



January 7, 2022

Mr. Ken A. Cornwall
ProVent Systems
1355 Capital Circle
Lawrenceville, GA 30043

Re: Sound Level Measurements of Drain Pipe Products
Whisper Quiet Shell on PVC vs. Cast Iron

Dear Mr. Cornwall:

At your request, Kolano and Saha Engineers, Inc. (K&SE), has conducted sound level testing of the Whisper Quiet Shell Pipe to compare its acoustical performance to that of cast iron pipe while passing water under controlled, similar conditions. These measurements were conducted in the K&S Acoustics Laboratory hemi-anechoic chamber on December 1, 2021. This report details the results of our measurements.

Measurement Equipment

The sound level measurements were captured with a Brüel & Kjær 2270 sound analyzer with a Brüel & Kjær type 4190 microphone and 2669 preamplifier. This system provides performance which exceeds the minimum requirements of the American National Standards Institute (ANSI) S1.4 Specification for Type 1 (precision) instrumentation. Calibration before and after all measurements was performed using a Brüel and Kjær type 4231 Acoustic Calibrator¹.

Measurement Procedure

Measurements were conducted in a hemi-anechoic chamber with the ProVent pipe assembly fixture. A photograph of this assembly is provided as **Exhibit 1**. This assembly is essentially a raised platform that supports a standard gravity flush toilet reservoir coupled to a drain assembly consisting of a series of waste drain pipes that conduct the water ultimately to a remote reservoir at floor level of the hemi-anechoic chamber. The series of pipes were constructed of the same diameter, length and fitting elements for each pipe material evaluated. These series of pipes were isolated from the test fixture with rubber couplings at the tank (top) and at the final drain pipe (bottom). From the elevated tank, a metered volume of 1.6 gallons of water was drained through the pipe assembly. This simulates the action of a toilet flushing water and passing through waste drain pipes for the specific purpose of measuring the sound created as that water passes through each respective type of pipe.

¹ Calibration traceable to the U.S. National Institute for Standards & Technology (NIST).

For this testing, the following pipe assemblies were measured:

- 4-inch Cast Iron DWV pipe, horizontal & vertical sections
- 3-inch Cast Iron DWV pipe, horizontal & vertical sections
- 4-inch PVC schedule 40 drain pipe with Whisper Quiet Shell Pipe, horizontal & vertical sections
- 3-inch PVC schedule 40 drain pipe with Whisper Quiet Shell Pipe, horizontal & vertical sections
- 4-inch PVC schedule 40 drain pipe, horizontal & vertical sections.

For a given assembly, multiple sections of pipe were measured with the microphone positioned at a distance of 4 inches from the pipe surface to detect the sound energy radiating from the given sections. **Exhibits 2 & 3** provide examples of these microphone positions. For each test, this cycle was repeated a minimum of three times to ensure consistent measurement results. The maximum standard deviation of the repeated measurements was 0.45 dB and the average standard deviation was 0.24 dB.

Results of the Measurements

The overall A-weighted sound levels are provided for comparison in the Tables below. Comparison of the A-weighted one-third octave spectral sound levels averaged over the duration of the simulated water flush and three flush events are presented in **Exhibits 4** through **7**.

Table 1

| Sound Levels of 4-Inch Drain Pipe Assemblies for Comparison to the Whisper Quiet Shell Pipe | | | | | |
|---|-------------------|-----------------------------|-------------------|--------|-------------------|
| Results are Leq (time averaged) for Three Drain Events - [dB(A)] | | | | | |
| Mic Location | 4" Cast Iron (CI) | 4" Whisper Quiet Shell Pipe | Level Over CI (+) | 4" PVC | Level Over CI (+) |
| Horizontal ¹ | 55.7 | 59.6 | 3.9 | 63.0 | 7.3 |
| Vertical ² | 53.1 | 55.0 | 1.9 | 61.5 | 8.4 |

Table 2

| Sound Levels of 3-Inch Drain Pipe Assemblies for Comparison to the Whisper Quiet Shell Pipe | | | |
|---|--------------|-----------------------|-------------------|
| Results are Leq (time averaged) for Three Drain Events - [dB(A)] | | | |
| Mic Location | 3" Cast Iron | 3" PVC w/ Quiet Shell | Level Over CI (+) |
| Horizontal ¹ | 49.4 | 52.9 | 3.5 |
| Vertical ² | 49.7 | 51.2 | 1.5 |

¹ Horizontal – microphone was positioned 4-inches below the middle of the horizontal section of pipe.

