



# Measuring Technologies and Applications

Central Station  
Steam Company

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## Energy Costs and Improved Efficiencies drive Innovations in Flow measurement Technology

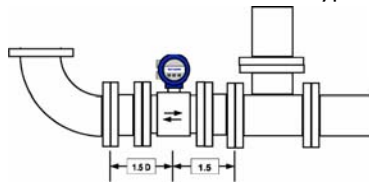
With energy costs soaring, improvements in efficiency and conservation have become a high priority. Accurate measurements for billing and energy allocation have required heating and cooling system upgrades or retrofits to meet the new demands.

One area that has seen increased scrutiny is the return of condensate to the central power boiler facility from steam distribution systems. In the past condensate, if measured, was typically taken to drain. With accurate condensate measurement essential to energy billing and with cost saving realized through heat recovery of high temperature condensate, condensate return systems have seen widespread implementation to new and existing steam distribution systems.

Since many of the return installations involve retrofitting existing condensate drain systems, existing piping typically is not available for the return. Providing new piping systems in a typically crowded location makes for very interesting piping schemes. This most often leads to less than ideal piping layouts in the immediate area around the condensate return collection system and pumps.

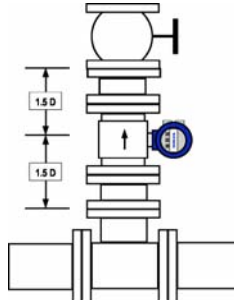
Conventional flow measurement technology available today, requires certain piping considerations for proper operation. These piping consid-

erations are required to provide a stable and well developed flow profile. Flow profiling is required to provide a uniform velocity, which is the parameter measured by 90% of current flow technologies. Profiling is typically accomplished by providing piping straight run upstream and downstream of the flow meter. Typical requirements are 10 pipe diameters upstream and 5 diameters downstream.



With the development

of the Cadillac® pumped condensate flow meter, flow profiling is no longer a concern. Employing a special tube design and manufacturing techniques the Cadillac® meter operates at a stated accuracy (+/- 0.50% of rate or reading) with just 1.5 pipe diameters up and down-



stream of the meter centerline. This means in a 4" meter size and below no piping straight run is required, since the straight run requirement is met within the meter flow body.

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- Briefly highlight your point of interest here.
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## The Original Cadillac Gravity Condensate Meter gets facelift

Still alive and turning after 100 years of service, the Original Cadillac® Condensate meter gets a facelift! First patented in 1904, the Gravity style condensate meter went through the remainder of the century essentially unchanged in design or construction.

With literally hundreds of thousands of the Cadillac® meters installed for steam usage and billing, the Cadillac® meter has been time tested and proven in its reliability and longevity. However, over that period of time material availability and manufacturing techniques have allowed the meter to be improved and updated.

Cast Iron, Brass, and Copper components have been replaced by Stainless Steel and high temperature Polymers to provide a lighter, stronger, and more durable product, extending the Cadillac® meter life expectancy well into the 22nd Century.

All parts are 100% interchangeable from the old to new meters and all parts are still supported in all materials of construction, allowing old meters to be upgraded if desired or maintained as originally manufactured.

Please visit our Website@[www.cadillacmeter.com](http://www.cadillacmeter.com) for additional information.



## Introduction of the new **Cadillac** battery powered Ultrasonic water flow meter

Central Station Steam introduces its newest flow product offering with the release of the **Cadillac®** Ultrasonic battery operated water flow meter.

Typical applications for **Cadillac®** battery-powered ultrasonic flow meters of the type series CU-WM include both commercial and industrial measurements of water flow rate and consumption in water supply systems, requiring data processing and archiving.

The technical parameters of the meters, in particular their high measurement accuracy and long-term stability over wide ranges of the measured values, make it possible not only to measure water consumption, but



Pictured above is a **Cadillac** 1-1/2" CU-WM Ultrasonic battery operated water meter with integral electronics

also to monitor water leakage and general conditions of water supply networks.

The **Cadillac®** CU-WM water meters do not need any external power supply, do not contain any movable parts nor need any filters to remove mechanical contaminants in water. Compared to conventional water meters, ultrasonic meters have substantially lower hydraulic head or pressure losses.

All meters come standard with a local display and pulse output (an optional analog output is available) for remote monitoring and data acquisition. The meter housings are rated NEMA 4 / IP67 for installation in exposed or outdoor locations. Replaceable battery life expectancy rated for 5-7 years.

