

PSINessi

Leak Detection and Location



The safe operation of pipelines requires the monitoring in view of possible leaks. Loss of product and environmental pollution have to be limited to a minimum.

PSI has developed various methods of leak detection that address the requirements of specific pipeline operation. These procedures are independent from one another and can be implemented alone or in combination with others.

The leak detection and location system developed by PSI can either be integrated with the SCADA system PSIControl Oil or coupled via standard interfaces such as OPC to third party SCADA systems.

PSI has many quality references for crude oil, mineral oil products and chemical products (petrol, diesel, propylene, ethylene, etc.) and gas (e.g. hy-

drogen) pipelines as well as transport pipelines for water.

The following leak detection methods are available; they have all been approved by TÜV, the technical inspection authority:

Line Balance

Based on a dynamic pipeline model, the quantities flowing in and out as well as changes in pipe inventory (e.g. because of changes of pressure) are balanced. This balancing is done using different averaging times.

This procedure requires the exact metering of all inflows and outflows. Large leaks are detected in a short period of time, small leaks in a longer period.

Due to the dynamic model, this procedure also supplies excellent results in transient conditions.

Leak Location by Pressure Gradient Intersection

The dynamic pipeline model determines the expected pressure profile based on the actual state of the pipeline (valve positions, pump speed, line inventory, etc.). This profile is then compared to the profile derived from the pressure measurements.

In the case of a leak, the two profiles will differ. The difference will be most significant at the location of the leak.

For precise location, a sufficient number of pressure measurements along the pipeline are required.

Pressure Drop Analysis

When a leak spontaneously appears, starting from this location a negative pressure wave arises and propagates at sonic speed in both directions along the pipeline.

The two neighbouring stations on either side of the leak will register this pressure drop with a high resolution in time.

In steady state conditions and with well known sonic speeds, this method can detect and locate a leak with a high degree of accuracy.

Tank Level Comparison

The flow paths within the pipeline system are determined and a balance for the active tanks is calculated.

Small leaks can be detected by monitoring a timeframe of several hours.

This method does not require flow meters at the beginning or end of the pipeline. Instead, the tank levels and valve positions within the tank farm must be known.

Transient Model Pressure Monitoring

This leak detection method is based on a transient model, including all parts of the pipeline system.

Border pressure measurements are used to connect this model to the reality. A leak within the pipeline system provokes a significant discrepancy between measured and calculated pressure values. This effect is used to detect and confirm a leak.

No flow meters are required. This method is effective during steady-state and transient operation.

Monitoring of Pressure Difference

This procedure is used during pipeline stand-still. After sufficient calming and temperature adaptation of the pipeline, all valves are closed.

The monitoring of pressure differences between both sides of a valve allows detection of loss of the size of litres.

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