² Vertical – microphone was positioned 14-inches up from the base of the test fixture and 4-inches away from the vertical section of pipe

Discussion of Results

Generally, the results show that the Whisper Quiet Shell Pipe helps to decrease the level of sound from PVC drain pipe down to a level that is comparable to cast iron.

For the 4-inch pipe assemblies, water draining through the Whisper quiet shell produced a sound level that was 4.4 dB higher than the cast iron at the horizontal pipe section. This would likely be perceived as a small increase in sound. For the vertical pipe section, the Whisper Quiet Shell Pipe was 1.9 dB higher than the cast iron. This difference would likely be unnoticeable.

For the 3-inch pipe assemblies, the horizontal section of the Whisper Quiet Shell Pipe produced a sound level 3.5 dB higher than cast iron. This is a barely perceptible difference. For the vertical pipe section, the Whisper Quiet Shell Pipe was 1.5 dB higher than the cast iron, which is an imperceptible difference.

Mr. Cornwall, based on the measurements we have conducted, we find that in most cases the difference in sound level between the Whisper Quiet Shell Pipe and cast iron is generally small with a likely small to imperceptible difference.

Sincerely,
KOLANO AND SAHA ENGINEERS, INC.



Darren Brown, P.E.
INCE Board Certified
Senior Consultant

EXHIBIT 1
PROVENT PIPE ASSEMBY TEST FIXTURE



Cast Iron Pipe Assembly



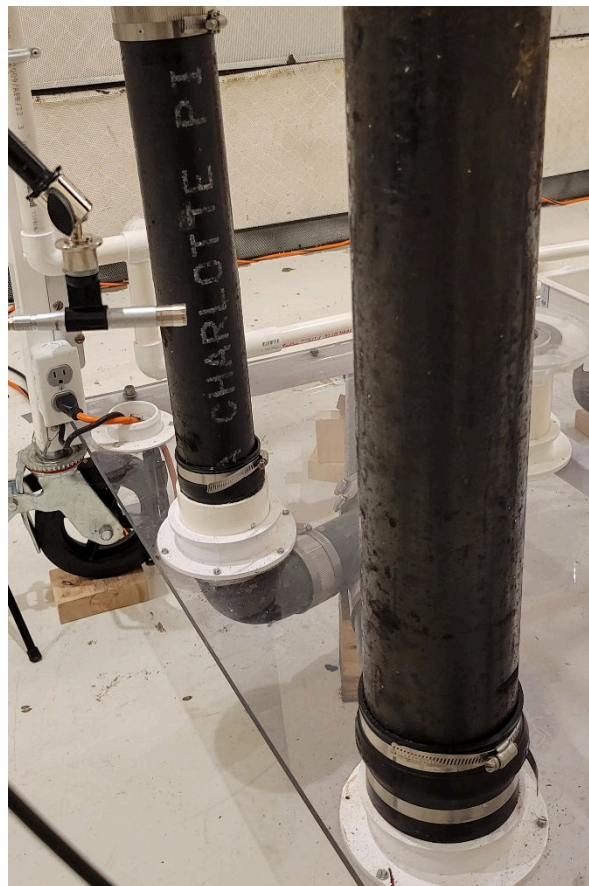
Whisper Quiet Shell Pipe Assembly

EXHIBIT 2

**MEASUREMENTS IN THE K&SE ACOUSTICS LABORATORY OF
THE CAST IRON PIPE ASSEMBLY (EXAMPLES)**



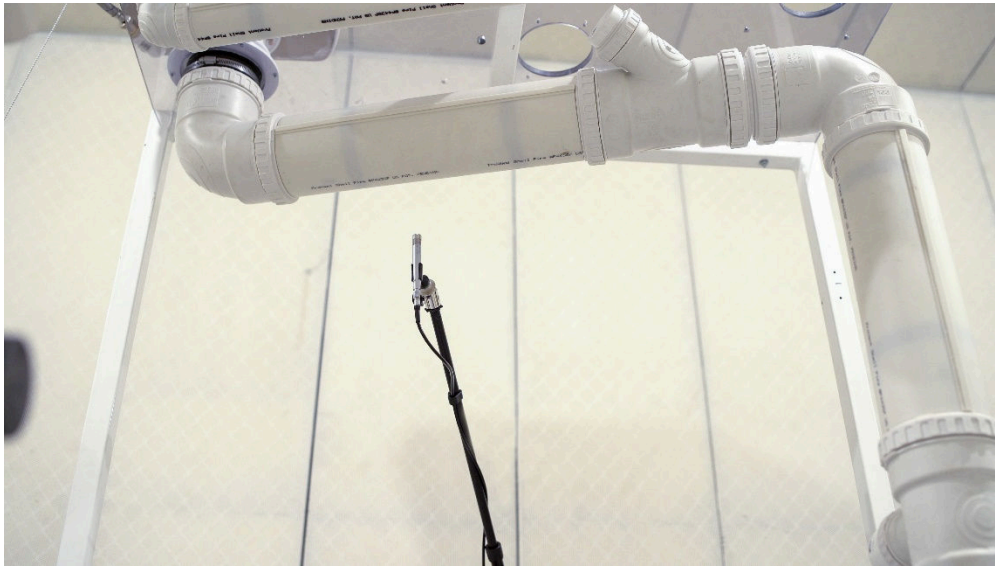
Horizontal Pipe Measurement



Vertical Pipe Measurement

EXHIBIT 3

MEASUREMENTS IN THE K&SE ACOUSTICS LABORATORY OF THE WHISPER QUIET SHELL PIPE ASSEMBLY (EXAMPLES)