## Standard feature in **CMAG** electronics provides troubleshooting tool for condensate return systems

*The “Empty Pipe” detection feature in Cadillac® CMAG allows troubleshooting of condensate return system preventing condensate backflow and pump cycling.*

One of the many features in the **Cadillac CMAG** electronics is “Empty Pipe” detection. Initially developed as a troubleshooting or diagnostic tool for start-up in new installations, the feature has found other benefits as applied in pumped condensate applications.

By continuously measuring the electrical impedance between the meter electrodes, the meter can identify when the water level in the meter has fallen below one or both of the electrodes. With the liquid in the meter body acting as the wire, completing the electrical circuit between electrodes, the meter can measure and distinguish when water is present and when it is not.

This feature can be very useful on the discharge side of condensate return pumps, which typically operate against system head and utilize integral check or foot valves to prevent backflow when inactivate. Over time these check valves have a tendency to build up with particulate and other materials, which leads to the valves intermittently

sticking in a partially open condition allowing condensate backflow and inadvertent pump cycling. Over time this causes premature pump wear and even failure, not to mention the unnecessary energy usage.

In addition, the “Empty Pipe” detection feature can identify if air has become trapped in the piping system, a typical problem especially during system start-up. If this occurs and the air is not vented within the meter body, it will effect the meter accuracy and performance, which if used for billing can be a significant issue.

“Empty Pipe” notification is provided in two modes. The first is local indication via the display, which will indicate the condition by displaying “Empty Pipe”. The second mode of notification is a remote signal via an optional discrete output. This can be tied to an alarm or sent to a building management system for proper notification of responsible personnel.



## Flow lab testing results verify the Cadillac® CMAG “Profile Independent” meter performance

The results of flow lab testing verify the Cadillac® CMAG meter’s “Profile independent” performance and accuracy conclusions.

Figure 3-1 and 3-2 shows an 8” CMAG wafer style magnetic flow meter in a double dogleg configuration. If you measure from the elbow flange to the center of the flow tube where the electrode is located, it is about 12”, which is 1.6 diameters from the elbow on both the upstream and downstream sides. According to the traditional flow meter installation “rule of thumb” it should be 5 to 10 pipe diameters or 4 ft. to 8 ft. from the elbow on both the upstream and downstream lengths.

Under these less than ideal conditions the results were quite dramatic yielding better than +/-0.25% of rate over the entire flow range as illustrated in figure 3-3 flow test 1, and verified again in figure 3-4 flow test 2.



Figure 3-1 Piping configuration

Double dogleg test set-up for 8” Wafer style CMAG magnetic flow meter in flow lab

Table 3-2 flow test 1-1

Flow rate (%)	25.1	50.0	74.9	99.7
Master meter flow (m <sup>3</sup> /h)	75.1725	150.1350	224.8350	299.0775
Tested meter flow (m <sup>3</sup> /h)	75.0075	149.9775	224.4525	298.4175
Error (% of rate)	-0.219	-0.105	-0.170	-0.221

Table 3-3 flow test 1-2

Flow rate (%)	25.0	50.2	75.0	99.4
Master meter flow (m <sup>3</sup> /h)	75.1050	150.6825	224.9100	298.2600
Tested meter flow (m <sup>3</sup> /h)	74.9475	150.5025	224.6025	297.5700
Error (% of rate)	-0.210	-0.119	-0.137	-0.231

