

LEAK DETECTION AND PIPELINE MONITORING SYSTEM BASED ON CLAMP-ON ULTRASONIC FLOWMETERS

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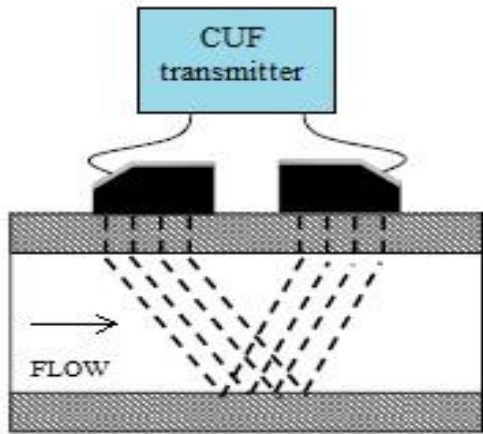
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Content:

- Advantages of the clamp-on ultrasonic flowmeters (CUF) and its influence on the applications.
- Technological monitoring and metering of the flow in pipelines.
- Technological applications at refineries and storage tanks.
Compounding systems.
- Leak-detection systems for water and oil-gas.
- other applications: municipal water metering, municipal heating energy metering, metering at building air-conditioning systems, etc.

Clump-on ultrasonic flowmeter produced by Wavelab.Tech LLC



- Electroacoustic transducer generates an ultrasonic wave of a certain frequency that passes through the pipe wall into the measured flow
- The wave after crossing the flow is detected by second transducer. Now the ultrasonic signal has a footprint of the flow velocity. Data from the transducers collected and analyzed by CUF transmitter and transferred to SCADA.

Clamp-on Ultrasonic
Flowmeter VLT-1
Designed and produced by
Wavelab.Tech LLC



Table 1. Advantages of the clamp-on ultrasonic flowmeters and its influence on the applications

UFC property	Influence on the application
No influence on the flow profile	Higher accuracy and reliability of the measurements
No pressure drop in the pipe	Substantially reduces the cost of pipeline transporting
low efect from hydro and pneumatic shocks	hydro-shocks do not disable equipment
No moving parts inside the pipe	significantly less equipment wear
No direct contact with inside-pipe measured substance	<ul style="list-style-type: none"> -does not contribute to the accumulation of dirt inside pipes and installation chambers -No physical wear of detectors by hard particles (sand, small stones) -Reduced requirements to corrosion -no need for filters installations

Table 1 (continuation). Advantages of the clamp-on ultrasonic flowmeters and its influence on the applications

UFC property	Influence on the application
Wide beam	<ul style="list-style-type: none"> -No blowing-off of the beam. Dynamic range of the measured velocities is over 1:250, one of the highest in industry - Simple installation and tuning -Substantially less effect from bubbles and impurities in the flow.
Low weight and dimensions	<ul style="list-style-type: none"> -Simple installation and tuning -There are “mobile versions” of the flowmeter for single measurements -One person can deliver and install even at remote location.
Clamp-on version	<ul style="list-style-type: none"> -Does not require pipe drilling or cutting at installation

Technological monitoring and metering of the flow in pipelines

Monitoring and Metering are most wide-spread applications of CUFs due to:

- Easy installation, high enough accuracy of the measurements, low maintenance cost.
- Allow to monitor and control custody transfer operations between suppliers and customers along with official custody transfer equipment.
- Metering of internal consumption, control and dosing at technological pipes

