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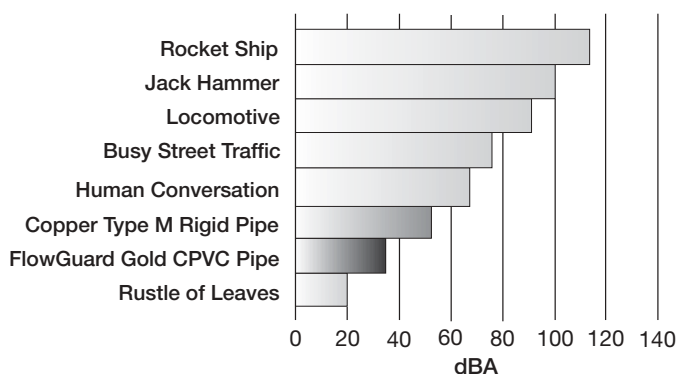
NSF International Conducts Noise Level Comparisons Between FlowGuard Gold® Pipe and Copper FlowGuard Gold® Pipe Proves Four Times Quieter

With all the environmental noise in our high-tech society, it's little wonder that peace and quiet have become highly prized luxuries. Noise ordinances are regularly sought and passed to control everything from the volume of recreational watercraft to the backfire of car engines. In most neighborhoods, residents are restricted from making noise or playing stereos loudly before 8:00 AM or after 10:00 PM as a courtesy to other neighbors. There is even a Noise Pollution Clearinghouse (NPC) that exists on the Internet to help reduce noise pollution and create an awareness of its various sources.

Inside a newly built or remodeled home, noise further gives the perception of low quality or poor workmanship. Often homeowner complaints stem from squeaky floors or doors, rattling windows, a dripping faucet or a toilet that continues to run. The value of most household appliances is also often based on the level of noise they generate. Manufacturers have invested heavily into technologies that make today's dishwashers, washing machines and even refrigerators much quieter. And homeowners are willing to pay extra for additional soundproofing procedures and insulation between living spaces.

Even plumbing alternatives are often judged by the level of noise they generate when water is flowing through them. That's why in May of 2001, NSF International conducted testing designed to compare noise levels of FlowGuard Gold® CPVC pipe and copper pipe. NSF International has been testing and certifying chemicals and products used to treat and distribute water since the inception of its Plumbing Products and Wastewater Treatment programs in 1965.

NSF International test results concluded that, as the human ear interprets sound level, copper pipe was four times louder than FlowGuard Gold CPVC pipe. The test results were an average of three individual sound tests. The decibel level of the 3/4" FlowGuard Gold® CPVC pipe was measured at an average of 35.9 decibels vs. an average of 55.4 decibels for the 3/4" Type M Rigid copper pipe, a 19.5 decibel sound level difference.



To compare the difference another way, consider that the human whisper at 25 decibel approximates the noise level of water running through a FlowGuard Gold pipe, vs. a washing machine at 65 decibel, which is closer to the level of noise of water flowing through a copper pipe.

How were the results determined?

Testing was conducted using procedures outlined in ISO-3822 (99) "Laboratory Test on Noise Emission from Appliances and Equipment Used in Water Supply Installations." The testing was modified to allow noise level comparisons of FlowGuard Gold CPVC pipe and copper pipe of the same nominal diameter (3/4 inch).

In each case, an INS (Installation Noise Standard) reference fixture was used as the sound source. Three replications of each test set-up were conducted with air venting procedures accomplished between each replication. The equipment was calibrated before, during and after each testing sequence, and the operating conditions were maintained at a nominal pressure of 43.5 psi with a flow rate of approximately 4.5 gallons per minute. All pipe and fittings (including elbows, couplings, tees and adaptors) were purchased from the open market by representatives of the testing lab.

Water Hammer

Noise reduction has become more of a focus in the plumbing industry in recent years in both the residential and commercial arenas. Builders of luxury homes note that their buyers have low tolerance levels for most any type of noise--not just the sound of running water through the pipes but also the common banging of copper pipes that comes from water hammer. The concerns regarding water hammer are even greater for the owners and operators of upscale hotels and motels, and even hospitals and nursing homes, where "neighbor" guests may be woke up in the middle of the night from the sound of banging pipes in the next room caused by a late night trip to the bathroom or shower.

Water hammer, the name commonly given to the pressure fluctuations that develop in a pipe when the flow is suddenly changed, may sound like a single bang, knock, clunk or clang, depending on the design of the plumbing system. When a valve is slammed shut, such as when a shower is turned off suddenly, a toilet is flushed or a washing machine cycles, the fluid inside decelerates sharply, causing the pressure to rise and the fluid to compress a small amount. The shock wave resulting from water hammer is essentially attempting to expand the wall of the piping material. FlowGuard Gold plumbing pipe, while every bit as rigid, is simply more dimensionally yielding than copper pipe. FlowGuard Gold pipe can actually

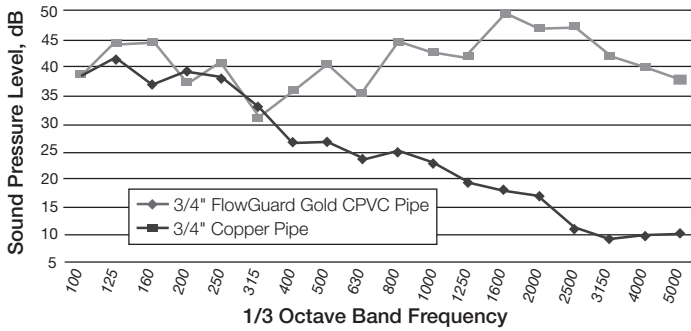
expand slightly and absorb some of the energy (noise). The maximum theoretical shock wave is, therefore, diminished by the wall expansion, which means it significantly reduces (or eliminates) water hammer.

Water hammer is not just a noise issue. It can also be very destructive. The shock waves going through the pipe can be so forceful that they can actually break poorly soldered joints. Over time recurring water hammer can loosen the nailed mounting brackets that attach the pipes to the studs and joists leading to even more movement and a greater risk of leakage at joints.

Conclusions

This graph demonstrates the ability of CPVC to absorb sound as opposed to transmitting sound especially with sound waves over 250 Hz. For crystalline materials such as copper, sound waves are much more readily transmitted across wide frequency ranges than is the case for a non-crystalline material such as CPVC. The natural chemical structure of CPVC contributes to dampening and absorbing the sound rather than transmitting it.

SPL Comparison of FlowGuard Gold CPVC Pipe to Copper Pipe
(average of 3 replications)



As stated in *PMEngineer*, March 1996 issue, “the shock wave resulting from water hammer is attempting to expand the wall of the piping material. When the piping material is flexible, the material absorbs some of the energy by allowing the expansion of the pipe wall. Hence, the resulting spike in pressure is much less in plastic than in metallic piping.”

To receive a copy of the final NSF report that compares FlowGuard Gold CPVC pipe to copper pipe, call 888/234-2436, Ext. 7393.