orifice plates with minimum downtime. High pressure simplex orifice plate holders are also available and are designed for measurement at high pressure, on injection systems and recycling operations.

- Fast, economical change out of orifice plate
- Plate removal without spillage
- Available sizes: 50 mm to 205 mm (2 in to 8 in)

**Venturi Tubes**
Corrosion-resistant and maintenance free, Daniel Venturi Tubes can be customized and engineered to cover a wide range of applications and measurement needs.

- High pressure recovery and permanent pressure loss
- Air, water, super, steam, gas, chemical substances, vessels and slurry applications
- Available sizes: 50 mm to 1220 mm (2 in to 48 in)
- Larger sizes available upon request

**Flow Nozzles**
Long radius Daniel flow nozzles are manufactured in strict accordance with ASME MFC-3M specifications. The nozzles create a flow restriction for high-velocity, non-viscous, erosive flows.

- Rounded design provides a more effective sweep though of particles in the flow stream, extending product life by reducing wear and potential damage
- Direct welding into line, eliminating potential gasket leaks
- Available sizes: 50 mm to 1220 mm (2 in to 48 in)
- Larger sizes available upon request

**Expertise to tackle high-demand applications**
Daniel is recognized as the only company in the world able to manufacture 2,500 ANSI class dual-chamber fittings in large sizes and exotic materials, and one of only two companies able to serve customers with applications requiring 1220 mm (48 in) fittings, the world’s largest.

**The Importance of A Concentrically Aligned Orifice Plate Carrier**

Orifice plate alignment is one of the most significant factors in reducing measurement uncertainty. The Daniel Orifice Plate Carrier alignment method is compliant with the existing AGA/API 14.3 standards including eccentricity tolerances.

There is a provision in AGA which allows the eccentricity tolerance to be increased by 0.5 mm (0.02 in) on 50 mm to 205 mm (2 in to 8 in) fittings, making up to 0.5% added measurement uncertainty acceptable. With the tight eccentricity of the Daniel Orifice Plate Carrier, this added measurement uncertainty is eliminated.

Considering the desired uncertainty control limits for custody orifice measurement is ±0.5%, empirical data has shown that orifice applications involving plate centering outside AGA eccentricity tolerances tend to give an under-reading of the actual flow rate.
Ultrasonic Flow Meters

Model 3814 4-Path Liquid Ultrasonic Flow Meter
This four-path, in-line ultrasonic meter is ideal for applications requiring high accuracy, flow dynamics intelligence, low maintenance and low pressure drop.
• Suited for custody transfer and inventory control applications.
• Cross-flow compensation in each measuring plane.
• Available with high temperature and high viscosity transducers.
• Integrated MeterLink™ diagnostics.

Model 3812 2-Path Liquid Ultrasonic Flow Meter
Reliable and economical two-path meter for non-custody transfer applications.
• No moving parts and a wide flow range.
• Field-replaceable transducers simplify maintenance.
• No incremental pressure drop reduces energy costs.
• Modern two-path measurement chords strategically positioned to reduce measurement uncertainty.
• Integrated MeterLink™ diagnostics.

Model 3818 8-Path Liquid Ultrasonic Flow Meter
Specifically designed for reducing measurement uncertainty throughout the LNG value chain.
• Unique multi-plane interleaved 8-path British Gas design ensures measurement accuracy and stability.
• Advanced transducer technology for reliability.
• Integrated MeterLink™ diagnostics enable operators to monitor system performance and meter health.
• Ideal for meeting strict safety and environmental regulations.
• Available sizes: 200 mm to 914 mm (8 in to 36 in).

LNG Ultrasonic Flow Meter

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• Unique multi-plane interleaved 8-path British Gas design ensures measurement accuracy and stability.
• Advanced transducer technology for reliability.
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• Ideal for meeting strict safety and environmental regulations.
• Available sizes: 200 mm to 914 mm (8 in to 36 in).

Turbine Flow Meters

Series 1500 Turbine Flow Meter
Rugged, reliable meter designed for demanding crude oil and refined product pipeline applications.
• High frequency pulse resolution.
• Field-mountable go/no-go repeatability on independent downstream lines while monitoring.
• Bidirectional flow models available.
• Available sizes: 25 mm to 457 mm (1 in to 18 in).

