

Atmos Rupture Detector

A highly reliable rupture detection module that provides the confidence to quickly shut-down a pipeline in the event of a rupture

The challenge

A rupture is a split in a pipeline that requires an immediate shut down. The devastation caused by pipeline ruptures can be extensive and expensive:

- Loss of life
- Damage to the environment
- Clean-up costs
- Fines

Conventional leak detection methods search for small leaks as well as ruptures. Rupture detection is a backup to the existing SCADA system that is designed to stop pumping should a pipeline rupture occur. The operator could try to restart the pipeline believing that the pump has just tripped, spilling more product through the ruptured pipeline.

Events such as instrument failure or a hydraulic anomaly can cause a false alarm. The operator has little time to confirm a leak before acting to shut down the pipeline.

A pipeline shut down is expensive, it loses revenue, and the emergency response costs are extremely high. To maintain operator confidence a rupture module must be highly reliable, and never fail to alarm when a rupture occurs.

A rupture detection module should:

- Not false alarm during any pipeline operations
- Detect ruptures quickly
- Detect a rupture irrespective of its location on the pipeline
- Alarm even when a rupture trips a pump

A rupture alarm should be treated differently to a leak alarm

API 1175 states that potential leaks requiring immediate shutdown are *'rupture alarms or rupture indications (for example if a unit trips at stations due to low pressure)'*.

A leak detection system is designed to detect the smallest leak in the shortest amount of time. Rupture detection is designed to detect the unique signature that occurs with a high volume, or high rate of product release.

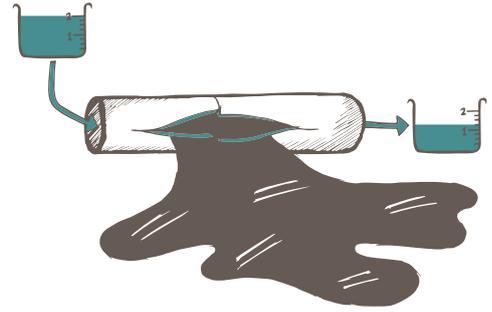
Rupture detection should be highly reliable, allowing the operator to confidently shut down the pipeline immediately minimizing damage.

Why Atmos Rupture Detector is extremely reliable

The rupture module is designed to make the final decision on the occurrence of a pipeline rupture.



Optimize the rupture module on each pipeline to detect the smallest loss that can be detected with high reliability



Atmos Rupture Detector has four separate algorithms to detect ruptures, for a highly reliable system. A rupture occurrence not covered by one algorithm will be detected by another of the four algorithms.



- Detects near pump stations where the product is easier to pump



- Detects on pipelines that can go slack - what comes out is less than what goes in



- Dynamic model analysis (DMA) pattern recognition can detect ruptures on all areas of a pipeline



- Pressure difference analysis (PDA) compares intermediate pressures along the pipeline to detect ruptures on all areas of a pipeline

Scenario	Low KL	Invent.	DMA	PDA
1. Leak at inlet, no trip, horizontal, well packed	✓	✓	✓	✓
2. Leak at inlet, trip, horizontal, well packed	✓	✗	✓	✓
3. Leak at middle, no trip, horizontal, well packed	✗	✓	✓	✓
4. Leak at outlet, no trip, horizontal, well packed	✗	✓	✓	✓
5. Leak at inlet, no trip, large elevation, well packed	✓	✓	✓	✓
6. Leak at inlet, trip, large elevation, well packed	✓	✗	✓	✓
7. Leak at middle, no trip, large elevation, well packed	✗	✓	✓	✓
8. Leak at end, no trip, large elevation, well packed	✗	✓	✓	✓
9. Leak at inlet, no trip, large elevation, slack	✓	✓	✗	✗
10. Leak at inlet, trip, large elevation, slack	✓	✗	✗	✗
11. Leak at middle, no trip, large elevation, slack	✗	✓	✗	✗
12. Leak at end, no trip, large elevation, slack	✗	✓	✗	✗
13. Horizontal, slack	✓	✓	✗	✗
14. Multiple slack start	✓	✓	✗	✗

Figure 1 shows a rupture at the start of the pipeline with no pump trip (scenario 9). The pipeline has a wide variation in the elevation profile, and there is the possibility of slack conditions. The rupture is detected by the 'Inventory' and the 'Low KL' algorithms of the rupture module.