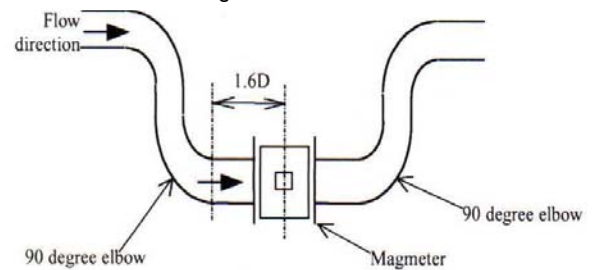


Figure 3-2 Piping diagram

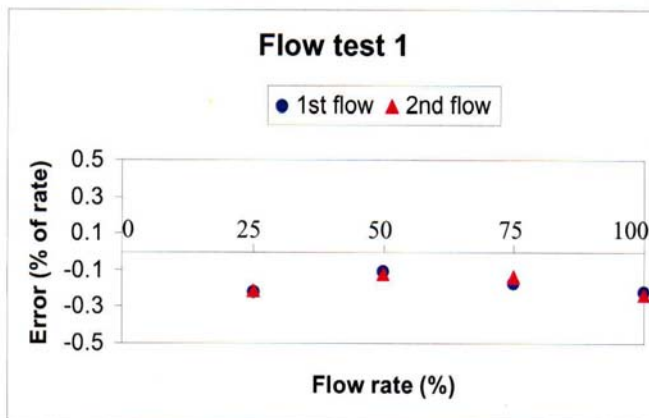


Figure 3-3 flow test 1

Table 3-4 flow test 2-1

Flow rate (%)	25.0	49.9	75.0	97.5
Master meter flow (m <sup>3</sup> /h)	74.9850	149.8200	225.0075	292.4775
Tested meter flow (m <sup>3</sup> /h)	75.0600	149.6475	224.9325	292.1325
Error (% of rate)	0.100	-0.115	-0.033	-0.118

Table 3-5 flow test 2-2

Flow rate (%)	25.0	49.9	75.1	97.3
Master meter flow (m <sup>3</sup> /h)	74.9175	149.6850	225.2850	291.8925
Tested meter flow (m <sup>3</sup> /h)	75.0375	149.5350	224.9025	291.5700
Error (% of rate)	0.160	-0.100	-0.170	-0.110

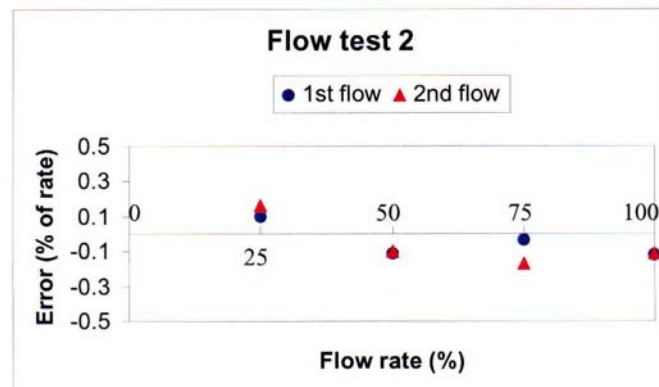


Figure 3-4 flow test 2

With the ability to mount in just about any piping configuration while maintaining very high measurement accuracy (+/- 0.50% of rate), the Cadillac® CMAG magnetic flow meter is ideally suited for installation in the retrofit of existing or in the building of new condensate return systems.



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### Innovative Flow Measurement Solutions



**Cadillac® Meters**

**We're on the Web!**  
[www.cadillacmeter.com](http://www.cadillacmeter.com)

Central Station Steam Company is committed to providing the highest quality instrumentation and services to support the challenges facing the commercial and industrial marketplace.

With a primary focus on flow products, Central Station Steam Company offers a wide variety of flow technologies to meet the demands of energy management, energy efficiency, and billing.

Innovative product design allows customers to make measurements in liquids and gases with an accuracy and repeatability unrecognized in the marketplace with other products or technologies.

For more information Please visit our website @ [www.cadillacmeter.com](http://www.cadillacmeter.com) . To contact us directly please e-mail us at [cadillacmeter@aol.com](mailto:cadillacmeter@aol.com) or call toll free @ 888-556-3913.

## Cadillac® Gravity meters 100 Years new and still serving the industry

Even today, with the many advances and offerings in flow measurement technology, the Original Cadillac® Gravity condensate meter is still the best choice for those applications requiring operation in partially filled piping, very low flow velocities, and/or infinite turn down such as typically found in a gravity condensate return system. No other meter has the capability to measure its full rated capacity or a drop at a time, while maintaining an accuracy of +/- 1.0% of consumption!

100 years of operation, withstanding the test of time, with the principle of operation that one pound of condensate is equal to one pound of steam, the Cadillac® Gravity style condensate meter still proves to be the best choice, even today, for the accurate measurement for energy usage and billing.

Primarily unchanged over the last century, the Cadillac® Gravity Condensate meter operates today as it did 100 years ago.

The original Cadillac® meter was manufactured with a cast iron casing, mechanical counter and welded copper internal drum. (Top Picture). This has changed with material availability and manufacturing techniques to a welded Stainless Steel casing, welded Stainless drum, and Electronic Counter/Totalizer with standard Pulse output for remote EMS monitoring. (Bottom Picture).

With all internal parts interchangeable from new to old meters, the Cadillac® Gravity condensate meter transitions seamlessly into the future decades with proven success and reliability.



Pictured above is the original Cast Iron "E" size condensate meter with a local mechanical counter.



Pictured below is a new Stainless Steel "G" size condensate meter with a remote electronic counter