

Our Ref: WRN/17.2
30 December 2016

Owners, Developers, Architects, Engineers, Contractors, and Builders

Dear Sir/Madam,

WATER/AIR TIGHTNESS TESTS FOR SANITARY PLUMBING/DRAINAGE SYSTEM

PUB has previously (WRN/17.2 dated 29 Apr 16) reminded QPs and sanitary plumbers to submit water/air tightness tests results for sanitary plumbing system with the QP's completion form (PUB-BPU-COMPOFWORK).

2. There has been some queries on how the tests should be conducted. We have worked with the Singapore Plumbing Society (SPS) to standardise the air tightness test procedures. The procedure and forms for reporting of test results are shown in Annex A, B1 & B2.
3. In the standardised testing, high pressure air test is first carried out on the sanitary piping including the main building stack before enclosing the pipes in service duct/shafts or above ceiling boards. Any leaks detected can still be rectified if found. This needs to be coordinated with the construction sequence floor by floor. Subsequently, after all the sanitary appliance and fittings have been installed, a low pressure air test or water test shall be carried out to check air tightness of the sanitary appliance installations.
4. The above standard dual stage air test will need to be carried out for all high rise development given PUB approval from 1 Apr 2017. In the interim period, low pressure air test or water test of the sanitary plumbing system shall continue to be carried out for all projects in advanced construction stage where sanitary pipes are already enclosed in ducts/shafts and sanitary appliances are already installed.
5. Single owner landed residential development and A&A works are exempted from the high pressure air test and shall continue with the current water or low pressure air test to ensure water/air tightness of the sanitary plumbing system.
6. PUB will be conducting pre-TOP site check to audit the water/air tightness test of the sanitary plumbing system during construction stage. QPs will be informed in advance for projects selected for the site audit. If you have any queries concerning this circular, please email us at PUB_BPU@pub.gov.sg

Yours faithfully



TAN CHEE HOON
for DIRECTOR,
WATER RECLAMATION (NETWORK) DEPARTMENT, PUB

Annex A

WATER/AIR TIGHTNESS TESTS FOR SANITARY PLUMBING/DRAINAGE SYSTEM

The water/air tightness test shall be done in accordance with the following procedures to ensure that the completed sanitary plumbing/drainage system is free of leaks.

1. Dual Stage Air Tightness Test of Sanitary Plumbing System

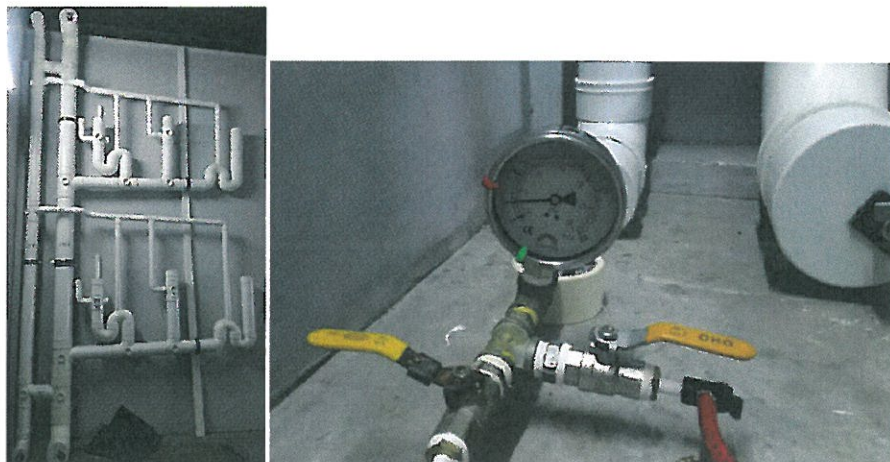
Air tightness test shall be carried out in two stages during development:

- a) Stage 1- A high pressure air test to confirm that all pipes and joints are air tight before they are covered up behind conduits/shafts. This test shall be carried out in sections of the completed pipework for every 2 to 4 floors of high rise development as the work progresses. This will allow any leaks to be easily detected and repaired before the pipes are concealed.
- b) Stage 2- After installation of sanitary appliances to wall and floor outlets, the appliance connections shall be tested for air tightness through a low pressure air test.

1.1 High Pressure Air Test

This test should be conducted when all sanitary appliances are not yet installed and all water traps are dry.

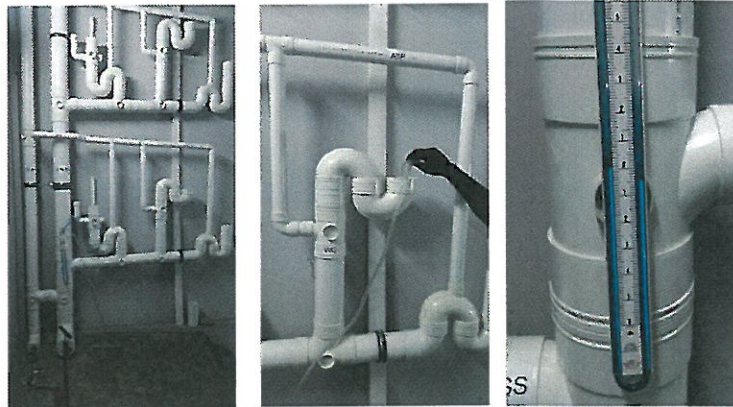
- i. Plug all open ends of the pipes with PVC pipe caps or inflatable rubber plugs.
- ii. Install at one end of the discharge stack under test, a modified pipe-end cap with a pressure gauge and an air inlet valve connected to an air pump.
- iii. Pump air into the pipes till an air pressure of 34kPa (or 5 PSI). Close the air inlet valve and check that the pressure in the pipe can be sustained for 15 minutes after shutting off the air pump.



