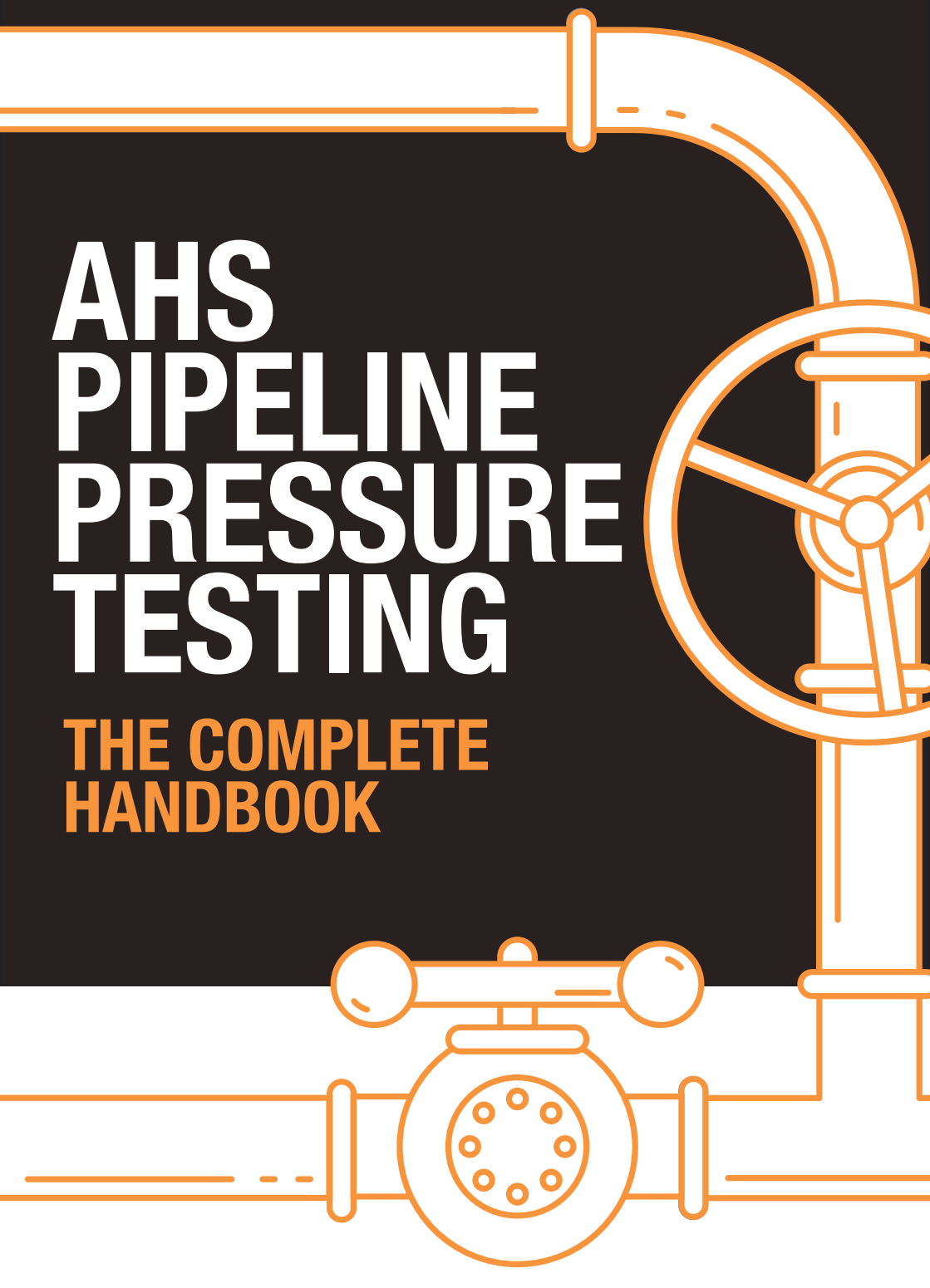
AHS PIPELINE PRESSURE TESTING

THE COMPLETE HANDBOOK



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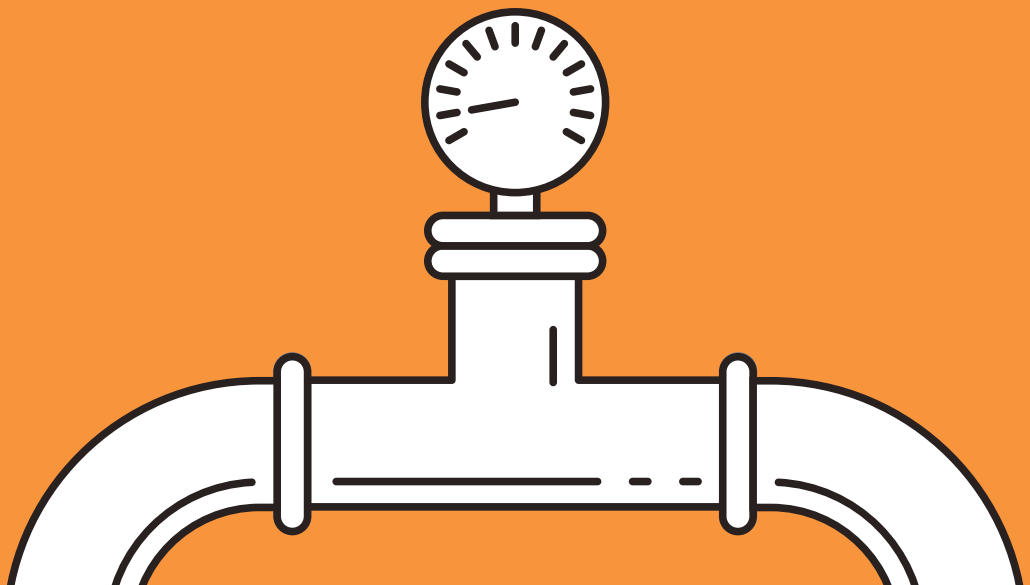



AHS
PIPELINE
INNOVATION
YOUR PARTNERS FOR
SAFETY,
EFFICIENCY, &
COMPLIANCE

INTRODUCTION

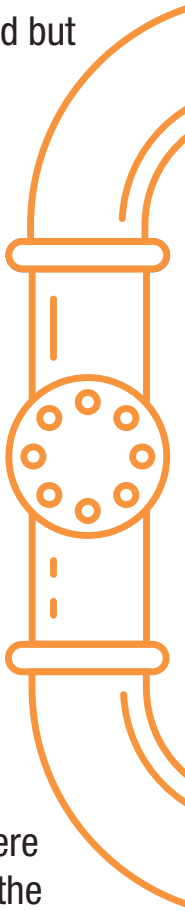
Hydrostatic pressure testing is an essential part of the pipeline commissioning process and is an industry requirement for any contractor installing or repairing potable water and rising mains.

Without adequate testing, faults go unidentified, creating expensive and time-consuming problems in the future. During a test, a section of pipework is exposed to water pressure levels above its usual operating pressure for a defined period of time. The integrity of the pipework is then tested by monitoring changes in pressure, temperature, and several other variables.

At AHS, we combine expertise, independent analysis, and certification together to offer the complete pressure testing package. With specialist equipment that is designed, built, and maintained by our own engineers, we offer a safe and effective solution for all testing requirements. Our unique 'remote intervention' approach also gives the test operator access to onsite assistance from our PT analysts, allowing them to work with our clients to identify and resolve test failures safely and efficiently.

1. PRESSURE TESTING TYPES

There are four types of pressure test: Type II, Type I, 10-Minute or Service Connections. The type of test method required primarily depends on the material of the pipe being tested but can also be influenced by other factors.



TYPE II

The Type II test is designed for pipe materials that exhibit visco-elastic behaviours, such as polyethylene. These materials expand under high pressures, a process known as 'creep'. The flexible nature of these materials makes it difficult to determine whether pressure loss during a test is the result of water leakage or pipe expansion. Other factors such as temperature can also influence the amount of expansion, further complicating the test analysis process.

