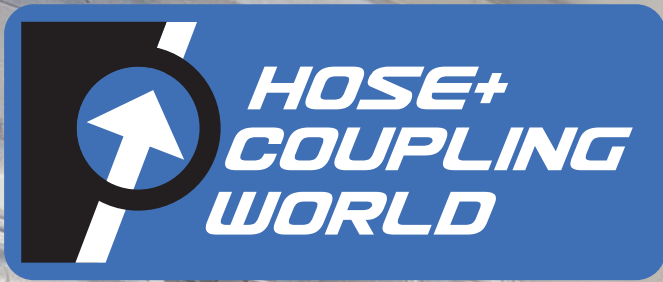


The global magazine for hose & coupling producers, movers and users



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PAVING THE WAY IN HOSE INNOVATION: An inside look at industry-leading Resistoflex®

For 63 years, Resistoflex, a business of Crane Co., has been serving customers with hoses and fittings lined with Teflon® PTFE, for applications in the chemical and pharmaceutical industries. Hose & Coupling World had the pleasure of meeting with James Strom - VP/General Manager CRANE ChemPharma Flow Solutions, David Yanik - Product Development/Engineering Manager, and Brad Allen - Value Stream Supervisor, at Resistoflex headquarters in Marion, North Carolina.

By Melanie Gogan, Editor



Celebrating its 160th anniversary this year, Crane Co. is a diversified manufacturer and distributor of highly engineered industrial products, servicing such niche markets as fluid handling, aerospace, automated merchandising and construction, among others. Part of Crane's *Fluid Handling Group*, Resistoflex is a leading manufacturer and distributor of corrosion-resistant lined pipes, fittings and hoses lined with Teflon® PTFE. It serves a global market, with satellite operations in the Netherlands, Singapore, China, Bangkok and Australia. Despite Resistoflex's global footprint, David Yanik – Product Development/Engineering Manager notes, Teflon® PTFE processing/lining capabilities are only available at Resistoflex's Marion headquarters,



CRANE®

considered the center of excellence for PTFE hose technology.

Resistoflex are experts at responding to customer needs, on a global scale. While there is certainly a great volume of internally-driven engineering innovation, most de-

"That's one thing that we do a good job of, honestly listening to customers," says Strom.

velopmental work, explains James Strom – Vice President/General Manager Resistoflex, is based on industry demand, customer feedback and understanding how customers want to be served. "That's one thing that we do a good job of," says Strom, "honestly listening to customers."

In this respect, Resistoflex has adapted to global diversity, driven by consumer demands. The United States is very distribution-focused, explains Strom, with approximately 75% of end-users going through distribution, including specialty distribution, and only a handful of Original Equipment Manufacturers (OEMs) supplying directly to clients. In places like Europe, Thailand, Indonesia and Singapore, on the other hand, customers prefer to bypass the distributor and buy direct from the manufacturer. According to Strom, this is where Crane's ChemPharma & Energy's global sales force has done an excellent job in listening to customer's needs and applying the right product for a variety of applications.

A history of innovation

With its 80th anniversary on the horizon, Resistoflex has a lot to celebrate, including ongoing global expansion, an industry-leading product line and a rich history of responding to customer needs. Resistoflex, a name derived from the concept of *resisting the ills of flexing*, was formed in 1936, just around the time there was an accidental discovery of a "strange white powder" by Dr. Roy Plunkett of DuPont Co. Of course, this was the discovery of Teflon® - a brand

name given to a whole family of fluoropolymers, for which polytetrafluoroethylene (PTFE) is one. Resistoflex was the first company, with the help of DuPont, to develop a process for converting this powdery substance into a mechanically sound tubular shape.

As the inventors of PTFE-lined hose technology in 1953, the initial applications were in the aerospace and chemical industries. This was followed, in 1956, by the introduction of the world's first pipe and fittings lined with Teflon® PTFE. These developments were a paradigm shift for both the aerospace and

anywhere from 70 to 75 percent of Resistoflex's business. PTFE's ability to withstand highly corrosive materials at high temperatures makes it an undeniable choice for clients, where "the demand for corrosion resistance and purity is paramount," says Strom. Next in line come pharmaceutical applications, which account for approximately 20 to 25 percent of Resistoflex hose applications. The remaining percentage, explains Strom, is allotted to a long list of varying applications, from plane de-icing to carrier tank loading.