Horizontal Pipe Measurement



Vertical Pipe Measurement

EXHIBIT 4

SOUND LEVELS OF DRAIN PIPE ASSEMBLIES COMPARING WHISPER QUIET SHELL PIPE TO CAST IRON & PVC

A-Weighted Sound Level Spectrum

Study Conducted for: ProVent

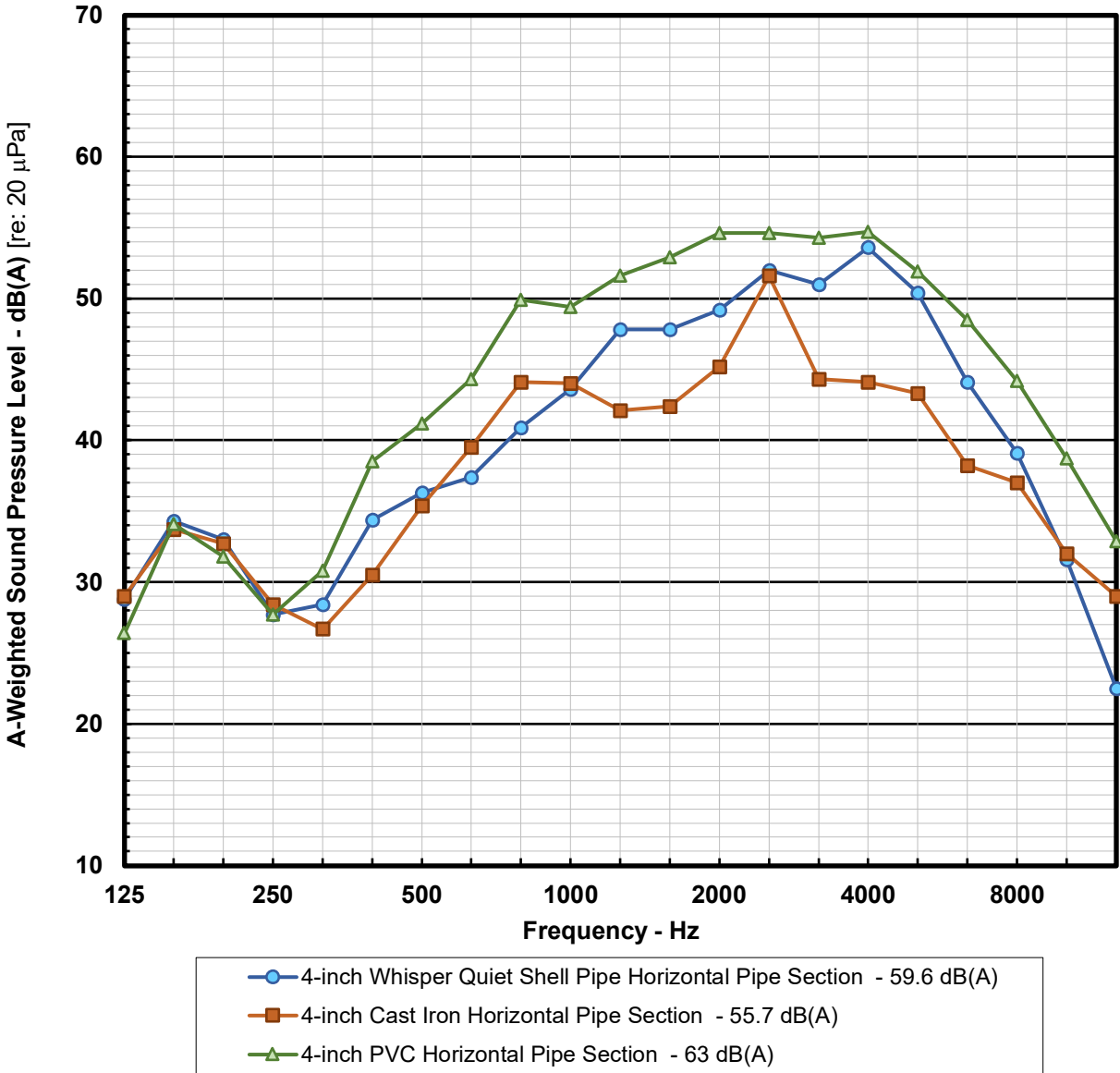


EXHIBIT 5