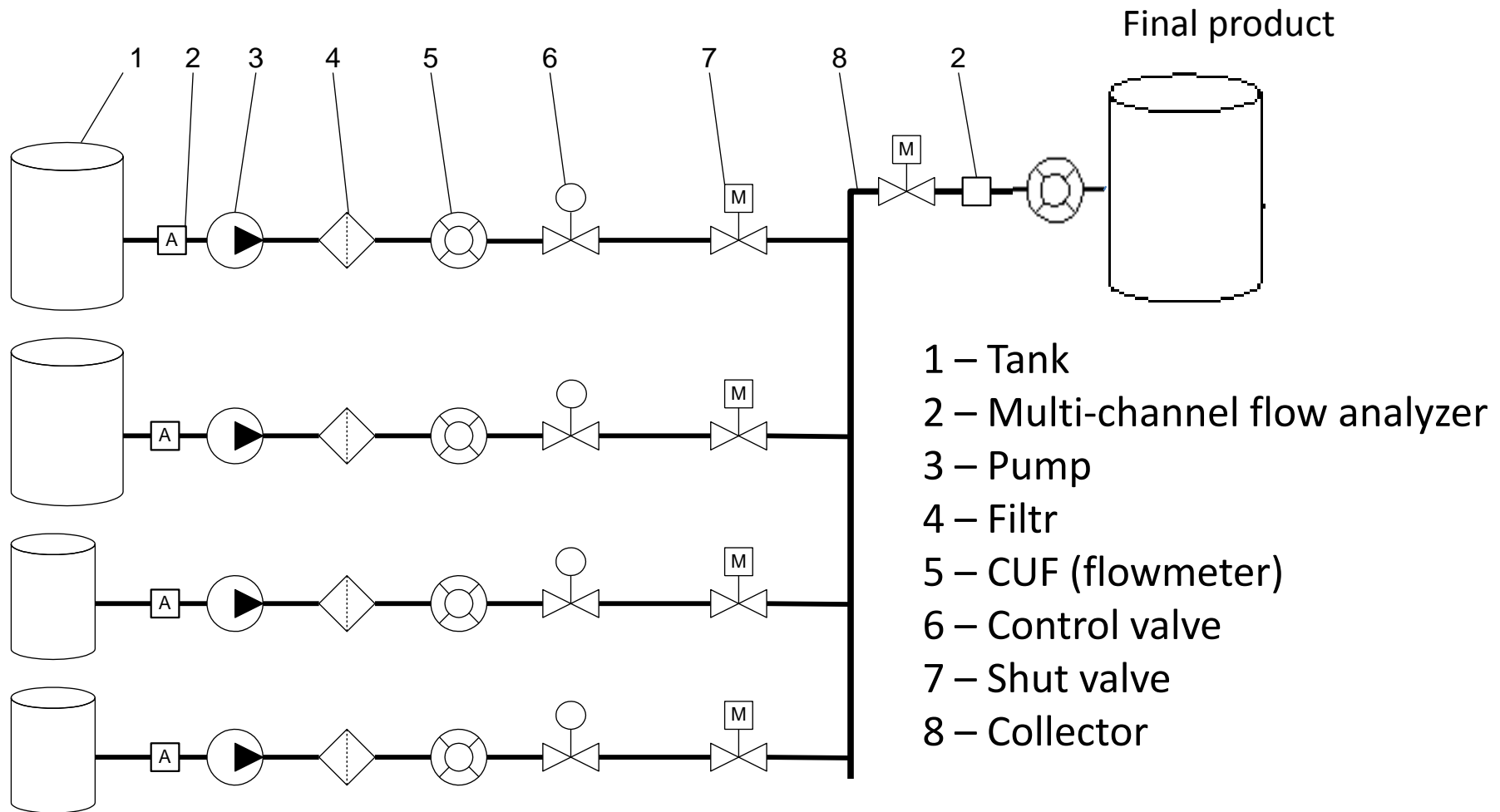


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Technological applications at refineries and storage tanks

- Between tanks distribution control.
- UFC are used practically at all stages of the refining process, where hydrocarbons measured.
- UFCs used at high-temperature processes (>250 °C), where direct measurements are not possible.
- Widely used at technological processes, where direct measurements are not possible.
- Compounding systems – UFCs used for dosing of components and final product control (see below)

Applications in technological processes: Gasoline and Oil compounding systems at refineries

