Understanding CPVC Material & Processing
A Foundation for Product Selection and Specification

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TECHNOLOGY UPDATE

The increased popularity of Chlorinated Polyvinyl Chloride (CPVC) for industrial applications has produced a variety of claims from both raw material suppliers and product manufacturers that can be conflicting, confusing and even misleading to designers, installers, and specifying engineers. An honest understanding of the development, standardization, and manufacturers' selection of CPVC used in thermoplastic piping system products can best dispel the confusion, falsehoods and myths.

Chlorinated Polyvinyl Chloride (CPVC) is a direct derivative of Polyvinyl Chloride (PVC) modified by the addition of chlorine (post chlorination). This produces a change in physical properties and altered chemical resistance, but primarily improves thermal properties for a higher heat handling capacity. CPVC resin is "compounded" by adding processing agents, stabilizers, and colorants making a material that can be injection molded into fittings and valves or extruded into pipe. Today, required compound ingredients are purchased on a global market resulting in high quality CPVC materials being available on an international basis.

Manufacturing processors played a key role in the development of CPVC compounds that could be processed into marketable products. Companies such as R&G Sloane (now George Fisher Sloane) and Spears® Manufacturing Company (in early 1980's) compounded their own CPVC materials using proprietary combinations of resin, stabilizers, processing aids, and colorants when quality materials were not available or were excessively priced. In the past twenty years, CPVC piping products have been produced in a variety of commercial compounds from raw material suppliers such as Auto-Chem, Nippon Carbide, Noveon (formerly B.F. Goodrich), and Georgia Gulf. These material suppliers have relied and called heavily on the manufacturing processors to assist in developing materials for improved processing. Why? Because it is the ***manufacturing process*** that dictates product performance. While differences in resin, processing aids, stabilizers, and colorants affect the way a material processes; the integrity of the finished product is directly determined by the manufacturing processor's capabilities and expertise. Today, there are numerous manufacturing processors of CPVC pipe, fittings, and valves such as the following:

Spears® Manufacturing Co., Inc.
Harvel Plastics, Inc.
Chemtrol Div. of Nibco, Inc.
Thompson Plastics, Inc.
Plastinetics, Inc.
IPEX, Inc.
George Fisher, Inc.
George Fisher Sloane, Inc.
Genova Products, Inc.
Colonial Engineering, Inc.
Plast-O-Matic Valves, Inc.
Dura Plastic Products, Inc.
Charlotte Pipe & Foundry, Inc.
Hayward Industrial Products, Inc.
Asahi/America, Inc.
FIP S.R.L.
Tyco Fire Products/Central Sprinkler, Inc.

Even from this wide selection, there is ***no single manufacturer*** capable of producing all pipe, valves and fittings in the full range of product sizes needed for today's industrial applications. Moreover, raw material suppliers produce more than one recipe-compound while some product manufacturers use more than one material supplier. As a result, piping systems include products from different manufacturing processors as well as materials from different CPVC compound suppliers.

As for compatibility, all CPVC compounds have the same basic molecular structure. As a result, the chemical action of solvent cement welding produces solid joints between all CPVC products, regardless of material brand, specific compound or product manufacturer. A variety of industry standards have been developed for CPVC in order to maintain material consistency and compatibility regardless of compound formulation used.

The American Society for Testing and Materials (ASTM) has established standard requirements for CPVC materials used in piping system components. The basic requirements are defined in a ***cell classification*** that represents base resin type, impact strength, tensile strength, modulus of elasticity, deflection temperature and flammability. Unlike PVC piping materials for which there are multiple classifications specified for piping applications, CPVC materials specified in current ASTM Standards for CPVC pipe and fittings fall under the ASTM cell classification of 23447. While certain variations have been developed for cell class properties of impact strength and deflection temperature on pipe, this cell classification remains the minimum specified for fittings.

Minimum performance requirements for piping system products made from CPVC materials are also established by ASTM. These include characteristics such as dimensions, hydrostatic burst pressures, and long term sustained pressures according to specific products. Reputable product manufacturers and material producers use a variety of third party certification organizations to provide additional assurance that ASTM and other industry requirements are met. The National Sanitation Foundation (NSF) has established standards for certification of CPVC products and materials with respect to their suitability for use with drinking water, as well as conformance to ASTM specifications. In addition to ASTM and NSF, other organizations that involve themselves in regulation of materials, manufacturing, or installation of CPVC products include:

Underwriters Laboratory (UL)

Underwriters Laboratory of Canada (ULC)

Factory Mutual Research (FM)

International Association of Plumbing and Mechanical Officials (IAPMO)

International Code Council (ICC)

International Organization for Standardization (ISO)

Canadian Standards Association (CSA)

Federal and State regulations

Local building codes

CPVC piping system designers and installers should research the manufacturing processors that supply products to ensure their capability of producing consistent quality products. At a minimum a processor should be capable of:

- Materials Testing – Processing Performance, Tensile Strength, Chemical Stress Testing
- Product testing for conformance with applicable standards
- Applications Testing – Pressure Cycling, Thermal Cycling

While all CPVC raw material compounds are fully compatible for piping system applications, they are not identical. Variations in processability and physical properties make certain compounds more suitable for some products, but not for others. The manufacturer's processing requirements for a raw material will vary according to the type, size, and intended use of the product as well as the processor's capability. The particular compound used by a finished goods manufacturer is one element of many that can be changed to achieve improvement or produce a superior quality product. Just as no single manufacturer can provide all products needed, no single raw material supplier can provide all the processing variations needed for today's demanding industrial applications.

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SPEARS® MANUFACTURING COMPANY

15853 Olden St., Sylmar, CA 91342

(818) 364-1611 • Visit our Web site: www.spearsmfg.com