## Vacuum Drainage for Buildings

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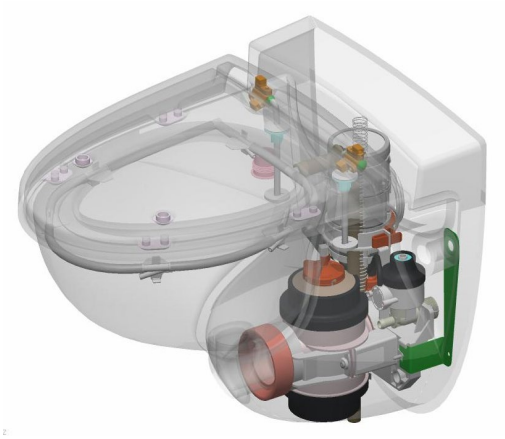
Knowledge and experience about vacuum drainage systems may vary significantly among the professional team members. Some of you may have specified and worked with vacuum drainage on a project, but there are still some myths associated with the operation of the vacuum toilet that we would like to dispel whilst outlining some key facts about the vacuum drainage sanitation.

Most people first encounter with vacuum toilets via aircraft, trains or ships – not the best environment to showcase the technology! Vacuum toilets for buildings are vastly different. They look and feel like a conventional flush toilet, but without the requirement for a flush cistern, as the flushing mechanism concealed with the body of the WC pan. Vacuum toilet fluing is operated pneumatically utilising the pressure difference (vacuum) in the system (so no electrical power is required to be connected to the WC).

Vacuum toilets look and feel like a conventional WCs



All vacuum components are concealed within the body of the pan

The next most asked question, manly based on the experience from aircrafts, is about noise from the toilet. There has been much development focused on the toilet flushing mechanism and the latest vacuum toilets on the market will emit just 67dB. While a standard gravity toilet will emit approx. 70dB, so there is no apparent difference in sound levels.

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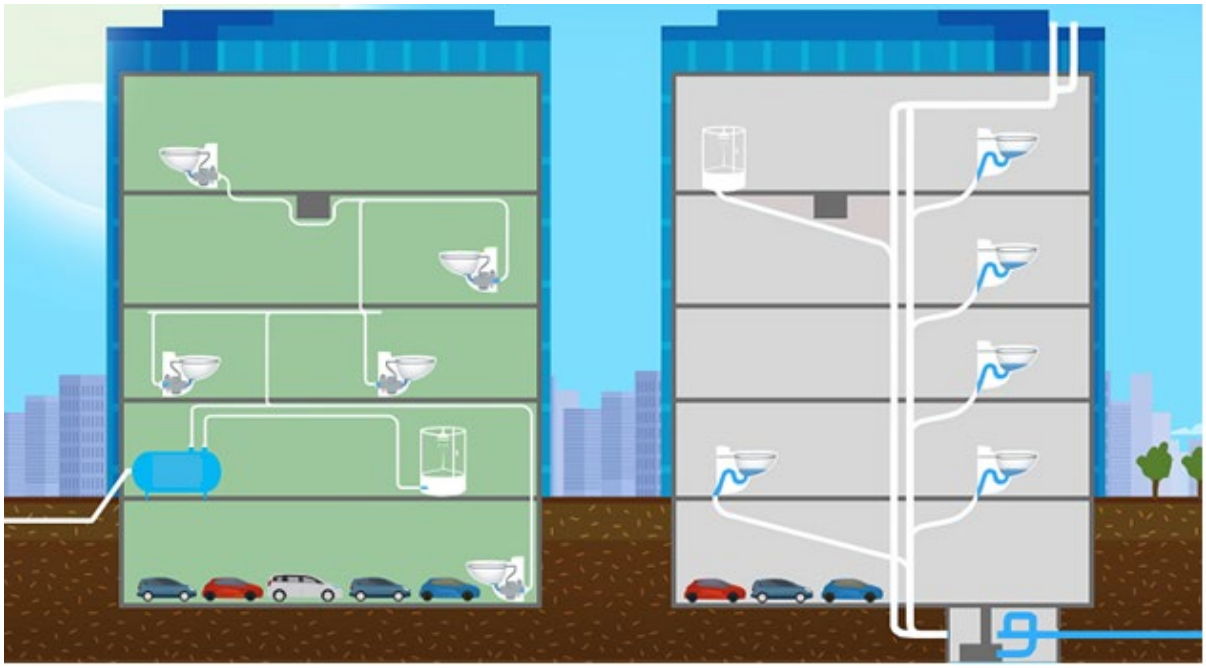
So where can a vacuum drainage system be used? Well just about anywhere – in any type of building: commercial office, retail, stadium, historical and refurbishments, and below are the main drivers for preference of vacuum drainage over the gravity system:

**Design flexibility** – the main reason for installing vacuum systems in buildings has been because 'I can't use a gravity sanitation system …' And there are many and varied reasons why gravity cannot be used.