Strom lists the four leading chemical applications for Resistoflex hoses: the *chlor-alkali* value stream, *silicon* group, *polyurethane* production and the manufacturing of *refrigerants*.



chemical segments because the chemically inert PTFE and temperature capabilities to 500° F offered significant cost savings compared to nickel alloy solutions. Strom remarks that finding an un-occupied space is rare and one of those blindingly obvious moments, "As a pipe liner, this would be fantastic!"

Critical hose applications

The vast majority of Resistoflex business is generated from the chemical industry. With its focus on PTFE technology and applications, it's no wonder Resistoflex finds itself in the most critical of applications as a specialized, highly engineered chemical transfer hose manufacturer. Strom estimates chemical applications account for

Chlor-alkalis

The chlor-alkali group, or chlorinated organics, includes the production of hydrochloric acid, chlorine, bromine and other halogenated acids. In part, these chemicals lead to the production of such things as polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC) and epichlorohydrin, which is a precursor to epoxy resin. Applications for these materials include hot and cold water PVC pipes and siding, epoxy resin for a variety of end-products, and chlorine for downstream organic chemistry and water treatment solutions. It is no wonder that the general mantra at Resistoflex is "follow the acid."

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Silicon

Then comes the silicon group, with its own unique chemistry. It starts with beach sand! Combined with variations of chemicals like chlorine, hydrochloric acid and methylene chloride, the resulting “viscous gooey stuff,” remarks Strom, is silicon or silicon metals. Again, the applications are endless - from silicon-based paint and rubbers to medical implants and other pharmaceutical applications. Silicon is now being applied to photovoltaic solar technology, due to its properties as a semiconductor.

Polyurethane

Polyurethanes make up the third largest Resistoflex end-use application within the chemical industry, says Strom. Requiring the use of chemicals like nitric acid and hydrochloric acid to produce it, polyurethanes are hugely popular for their insulating properties, and find use in everything from polyu-



rethane foams, heat seals, paints and the paneling within our refrigerators. With no foreseeable end to customer demand, Strom jokes, “thank goodness for Nike, Reebok and New Balance, because what’s in the soles and cushioning of the shoe is all polyurethane.”

Refrigerants

Last but not least, refrigerants – used in your automobile or home air conditioning units. The manufacturing of refrigerants involves difficult fluorine chemistry, which is particularly tough to handle in terms of corrosion resistance. As Yanik points out, hydrofluoric acid is so toxic and corrosive, even a few drops on human skin have the potential of being lethal. This

is where a truly reliable chemical transfer hose is imperative – a true testament to the quality of Resistoflex PTFE technology.

Setting the bar for hose technology

While there are many manufactur-

“While we might refer to it as an elephant hose, inside it is all PTFE, which is chemical resistant... [it’s] not something that anyone else offers,” says Yanik.

ers producing variations of rubber, metal or silicon hose, with stainless braid, rubber covering, and any number of additional material and constructional combinations, Resistoflex has engineered three very unique hoses that are not found elsewhere in the industry. Apart from Resistoflex’s extensive line of high performance hoses, these three hoses: the *Twister*, *Stratus* and *TR hose* stand apart.

TWISTER - the kink-resistant hose

Twister is a unique patented design incorporating a seamless, convoluted Teflon® PTFE tube reinforced with a stainless steel wire wrap and ethylene propylene diene monomer (EPDM) rubber cover, with a crimp style fitting. Yanik refers to this hose as “kink proof” because it is virtually impossible to kink.

Twister’s light weight and flexibility makes it ideal for tank, truck or rail car loading and unloading. It has also proven itself effective in the pharmaceutical and chemical industry for load cell applications, where the exact weight of various raw materials is critical to proper batch mix-

ing ratios. Not to mention its uses in pharmaceutical applications, where specific ingredient combinations are routinely switched according to new “campaign” requirements. Again, the lightweight and flexible Twister makes for an ideal easy-to-use connection.

STRATUS - the high purity hose

Stratus is the first silicone hose lined with PTFE Teflon®. Yanik remarks “for high purity applications, customers like silicone hose, for its inertness. Plus it is USP class VI certified, which means it has no bio-reactivity.” Designed to reduce the risk of potential contaminations in pharmaceutical and biopharmaceutical processing, Stratus is resistant to Steam-In-Place temperatures and corrosive effects. Moreover, it offers zero entrapment potential. According to Yanik, “In addition to its flared through design, Stratus has best-in-class drain-ability of any hose for high purity applications.”

