



Technical Report BlazeMaster® Fire Sprinkler Pipe and Fittings Flammability and Products of Combustion

Flammability

BlazeMaster CPVC is ideally suited for wet automatic fire sprinkler systems due to its outstanding balance of properties such as light weight, excellent corrosion resistance, low friction loss and ease of fabrication. BlazeMaster CPVC is unique in that it offers outstanding resistance to fire and low smoke generation qualities. Because of these features, BlazeMaster systems are approved for use in plenum spaces as defined by NFPA 90A, the National Standard for the Installation of Air Conditioning and Ventilating Systems.

Ignition Resistance

BlazeMaster CPVC has a flash ignition temperature of 900°F which is the lowest temperature at which sufficient combustible gas is evolved that can be ignited by a small external flame. Many other ordinary combustibles, such as wood, ignite at 500°F or less. Accordingly, BlazeMaster systems cannot be the ignition source of a fire.

Burning Resistance

BlazeMaster CPVC will not sustain burning. It must be forced to burn due to its very high Limiting Oxygen Index (LOI) of 60. LOI is the percentage of oxygen needed in an atmosphere to support combustion. Since earth's atmosphere is only 21% oxygen, BlazeMaster CPVC will not burn unless a flame is constantly applied and stops burning when the ignition source is removed.

Flame Spread/Smoke Generation

The flame spread and smoke generation characteristics of BlazeMaster CPVC materials have been evaluated by Underwriters Laboratories of Canada (ULC), Underwriters Laboratories, Inc. (ULI) and the Southwest Research Institute (SWRI) employing a number of recognized test methodologies. The ULC method, CAN-S102.2M83 compares the flame spread, smoke development and fuel contribution of a material to a known "non-combustible" and a known "combustible" on a scale of 0 – 100, respectively, as follows:

Material	Classification or Rating		
	Flame Spread	Smoke Developed	Fuel Contribution
0.8 to 1.6 mm thick	0	0 – 25	0

ULI investigated CPVC pipe for use in air handling (plenum) spaces using test method UL 1887 which measured the maximum flame propagation distance and peak and average optical smoke density (obscurity of a visible light) against a set of prescribed values as summarized below:

	Flame Travel (ft.)	Optical Density	
		Peak	Average
Requirement	5 or less	0.5 or less	0.15 or less
Result	4	0.19	0.03

In addition, BlazeMaster CPVC has also been evaluated for flammability in accordance with UL 94 which is used for determining the flammability of plastic materials used in the components and parts of finished products. This test measures a materials' resistance to burning, dripping, glow remission and burn through. BlazeMaster CPVC has achieved the highest rating available within the scope of this test of V0, 5VB and 5VA.

Furthermore, when BlazeMaster CPVC is exposed to flash ignition temperatures, it merely chars or intumesces, and does not drip or otherwise propagate a fire. The char layer acts as a thermal barrier which restricts the flow of heat into pipe wall which reduces the rate of burning. Tests have also shown that CPVC does not contribute to "flash-over", the sudden explosive development of a flame front.

Products of Combustion

BlazeMaster CPVC is an organic thermoplastic material. All organic materials, either natural or synthetic, generate toxic gas when exposed to heat and fire. The products of combustion of BlazeMaster CPVC are carbon monoxide (CO), carbon dioxide (CO₂) and hydrogen chloride (HCl).

Considerable research has been done on the effects of HCl on primates other than man. Two separate studies were done to determine the amount of HCl found in real fires. The Boston Fire Department, in conjunction with Harvard University and the San Antonio Fire Department, in conjunction with the Southwest Research Institute, sampled the atmosphere of 260 fires in both residential and commercial buildings. The highest concentration of HCl found in any of the fires was 260 ppm.

Baboons were then chosen for exposure to HCl because they have respiratory systems similar to a human child. The baboons were exposed to concentrations of HCl as high as 11,000 ppm and there were no fatalities among the baboon community. Accordingly, the amount of HCl found in real fires is small compared to the high concentrations that were found to be neither incapacitating or fatal. In addition, HCl decays rapidly and is readily absorbed into common construction materials.

The results of tests on BlazeMaster sprinkler pipe, using the New York State modified University of Pittsburgh test protocol for determining the toxicity of combustion products, conclude that BlazeMaster sprinkler pipe is "no more toxic than wood, and less toxic than common materials, such as wood or cotton."

Because of these unique characteristics, BlazeMaster sprinkler systems do not pose an unusual threat to life safety. In fact, BlazeMaster fire sprinkler systems have a track record of success better than national statistics.

Without the benefit of flame retardants and smoke inhibitors, BlazeMaster CPVC inherently exhibits outstanding fire performance characteristics in terms of limited flame propagation and low smoke generation. When coupled with its excellent balance of improved hydraulics, light weight, corrosion resistance and ease of fabrication, BlazeMaster sprinkler systems provide an affordable solution to life safety and property protection.