



Plastic Pipe and Fittings Association

PUBLICATIONS

ABS Cellular DWV Piping Systems: A Sustainable Choice

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800 Roosevelt Road
Building C, Suite 312
Glen Ellyn, Illinois 60137
ppfahome.org

ABS Cellular DWV Piping Systems: A Sustainable Choice

Durability & Reliability

Perhaps the first thing a drainage system needs to do in order to protect the environment is to effectively transport greywater, blackwater and other waste to the appropriate place for discharge or treatment. Pressure pipeline system failures are often catastrophic and are usually recognized immediately when flow is lost or reduced. In drainage applications; however, failures and leaks can go undetected for years. The durability and reliability of ABS is key to avoiding costly failures that could otherwise result in spilling wastewater.

ABS offers one of the broadest temperature ranges of any plastic piping material. It can perform at operational temperatures up to 140°F (71°C). And when it comes to impact resistance, ABS is near the top of the scale. Many products become highly brittle at lower temperatures...while ABS maintains considerable strength. In colder climates, this low-temperature strength and impact resistance help to avoid system failures.

One of the key material ingredients in ABS is butadiene. This compound imparts ductility and flexibility



ABS DWV system with solvent welded joints

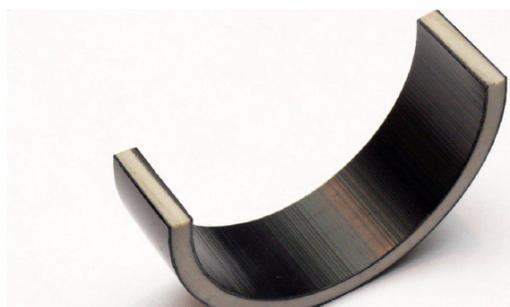
to the final product. This ability to absorb movement is a prime factor in avoiding failures in a number of applications and environments including:

- manufactured housing
- recreational vehicles
- areas prone to seismic activity
- burial in expansive soils

With over fifty years of successful history in use and over ten billion feet installed in North America, ABS has proven to be durable and reliable. The one-step cementing procedure for joining creates a permanent bond between pipe and fitting, as opposed to the elastomeric seals commonly relied on with other drainage systems. ABS piping has no documented records of bacteria or termite attacks and has excellent chemical and corrosion resistance. Thus, specifiers can trust that these systems will remain reliable for years to come.

Safe and Easy to Install

Another priority for any piping system is for it to be easily installed and safe to work with. ABS is the most light-weight drain, waste, and vent (DWV) piping material used in North America. This feature is due, in part, to a proven pipe extrusion process known as “cellular core” or “foam core” manufacturing. Over the last 25 years, several pipe producers have perfected a tri-layered ABS piping product that



ABS Cellular core pipe showing layers

is designed specifically for non-pressure applications.

The inner and outer layers are solid, rigid ABS. These layers encapsulate a middle layer composed of the same ABS resin but injected with a blowing agent to create a cellular structure, thus lowering the density

of the center pipe. A simple form of biomimicry, the core of this pipe gains its strength-to-weight ratio by utilizing designs commonly found in nature. The result is a pipe which is 25% lighter than solid ABS pipe, without sacrificing the superior physical properties.

The lightweight nature of ABS makes transport and placement on the jobsite both safe and simple in comparison to other materials. Competitive plastic pipes generally weigh 22% more, and competitive metal pipes weigh 800% to over 1000% more. This can



*ABS systems
—easy to
install*

require additional heavy equipment, which further creates opportunities for on-site accidents.

ABS is also easy to install due to the one-step, permanent joining process that eliminates the need for a primer. Low VOC (volatile organic compounds) solvent cements are readily available to support air quality requirements for both the installation and use phase. In fact, ABS has the lowest potential VOC impact of any solvent cement piping system. Unlike metals, the joints do not require potentially dangerous open flames or molten lead. Buried ABS systems generally do not require thrust blocking or seismic restraints, nor added coatings, wraps, or linings.

Environmentally Sound

Becoming more recognized, Life Cycle Assessments (LCAs) are independent third-party, scientific studies designed to capture the full environmental impact of manufactured products from cradle to grave. The LCA data shows that ABS piping systems have considerably less net impact on the environment, when compared to metal systems. The following explain some of the reasons for the superior rating.

From an energy use standpoint, ABS piping really shines compared to metals. It uses considerably less energy in manufacturing; less in the transportation of finished products; less in the transportation of fluids (due to the smooth and long-lasting inner pipe bore); and less in recycling and preparing for re-use. Even in installation, the lightweight nature of ABS can allow contractors to move material into place by hand, forgoing the motorized equipment often necessary for positioning metal pipes.