A Type II pressure test begins by bringing the pipeline up to system test pressure (STP) where it is left for a specified time-period based on the pipe's ramp-up time. The pressure loss during the test period is recorded and then resolved through a series of algorithms.

TYPE I

The Type I test method is used on rigid pipe materials that do not display creep such as ductile iron, stainless steel or glass reinforced plastic (GRP). The method measures the pressure loss from a pipeline by recording the volume of water that must be added to maintain system test pressure (STP).

10 MINUTE TEST

The 10 Minute test method is used on rehabilitated pipelines installed using trenchless techniques, such as sliplining or pipe bursting. It is commonly used in situations where disruption to the water supply must be kept to a minimum, such as for water mains supplying residential areas.
A specialist pump is used which can accurately maintain STP whilst measuring the volumes of water added to the pipeline. This is used in conjunction with a visual inspection of the exposed joints. This method is only appropriate for pipelines up to 180mm in diameter and 200m in length.

SERVICE CONNECTION

A Service Connection test is used for connections running from a water main to residential or commercial properties, measuring approximately 25mm to 32mm in diameter. It follows the same principles of a modified Type II test.

2. PRESSURE TESTING EQUIPMENT

Careful consideration needs to be given to the choice of equipment used for the pressure test to be undertaken. At AHS, our pressure testing services provide you with all the necessary equipment for your testing requirements. For the majority of pressure tests, there are five key pieces of equipment required:

TEST PUMP

The test pump is used to achieve and maintain STP. For Type II tests, the pump must be able to bring the pipeline to STP within a maximum of 30 minutes. For Type I testing, the pump must be able to add volumes of water in small increments in order to accurately maintain STP.

FLOW METER

The flow meter measures the amount of water added to the pipeline by the test pump. An accurate flow meter is critical for calculating the amount of air in a pipeline during a Type II test. It must have a resolution of 1l or better, and be compatible with the AHS data logger.

PRESSURE GAUGE

The pressure gauge allows the onsite operative to monitor the pipeline's pressure throughout the test. AHS pressure gauges are calibrated and traceable through UKAS, with a resolution of 0.01bar.

DATA LOGGER

The AHS data logger collects and records all the necessary test data. It consists of:

- Data recorder and modem
- Pressure transducer with a minimum accuracy of 0.25% across the full scale
- Temperature probe
- GPS locator

The data is collected in approximately 10 second increments and is directly sent to our pressure testing team for real-time analysis.

PIPE ENDS

Pipe ends are used for isolating the pipework to be tested. These must have a pressure rating of no less than 1.5 times the PN rating.

3. HEALTH & SAFETY PRECAUTIONS

When performed incorrectly or without due process, hydrostatic pressure testing can be potentially dangerous. When there is excess air present in the pipeline, an unexpected pipe failure can cause damage and injury. It is therefore incredibly important that the relevant health and safety regulations are followed:

Precautions that must be applied include:

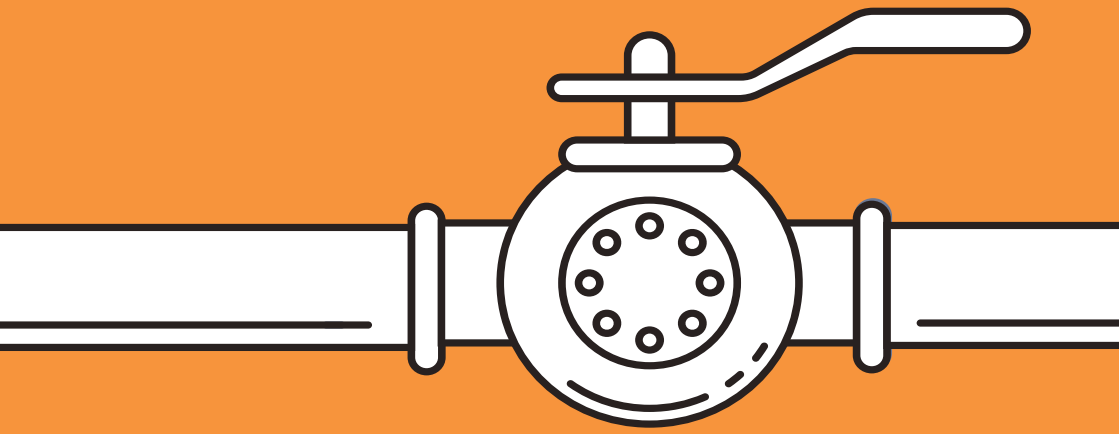
- Only approved and safety-briefed operatives are allowed near any exposed part of the pipeline when it is under pressure
- A safe zone must be created around the pipe, cordoning off the test area using barriers
- Warning signs must be erected to indicate that a pressure test is in progress
- Operatives conducting the test must be in communicatioon at all times. This is particularly important on long test lengths
- The test equipment must be positioned to the side of the pipe end, not in front