TR HOSE aka “Elephant Trunk” - built for toughness

The TR hose is made of heavy wall smooth bore Teflon® PTFE tube, reinforced with multiple plies of fabric supported styrene-butadiene rubber (SBR), embedded spring steel helix wire and a Neoprene cover. Known for its toughness, one refrigerant manufacturer and client of Resistoflex actually tests the TR hose performing what they call the *End Pull Test*, where a truck is rolled off a loading dock to see if the hose is able to restrain the truck. Results: it does!

Yanik remarks, “While we might refer to it as an elephant hose, inside it is all PTFE, which is chemical resistant. So it’s a very tough exterior, with high pull test resistance, and not something that anyone else offers.” It stands up to hydrofluoric acid. Needless to say, a tough hose, inside and out.



Resistoflex - Marion, North Carolina

Resistoflex end-fittings – the universal shank

Resistoflex believes that if a manufacturer is going to sell a high performing critical service hose, it's essential to think in terms of the entire hose assembly. After all, what good is a hose's high pressure rating and corrosion resistance, when it's coupling, or "end-fitting," does not perform to the same standard? In response to this, Resistoflex developed its unique universal shank. With a universal OD common to all Resistoflex-manufactured end-fittings. Be it a camlock fitting, flanged, threaded, sanitary tri-clamp or I-line, the universal shank is made to fit any Resistoflex hose. "The integrity of the fitting connection is paramount," says Yanik, "because you are only as strong as your weakest link." In effect, Resistoflex has taken the guesswork out of hose assembly, offering a complete hose package that is tested reliable.

Crane's Critical Hose Standards and testing

Resistoflex operates under Severe Service Critical Hose Standards guidelines, stringent internal regulations regarding the manufacturing and testing of Resistoflex hoses and end-fittings. Adhering to Resistoflex's internal minimum threshold testing, every hose is qualified to a battery of testing, including high and low temperature testing, burst pressure testing and vacuum testing. Then comes ongoing quality-control testing,

which can include specific gravity testing, tensile strength and elongation testing, and differential scanning calorimetry (DSC) testing, which provides data on the heat history of PTFE.

The Occupational Safety Health Administration (OSHA) in the United States specifies a special code, OSHA 1910, which designates process safety management guidelines for 177 highly hazardous chemicals. Plants that

"There are a lot of manufacturers that just make hose... Resistoflex took a different approach," says Strom.

use these chemicals are placed at higher levels of scrutiny for the mechanical integrity of piping, and understandably so. Strom suggests, this same level of regulatory standards should be applied to hoses and end-fittings, especially in reference to these "critical service" applications.

Strom further notes, while there is the Chlorine Institute, an American technical trade association focused on chlorine, and the National Association of Hose Assemblers and Distributors (NAHAD), neither of these organizations offer code or government-mandated standards on hoses. The American Society of Mechanical Engineers offers regulations on Bioprocessing Equipment (ASME BPE), but most of these

standards do not speak specifically to hoses. In this respect, Strom explains, end users are left in the unfortunate position of having to adapt a "buyer beware" mentality. Strom believes there is an industry need for change.

Harnessing the ethylene cracker

There is an interesting development taking place in the US chemical industry, explains Strom. With the increased exploration of natural gas resources, huge potential is opening-up for the chemical markets and related industries – and it all starts with the ethylene cracker.

In the ethylene cracker, a simple double-bonded hydrocarbon molecule is formed and becomes the building block of organic chemistry and most plastics. The ethylene cracker facility is one of the most expensive investments made by chemical companies, offering the potential of billions in increased exports. Commonly extracted from crude oil through a process of Naphtha cracking, ethylene crackers derived from ethane gas, make for a "cleaner," less costly ethylene

building block... with huge potential! When we consider the massive reservoir of natural gas in the United States, Strom explains, this spells huge production advantages and profits for downstream chemical processes.

Looking five to ten years ahead, it is this ethane gas-to-ethylene conversion that Strom predicts, offers the most exciting potential for growth. Coupled with Crane's five-year plan, focused on product development and geographic expansion, Resistoflex is well positioned to maintain its position as an industry leader and innovator.

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