Material Selection

Thermoplastic and Elastomers

ABS

(Acrylonitrile-butadiene-styrene) Class 3-2-2-2-2, conforming to ASTM D3965, is a time proven material. The smooth inner surface and superior resistance to deposit formation makes ABS drain, waste and vent material ideal for residential and commercial sanitary systems. The residential DWV system can be exposed in service to a wide temperature span. ABS-DWV has proven satisfactory for use from -40°F to 160°F. These temperature variations can occur due to ambient temperature fluctuations or the discharge of hot liquids into the system. ABS-DWV is very resistant to a wide variety of materials ranging from sewage to commercial household chemical formulations. ABS-DWV is joined by solvent cementing or threading and can easily be connected to steel, copper, or cast iron through the use of transition fittings.

PVC

(Polyvinyl Chloride) conforming to ASTM D1784 Class 12454, formerly designated Type 1, Grade 1. PVC is the most frequently specified of all thermoplastic materials. It has been used successfully for over 30 years in such areas as chemical processing, industrial plating, chilled water distribution, deionized water lines, chemical drainage, and irrigation systems. PVC is characterized by high physical properties and resistance to corrosion and chemical attack by acids, alkalies, salt solutions and many other chemicals. It is attacked, however, by polar solvents such as ketones, some chlorinated hydrocarbons, and aromatics. The maximum service temperature of PVC is 140°F. With a design stress of 2,000 psi, PVC has the highest long-term hydrostatic strength at 73°F of any of the major thermoplastics being used for piping systems. PVC is joined by solvent cementing, threading, or flanging.

CPVC

(Chlorinated Polyvinyl Chloride) Class 23447, formerly designated Type IV, Grade 1 conforming to ASTM D1784, has physical properties at 73°F similar to those of PVC and its chemical resistance is similar to or generally better than that of PVC. CPVC, with a design stress of 2000 psi has, over a period of about 30 years, proven to be an excellent material for hot corrosive liquids, hot and cold-water distribution, and similar applications above the temperature range of PVC. CPVC is joined by solvent cementing, threading, or flanging.

PTFE

PTFE (Polytetrafluoroethylene) has outstanding resistance to chemical attack by most chemicals and solvents. PTFE has a temperature rating of -200°F to 500°F. PTFE, a self-lubricating compound, is used as a seat material in NIBCO/Chemtrol® ball valves.

FPM

FPM (Fluoroelastomers or Fluorocarbons) are inherently compatible with a broad spectrum of chemicals. Because of this extensive chemical compatibility, which spans considerable concentration and temperature ranges, fluorocarbons have gained wide acceptance as a material of construction for butterfly valve "O"-rings and seats. Fluorocarbons can be used in most applications involving mineral acids (with the exception of HCl), salt solutions, chlorinated hydrocarbons, and petroleum oils.

EPDM

EPDM is a terpolymer elastomer made from ethylene, propylene and diene monomer. EPDM has good abrasion and tear resistance and offers excellent chemical resistance to a variety of acids and alkalines. It is susceptible to attack by hydrocarbons and is not recommended for applications involving petroleum oils, strong acids, or strong alkalines.

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Material Selection

Plastic Piping Standards

ASTM Test Methods	Properties	Material		
		ABS 3-2-2-2-2	PVC 12454	CPVC 23447
General D792	Specific Gravity	1.00 - 1.08	1.38	1.55
D570	Water Absorption % 24 Hrs. @ 73°F	0.3	0.05	0.05
Mechanical D638	Tensile Strength psi @ 73°F	4,500	7,000	7,000
D638	Modulus of Elasticity in Tension psi @ 73°F x 10^5	2.4	4.0	3.6
D790	Flexural Strength psi	10,000	14,500	15,600
D256	Izod Impact Strength @ 73°F (Notched)	4.0	0.65	1.5
Thermal D696	Coefficient of Thermal Expansion in/in/°Fx10^{-5}	5.0	3.0	3.8
C177	Thermal Conductivity BTU/HR/Sq. Ft./°F/in	1.35	1.2	0.95
D648	Heat Distortion Temp. °F @ 66 psi	219	165	238
D648	Heat Distortion Temp. °F @ 264 psi	180	158	212
	Resistance to Heat °F at Continuous Drainage	180	140	210
Flammability D2863	Limiting Oxygen Index (%)	19	43	60
E84	Flame Spread	150-250	15-20	15
	Underwriter's Lab Rating (Sub. 94)	94HB	94V-0	94V-0

Plastic Piping Standards

Many commercial, industrial, and governmental standards or specifications are available to assist the design engineer in specifying plastic piping systems. Standards most frequently specified in plastic piping systems are ASTM International. Following is a list and description of those standards most typically applied to industrial plastic piping.

ASTM Standard D1784

This standard covers PVC and CPVC compounds used in the manufacture of plastic pipe, valves, and fittings. It provides a means for selecting and identifying compounds on the basis of a number of physical and chemical criteria. Conformance to a particular material classification in this standard requires meeting a number of minimum physical and chemical properties.

ASTM Standards D2665 and D3311

These standards provide the material and test requirements as well as the fitting geometries for PVC-DWV (drain, waste and vent) fittings. These fittings are joined by threading or solvent cementing.

