

AIR TESTING Technical Information



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Scope

The following guidelines are applicable to the air testing of circular concrete flexibly jointed trench pipes, up to and including DN750. The main intended use of these pipes being the conveyance of sewerage, rainwater and surface water under gravity or occasionally at low pressure in pipelines that are generally buried.

Introduction

The guidelines in this document are in line with Sewers for Adoption 7th Ed (August 2012).

There are other specification documents which cover testing of pipelines:

- Civil Engineering Specifications for the Water Industry
- Specification for Highway Works
- BS EN 1610 'Construction and Testing of Drains and Sewers'

The underlying principles, methods and techniques are the same for all air tests.

Sewers for Adoption says:

'Sewers shall be tested after they are jointed and before any concreting or backfilling is commenced, other than such as may be necessary for structural stability whilst under test' (Clause E7.3.1).

'Sewers up to and including 750mm nominal diameter shall be tested by means of an air or water test' (Clause E7.3.2).

'An air test shall be carried out after the backfilling is complete' (Clause E7.3.3).

And

'Failure to pass the test shall not preclude acceptance of the pipeline if a successful water test can subsequently be carried out . . . ' (Clause E7.3.4).

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1 AIR TESTING

Air testing is a quick and simple way of checking a pipeline as installation proceeds. Correct assembly of joints, workmanship and site handling damage would be checked by such a test.

Stanton Bonna recommend that this test is done every 3 - 5 pipes before backfilling and then at the finish preferably before both manholes have been constructed.

The requirements of the test are that the pipeline is pressurised with air to 100mm of water in a 'U' tube (Manometer) connected to the system.

The test is performed by sealing and pressurising a discrete length of pipeline with air to support 100mm of water. The test is satisfactory if the column of water does not fall below 75mm with 5 minutes.

Sewers for Adoption says:

'The sewer shall be accepted if the air pressure remains above 75mm head of water after a period of 5 minutes without further pumping after a period for stabilisation' (clause E7.4.1).

An air test failure does not necessarily indicate a pipeline failure. The failure could be due to:

- the equipment
- insufficient time for stabilisation
- a relatively small volume of air in the pipeline.

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1 Understanding the air test and its variants

For the pressure in the pipeline to reduce, air must escape. Thus the test is indirectly measuring a percentage loss of air in a given time.

If a DN450 stub, rocker and full length (~ 3.5m length) were tested and lost 100cm³ of air, the percentage loss would be ~ 0.02%.

If another full length pipe was added (~ 6.0m length) the same loss of air would be n 0.01%.

Thus the test is more severe on a short run of small diameter pipes than a longer run of larger diameter pipes.

- The air test specifies a constant requirement regardless of diameter and length of the pipeline (volume).
- Temperature & weather has a big effect on the test and stabilisation.

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a) Test equipment.

The air test is very searching but is quicker and more convenient than the water test. It will find leaks that water may not.

An excessive drop in pressure in the air test is more likely to indicate a fault in the test equipment or assembly of the pipeline itself.

Therefore, we advise to check the test equipment first:

- check the seal of the Inflatable Stoppers against the inside of the pipe;
- check all connections coming off the stoppers (some have $\frac{1}{4}$ turn taps that need to be turned off),
- check the tube that connects the 'U' gauge the stoppers for splits.
- check the inlet valve during the test. A common fault is to leave the inflator connected to the open inlet valve which results in a leak.

b) Volume / Size

Consideration to the volume sensitivity of air testing must be taken in to account. Just passes or marginal failure at the start of a line of small diameter pipes is not uncommon but as more pipes are laid and the volume increases the test will get better.

Failure to pass this test is not conclusive, when a marginal fail does occur try allowing more time for stabilisation (this is particular relevant in cold weather).

On small diameter pipes an air test should not be carried out before the first full length pipe has been laid, e.g. stub, rocker and full length all tested together.

Short branch drains connected to a main sewer between manholes can be capped and tested as one system with the main sewer / drain. Long branches should be tested separately; gullies should not be included in this type of air test.

c) Stabilisation

For the air test to be applied correctly the air in the pipeline must have stabilised. Stabilisation is affected by temperature and degree of moisture in the pipeline.

One method of stabilisation is to maintain the air pressure in the pipeline at 120mm for a period before performing the test. Another method is to introduce water into the pipeline before replacing the stoppers. This will increase the moisture in the walls. These techniques may be combined.

Failure to pass this test is not conclusive, when marginal failure does occur try allowing more time for stabilisation (this is particular relevant in cold or very hot weather).

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d) Environment / Temperature

Where pipelines are below the water table the air test is not effective due too possible infiltration. The only way around this is for continued dewatering of the ground around the whole pipe line. Alternatively an infiltration test can be done.

In very hot weather the water in the 'U' tube can sometimes rise. This is due to expansion of air inside the pipeline which is quite difficult to combat and can take a long time to stabilise. This can be exaggerated by leaving several pipes not backfilled and exposed to direct heat from the sun.

Even more difficult to judge, is a leak in the pipeline that is smaller or equivalent to the rate of expansion of the air. This will not be detected until the whole pipeline is backfilled and ambient temperature in the pipeline is stable.

During these conditions consider doing a test early morning or late evening. Putting the test on a low pressure of around 60mm before breakfast or lunch, then providing the water has not been blown out of the manometer ('U' gauge), a standard air test could be done straight after your break has finished.

