CAMERON

CALDON LEFM 380Ci Gas Ultrasonic Flow Meter

Integrating experience, proven technology and innovation

TECHNOLOGY

CAMERON

CAMERON'S CALDON® LEFM® 380Ci gas ultrasonic flow meter combines world-leading flow control technology with one of the lowest costs of installation and operation of any flow meter on the market today for the natural gas industry.

The LEFM 380Ci meter design addresses the needs of the natural gas industry by eliminating the need for flow conditioning, providing a smaller meter installed footprint, reducing the risk of corrosion and/or contamination of internal meter surfaces, and improving safety for technicians servicing the meter.

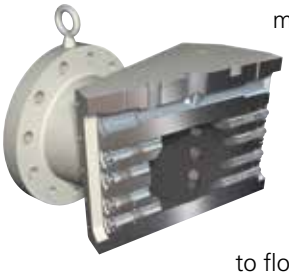
As a world leader in transit-time ultrasonic technology applications, Cameron has integrated its eight-path, dual-plane flow meter design with new technology to introduce the LEFM 380Ci gas ultrasonic flow meter for use in natural gas applications, including, but not limited to, custody-transfer metering, fiscal metering, city gate metering, check metering and transfer of product to and from underground storage facilities.

FEATURES AND BENEFITS

- The LEFM 380Ci flow meter has been designed to reduce the cost of installation, reduce yearly maintenance and operating costs and increase personnel safety.
- Savings realized in installation, maintenance and operating costs can result in a payback of up to three times the initial cost of the meter over the life of operation.
- The unique eight-path, dual-plane, cross-path design of the LEFM 380Ci flow meter is insensitive to velocity profile asymmetry and swirl.
- Transducer assemblies are inserted into transducer housings sealed into the meter body. The transducer housings are pressure boundaries isolating the transducers from the process. This eliminates the need to shut down flow and depressurize the pipeline if a transducer should ever need to be replaced.
- Proprietary internal coating significantly reduces the risk of corrosion and/or contamination of the internal meter surfaces.

Product Features

Dual-plane, Eight-path Configuration



The LEFM 380Ci gas ultrasonic flow meter features Cameron's unique multipath, dual-plane, cross-path flow meter design. It is equivalent to having two four-path flow meters in one meter body. Cameron has conducted extensive research and testing to demonstrate that the four paths in any one plane can effectively determine the flow rate by averaging the four chordal path velocities, resolving any effects due to flow profile asymmetry.

Fluid velocity measurements are averaged over the eight chordal paths of the two combined planes. Swirl effects in one plane will be equal but opposite in magnitude to the effects in the second plane. Averaging the velocity measurements has a net result of resolving any effects due to swirl on the overall measurement.

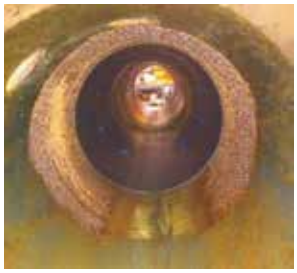
Sealed Transducer Housing Design

The LEFM 380Ci gas ultrasonic flow meter has transducers that are installed into titanium transducer housings, as a resistance temperature device (RTD) inserts into a thermowell. The transducer housing is a pressure boundary between the transducer assembly and the process. This feature is common to Cameron's liquid flow meters, but is a first for an ultrasonic natural gas flow meter.

The operator does not have to block and depressurize the meter if an LEFM 380Ci transducer should ever need to be replaced. A transducer can be replaced safely with gas flowing in the meter. The design does not require any special tools or extraction devices for transducer replacement.

A 24" LEFM 380Ci gas ultrasonic flow meter was installed in an application that needed a short footprint. The operator requested that the entire meter package (upstream piping, meter and downstream piping) be no longer than 10 pipe diameters. This meter package was installed downstream of piping elements that could create asymmetrical flow profiles and swirl. After the LEFM 380Ci was installed, Cameron remotely monitored the meter using eCheck and was able to determine that up to 42% swirl was present. The flow meter provided measurements well within the operator's expectations.

Proprietary Coating



Corrosion and contamination of the flow meter and adjacent piping can be problematic in regards to meter performance. The LEFM 380Ci gas ultrasonic flow meter has a proprietary internal coating that significantly reduces or eliminates the risk of corrosion and/or contamination. This coating was selected based on Cameron's experience with buildups that can occur in liquid applications. This specific coating was selected because it has good anti-corrosion properties, high thermal stability, chemical inertness in aggressive environments and superior anti-stick properties.

The second image is a view looking upstream through the downstream meter spool into an LEFM 380Ci 10" meter that was in service for six months. The downstream section shows signs of rust and corrosion, with markings indicative of liquid having run along the bottom of the pipeline. The LEFM 380Ci coated meter body remained clean. Cameron can provide upstream and downstream pipe spools with this coating at the operator's preference.