THE DANGEROUS EFFECT OF AIR ON PIPELINE PRESSURE TESTING

To minimise risks and ensure effective results, air must be removed from the pipeline prior to testing. When placed under pressure, air contains significantly more stored energy than water. A pipe failure can result in the sudden release of this stored energy, potentially causing damage and injury.

The presence of air can also distort the interpretation of pressure decay in PE pipes, masking the evidence of leaks and invalidating the test results.

To conduct a safe and valid test, air should not exceed 6% of the pipe volume. Tests containing greater than 6% air should be abandoned immediately in the interests of health and safety.



4. SWABBING

When it is not possible to remove air through strategically positioned valves, swabbing is essential to remove as much air as possible from the pipeline.

The process involves inserting a soft foam swab at the lowest point of the pipeline and pushing it along whilst filling with water, forcing residual air out through open valves at the highest point. All washout valves must remain closed. This process must be carried out without interruptions to avoid any water passing the swab or the swab collapsing in on itself.

Once the swab has reached the end of the pipe section, the water supply must be immediately turned off and disconnected. This ensures there is no build up of pressure in the pipe. The end valve is closed, and the swab is left in the line until the test is complete. Some water companies require that the swab is removed fully from the pipeline before testing. Please confirm this with your client if you are unsure.

5. THE TESTING PROCESS

*Please remember, **NEVER** begin testing without notifying our team. This prevents us from collecting vital data designed to keep you safe and compliant throughout the process.*

TYPE II

Type II testing cannot commence on any pipeline that has been subjected to pre-pressurisation (any pressure above the static head).
Where pre-pressurisation has occurred, the analyst will advise on the length of time the pipe must be left to relax at ambient pressure before testing.

Stage 1 – Achieving STP (System Test Pressure)

The first stage of a Type II pressure test involves bringing the pipeline up to STP, a process known as the 'ramp-up'. Before the ramp-up can begin, the operative must contact an AHS test analyst. The analyst will use the information provided, such as the pump size and pipe volume, to calculate the ***estimated*** ramp-up time.

The ramp-up time is crucial for calculating the amount of air in the pipeline, and therefore requires close observation to ensure safety standards are being met. The maximum allowable duration to reach STP is 30 minutes.

The ***actual*** ramp-up time and air content are then used to calculate the required test duration; either a minimum of 1-hour or 20 times the ramp-up time (<4% air), whichever is greater. If the air content is greater than 4% but less than 6%, a longer test duration is required (minimum of 1-hour or 30 times the ramp-up time).

The data logger should be located at the lowest point of the pipe section. Where this is not possible, the pressure reading displayed on the digital gauge must be reduced by **0.1bar** for every meter the data logger is above the lowest point on the pipeline. This will give you the correct, adjusted pressure reading.

EXAMPLE
STP to be reached = 15bar
Test equipment located 5m above the lowest point
Adjusted gauge reading 14.5bar
14.5bar + (0.1 x 5) = 15bar

SAFETY NOTE
If the pipeline does not reach STP in the estimated time provided by AHS, this is often an indicator of excessive air, a leak, or an error in the test set up.

The test must be immediately abandoned, and the operative must contact an AHS analyst as soon as possible. The PT analyst will help to identify the problem.