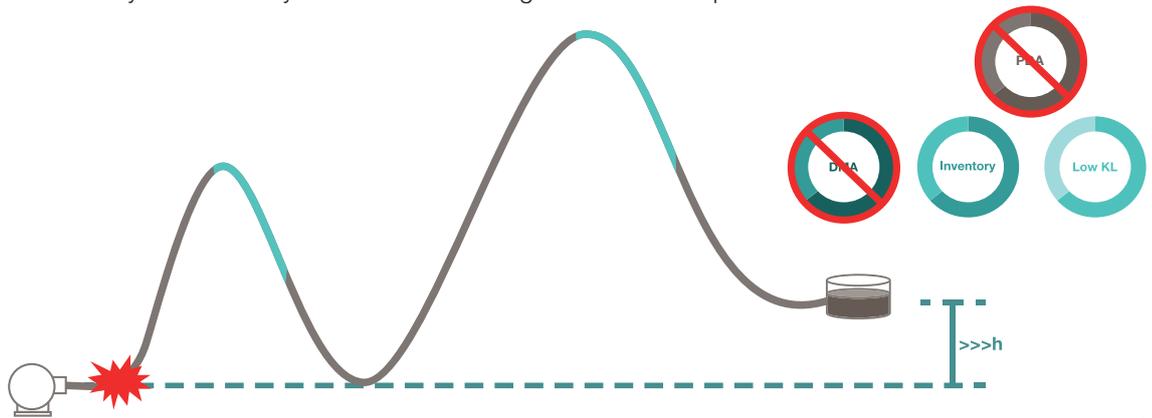


Figure 1

In Figure 2, there is a rupture towards the end of the pipeline with no pump trip (scenario 3). The pipeline is flat and well packed. The rupture would be detected by the 'DMA' and the 'Inventory' algorithms of the rupture module.

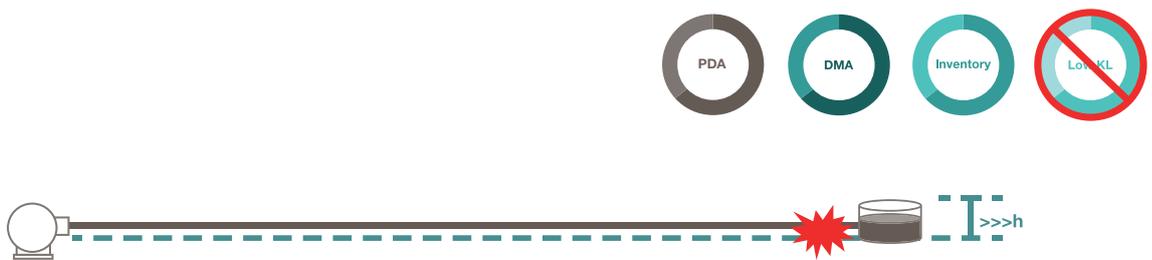


Figure 2

Atmos Rupture Detector can be installed as an upgrade to an existing Atmos Pipe installation, or as a standalone option. These options provide greater security, assuring the immediate shutdown of the pipeline in the event of a rupture alarm.

Atmos Rupture Detector is included as an option in the latest releases of Atmos Pipe and Atmos Wave Flow leak detection systems.

Atmos Rupture Detector was tested with data from a variety of different pipeline types and with data from real ruptures that occurred in the past to assure the high level of confidence that a rupture will be detected.



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About Atmos International

Founded in 1995, Atmos International provides pipeline leak and theft detection, simulation technology, instrumentation and engineering services to the energy, water and associated industries. Atmos is the first choice of most pipeline companies worldwide, and is extensively used by major operators like Shell, BP, ExxonMobil, Petrobras, Enbridge and Total. With associated offices in the USA, China, Russia, Singapore, Indonesia, Colombia, Ecuador, Peru and Costa Rica, and local agents in 28 countries, our multi-cultural and multilingual team is dedicated to effective global support for the lifetime of our products all around the world.

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