SOUND LEVELS OF DRAIN PIPE ASSEMBLIES COMPARING WHISPER QUIET SHELL PIPE TO CAST IRON & PVC

A-Weighted Sound Level Spectrum

Study Conducted for: ProVent

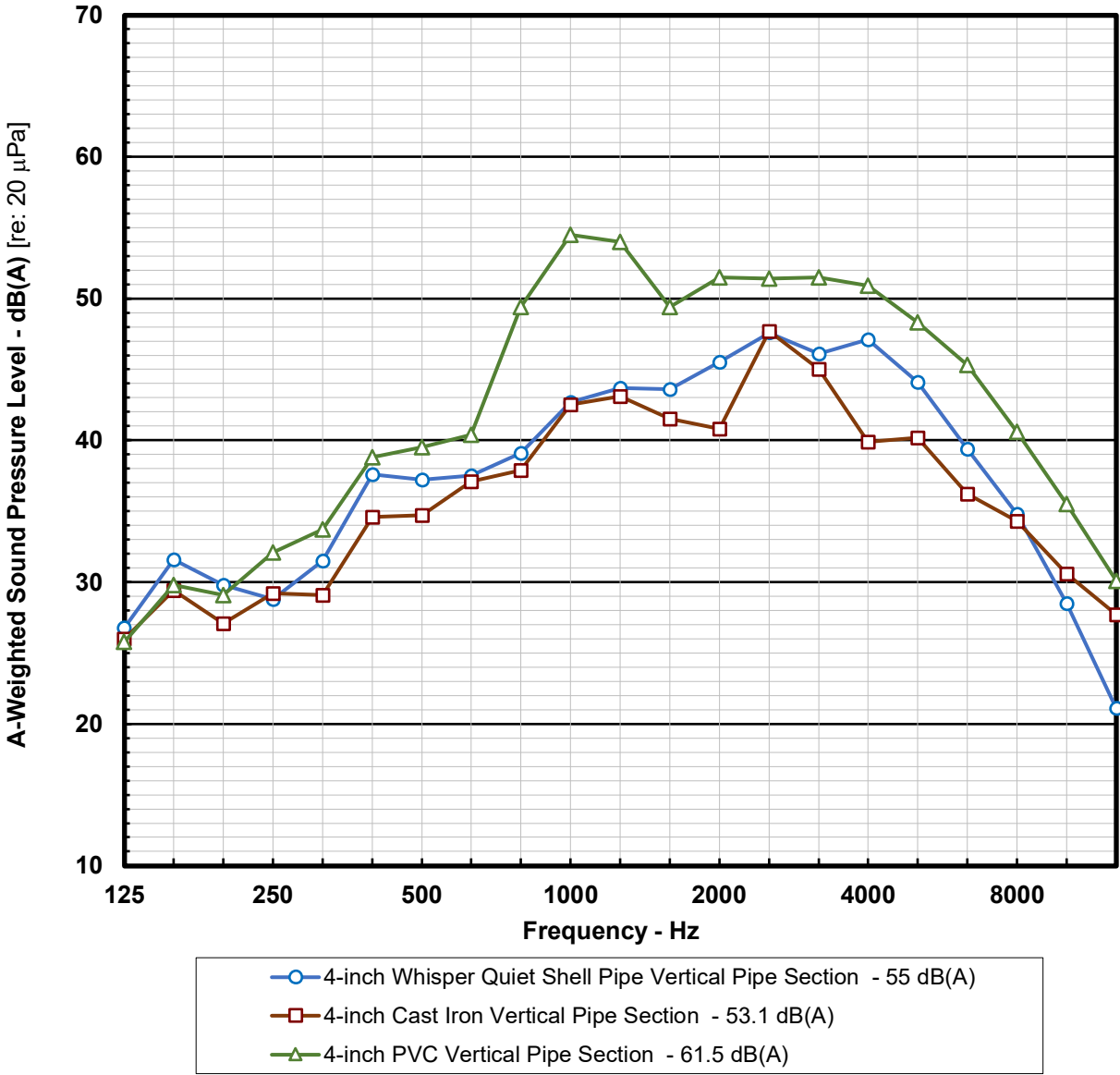


EXHIBIT 6

SOUND LEVELS OF DRAIN PIPE ASSEMBLIES COMPARING
WHISPER QUIET SHELL PIPE TO CAST IRON