Stage 2 - Test Monitoring & Analysis

Once the pressure test is underway our analysts at AHS will monitor progress throughout the test duration. The analyst will contact the lead operative if the test data indicates any of the following:

- Air content breaches the 6% safety level. Any test with air content of 6% and above will be aborted immediately
- An extended test time is required to allow for air content >4% and <6%
- Operator errors or environmental changes that are likely to affect the outcome of a test
- A leak is detected in the pipeline

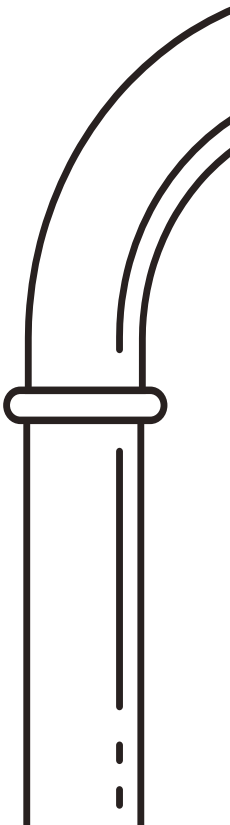
Retesting

Before retesting, PE pipes (or any material that exhibits creep) must be left to relax at ambient pressure. The PT analyst will advise on the length of time required. It is therefore crucial that our analysts can intervene at the earliest signs of test failure to minimise the delay before retesting.

Stage 3 – Completing the Test

When the test is complete, the AHS analyst will contact the lead operative to confirm the outcome of the test. On confirmation of a completed test, the pressure should be released at the highest point in the pipeline. This prevents a vacuum that could pull the swab back down into the pipe.

No further work to the main must take place (e.g. chlorination or reconnection) until the 'Test Pass' confirmation is received. This is to ensure that the main is left charged but not pressurised.



TYPE I

Stage 1 – Soaking (Preliminary Test Preparation)

For ductile iron pipelines, the first stage of a Type 1 test involves 'soaking' the pipe. This prepares the pipeline for testing by bringing it up to its working pressure for a minimum of 24 hours. By doing so, this allows some of the water volume to be absorbed into the concrete lining of the pipe. This absorption results in a pressure loss in the pipeline that could affect test results if not accounted for prior to the test. Other pipe materials do not require this process.

Stage 2 – Conditioning (Preliminary Stabilisation)

Once the pipeline has been soaked, it can be brought from its working pressure up to system test pressure (STP). STP is then maintained for either 1 hour (concrete-lined ductile iron) or 15 mins (GRP or welded steel), depending on the pipe material.

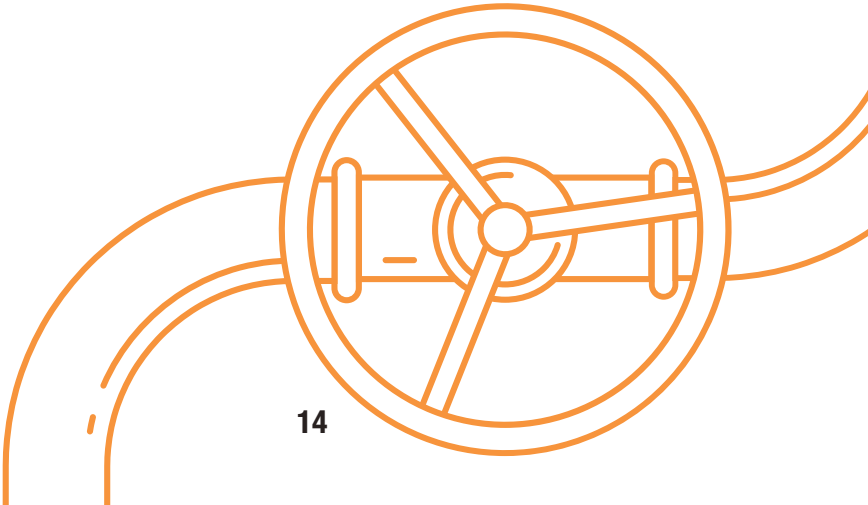
Conditioning is essential prior to starting the test as it allows for any movement to take place between the pipe sections. This movement can result in a loss in pressure, so it is important that the pipeline is stabilised before the test begins.

