

Sloan Flushmate, a division of Sloan Valve Company, is a world market leader in the design and manufacture of pressure-assisted toilet flushing systems. Its advanced technology offers high performance but uses much less water than conventional gravity toilets. A 4-channel PULSE™ system is used to optimise the sound generated by the flushing mechanism.

A World Leader

Fig. 1
Sloan Flushmate's headquarters at New Hudson, Michigan

Sloan Valve Company, a world-class manufacturer of plumbing systems, was founded by William E. Sloan in 1906. Its Sloan Flushmate division was established in the mid 1980s and has focused on the development and manufacture of pressure-assisted toilet flushing systems.



Sloan Flushmate's headquarters is at New Hudson, Michigan. The purpose-designed facility was built 2½ years ago and houses about 75 employees.

Sloan Flushmate is a world market leader with a majority share of the world market for pressure-assisted toilet systems. This represents some 7% of the total world market for flushing toilets. Sloan Flushmate's customers include:

- Commercial and Industrial users
- Health Care
- Education
- Hotels
- Airports and Stadiums
- Ships
- Residential and Consumer

Flushmate® – How it Works

The Flushmate® vessel traps air and, as it fills with water, it uses the water supply line pressure to compress the trapped air inside. This compressed air is what forces the water into the bowl, so instead of the “pulling” or syphon action of a gravity unit, the pressure-assist unit “pushes” waste out.

*Fig. 2
A typical
Flushmate®
pressure-assist
system*

Advantages

1. Flushmate's vigorous flushing action cleans the toilet bowl better than gravity units
2. It's environmentally friendly – the pressure-assist system uses less than 1.6 gallons (6 litres) per flush without sacrificing performance. This saves up to 20% more water than conventional toilet technologies
3. Flushmate® equipped toilets eliminate the need to double flush
4. Toilets with Flushmate® use a syphon-jet bowl to meet and exceed ANSI/ASME A112.19.2M and CSA B45 performance requirements
5. The expanded trapway facilitates the removal of waste – this reduces stoppages by over 90% compared to conventional gravity units
6. Flushmate® equipped toilets provide a larger water surface area in the bowl



Product Development

*Fig. 3
Ming Ge is Sloan
Flushmate's
Product Design
Engineer*



Ming Ge is Sloan Flushmate's Product Design Engineer. He holds a Masters Degree in Mechanical Engineering from Wichita State University, Kansas. Ming explains, "The sound created when a toilet is flushed is an important issue for our customers. The flushing cycle of a pressure-assist system is shorter than with a conventional gravity toilet. Our aim is to minimise the sound while ensuring high-performance products that are environmentally friendly". Ming continues, "We cooperate closely with toilet bowl manufacturers and the data from our R&D investigations is widely used in making design recommendations. The bowl acts like a loudspeaker so its design is important when considering the sound generated by flushing".

Sloan Flushmate manufactures a number of pressure-assist systems for different applications. Its products either use 1.6 gallons (6 litres) or 1 gallon (4 litres) per flush.

PULSE

Ming says, "Quality demands from toilet manufacturers and the building industry are constantly increasing. Two years ago we decided to invest in a multi-analyzer to make sound and vibration tests. We knew of Brüel & Kjær's excellent reputation in the field of sound and vibration, and we also had some recommendations". Sloan Flushmate purchased a Brüel & Kjær 4-channel PULSE system together with a number of microphones, accelerometers and calibration equipment.

R & D Testing

Fig. 4
A specially built acoustic chamber is used to make tests

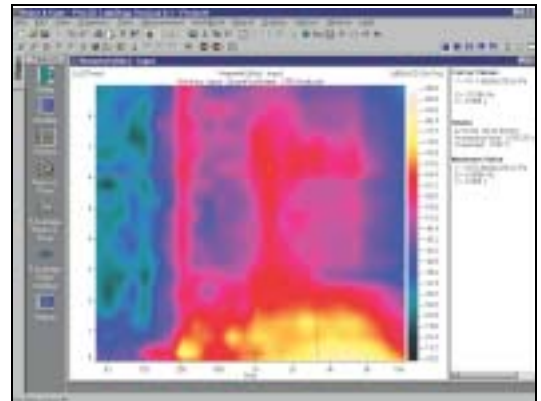
Tests are made in a specially built acoustic chamber (1.07 × 0.91 × 1.91 m high). The internal walls of the test chamber are lined with fully reflective hard surface laminate, with deadening material between the inside surface and the outside surface of each wall. A Brüel & Kjær microphone is supported on a light tripod at a constant predetermined position. When required, a Brüel & Kjær accelerometer is mounted on the water-pressure regulator to measure vibration.



Ming explains, “It takes about 30 minutes to set up a typical test. I carefully check the position of the microphone and calibrate it using a Brüel & Kjær Type 4231 Calibrator before each test. We are interested in frequencies over a wide range and typically investigate from 100 Hz to 16 kHz”.

Fig. 5
A PULSE contour plot displays test data

PULSE is set in data acquisition mode, the toilet is flushed remotely and 10 seconds of data is recorded. The test is repeated four more times to ensure that the toilet's operation is stable and the average of the five tests is calculated. The peak sound pressure level is also noted. Ming says, “We would typically see an A-weighted SPL of 80–83 dB. Of course, we also make benchmark tests on our competitors' products”.



Durability and Performance Testing

Fig. 6
A specially built test setup is used by Sloan Flushmate to check product performance and durability

To ensure the durability and performance of its products, Sloan Flushmate carry out an extensive test program using a specially built test setup.

A number of toilets equipped with Flushmate® pressure-assist flushing systems are operated continuously to simulate the products' expected life cycle. Specifications of the outlets pipes are strictly controlled by building regulations – the pipe size, length and fall-angle must be accurately reproduced.



User-friendly

“PULSE is easy to use and we set up our own standard test template without difficulty”, says Ming. For security, the test data is saved on two hard disks. Previously stored data is often recalled for comparison.

We generate reports using the report generating function in PULSE. The data is exported, normally to Microsoft® Word, but Excel is also sometimes used. “The reporting facility is very user-friendly”, says Ming.

Joseph M. Bosman is Sloan Flushmate’s Chief Operating Officer. Mr. Bosman explains, “With our products, ‘sound perception’ is very important. The PULSE system is a high-quality product and does everything we need. We get great technical support from the local Brüel & Kjær office – it’s above and beyond the normal. PULSE has been a great investment”.

The Future

“We intend to expand our test and analysis capability with PULSE and our future plans include investing in the Brüel & Kjær Sound Quality software solution. This will enable us to create a model from the previously saved test data and to analyse the various sound metrics. We can then modify the model to achieve the optimum flushing sound, and use the jury test facility to play different sounds to a group of listeners and get their subjective opinions”, says Mr. Bosman.

Joseph Bosman concludes, “When making design modifications to our products to optimise the sound quality, we will immediately make a new test and quickly see the effects of the changes – the aim is to get as close as possible to optimum perceived sound”.

Key Facts

Sloan Flushmate is a division of Sloan Valve Company
The Flushmate® pressure-assist flushing system is a world market leader
Flushmate® is environmentally friendly and uses less water than conventional toilets
Quality demands from customers are constantly increasing
Sloan Flushmate purchased a Brüel & Kjær 4-channel PULSE system, transducers, etc.
Tests are made in a specially built acoustic chamber
Test data is used in R&D to make design changes
The “perceived sound” is very important
“PULSE is easy to use”
Reports are generated using the PULSE reporting facility
“PULSE has been a great investment”
Sloan Flushmate intends to expand its PULSE platform to include PULSE Sound Quality software