1.2 Low Pressure Air Test

This test should be conducted after all sanitary appliances are installed

- i. Fill all the floor and WC traps (water seals) with water. Plug any remaining open ends of the pipes with PVC pipe caps or inflatable rubber plugs.
- ii. Insert a flexible hose pass a water seal and pump in air until air pressure of 38mm water is obtained, measured by a water gauge manometer.
- iii. Close the air inlet valve and check that pressure in the pipe is sustained for at least 3 minutes after shutting off the air pump.



1.3 Water Test

In place of the low pressure air test, a water test may be conducted on the section of the pipes/stacks for each floor with the whole sanitary system filled with water up to the overflow level of the lowest sanitary appliance connected to it. No water leak shall be detected.

2. Water Tightness Test of Sanitary Drainage System

For sanitary drainage system laid below ground, water tightness test in accordance with **BS EN 1610** shall be done before covering up the pipes. Fill pipe with water up to the ground level (overflow level) of the upstream manhole, within a maximum pressure of 5.0 m head of water and a minimum pressure of 1.0m head of water measured at the top of the pipe. For inspection chambers, fill with at least 5.0m head of water or up to 10cm below the chamber's cover slab for shallower chambers.

Maintain pressure within 1 kPa of the test pressure by topping up with water. To pass the water tightness test, the amount of make-up water added should not exceed 0.15 lit/m² of pipes wetted surface and 0.40 lit/m² for inspection chambers wetted surface during the 30 min.

Annex B1**Result of Leak Tests on Sanitary Plumbing System**

Project Reference:

Project Title:

Test Method:

*High pressure air test / Low pressure air test/Water test

Block No:	Storey Level: (eg. 1 st Floor, 2 nd Floor)	Unit No: (eg. #02-01, 03-01, etc)	Date of 1 st test of sanitary discharge pipes/stacks, ventilating pipes/stacks, WCs, Floor traps , etc at the unit	1 st test Result (Leak / No Leak) (To specify the point of leak detected)	(if found leak at 1 st test) Date of <u>final retest which shows no Leak</u> in the sanitary discharge pipes/stacks, ventilating pipes/stacks, WCs, Floor traps , etc at the unit
	<i>Example 1:</i>				
102	1 st floor	Common area			
	2 nd floor	#02-01			
		#02-02			
		#02-03			
	3 rd floor	#03-01			
	<i>Example 2: (for typical unit layout, eg HDB flat)</i>				
103	2 nd to 15 th floor	#02-01 to #15-01			
		#02-02 to #15-02			
		#02-03 to #15-03			
		--ditto--			

Tested/Checked by: (Name of plumbing contractor in charge of test)	Signature:	Company & Designation:	Date:
Witnessed by: (Name of QP's authorised representative)	Signature:	Company & Designation:	Date:

Annex B2

Result of Water (Hydrostatic) Tests on Sanitary Drainlines, Inspection Chambers, Sewer, Manholes

Project Reference:

Project Title:

Test Method: Water test method as specified in Clause 13.3 of BS EN 1610:2015.

Section of drainlines/sewers (eg. IC1-IC2, IC-MH); Inspection chamber/manhole	Diameter (mm)	Length of Pipe (m)	Date of test	Water Loss [Pipe: litres per m length; Manhole/chamber: litres per m ²]	Result [Pass/Fail]

Tested/Checked by: (Name of plumbing contractor in charge of test)	Signature:	Company & Designation:	Date:
Witnessed by: (Name of QP's authorised representative)	Signature:	Company & Designation:	Date:
Certified by: (Name of QP and QP's stamp)	Signature:		Date:

Notes:

1. Sewer/Sanitary Drainline:

BS EN 1610 Allowable water loss Calculation	150mm dia pipe	200mm dia pipe
<p>Not greater than 0.15 l/m² during 30 min for pipelines</p> <p>m²- wetted internal surface</p> <p>D- Diameter</p> <p>L- Length</p> <p>Allowable water loss $\leq D*3.142*L*0.15$</p>	<p>Wetted internal area $=D*3.142$ $=0.15*3.142$ $=0.4713 \text{ m}^2 \text{ per m length}$</p> <p>Allowable water loss $\leq 0.15*0.4713$</p> <p>$\leq 0.0706 \text{ litres per m length}$</p>	<p>Wetted internal area $=D*3.142$ $=0.2*3.142$ $=0.6284 \text{ m}^2 \text{ per m length}$</p> <p>Allowable water loss $\leq 0.15*0.6284$</p> <p>$\leq 0.0942 \text{ litres per m length}$</p>

2. Manhole/Inspection Chamber:

The test requirement is satisfied if the amount of water added is not greater than 0.4 l/m² during 30 minutes for manhole / chambers

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