Stage 3 – Test Monitoring & Analysis

Traditionally, a Type 1 test involves bringing the pipeline to STP and leaving it for one hour, after which water is added to the pipeline to bring it back to STP. The volume of water added is siphoned off and measured to indicate either a test pass or fail. However, the issue with this method is that there is no indication about the performance of the pipeline prior to the end of the test.

At AHS, our unique **Water Added Machine** allows for a more intuitive approach to type 1 testing. The device precisely measures the volume of water added to the pipeline at the required intervals.

Before the test can begin, a PT analyst will inform the lead operator of the maximum volume of water which can be added to the pipeline, and at what intervals, in order for the test to pass. This allows the operatives on site to monitor test progress and spot early signs of test failure.



Once the pressure test is underway our analysts at AHS will monitor progress throughout the test duration. The analyst will contact the lead operative if the data suggests that the test is not progressing as expected. The PT analyst will work with the operatives to investigate the source of the problem.

NOTE
In small diameter pipelines where the allowable water loss equals 20ml or less, and therefore is difficult to measure accurately, a pressure loss of 0.2bar per hour is acceptable.

Stage 4 – Completing The Test

When the test is complete, the AHS analyst will be in contact with the lead operative to confirm the outcome of the test. On confirmation of a completed test, the pressure should be released at the highest point in the pipeline.

This prevents a vacuum that could pull the swab back down into the pipe. No further work to the main must take place (e.g. chlorination or reconnection) until the 'Test Pass' confirmation is received. This is to ensure that the main is left charged but not pressurised.

10-Minute Test

Designed for use on rehabilitated PE pipelines installed with trenchless techniques, the 10-Minute test provides a rapid and effective solution for pressure testing where the supply disruption must be kept to a minimum. It is applicable on pipes up to 180mm diameter and 200m in length.

The pipe is isolated and filled from an existing main, and once prepared, the specialist 10-Minute test pump and data logger are attached. Rather than measuring the pressure decay, the pump accurately maintains STP by adding volumes of water to the pipeline.

Once STP is achieved, the pipe must be stabilised for 2 minutes, after which the test can commence. Where the pipeline is exposed, the site operatives must also carry out a visual inspection throughout the test. Once the test is complete, a PT analyst will contact the lead operative with the test results.

Service Connection Testing

Designed for use on small diameter connections (25-32mm), service connection testing can detect the very smallest of leaks. Air is removed from the pipeline by creating a negative pressure in the pipe using a specialist test pump. A negative pressure of -0.8 bar is applied to the test section and held for a period of 60 seconds. This pressure is then released, drawing in water from a gravity feed and filling the test section until the reading on the gauge is positive.

NOTE
If the pressure rises above -0.7 bar when holding the negative pressure, there is a leak in the system which should be rectified, and the test repeated.

The pressure is then immediately raised to STP, in no more than 60 seconds. The pump is shut off, and the test pressure is measured and recorded over a period of 15 minutes. Where the pipeline is exposed, the site operatives must carry out a visual inspection throughout the test. The Service Connection testing app will display the results on completion.

6.TEST CERTIFICATION & DATA MANAGEMENT

As soon as a ‘test pass’ is achieved the test operative will be informed and a pass certificate created on the PIPE (Pipeline Installation Performance Evaluator) data dashboard to certify compliance.

AHS test certficates are comprehensive and provide a detailed record of all data collected during the test. They also display both the raw data and algorithms used to calculate the test result, creating a complete and transparent picture of the test outcomes.

The PIPE dashboard is designed to allow our customers to monitor long-term trends in pipe testing performance. Its easy-to-use interface allows customers to filter completed tests by a number of variables such as location, operative, test outcome, and much more. PIPE also allows customers to track reasons for test failure, helping to identify areas for improvement.

For managers and site teams requiring additional assistance, AHS provides a number of training opportunities both on and off-site. Call us on **0333 567 3210** to find out how we can help you improve your pipeline comissioning processes.

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PIPELINE INNOVATION

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