When ABS is processed into pipe and fittings via extrusion and injection molding methods, nearly all post-industrial scrap is incorporated back into the process. ABS has a long functional life. Field re-pipe needs are virtually unheard of – even after fifty years of common use. Equally as important, at the



*ABS DWV pattern
fittings*

end of its functional life the material can be easily and economically recycled into dozens of other useful products with nearly identical physical properties and benefits of the original ABS material.

Cost Effective

Environmentally preferred solutions often result in long-term cost savings, and ABS solutions are no different. In 2006, a comprehensive study compared ABS to metal piping for the DWV and storm drainage systems on a 12-story residential high rise building. ABS piping systems showed a savings of over 80% in material costs and 25% in labor savings¹.

Strength in Numbers

A full truckload of 3-inch ABS cell core piping, composed of the industry standard 20-foot lengths, can total 30,000 linear feet and weigh approximately 23,400 pounds. In fact, trucks handling plastic piping are always limited by height restrictions, not weight. Metal piping of a similar diameter would be composed of 10-foot lengths, for a total of 7,200 lin-



ABS is lightweight and efficient to transport.

ear feet and weighing approximately 38,800 pounds. The shipping limitation for metal piping is generally weight, which can vary somewhat by jurisdiction but is commonly capped near 40,000 pounds.

Thus, if 30,000 feet of 3-inch pipe is required on a site, the option is to send 1 truckload of ABS versus 4 truckloads of metal pipe. The environmental impact of those four truckloads would be felt in terms of fossil fuel consumption, greenhouse gas emissions, air pollution, etc. This gap is just one of the less obvious reasons that ABS performs well in comparison to metal piping systems when considering the full Life Cycle Assessment data.

Versatility

Finally, ABS-DWV is versatile enough and affordable enough to support environmentally responsible systems beyond of the typical residential and commercial drainage applications. ABS is used in rainwater harvesting systems to capture natural precipitation and utilize it to feed plants and vegetables. ABS is also used in radon venting applications to protect inhabitants from toxic levels of the naturally occurring gas.

For more information on ABS piping systems, visit www.ppfahome.org/abs or contact a member producer.

¹ Note: JB Engineering and Code Consulting, P.C.
Julius A. Ballanco, President
Report Number: 06A0706E1
July 6, 2006

Appendix: Physical Properties of ABS Piping Materials

Materials	Units	ABS	Test Method
General			
Cell Classification	Pipe/fittings	42222/32222	ASTM D 3965
Material Specifications	Cell core pipe/fittings		ASTM D 3965
Material Dimensions	Cell core pipe		ASTM D 628
Material Dimensions	Fittings		ASTM D 2661
Maximum Service Temperature	° F (drainage psi)	140	
Water Absorption	% increase in 24 hrs	0.40	ASTM D 570
Hazen-Williams Factor	C Factor	150	
Mechanical			
Specific Gravity	g/cm	1.05	ASTM D 792
Tensile Strength	psi@73 ° F	4,500	ASTM D 638
Modulus of Elasticity	psi@ 73 ° F	240,000	ASTM D 638
Flexural Strength	psi@73 ° F	10,585	ASTM D 790
Compressive Strength	psi@73 ° F	7,000	ASTM D 695
Izod Impact	ft-lbs/in. of notch	6.00	ASTM D 256
Hardness	Rockwell "R"	100	ASTM D 785
Hardness	Durometer "D"	70	ASTM D 2240
Taber Abrasion (5,000 revs)	mg	275	
Thermal			
Coefficient of Linear Expansion	in/in/° F x 10 ⁻⁵	5.5 x 10 ⁻⁵	ASTM D 696
Coefficient of Linear Conductivity	BTU/in/hr/ft ² /° F	1.1	ASTM C 177
Flammability			
Flammability Rating		HB	UL 94
Limiting Oxygen Index	%	19	ASTM D 2863
Flash Ignition Temperature	° F	871	ASTM D 1929

There are many reasons why plastic piping systems like ABS – Drain, Waste, and Vent have made such inroads in piping systems through- out the world. They include:

Durability:

- Chemical resistance
- Corrosion resistance
- Abrasion resistance
- Rigorous manufacturing standards
- Joint integrity
- Optimum flow characteristics
- Flexibility

Safe and Easy to Install:

- Lightweight
- Ease of joining
- Variety and breadth of line
- Code acceptance
- Product identification
- Product availability
- Reduced on-site accidents

Environmentally Sound:

- Low thermal conductivity
- Non-toxic and odorless
- Energy savings
- Completely recyclable
- Positive Life Cycle Assessments
- No heavy equipment needed

Cost Effective:

- Low material costs
- Low installation costs
- Low maintenance costs
- Low overall installed costs
- Low on-sight theft
- High strength-to-weight ratio
- No wraps or liners required



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Also available online at

https://www.ppfahome.org/Landing_Pages/ABS_Sustainable_Choice.pdf