Vacuum Plumbing

A NEW DIRECTION IN PATIENT ROOM DESIGN AND CONSTRUCTION

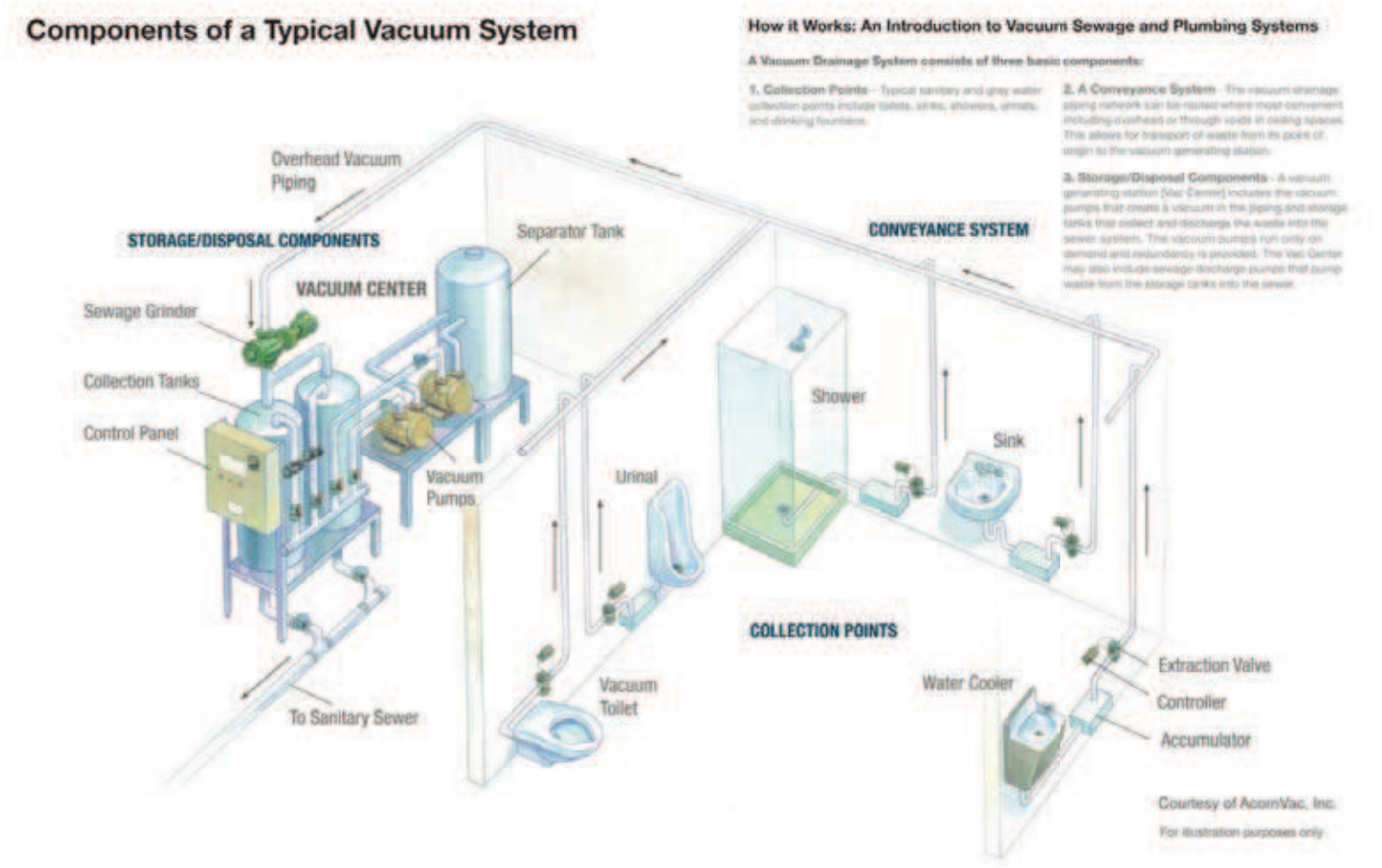
by Bruce R. Blanchart

Vacuum drainage systems allow flexibility in building layout and design by incorporating a plumbing system that uses vacuum to transport wastewater through the drainage piping network before discharge to the sanitary waste main. Vacuum plumbing offers architects and designers the freedom to locate within a patient room all drainage devices "at will," allowing an open architectural environment with flexibility of space planning. Any last-minute architectural or client space changes with sinks, water closets, and showers can be accommodated as easily as moving furniture.

How Does It Help?

Reductions in water flows from the 1.28-gallon-per-flush toilets in a conventional gravity design drainage system has lead to some unexpected problems. The reduced water flow has resulted in some drainline blockages in both the horizontal and vertical legs of the drain pipe in the existing gravity piping. The low-flow toilet flush has been insufficient in some cases to carry all of the sewage from the point of use to the sanitary drain ("Time for a Gravity System Redesign?" *World Plumbing Review,* March 2008).

A typical vacuum drainage system for a patient room would start with a vacuum toilet. The vacuum toilet minimizes the chance of infection by controlling vaporization (the aerosol effect) of the flush cycle (see "Flushing Can Spread Diarrhea Disease" at abcnews.go.com/blogs/health/2012/01/02/flushing-can-spread-diarrhea-disease). Vacuum toilets use 0.5 gallon of water per flush and, depending on the number of toilets installed, can help earn LEED points under the "Water



Efficiency" section.

The vacuum drainage system can also accommodate the drain flow from the shower, sink, and wash basin. This drainage can be lifted up and easily conveyed to avoid restrictive site or structural issues. Offered as an alternative to conventional gravity drainage piping, the design is no longer limited by the rules of a gravity drainage system.

How Does It Work?

The way the vacuum drainage system functions is that air becomes the transporting medium for the gas and/or the suspended solids. The negative pressure provides the energy, and by using smaller pipe sizes an optimum transporting velocity is attained.

Piping can be routed vertically and horizontally and still maintain the necessary pipe velocity, virtually reducing to zero the chance of drainline blockage. The vacuum waste piping is virtually self-venting, and the only atmospheric vent is located at the vacuum pump discharge, eliminating nearly all roof penetrations. Also, the vacuum waste piping is smaller in diameter than gravity drain piping.

Depending on code, vacuum waste piping materials can be pressure-rated Schedule 40 PVC, CPVC, type M or better copper, or stainless steel—all with DWV pattern fittings.

Vacuum Drainage Design Criteria

The design team is responsible for identifying and locating the number of fixtures and tallying the required airflow rate (in cubic feet per minute) for each. The flow rate per fixture can be obtained from the manufacturer of the equipment.

Once the fixtures and vacuum source equipment have been located and the number of simultaneous usage factors applied, the size and layout of the system can be completed.

The vacuum source equipment is located as close to the building sanitary waste main as possible. The vacuum equipment usually consists of a minimum of two vacuum pumps and two storage tanks.

See the graphic for a depiction of a complete vacuum drainage system.

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