Series 1200 Turbine Flow Meter
Well-suited for light hydrocarbon load rack and fuel blending applications, this proven meter features a lightweight internal assembly and options for complete measurement redundancy.
• Simple configuration assures high flow rates.
• Integrated transducer technology and optimized accuracy.
• Interfaces to both horizontal and vertical installations.
• Available sizes: 25 mm to 150 mm (1 in to 6 in).

When to choose a turbine meter

<table>
<thead>
<tr>
<th>Type of product</th>
<th>Turbine meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean product</td>
<td>Yes</td>
</tr>
<tr>
<td>Dry product</td>
<td>No</td>
</tr>
<tr>
<td>Viscous product</td>
<td>Yes</td>
</tr>
<tr>
<td>Abrasive product</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Heated Crude Oil Refining Applications

The high temperature and high viscosity transducers make the Daniel 3814 Ultrasonic Flow Meter ideal for a wide variety of challenging heated crude oil refining applications including heavy vacuum oil, Naphtha and kerosene.

The transducers are designed for high temperature use from -50°C to +150°C (-58°F to +302°F) and extend the viscosity range of the 3814 meter up to 1,000 centistokes (cSt) with an extremely wide range of Reynolds numbers.

Advantage of Dynamic LNG Volume Measurement

A typical liquefaction plant moves $4M/hr of LNG during loading and unloading with measurement uncertainty requirements at ±0.5%. An overall reduction of ±0.20% of measurement uncertainty would equate to a $12,000/hr reduction in financial risk.

Typical LNG Applications

• Tanker loading and off-loading
• Liquefaction trains (run-down lines)
• Storage allocation
• Check metering
• Line balancing

Around the world, from crude to refined products and across every stage of the oil and gas value chain—from production to transportation to distribution—Daniel liquid measurement products are delivering vital metering solutions. Our products are commonly found in onshore and offshore production facilities, refining and storage locations, crude oil and refined product transportation pipelines, and in all types of distribution facilities such as load racks and marketing terminals.
Compact Prover
Complete packaged proving system significantly reduced in size, weight and cost while equaling or exceeding the performance of conventional provers.

- Flexible configuring configurations for volumetric or mass meter proving
- Versatility — operates with virtually any pulse output flow meter
- Rapid proving operation offers single or multi-pass operation with immediate K-factor calculation
- Automatic mechanical operation assures undisturbed product flow

Stationary Prover
Daniel provides pipe provers with 100 mm to 1066 mm (4 in to 42 in) measuring sections, flow rates from 15.89 m³/hr to 6.674 m³/hr (100 bph to 42,000 bph) and suitable for temperatures from -46°C to +88°C (-50°F to +190°F).

- Precise on-site meter calibration saves money by minimizing uncertainty of metered volumes
- Comply with the recommendations of API chapter 4 and individual application specifications
- NACE certified materials
- Repeatability of ±0.02% (waterdraw)
- Models available include ball type bi-directional as well as uni-directional and piston-type for low temperature applications

Bi-directional provers are:
- Most popular for crude oils and dedicated refined products
- Not suitable for corrosive and aggressive chemicals
- For rates above 700 BPH
- Limited 10:1 turndown ratio
- Least complex of provers
- Not practical above 42,000 BPH

Uni-directional provers are:
- Preferred for multi-fluid pipelines
- Not suitable for corrosive and aggressive chemicals
- Limited 20:1 turndown ratio
- For rates above 700 BPH
- Only alternative for flow rates above 42,000 BPH

Piston type small volume provers are:
- Most suitable for clean fluids, not suitable for dirty or sandy crudes
- Good for corrosive and aggressive chemicals
- Pulse interpolation required for 0.0001 resolution
- Best if high turndown ratio of 1000:1 is required for proving several meter sizes including smaller meters
- Good when space is limited – offshore platforms with clean crudes

From concept and design, through fabrication, commissioning and start-up, Daniel delivers proving solutions manufactured to global standards for today’s flow measurement challenges.
Customers rely on Daniel’s certified engineering and design, international fabrication facilities, and success in field-testing, start-up and support.

**Flow Data Management and Control**

**DanPac Measurement and Control System**

A single software platform for smarter fiscal metering systems, DanPac control system provides accurate measurement and unparalled control of oil and gas fiscal metering installations, providing extensive reporting and built-in redundancy.

- Allows unparalleled monitoring and control of all key metering parameters, proving and sampling—all from one location.
- Supports multiple meters and analytical devices.
- Process alarms alert operators to possible issues in real-time.
- Easy access to measurement uncertainty reports and online calculations.

