

Ask Tom! Column

Specifying Rotationally-Molded PE Storage Tanks

Guest Article by Darrell Oltman & Arthur Blaker

Each of the commonly used materials of construction for PE bulk storage and processing tanks has advantages and disadvantages in particular use conditions. For some applications, several materials of construction may be acceptable. The key is recognizing each materials' strengths and weaknesses and applying them to the application requirements.



Applications

Polyethylene (PE) tanks can be used successfully in a variety of liquid and dry material applications.

Rotationally molded PE tanks are also acceptable for storing many liquids at atmospheric pressure and can be designed for use with corrosive liquids, commonly used in the water and wastewater treatment industry, such as sulfuric acid, hydrochloric acid, sodium hypochlorite, hydrofluoric acid, and sodium hydroxide.

PE tanks are highly impact resistant, have homogeneous wall construction, good weatherability, broad chemical resistance, excellent adaptability for numerous nozzle (outlet) configurations. These attributes make PE tanks an effective alternative to costlier FRP and metallic fabricated vessel assemblies. A result of stress-free construction, PE resists cracking, does not dent, and is rotationally molded seamless.

PE tanks are not suitable for high heat (over 150°F), pressurized applications, and exposure to aromatic hydrocarbons, halogenated solvents, some aliphatics, and chemical reactions or processes that release free oxygen molecules. In applications that do not involve these conditions, rotationally molded polyethylene tanks should be considered.

Some engineers are not aware of what rotational molding is capable of producing. HDLPE tanks are molded for a wide variety of applications in vertical, horizontal, and conical bottom configurations.

Sizes range from five gallons to 16,500 gallon vertical! Wall thickness vary from 0.125 inches to over 2.75 inches. PE tanks are extremely durable and may be constructed from both crosslinkable and linear PE resins. The two resin types have similarities, but also have some very basic differences.

Linear vs. Crosslinked Polyethylene

Linear polyethylene is a long-chain polymer consisting primarily of ethylene groups. On the molecular scale, it may be described as a long chain of repeating groups, each having one carbon atom connected to two hydrogen atoms, one on either side. At each end, the carbon of one group is connected to another group.

Individual molecules are very long, generally containing between 10,000 and 100,000 atoms in the carbon backbone of each molecule. The solid polymer contains millions of those long molecular chains entangled together. The strength of the molded polyethylene part lies in the complexity of that entanglement, which mechanically restricts the polymer from changing shape.

Crosslinkable PE resins contain a small amount of crosslinking agent dispersed throughout a linear polyethylene material. The crosslinking agent is designed to decompose at a selected temperature during the rotational molding process.

During the decomposition sequence, crosslinking agents break down into two reactive products, each of which strips a single hydrogen atom from the carbon backbone of the nearest PE molecules. Stripped of their hydrogen, the remaining carbon atoms are reactive and combine with each other, thus “crosslinking” the carbon chains of two molecules.

Strength of the crosslinked PE depends solely on the links, usually no more than one or two for every 1000 carbon atoms. The strength of crosslinked PE no longer depends solely on the mechanical entanglement of molecules, but is reinforced by a network of chemical bonds.

These basic differences between the resins cause variation in properties. Linear PE is capable of being recycled and welded (repaired). Has good cold impact resistance, excellent elongation characteristics, meets the requirements of the U.S. Food and Drug Administration (FDA) Regulation 177.1520, has good environmental stress-crack resistance and can develop high tensile strength. Crosslinked PE is a tough material that cannot be recycled or welded (repaired). Has excellent cold impact resistance, good elongation characteristics, excellent environmental stress-crack resistance and can develop a high tensile strength if processed correctly.

Crosslinked PE resins are not FDA approved because of the by-products of the crosslinking agent decomposition during the rotational molding process. A crosslinked resin, even with a linear liner, should not be used for food processing or potable water applications.

Discuss Each Application

Different materials and processing methods can also cause variations in other physical characteristics of the material. Discuss each application with the rotational molders’ representative.



Type of chemical, concentration, specific gravity, temperature range, dimensions, mechanical loading, indoor or out-of doors exposure, and physical location of tanks are just a few of the considerations that must be analyzed during the specification phase of PE storage tanks.

Compare competitive quotations to ensure they are for similar conditions. Here are some points to consider:

1. Have the tank described to a consistent spec such as ASTM D-1998-97.
2. Check the accessories quoted to ensure they are of comparable construction and quality.
3. Specify that the manufacturer will use only virgin materials (no regrind material).
4. Insist on a “chemical specific” warranty not “workmanship and materials.”
5. Larger tanks are heavy, insist on lifting lugs. The best lifting/tiedown lugs are rotationally molded as part of the vessel; no drilling, no expensive alloy hardware.
6. Insist on ample flat areas on the dome of the vessel for fittings and accessories.
7. Full drainage molded-in FNPT inserts available in hastelloy, titanium, or stainless steel make tank draining and cleaning chores “routine.”
8. When working with double wall tank assemblies, insist on a UFO (Unified Fitting Outlet) design that allows side wall fittings to be installed and safely sealed through both walls, primary and secondary.

About the authors, Mr. Darrell Oltman is an industrial products engineer with Snyder Industries, Inc., <http://www.snydernet.com> and Mr. Arthur Blaker is with Kefco Inc., <http://www.kefco.com>.

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Welcome to Ask Tom!, a monthly column by our resident water treatment guru, Tom Keenan of National Environmental Services Agency (NESA). Tom addresses the issues that bug you the most. And Tom knows!! With 35 years experience in providing environmental support services to public and private sector clients on a wide range of environmental issues.

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Guest articles for the **Ask Tom!** Column are always welcome, for more information please contact Tom Keenan directly at his email address: info@nesa.ie

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