A-Weighted Sound Level Spectrum

Study Conducted for: ProVent

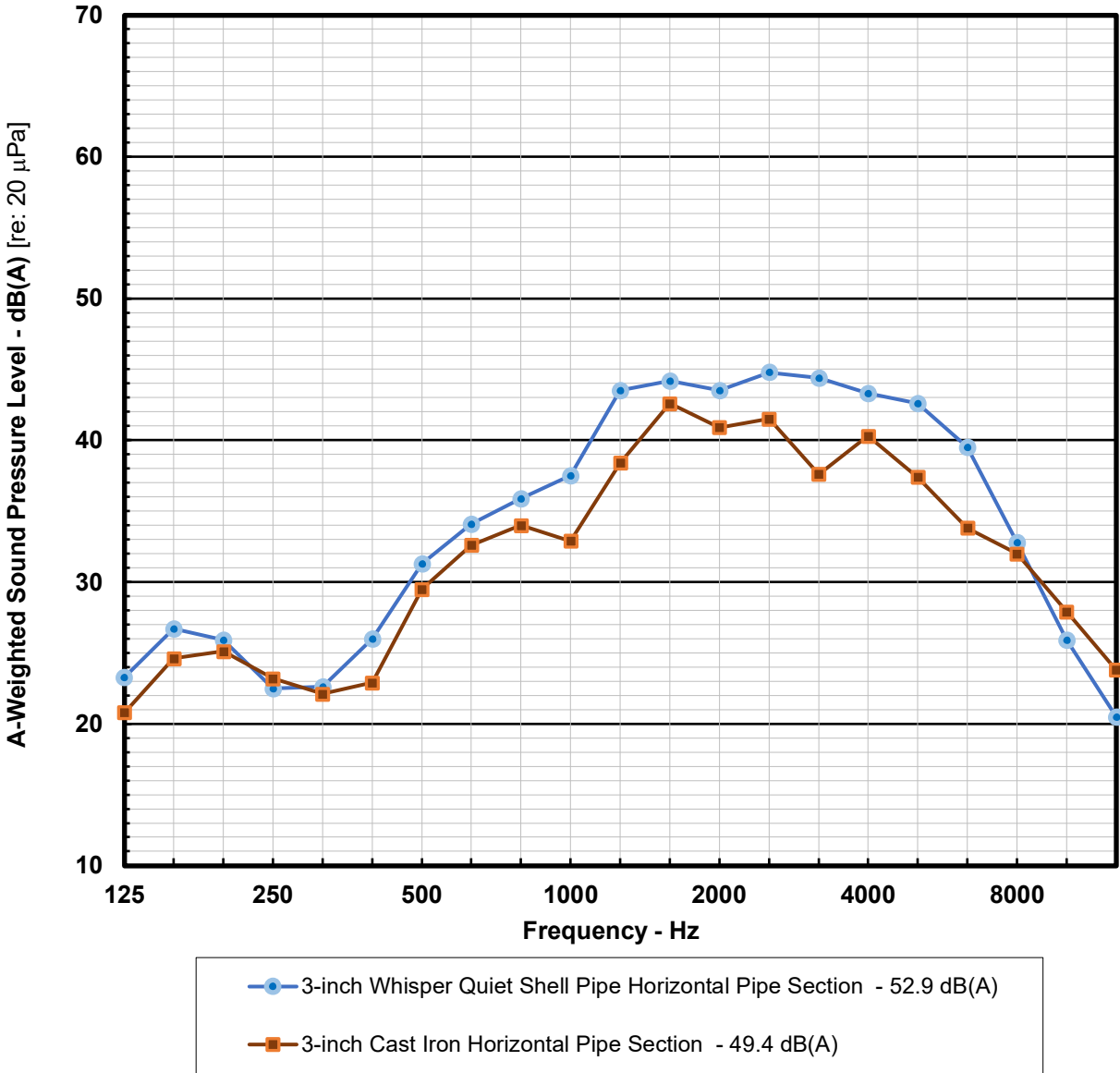


EXHIBIT 7

SOUND LEVELS OF DRAIN PIPE ASSEMBLIES COMPARING
WHISPER QUIET SHELL PIPE TO CAST IRON

A-Weighted Sound Level Spectrum

Study Conducted for: ProVent

