MATERIAL CONSIDERATIONS

When faced with the selection of piping materials to convey a particular liquid (i.e. hot water, corrosive chemicals) chemical engineers are confronted with a variety of materials both in plastics and metals. For each application a piping material is selected by its specific physical, chemical and thermal properties. Once acceptable performance characteristics are established for any material then the cost to purchase, install and maintain an economical piping system can be determined.

This catalog describes PVC and CORZAN® CPVC materials for pressure fittings and PVC, CORZAN CPVC, PP, and PVDF valve products with various "seal" options. Selection information is provided as well as design and specification recommendations to incorporate these components into piping projects.

OVERVIEW OF THERMOPLASTIC MATERIALS (FITTINGS AND VALVES)

PVC (POLYVINYL CHLORIDE)
Conforms to ASTM D-1784 Cell Class 12454

Since the mid 1950’s, PVC has become the most frequently specified plastic piping material because of its performance versus cost. PVC has excellent rigidity and long-term strength. PVC can be used in systems up to 140°F with appropriate reductions in pressure. PVC is resistant and generally inert to most mineral acids, bases, salts and paraffinic hydrocarbon solutions. There is some attack from chlorinated or aromatic hydrocarbons, esters or ketones. The resistance of PVC to certain other fluid mixtures such as fuel oils with moderate aromatic content cannot be determined on the basis of immersion testing alone. For this class of fluid mixtures, actual use data must be obtained by the user.

Applications include the following: potable water, irrigation, chilled water, deionized water, chemical drainage, plating and chemical processing, among others. Be sure to consult the Chemical Resistance Table in this catalog prior to use. Joining is accomplished by solvent cementing, threading or flanging.

CORZAN® CPVC (CHLORINATED POLYVINYL CHLORIDE)
Conforms to ASTM D-1784 Cell Class 23447

This material retains all the desirable properties of PVC but expands the useful performance range in many of the same chemical environments up to 210°F with appropriate reductions in pressure. Corzan CPVC has not only extended the performance range of “PVC type” products to handle hot corrosive liquids, it can also be used in hot and cold water applications. Joining is accomplished by solvent cementing, threading or flanging. Be sure to consult the Chemical Resistance Table in this catalog prior to use. For additional information on CORZAN, see pages 113-116.

PP (POLYPROPYLENE)
Conforms to ASTM D-4101

Polypropylene is a complementary material to the “PVC’s” in terms of both temperature range and chemical resistance capability. Polypropylene is very resistant to most organic solvents as well as many acids and alkalis. It has also gained use in hydrocarbon environments, salt water applications, waste disposal, crude oil gathering systems, and laboratory and industrial drainage systems. Colonial uses natural unpigmented homopolymer polypropylene material. This material is severely degraded by UV radiation and therefore should be protected from direct exposure to the sun and other UV exposure. Polypropylene is capable of withstanding temperatures up to 180°F (with appropriate pressure reduction). Polypropylene components are joined by thermoseal fusion, threading or flanging.

PVDF (POLYVINYLIDENE FLUORIDE)

This material further extends the operating temperature/pressure range of thermoplastic piping while maintaining chemical resistance to most acids, alkalis, alcohol, aliphatic and aromatic solvents and certain halogens. Generally, PVDF is not recommended for ketones and esters.
In applications that demand high purity (i.e. electronic, pharmaceuticals, food and beverage processing) PVDF’s low extractables and ability to be cleaned at elevated temperatures give it performance preference. Colonial uses natural unpigmented PVDF material. Unpigmented PVDF material is generally transparent to UV radiation. This means, however, that the contents flowing through the PVDF piping system would be subjected to UV exposure. It is therefore recommended that natural unpigmented PVDF material be protected from solar or other exposure. Joining is accomplished by thermoseal fusion, threading or flanging.

OVERVIEW OF ELASTOMERIC MATERIALS (VALVES)

VITON® (FLUOROCARBON ELASTOMER)

Viton is used for o-ring seals and has resistance to a broad spectrum of chemicals with greatly expanded temperature ranges. Tear and abrasion resistant, o-rings seals made of Viton resist most mineral acids, salt solutions, chlorinated hydrocarbons and petroleum oils.

EPDM (ETHYLENE PROPYLENE DIENE MONOMER)

EPDM is used for o-ring seals and butterfly valve boots. It has excellent tear and abrasion resistance and is chemically resistant to a large variety of acids, alkalis, alcohol and oxidants. It is not recommended for use with petroleum products, strong acids or strong alkalis.