LEFMLink 2G and eCheck Software

LEFMLink 2G provides an on-demand interface between the LEFM 380Ci gas ultrasonic flow meter's electronics and an operator's PC via a serial connection. LEFMLink 2G enables the operator to view process and diagnostic information to verify proper operation.

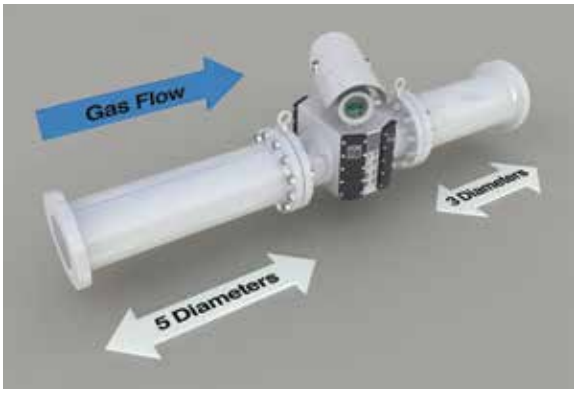
eCheck includes a single user interface for viewing real-time meter data that resides on a local eCheck server. eCheck is a level above LEFMLink 2G in that it alerts operators to the first signs of a problem. eCheck then drills down through sophisticated diagnostics to determine the nature of the problem and generates a list of recommendations for the operator to take.

Results You Can Measure

The LEFM 380Ci gas ultrasonic flow meter is insensitive to velocity profile asymmetry and swirl. The general installation recommendation is based on Cameron's history with eight-path liquid ultrasonic flow meters, LEFM 380Ci field tests and third-party testing of the LEFM 380Ci at CEESI. This recommendation meets or exceeds the AGA Report 9, Section 7.2.2 requirement that there will be a maximum deviation of ± 0.3% due to installation configuration.

Having the smallest installed footprint means a compact installation and reduction in CAPEX by reducing the length of required upstream pipe and eliminating a flow conditioner. The ability to isolate the transducers from the flowing gas in the pipeline means increased safety for the technicians should a transducer ever need replacing, as well as a simplified, time-saving replacement procedure. The proprietary coating of the LEFM 380Ci can provide higher accuracy of measurement over the months a flow metering section is being conditioned by corrosion and contamination of the process after it is installed, or fewer cleaning cycles for operators who may need to periodically remove the meter section for cleaning.

The LEFM 380Ci has been designed to address technical and operational challenges associated with natural gas measurement. However, it also is a flexible design, which allows Cameron to meet the specific local needs of operators, which is equally important. The LEFM 380Ci is available in various materials of construction and has a design that is configurable to accept various end connections requirements. The transmitter can be integrally or remotely mounted from the meter body and has a wide range of input and output options.



Count On Cameron

Cameron is constantly developing cutting-edge ultrasonic technology to better meet industry demands for custody transfer. LEFM multipath in-line ultrasonic flow meters are backed by more than 40 years of experience and a history of technological firsts for their use.

Cameron designed the LEFM 380Ci based on feedback gathered from users of ultrasonic flow meters for custody transfer of natural gas:

- Improve meter reliability over a wide range of application conditions
- Improve safety for technicians when replacing transducers
- Simplify installation and reduce the meter footprint and overall metering section weight
- Reduce maintenance

The LEFM 380Ci gas ultrasonic flow meter represents the integration of three crucial design elements to create a truly unique meter to address the above concerns:

1. Eight-path design creates a smaller installed footprint for custody-transfer measurement and reduces the weight of the metering section by eliminating a flow conditioner and reducing upstream piping; also delivers high redundancy, and thus, online availability
2. Innovation makes the LEFM 380Ci flow meter the first gas ultrasonic meter with transducers that are not "wetted" by the gas
3. Proprietary coating effectively deals with the potential for corrosion and contamination from components in the gas stream

Cameron's LEFM 380Ci gas ultrasonic flow meter can significantly reduce installed cost and yearly operating cost while increasing personnel safety.

LEFM TECHNOLOGICAL FIRSTS

1965-70 First LEFM hydroelectric application

1970-75 First LEFM nuclear reactor coolant application

1974-75 First LEFM petroleum application

1994-99 First measurement uncertainty recapture uprate at nuclear facilities

1995 First LEFM MIL-SPEC

2003 First LEFM for custody transfer of liquid hydrocarbons

2005 First LEFM for custody transfer of LNG

2008 First LEFM for custody transfer of heavy, viscous crude oils up to 3000 cst

2010 First LEFM 380Ci meters installed on natural gas pipelines with isolated transducers

CAMERON

1000 McClaren Woods Drive
Coraopolis, PA 15108
USA
Tel 1 724 273 9300

Learn more about Cameron at:
www.ultrasonicgasmeter.com
or email
gasufm@c-a-m.com

HSSE Policy Statement
At Cameron, we are committed ethically, financially and personally to a working environment where no one gets hurt and nothing gets harmed.