**DanPac Express Measurement and Control System**

Engineered to fulfill the growing demand for a scalable, easy-to-use metering control solution that provides real-time access to alarms and events.

- Streamlined hardware configuration reduces complexity and cost.
- Robust software package provides a user-friendly interface, historical trending capabilities, a powerful reporting package, user-specific alarms and system-wide security.

**Ultrasonic Software**

**MeterLink™** - Advanced Ultrasonic Diagnostics

Sets the industry standard for real-time flow monitoring by providing flow dynamics intelligence.

- Designed for Daniel gas and liquid ultrasonic meters
- Robust software package provides a single at-a-glance view of key flow parameters including cross-flow, swirl angle, symmetry, turbulence, profile factor, and average velocity.

**Flow Replacement Software**

**Flowel 4**

Designed for accurate sizing of orifice plates, nozzles and Venturis.

- Supports current hydrocarbon measurement industry standards
- Calculates fluid properties, both pure and mixed
- Helps attain the most accurate design calculations

**FlowCheck**

Uses industry-standard equations to calculate and verify the flow of hydrocarbon gases or liquids through orifice fittings, turbine meters and pipe junctions.

- Improves efficiency of commissioning and configuring metering stations.
- Helps operators calibrate and troubleshoot flow measurement equipment.
- Part of/Blacklick over measurement displays

**FlowCheck**

Helps operators easily estimate flared and vented volumes of natural gas as well as unmetered fuel gas by performing complex natural gas calculations.

**Integrated Fiscal Metering Solutions for Oil and Gas**

From the simplest single-stream skid to complex on-site installations, Daniel metering systems are a single-source solution proven to minimize risk, improve accuracy and increase reliability. Manufactured to global product and fiscal metering standards such as CE, UL, PED, ATEX, DIN, RS, NACE, ANSI, ASTM, API, RO and OIML, these solutions typically include meters, valves, provers, control panels, samplers, user interfaces, software and hardware.

**Expert Engineering Design (EEDx)**

- Specification evaluation
- Compliance with fiscal standards
- Sizing calculations
- Uncertainty budget
- Piping and structural design and analysis
- Control and supervisory design

**Expert Project Management**

- Limited risk predictions in project management
- Global resources to deliver projects
- Proven record in managing mega projects
- Quality control using rigorous functional FAT and SAT processes
- Integrated tools for managing budget, time, materials and documentation to minimize risk
- ISO 9001 and Daniel quality approved sub-contractors

**Start-up and Commissioning**

- Installation best practices and site safety policies to ensure faster and more efficient implementation
- Start-up and live operational testing
- System operation and maintenance training
- Post-commissioning support and handover
- Maintenance programs and online support

**DanPac Condition-Based Monitoring (CBM)**

Watching over your complete metering system

Daniel CBM is an innovative metering system support service that aggregates and securely delivers personalized real-time service intelligence tailored specifically to your metering system architecture.

CBM provides a single point of critical system information to help operators monitor and manage the performance of multiple metering stations and system devices simultaneously, delivering diagnostic information to predict maintenance requirements, reduce measurement uncertainty and maximize system uptime.

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Surge Relief Systems

Complete design, fabrication, documentation, testing and commissioning of systems for surge relief, both as skid mounted systems and as loose integrated solutions.

- Protect your pipeline from excessive surge pressures caused by Pipeline ESD valve closure
- Reduce excessive pipe loads caused by high pressure and rapid pressure changes
- Stabilize operation due to control valve misuse or incorrect setting

Sampling Systems

Turnkey automatic hydrocarbon sampling systems guaranteed to comply with international sampling standards.

Analyzer Houses

Daniel supplies units fully-equipped with gas chromatographs, samplers and data loggers to serve multiple lines and sampling points.

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Control Valves

Series 700 External Pilot Controlled Valves

Unique design features and unit-built construction assures positive sealing, linear valve action, uniform fast response and leak-proof performance. Multiple pilot arrangements easily customized to fit your needs.

- Sensitive regulation - pressure from 50 to 1,040 psi (350 to 7,100 kPa) can be controlled within ±2 psi of set point (±13.8 kPa)
- Zero leakage - contoured edge of piston provides a tight seal and assures drip-tight operation and dead-end service

Series 600 Aircraft Refueling Control Valves

Designed for safe and economical flow control when fueling all jet aircraft, including supersonic transports.