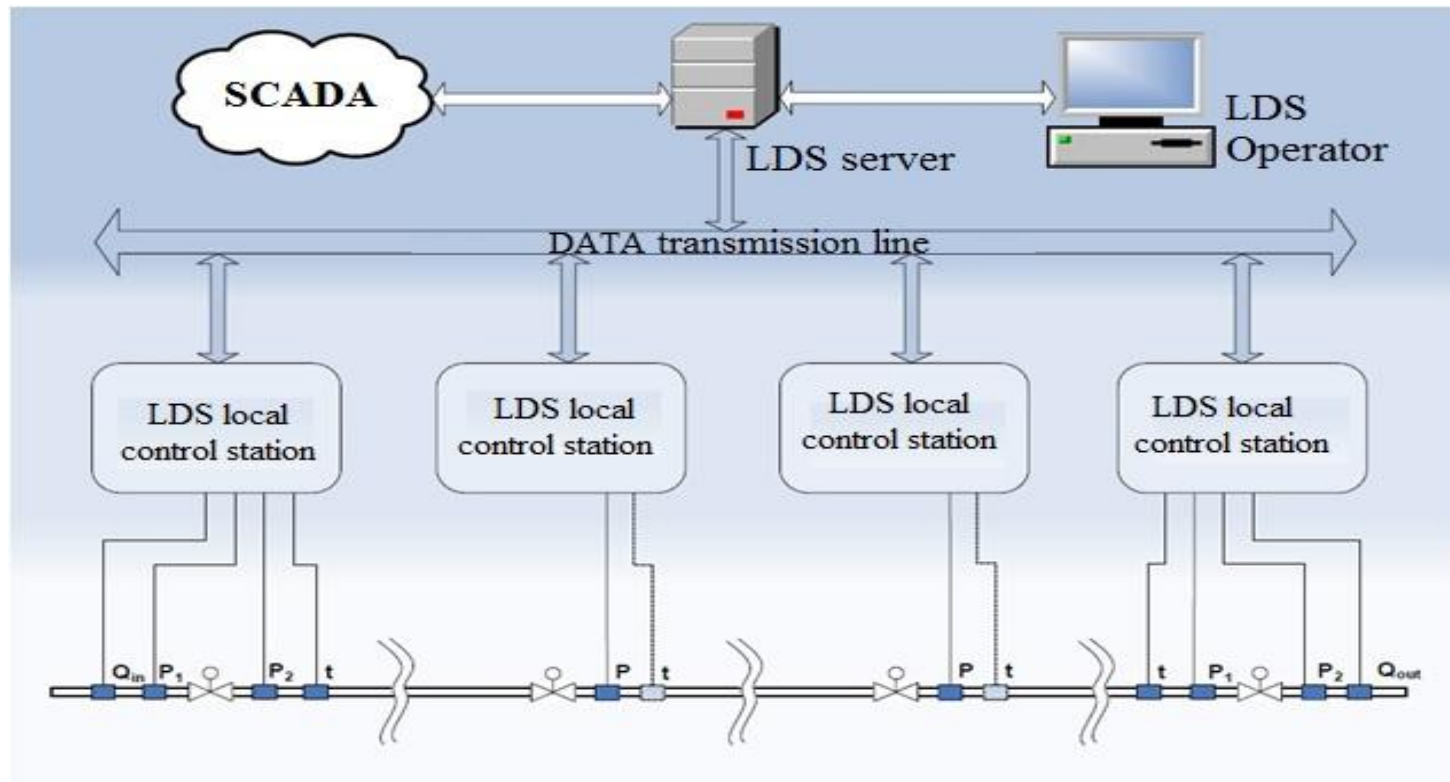


Application of CUF at Leak Detection Systems (LDS).



- Experience in applications of CUFs at LDS – more than 20 years in Russia
- CUFs used at LDS systems, based on volume balance control in the pipeline, which differs from LDS systems, based on registration of the pressure wave.

Application of CUF at LDS (contin.)



Volume balance method provides detection of a leak equal to 0.75 – 1% from total flow. For instance, for a pipeline with D500 and flow 1100 m³/hour, the LDS will detect ~ 8 m³/hour.

CUFs also control sound speed in the measured medium, which in turn depends on the pressure. The pressure wave from the leak will be detected. Two synchronised CUFs separated by 100 km will be able to measure the leak location with accuracy up to 30 m. The lower the leak volume – less accuracy of the location determination.

Application of CUF at LDS (contin.)

Is it Easy to Install and Use:

- No stopping of flow or operation is required
- No change to Piping is required
- LDS Operator Station is Self Alarming-Teaching
- Real Time Data communicated anywhere
- Data archived for subsequent review
- Adaptable to existing data communication systems
- Segment Length Determined by Environmental Considerations

Summary and Conclusions for Wavelab.Tech LDS applications

- Wavelab.Tech LLC Clamp-On Ultrasonic Flowmetering technology applicable for:
 - Rapid and Economical Installation on Any Pipeline
 - Wider Range of Operating Conditions
 - More Sensitive and Faster Leak Detection
 - Highly Accurate and Immediate Leak Location
 - Free of False Alarms
 - Available for Gas, Crude Oil, Refined Products and Liquefied Gas

Other applications: municipal water metering, municipal heating energy metering, metering at building air-conditioning systems, etc.

- Municipal heating plants
 - Heated water metering from heating plants to the customers.
 - Water metering plus temperature control provides energy metering.
- CUFs application in the air-conditioning systems of buildings – this application is very critical in countries with high temperature climate.
- Water use and wastewater treatment
 - wastewater treatment and metering of the purified water
 - sewage metering
 - metering at desalination plants
 - metering of cold and hot water delivered to the customers.



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Thank you for your attention!