Very cold weather gives its own problems of stabilisation as a drop in temperature of 1°C can result in a significant loss of pressure which would mean a failure. Allowing a longer period for stabilisation will help this result. If the pipes get a frost on them or are left outside in temperatures of below freezing this can mask air test problems and will take a very long time for any introduced air to stabilise. Keeping pipes covered and insulated may help. Keeping pipes under cover is not usually feasible but worth looking at.

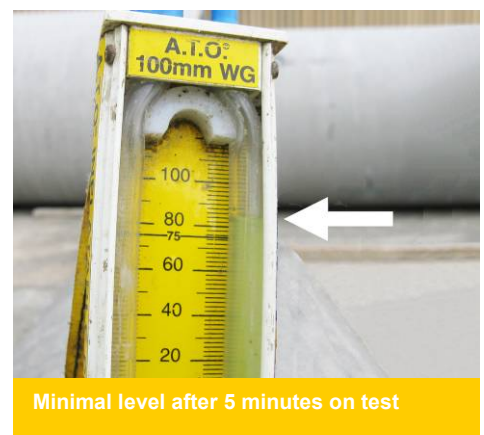
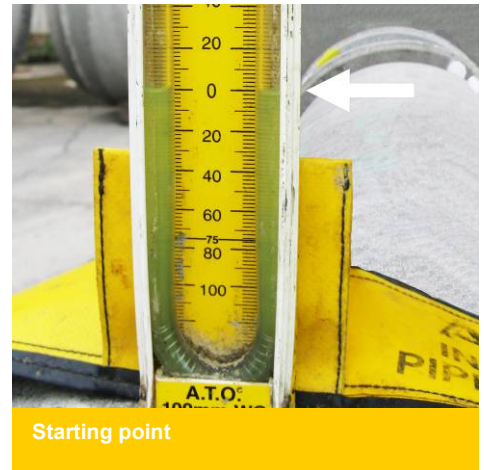
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2 How to air test the pipeline

The following air test procedure is a recommended guideline as supplied by Stanton Bonna Concrete Ltd. The times and pressures indicated are in line with Sewers for Adoption 7th Edition (August 2012). The same technique can be used for other guideline but the times and pressures may differ.

1. Ensure there are no snots, roughness or debris on the pipe wall where the inflatable stopper will seal against.
2. Seal each end of the pipeline with neoprene faced inflatable stoppers (Milltest /ATO Type only) inflating to the manufacturers recommended pressure.
3. Make sure you have the correct type of manometer ('U' gauge). When sat vertical the water is level with the 0 mark (see top image on the right). Connect the manometer tube to the "out test" tap of the inflatable stopper.
4. Position the manometer where it is clearly visible and in a stable position. Some have spikes to hold to the trench wall others may need to be held down with the aid of a heavy object.
5. Connect pump to the stopper and pump until the internal pressure shows 110 to 120mm on the manometer.
6. Allow a minimum of 5 minutes for stabilisation of the air pressure, longer may be needed in cold or very hot weather. Stabilisation time is dependent on temperature, volume, weather and how much of the pipeline has been backfilled.
7. After stabilisation time adjust the pressure to 100mm by either introducing further air or by bleeding off any excess pressure.
8. Observe the fall in indicated pressure over a 5 minute test period. The residual pressure should be not less than 75mm.
9. In extreme conditions it may be necessary to repeat steps 5, 6 & 7 several times before a good test is achieved.

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3 Suggestions

- For better visibility of manometer results a 50/50 mix of water and skimmed milk or a weak dilution of vehicle screen wash can be substituted for the water but make sure proper hygiene precautions are taken. Please be aware that these two solutions will have a slightly different specific gravity than 100% water. Although the effect is minimal a re-test using just water should be done where the test is a just pass or just fail. Vegetable dyes tend to stain the manometers clear tube.
- Spraying a washing up liquid and water solution on to the neoprene outer of the inflatable stopper before placing into the pipe will give a better seal and an early indication of any leakage between the stopper and the pipe. This will be apparent by the presence of bubbles, be patient the bubbles can sometimes take a little time to develop. The better the quality of the washing up liquid the better the quality of the bubbles.
- Never place the inflatable stoppers at the very end of the pipes, seat 50mm or so back from the end. If you find it difficult to get a seal between the stoppers and the pipe bore try putting some water based pipe lubricant on the outside of the stoppers or try rubbing the bore with a brick rub or Carborundum stone to smooth out any imperfections.
- Do not introduce air into the pipeline by mouth, always use a pump or compressor.
- The neoprene seal on the ATO and Milltest type stoppers is much more tolerant and forgiving of the surface texture in machine made pipes. Nylon, multifit, unifit air bags and screw up or camlock stopper can be unreliable.
- Pipes that are damp will always give a better test than dry pipes. If a pipeline marginally fails an air test the introduction of water into the pipeline could help and may be the difference between a failure and a pass. One way to do this would be to leave the downstream stopper in and throw a couple of buckets of water down the pipeline and replace the upstream stopper. Leave for as long as practically possible (the longer the better) and re-test.
- Laying a pipeline manhole to manhole before air testing is very risky and if a problem is found it can be very expensive to rectify. This is not considered best practice. Stanton Bonna recommend testing every 3-5 pipe as laying progresses.

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