- Hydraulically operated and suitable for fueling trucks, hydrants and service carts
- Surge control at the wing manifold to safely protect the aircraft fuel system
- Reliability of accurate fuel delivery up to 1,200 gallons per minute
- Positive, bubble tight shutoff

Series 500 Power Cylinder Operated Control Valves

Ideal when minimal pressure drop is required, these valves serve different control functions including tank safety, remote on-off control, bypass control on distribution system, emergency shut-off, in addition to two-stage and digital batch control.

- Fail safe on loss of power medium
- 45° body design assures high capacity fluid flow
- Extremely low pressure drop
- No diaphragms or stuffing boxes

Series 700 External Pilot Controlled Valves

Series 600 Aircraft Refueling Control Valves

Series 500 Power Cylinder Operated Control Valves

Control Valves

Controlling surges in liquid pipelines

Some design approaches to alleviate surge pressures in pipelines are:

- Complete computer modeling of pipeline profile during initial stages of pipeline design work
- Stage pump shutdown sequence
- Limited Ship/ Shore Emergency Shutdown (loading and off-loading tankers)

- Stage emergency shutdown or motor operated valve (MOV) closure times
- Select proper surge pressure relief system based on:
  1. Lowest set pressure
  2. Location; immediately upstream of critical Emergency Shutdown Device (ESD) or MOV valve or other source of surge pressure

Quality Models

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- Extremely low pressure drop
- No diaphragms or stuffing boxes

Series 700 External Pilot Controlled Valves

Series 600 Aircraft Refueling Control Valves

Series 500 Power Cylinder Operated Control Valves

Control Valves

Controlling surges in liquid pipelines

Some design approaches to alleviate surge pressures in pipelines are:

- Complete computer modeling of pipeline profile during initial stages of pipeline design work
- Stage pump shutdown sequence
- Limited Ship/ Shore Emergency Shutdown (loading and off-loading tankers)

- Stage emergency shutdown or motor operated valve (MOV) closure times
- Select proper surge pressure relief system based on:
  1. Lowest set pressure
  2. Location; immediately upstream of critical Emergency Shutdown Device (ESD) or MOV valve or other source of surge pressure

Quality Models

Sampling Systems

Turnkey automatic hydrocarbon sampling systems guaranteed to comply with international sampling standards.

Analyzer Houses

Daniel supplies units fully-equipped with gas chromatographs, samplers and data loggers to serve multiple lines and sampling points.
SERVICES

Start-up and Commissioning Services

Start-up and Commissioning

Ensure faster, safer and more efficient implementation of your Daniel flow measurement equipment, taking into account local metrological requirements and best practices during all phases of start-up-operation.

• Supervision of correct installation
• Pre-commissioning and validation testing
• Start-up and first operational testing
• Operations and maintenance training
• Post-commissioning support and download

Maintenance and Repair Services

Preventive Maintenance

This program keeps metering equipment and instruments operating within specified factory accuracy and repeatability, maximizing uptime and minimizing maintenance/repair costs by addressing small problems before system failures occur.

• A complete system check of all parameters
• Routine maintenance as well as needed adjustments or repairs
• Verify that instrumentation is operating to specifications
• Provide records of “as found” and “as left” conditions
• Advise customers on valuable hardware and software upgrades

Remote Performance Verification and Diagnostics

Using satellite communication and the latest software and hardware, Daniel helps keep your equipment at peak performance, monitor configuration changes and perform calibrations.

• Immediate availability of measurement support from Daniel can help quickly return your operations to normal
• Troubleshooting handled quickly and expeditiously via electronic communication
• Allows a Daniel measurement expert to “see” the instrument and/or software problem directly and apply diagnostic tools

Measurement External Value

Daniel flow measurement services are designed to optimize the availability, sustainability and performance of metering equipment throughout its lifetime. Our comprehensive portfolio of services reduces your measurement uncertainty, ensures the reliability and regulatory compliance of your flow measurement equipment and minimizes cost of asset ownership.

Metering Equipment Audit

Whether your system has been recently commissioned or has been in service for a longer period of time, a metering equipment audit from Daniel can be a major step toward improving your business bottom line.

• Verification that the metering equipment is performing within specifications
• Recommendations to improve measurement accuracy
• Best practices for reducing operating and maintenance costs
• Detailed reports of the audit results

Warranty Plus!

Warranty Plus! offers predictable, long-term operating costs and proper operation within factory specifications.