TEFLON® PTFE FLUOROCARBON

This nearly insoluble and chemically inert fluorocarbon is used for valve seats. PTFE has a natural lubricating quality and high thermal stability.

SANTOPRENE®

Santoprene is used for o-ring seals and ball seats. It is a thermoplastic rubber that combines the performance characteristics of vulcanized rubber (such as heat resistance and low compression set) with the processing ease of thermoplastics. Santoprene rubber has environmental resistance equivalent to general purpose EPDM rubber compounds. Note: The Santoprene compound used by Colonial Engineering is approved by NSF International for contact with drinking water.

Table 1: Material Specifications Data (Fitting & Valve Materials)

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>TEST METHOD</th>
<th>PVC</th>
<th>CPVC</th>
<th>PP</th>
<th>PVDF</th>
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<tbody>
<tr>
<td>SPECIFIC GRAVITY</td>
<td>D-792</td>
<td>1.4</td>
<td>1.53</td>
<td>.90</td>
<td>1.76</td>
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<tr>
<td>WATER ABSORPTION</td>
<td>D-570</td>
<td>.05</td>
<td>.05</td>
<td>.02</td>
<td>.04</td>
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<tr>
<td>ASTM CELL CLASS</td>
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<td>12454</td>
<td>23447</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>TENSILE STRENGTH, PSI</td>
<td>D-638</td>
<td>7100</td>
<td>8200</td>
<td>5150</td>
<td>6000</td>
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<tr>
<td>MODULUS OF ELASTICITY, PSI</td>
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<td>400,000</td>
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<tr>
<td>FLEXURAL STRENGTH, PSI</td>
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<td>15,000</td>
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<td>9,000</td>
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<td>NOTCH IMPACT FT#IN</td>
<td>D-256</td>
<td>.65</td>
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<tr>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>COEFFICIENT OF LINEAR EXPANSION</td>
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<td>3.8</td>
<td>5.4</td>
<td>6.6</td>
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<td>THERMAL CONDUCTIVITY</td>
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<td>HEAT DISTORTION TEMP.</td>
<td>D-648</td>
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<td>243</td>
<td>225</td>
<td>284</td>
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<tr>
<td>HEAT DISTORTION TEMP.</td>
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<td>—</td>
<td>243</td>
<td>225</td>
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<td>FLAMMABILITY</td>
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<td>10</td>
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<tr>
<td>UL 94 RATING</td>
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<td>94V-0</td>
<td>94V-0</td>
<td>94HB</td>
<td>94V-0</td>
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</tbody>
</table>

Years ago, it was popular to install a standpipe full of air at each fixture (behind the wall). The purpose was to provide a cushion of air to absorb water hammer. It is now known that this type of system works for only a couple of months until the air dissolves into the water. The preferred method today is to use a bladder tank surge suppressor that keeps the air separate from the water.
**PRODUCT SPECIFICATIONS**

**FITTINGS**

**SCHEDULE 40 FITTING SPECIFICATIONS**

White and gray PVC products, both socket and threaded types shall conform to the requirements of ASTM D-2466. Fittings shall be manufactured from PVC compound which meets or exceeds the cell classification of 12454 as outlined in ASTM D-1784 (formerly known as type 1, grade 1). Fittings shall have been tested and approved for potable water service by a third party certifier such as NSF International.

**SCHEDULE 80 FITTING SPECIFICATIONS**

Gray PVC and CPVC products, both socket and threaded types shall conform to the requirements of ASTM D-2467 and D-2464 (PVC) and ASTM F-439 and F-437 (CPVC). Flanges shall be of solid one piece or two piece (Van Stone design). They shall be compatible with ANSI B16.5, Class 150, Metal Flanges. Flanges require a full-face gasket for assembly. **Note: Do not use ring gaskets.** Flanges shall be manufactured from PVC compound which meets or exceeds the cell classification of 12454 as outlined in ASTM D-1784 (formerly known as type 1, grade 1) or CPVC compound which meets or exceeds the cell classification of 23447 as outlined in ASTM D-1784. Fittings shall have been tested and approved for potable water service by a third party certifier such as NSF International.

**SCHEDULE 80 UNION SPECIFICATIONS**

Gray PVC and CPVC products, both socket and threaded types shall conform to the requirements of ASTM D-2467 and D-2464 (PVC) and ASTM F-439 and F-437 (CPVC). Unions shall be produced from PVC type I, cell classification 12454 or CPVC type IV, cell classification 23447. Unions shall be of the o-ring seal type (EPDM or made of Viton®). They shall meet the pressure rating requirements of DIN Standard 3441.