Vacuum drainage offers a useful solution in situations like this as the pipework from toilets and kitchen or bathroom appliances can rise and run at high level (in ceiling void). Not only is this possible, but the pipework can be small diameter of 50mm and be installed to a very shallow gradient of just 1:200, allowing long horizontal runs within a very shallow ceiling compartment. The risk of pipework blockages is minimised as the sewage is travelling through the pipework at speeds reaching 10m/s.

Pipework routing to high level can eliminate expensive excavation works at basement levels or where normally the under-slab drainage would be required. This not only saves time and but also has an increased environmental benefit associated with the reduction of operation of heavy machinery and tools.



| Vacuum Drainage Option<br>Complete Design Freedom | Traditional Gravity System<br>Design Restricted to Riser Location |
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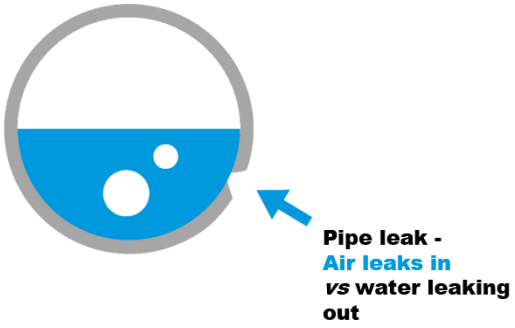
The use of vacuum drainage can positively aid on the impact on water leaks. Water leaks can cause much damage and down time for a building. You may not realise the leak until it's too late.

A leak in a vacuum drainage pipe will involve air leaking into the pipework, not fluid leaking out. In addition, a larger air leak can produce a low vacuum message reported

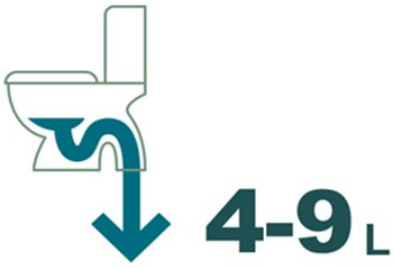
on the system thus make the user/owner aware about this situation. This is a particularly useful solution if pipework is routed above water sensitive areas.




**Water savings** – How much water a gravity toilet uses is open to debate. There are toilet cisterns that will deliver as little as 3½ litres and many are installed with full/reduced flush options. A much-asked question is …which button do I use for which flush? And many respond that they simply flush the toilet twice!

None of this is relevant with vacuum toilets as they will use just over 1 litre per flush. There is no dual flush button as all flushes are low water use flushes. The vacuum toilet doesn't use a toilet flush cistern which requires some time for re-filling, therefore should you need to re-flush the toilet, then this can be instantly done without delay.

While the figure varies among different building types and uses, it is estimated that on average 30% of the personal daily water usage is to flush toilets. Not only is it a large percentage of the daily usage, but this is also further compounded that the water is drinking water that has been through a journey of extraction, sterilisation and pumping stations to get to the building, for you to simply use it to push sewage through a pipe. A waste of resource when the task can be carried out with much less water.




Gravity Toilet – High water usage


Vacuum Toilet – Low water usage

**Infection control** – a conventional toilet flush emits to the surrounding area small water droplets capable of carrying viruses and pathogens

Each time a vacuum toilet is flushed, between 60 – 80 litres of air is pulled into the WC pan. This inrush of air is what helps give the fluid the ability to rise to high level, travel through the pipework at a high velocity and - eliminate any airborne mist.

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Drainage designs can impact sustainability assessments of the built environment. Instead of demolishing existing buildings, consider implementing vacuum drainage as such systems would enable re-modelling or re-purposing of the existing structure to be easily achievable, and remembering the following thoughts from architect Carl Elefante... **'The greenest building is the one that already exists.'**

**Selected examples of buildings fitted with vacuum drainage**

Heathrow Airport Terminal 5
Bloomberg HQ London
Abba Voyage, London
London St Pancras International Station
Stonehenge Visitors Centre
Plus, many more....

Vacuum sanitary systems area recognised in Building Regulations as alternative to gravity /pumped systems.

Further guidance can be found in BS EN 12109: *Vacuum Drainage Systems Inside Buildings*, which was introduced in 1999 and covers principles of the design, installation, testing and commissioning of vacuum drainage systems.

More information on vacuum drainage can be obtained from vacuum drainage specialists listed on CIBSE/SoPHE Industrial Associates list (cibse.org)