• Elimination of unplanned expenses for repairs
• Replacement parts and timely repairs using factory-approved procedures and equipment
• Restoration of performance to original factory standards and recertification
• Full access to OEM product knowledge and support

Service Contract

Provides a more predictable maintenance plan for your metering system. It is also the most cost-effective way to assure support of your metering installation and help maintain the highest level of measurement performance.

• Life-cycle planning and management
• Asset management and data backup
• Emergency on-site response
• Remote monitoring of equipment performance

Best practices to mitigate measurement uncertainty

Design considerations

Measurement system audit
• Assures level of accepted uncertainty
• Identification of elements or practices causing deviation and actions to bring back into conformance

Recertification and verification
• Compare measurement performance with design
• Validate performance and reported figures in conjunction with operating practices

Operational and maintenance practices

Training of personnel
• Establish regular maintenance schedule for each key equipment item or device
• Periodic equipment health checks

Whether the emphasis is uptime, asset management or maintaining the highest level of measurement performance, a service contract from Daniel provides a more predictable maintenance plan for your metering system.
SERVICES

Series 3410/3810 Electronics Upgrade for Gas Ultrasonic Meters
This comprehensive on-site electronics upgrade program extends meter usable life, expands its capabilities and helps ensure measurement accuracy.
• Improves repeatability with fast signal processing
• Provides quick remote access to detailed device diagnostics, delivering real-time information when and where it counts
• Utilizes internal calculations to monitor meter health

Compact Prover Inspection and Refurbishment
A wide range of upgrade packages are available to guarantee your Compact Prover is functioning at peak performance according to its design specifications.
• Extends the useful life of in-service Compact Provers
• Improves ease of operation with a Prover Controller Upgrade
• Ensures and verifies measurement accuracy
• Helps gain operating efficiencies with the latest technology components

System Upgrades and Refurbishment Services
DanPac Measurement and Control System Upgrade
Improve functionality by upgrading legacy Daniel metering systems to the latest generation DanPac Standard or DanPac Express System. These industry leading solutions are secure, robust and maintainable, providing unparalleled control over your flow measurement system.
• This upgrade opportunity provides a tiered solution of standard components for faster implementation, reduced cost of ownership and increased serviceability via Emerson Global Lifecycle Services.

Meter Inspection and Recertification
The ideal remedy for internal meter tube build-up, component damage and installation problems. This service ensures that the meter tubes and devices are recertified to meet the requirements of AGA 3/API 14.3 or any other measurement standards.
• Minimizes the financial burden of “lost and unaccounted for” product
• Mitigates measurement uncertainty
• Identifies and eliminates installation problems
• On-site service minimizes downtime and transportation costs

Educational Services
Training Programs
A comprehensive portfolio of educational services including measurement basics, operation and maintenance of equipment, hands-on programming and diagnosis of potential on-site problems.
• Ideal for engineers and technicians who install, operate and maintain equipment
• Instruction either at customer site or a Daniel facility, led by Daniel engineers, technicians and service specialists

Abnormal conditions that cause inaccuracy of orifice measurement
Typical abnormal conditions include but are not limited to:
• Rough upstream pipe wall: Gas flow is slower along pipe walls due to friction causing the entry flow profile to be more arrow shaped
• Improperly designed or installed flow conditioner: Entry flow profile is not developed properly and may be altered by abnormality
• Swirling gas flow pattern

Factors Contributing to Increased Measurement Uncertainty
• Flow distortion
• Faulty system design
• Excessive flow
• Liquid in gas
• Wax
• Soot
• Debris or damage
• Installation issues
• Operating conditions differing from design conditions

Phase change
• Retrograde condensate
• Gas break-out

Contamination
• Liquid in meter tube
• Valve ‘noise’ or pulsation
• Orifice with damaged bore
• Obstruction in orifice bore
• Meter tube shorter than AGA 3 specifications
• Orifice not centered in tube per AGA 3 specifications
• Protrusions in upstream piping

through a worldwide network of certified facilities and technicians, our service centers assure support 24 hours a day, 7 days a week for the life of your metering installation.

Consistent, accurate flow measurement calls for partnering with an experienced global organization capable of delivering the required services when and where they are needed.
Consistent, accurate flow measurement calls for partnering with an experienced global organization capable of delivering the right solutions when and where they are needed.

Daniel’s worldwide network of certified facilities and personnel ensures the right resources, skills and experience are in place to provide the highest quality services and solutions.

For detailed contact information of local offices, please visit our website at www.Daniel.com