**MARKINGS**

All PVC and CPVC products are to be marked as follows: manufacturer’s name or trademark, NSF International seal of approval (if applicable), product size, ASTM designation, material type, schedule number, USA and cavity designation.

**CPVC CTS (COPPER TUBE SIZE) FITTINGS SPECIFICATIONS**

Tan CPVC Copper Tube Size pipe and fittings shall conform to the requirements of ASTM D-2846. Fittings and pipe shall have been tested and approved for potable water service by a third party certifier such as NSF International.
VALVES

OVERVIEW

Colonial valves are designed and built to require very little maintenance and provide years of trouble-free service. Our unique polymeric locking strip provides the utmost in personal safety in our true union ball valves. The Super “C” compact valve is the smoothest turning, lowest torque compact valve available.

TRUE UNION BALL VALVE (TUBV) SPECIFICATIONS

All thermoplastic true union ball valves (1/2” through 6”) shall be produced of PVC type I, cell classification 12454 or CPVC type IV, cell classification 23447 or PP or PVDF material. Valve o-rings shall be made of EPDM, Santoprene® or Viton® material. The valve stem shall have two o-rings. The valve body shall have two stem stops. The valve carrier shall have a full block polymeric locking strip. Valve seats shall be Teflon® material. Valves shall be operated by a handle or pneumatically or electrically by an actuator. Valves shall be full port (equal to or greater than the minimum inside diameter of sch 80 pipe). End connectors shall be of socket, thread or flange type. Valves shall meet or exceed the European DIN 3441 standard for pressure rating. Valves shall be capable of being adjusted externally for seat wear.

MULTI-PORT VALVE SPECIFICATIONS

All thermoplastic multi-port valves (1/2” through 2”) shall be produced of PVC type I, cell classification 12454 or CPVC Type IV, cell classification 23447. Valve o-rings shall be made of EPDM or Viton material. Valve seats shall be Teflon material. Valves shall be operated by a handle or pneumatically or electrically by an actuator. Valves shall be capable of being field retrofit with a pneumatic or electric actuator. Valves shall be full port (equal to or greater than the minimum inside diameter of sch 80 pipe). Valves shall have three union nuts for ease of disassembly. End connectors shall be of socket, thread or flange type. Valves shall meet or exceed the European DIN 3441 standard for pressure rating. Valves shall be capable of being adjusted externally for seat wear.

SUPER “C” COMPACT BALL VALVE SPECIFICATIONS

All thermoplastic compact ball valves (1/2” through 2”) shall be of sealed unit type. Valves shall be produced of PVC type I, cell classification 12454 or CPVC type IV, cell classification 23447 material. Valves shall have independent internal carrier for maximum seat life. Valve seats shall be produced of Teflon or Santoprene material. Valve o-rings shall be made of EPDM, Viton or Santoprene material. Valve stem shall have two o-rings. The valve body shall have two stem stops. Valves shall be...
operated by a handle or pneumatically or electrically by an actuator. Valves shall be full port (equal to or greater than the minimum inside diameter of sch 80 pipe). Valves shall be capable of being field retrofit with a pneumatic or electric actuator.

**MIP (MOLDED IN PLACE) BALL VALVE SPECIFICATIONS**

All thermoplastic MIP ball valves (1/2” through 2”) shall be of one-piece construction and produced of PVC type I, cell classification 12454 material. Valve seats shall be of Teflon or Santoprene material. Valve stem o-ring shall be of EPDM or Santoprene material. Handle shall be attached with thermoplastic locking pin. The valve shall contain no metal components.

**CTS (COPPER TUBE SIZE) BALL VALVES SPECIFICATIONS**

All thermoplastic CTS ball valves (1/2” and 3/4”) shall be of one-piece construction and produced of CPVC type IV, cell classification 23447 material. Valve seats shall be of Teflon or Santoprene material. Handle shall be attached with thermoplastic locking pin. The valve shall contain no metal components.

**BALL CHECK VALVE SPECIFICATIONS**

All thermoplastic ball check valves (1/2” through 3”) shall be of single union design and produced of PVC type I, cell classification 12454 or CPVC type IV, cell classification 23447 or PP or PVDF material. Seat shall be made of Viton. End connectors shall be of socket, thread or flange type.

**WYE LINE STRAINER SPECIFICATIONS**

All thermoplastic wye line strainers shall be produced of PVC type I, cell classification 12454 or CPVC, cell classification 23447. Strainer assembly shall have a union nut for ease of removal during cleaning. Strainer screens shall be of stainless steel or polypro material. Screens shall be of 20 or 40 mesh in stainless steel and 20 mesh in polypro material. End connectors shall be of socket or thread type.