ASTM Standard D2466

This standard covers Schedule 40 PVC threaded and socket pressure fittings. Included in the standard are thread and socket specifications, lay length, wall thickness, burst, material, quality, and identification requirements.

ASTM Standard D2467

This standard covers Schedule 80 PVC threaded and socket fittings. Included in the standard are thread and socket specifications, lay length, wall thickness, burst, material, quality, and identification requirements.

ASTM Standard D2846

This standard covers plastic hot and cold-water distribution system components made in one standard dimension ratio. This includes a series of CTS (copper tube size) CPVC fittings meant for use with SDR 11 tube and plastic-to-metal transition fittings.

ASTM Standard D3965

This standard covers ABS compounds used in the manufacture of pipe and fittings. It identifies the chemical and physical properties of several ABS compositions based upon impact strength, deflection temperature under load, and tensile stress at yield point. These properties identify the polymers or blends of polymers that make up this rigid thermoplastic material.

ASTM Standards D2661 and D3311

These standards cover ABS-DWV (drain, waste and vent) by material and by physical configuration. These products are threaded or joined by solvent cement.

ASTM Standard F1498

This standard covers dimensions, tolerances, and gaging of tapered pipe threads used on plastic ends of pipe and fittings.

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This standard covers dimensions, tolerances, and gaging of tapered pipe threads used on plastic ends of pipe and fittings.

Material Selection

Plastic Piping Standards and Chemical Resistance

ASTM Standard F1970

This standard covers fittings and appurtenances intended to be used in PVC or CPVC plastic piping, or as a transition from such systems to metal systems. These products, such as unions, flanges, or valves, are not included in the scope of other ASTM specifications.

ASME B1.20.1 (American Society of Mechanical Engineers)

This specification details the dimensions, tolerances, and gaging of tapered pipe threads used on metallic ends of pipe and fittings, plus machined plastic threaded ends.

NSF/ANSI Standard 14 (NSF International)

This standard establishes the minimum physical and performance requirements for plastic piping system components and related materials. It also provides a basis for certification of products to consensus standards, or other physical and performance requirements where no consensus standard exists. It requires adherence to appropriate ASTM Standards and specifies minimum quality control programs. To comply with this standard the manufacturer must allow periodic testing of product and auditing of procedures by a third-party agency.

NSF/ANSI Standard 372

This standard establishes procedures for determination of lead content based on the wetted surface area within the product. This standard is used in conjunction with NSF/ANSI 61 for the purpose of compliance with the Safe Drinking Water Act (SDWA), the federal law that ensures the quality of America's public drinking water supply.

NSF/ANSI Standard 61

At the request of the U.S. Environmental Protection Agency (EPA), a consortium led by NSF International developed this standard. It was developed to establish minimum requirements for the control of potential adverse human health effects from products which contact drinking water. This Standard complements the performance requirements that are contained within ASTM product standards. NIBCO® PVC & CPVC fitting products intended for potable water applications are tested and certified by a third-party agency for compliance to ANSI/NSF Standard 61.

CSA (Canadian Standards Association)

CSA Group has several codes including the Canadian Plumbing Code as well as numerous standards. Several third party agencies provide testing and certification to show compliance with these codes and standards. For further information on third party listings contact NIBCO customer service.

IAPMO (International Association of Plumbing and Mechanical Officials)

IAPMO has several codes including the Uniform Plumbing Code (UPC). Many products are third party tested and listed showing compliance to this code by one or more third party agencies. For further information contact NIBCO customer support.

Chemical Resistance

Thermoplastics exhibit a 'GO' or 'NO-GO' type of resistance when contacted by aggressive chemicals. That is, they either resist attack completely or they deteriorate rapidly, in which case, the mechanism of attack is either solvation or reaction with the base molecule. Solvation, which is the most common form of attack, involves penetration of a chemical into the plastic causing softening, swelling, and loss of physical properties. Reaction with the base molecule involves the breakage of the molecular chain, crosslinking, or substitution reactions.

The NIBCO *Chemical Resistance Guide* contains specific chemical resistance information for the various plastic and elastomeric materials used in the NIBCO product line. When interpreting the information presented in this brochure it is important to note that it is based only on unstressed immersion testing at the temperatures noted, using pure chemicals or saturated solutions, except where otherwise specified. It is unwise to specify a plastic material without chemical resistance information relative to the specific environment of the intended application. Therefore, in situations where the aggressive environment involves a mixture of chemicals, the Chemical Resistance Guide can be used to investigate the effects of individual chemicals; however, because of possible synergisms, the suitability of a particular plastic for handling a chemical mixture should be verified. Also, since chemicals are more aggressive at higher temperatures and concentrations, chemical resistance information should not be extrapolated to higher temperatures and concentrations. Conversely, chemicals are generally less aggressive at lower temperatures and concentrations; therefore, extrapolation of chemical resistance information to lower temperatures and concentrations is generally acceptable.

When chemical resistance information is not available or a first-of-a-kind process is involved, data may be obtained through immersion testing. ASTM D543 provides a method for conducting such tests, and the chemical, as well as, the temperature used in this test should be identical to the anticipated process condition.