Cistern & Tank Ventilation

For safety's sake, give your Tank some air.

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The need to allow all cisterns and non-pressurised tanks to breath is paramount. Specialised fittings are required to ensure atmospheric pressure acts on the fluid surface at all times. Failure to meet this requirement endangers vessel construction and liquid flow in and out could well be impaired or restricted.

I wonder how many tank and cistern manufacturers or their customers for that matter give any consideration to these aspects or in fact know how critical it is to design vessels with appropriately sized **Breather Vents.**

In general terms, the main purpose of a tank's construction is to ensure its capability of containing safely the liquid within.

A thin walled tank particularly of rectangular construction is not the most appropriate design to resist external forces. The larger the vessel the greater the problem.

One could think of many scenarios, which could cause catastrophic failure of the vessel due to external loading, but not many of them very practical. **However what would happen if the cistern's Outlet Pipe ruptured?**

Would the vessel implode or would the Breather Vent save the day?

To assess the risk the maximum differential pressure across a tank's thin walled surfaces requires to be determined.

No specific guidance is available other than in BS 6399 Part 3 "Loadings on Buildings" which advises 0.6 kn/m2 for maximum UDL loading on flat roofs.
In real English, this represents 60 Kg/m2 loading or the equivalent of **60mm water gauge pressure differential** across this flat surface. This would seem to be a reasonable start point given the tank construction requires to satisfy "safety at work" legislation.

For the purposes of tank design it would be reasonable to consider the maximum differential allowable to be half this value. i.e. **30mm wg. or 0.003 bar**.

For potable water tanks and cisterns it is necessary to fit appropriate mesh screening to any atmospheric openings in the vessels construction. The Water Regulations state that no mesh should have apertures greater than 0.65mm sq.

The appropriate formula therefore for determining air flows through a Breather Vent, taking account of the imposed restriction of the 0.65mm mesh when operating on a 30mm wg. differential is advised as follows;

$Q = 307\,d^2$ (cu. m / min.) **Where d = Vent dia. (m)**

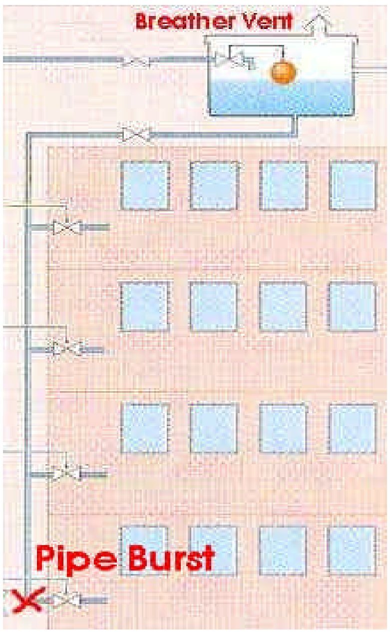
Therefore the maximum flow capacity for Vents sized;

25mm dia. = 0.19 cu m /min.
40mm dia. = 0.49 cu m /min.
50mm dia. = 0.76 cu m /min.
100mm dia. = 3.04 cu m /min.

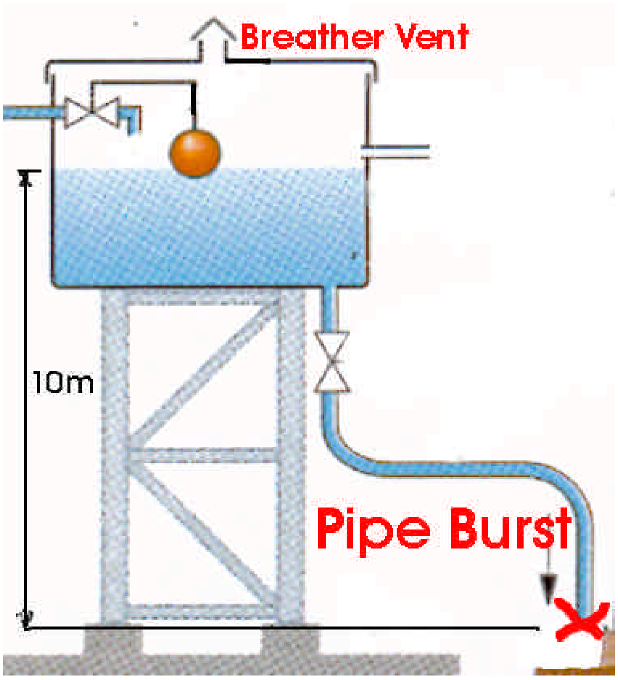
The next stage in the analysis is to determination the maximum possible out flow from a tank under pipe rupture conditions. This is a function of outlet pipe dia. and differential head from tank TWL to pipe rupture point. In each case the pipe to the rupture point is short (low line loss) but the vertical drop high (differential pressure high). Say, of the order of 10 m.

The following examples are typical examples of what could arise;

a) Block of Flats



b) Large Capacity Tank on Tower



The following maximum uncontrolled flows could be expected from the following sizes of Outlet Pipes on a 10m differential head.

25mm dia.	=	0.24 cu. m / min.
50mm dia.	=	0.94 cu. m / min.
80mm dia.	=	3.01 cu. m / min.
100mm dia.	=	4.71 cu. m / min.
150mm dia.	=	10.60 cu. m / min.

To ensure the pressure within the tank under emergency burst conditions does not exceed the 30mm wg. vacuum it is imperative that air inflow matches the water discharge rate.

Consequently for a Tank fitted with a 25mm Cold Feed, a 40mm dia. Screened Vent is required. However for a 50mm C/F, 2 x 40 mm Vents are required.

Similarly for 100mm C/F, 2 x 100mm or 6 x 50mm Vents would be required and for 150mm C/F, 4 x 100mm Vents should be fitted.

When the differential head is reduced, venting requirements are reduced. However, not as much as one would expect. Even in shallow tanks, a pipe burst say 2m below TWL, the respective maximum uncontrolled flows would reduce to only 45% of those advised above.

Hence, a tank with a 25mm C/F would still require a 40mm Vent that could be just accepted for a 50 mm C/F. A 2m deep tank with say a 80mm C/F would require 2 x 50mm Vents.

It would also be prudent for tanks with large plan areas to have more vents spaced equally over its roof area rather than one central vent of larger diameter.

The possible additional venting potential of W/Ps, O/Fs and Spill Slots are not considered in this assessment.

Note: the information advised is for guidance only.