TECHNICAL ARTICLE SERIES

Maintenance at the Boeing Company

ARTICLE # TL-124

INDUSTRY: Metal Finishing

ENTITY: Boeing Company

SOLUTION(S) PUMPED: Acid salts, Caustic solutions, Chromic acid, Hydrochloric

PUMP TYPE(S): FLEX-I-LINER Sealless Self-Priming Peristaltic Pumps

Vanton Pump & Equipment Corp.
201 Sweetland Avenue
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Fax: 908-686-9314
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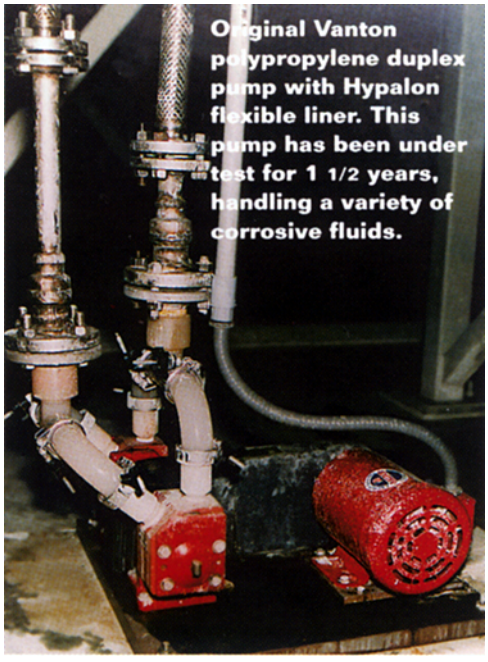
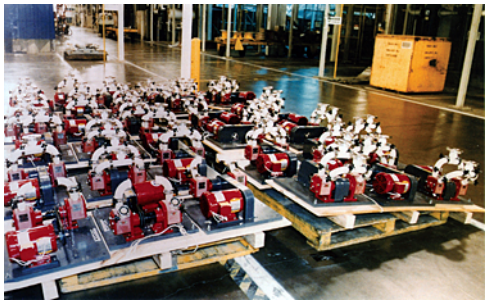


Original Vanton polypropylene duplex pump with Hypalon flexible liner. This pump has been under test for 1-½ years, handling a variety of corrosive fluids.



These 35 Flex-i-Liner® Duplex Teflon Pumps with Viton flexible liners are scheduled to replace the troublesome diaphragm pumps at Boeing's Wichita, Kansas facility. They will be handling a variety of acids, caustics and solvents.

Maintenance at The Boeing Company

Reprinted from PLANT SERVICES
By Charles M. Boyles, C.P.E., Editor-in-Chief

Upgraded system for handling corrosives improves safety and reduces waste

The building has the latest in environmental controls, which provide a safer workplace for employees while increasing productivity and protecting the environment.

One of the reasons the Boeing Company has become the largest aerospace firm in the United States is its published commitment to cut waste and boost productivity with less time at the lowest possible cost. Coupled with this high quality and low cost drive is Boeing's emphasis on changing manufacturing processes to improve worker safety and reduce the environmental impact of its operations.

When the huge —more than a million square feet —manufacturing process facility in Wichita, Kansas was completed in September 1991, it was hailed as one of the largest and most technologically advanced facilities of its kind in the world.

It is truly a state-of-the-art metal finishing and painting facility. There, critical parts for every Boeing commercial jet liner undergo a variety of corrosion-inhibiting processes to extend service life.

According to Boeing's Health and Safety Administrator, Chris Frederick, construction of the manufacturing process facility allowed Boeing to consolidate many of these chemical processes in a single building. The building has the latest in environmental controls, which provide a safer workplace for employees while increasing productivity and protecting the environment. Specific emphasis was placed on incorporating an automated chemical addition system in the facility design. The system reduces direct operator exposure during tank filling and periodic chemical additions. Also, it has a sophisticated chemical milling recovery system.

The recovery system regenerates sodium hydroxide used for chemical milling and removes the dissolved aluminum from the process. These products are recovered and recycled as part of Boeing's environmental program. Boeing is determined to comply with and exceed EPA regulations. Existing chemical addition practices associated with charging and maintaining pH control in metal finishing tanks were considered impractical for this modern facility.

A better way

In the past, many of the chemicals used were received in powdered form and were handled by production process mechanical cranes. This approach was relatively slow. The powdered chemicals did not

dissolve readily in the finishing tanks. Also, the employees were subject to possible chemical exposure during the transfer of powders that had hardened in drums.

Boeing conducted a thorough examination of the equipment design and the potential hazards for employees. From this study, Boeing decided to standardize on the use of liquid formulated metal finishing chemicals instead of powdered.

The new liquid chemical addition system uses bulk loads of the chemicals for initial tank charging. The new system has dedicated pipelines to transfer the chemicals to specific tanks safely. This system completely eliminated any manual contact with the chemicals.

For the daily or "on demand" chemical additions, Boeing engineers specified 350-gallon portable tanks with flow-controlled chemical metering pumps. Thirty-six chemical metering stations were established to transfer chemicals safely from the portable tanks to the appropriate metal finishing tank.

The corrosive, hazardous and toxic chemicals —nitric, sulfuric, phosphoric, hydrochloric, hydrofluoric, chromic acids, acid salts, caustic solutions and solvents —required the closed piping systems for safe handling.

The variety of chemicals Boeing handled dictated the use of non-metallic pumps. Non-metallic pumps ensure resistance to corrosion and avoid the potential for metallic contamination in process solutions.

Boeing engineers also wanted to test several different types of positive displacement chemical metering pumps for comparative evaluation. Initial studies resulted in the decision to install electric and air operated diaphragm type pumps.

Although the new liquid handling system was a decided improvement over the powder drums, there were problems with the diaphragm pumps. They were relatively noisy and required pulsation dampers to ensure even flow of chemical additions. This resulted in costly maintenance procedures.

In keeping with Boeing's ongoing quality improvement program, the maintenance department decided to test a non-metallic peristaltic metering pump that was in use for handling a wide range of corrosive chemicals.

The pump had to meet some basic requirements. It had to be sealless and self-priming. Fluid contact components had to be non-metallic. Also, the pump had to preclude the danger of external leakage or fugitive emissions —in keeping with Boeing's environmental commitment.

Boeing engineers selected a pump with a polypropylene casing —body block —and a flexible liner made of Hypalon™—a chloro-sulphonated polyethylene elastomer. They also specified that the pump be supplied with a variable speed motor and speed controller for controlled metering.

According to Boeing's Maintenance Supervisor, Bert Montgomery, and

Maintenance Project Engineer, Lawrence Hole, the test pump has been in service for 1-½ years without any problems.

Results

As a result of the successful test, the project engineers wrote a detailed specification for a similar unit with duplex pumps. The pumps are constructed of a single group of non-metallic materials that are inert to the corrosive chemicals and solvents handled by the portable tanks.

Boeing engineers decided on this combination of pump materials: pump casing —reinforced Teflon™, flexible liner —Viton™, expansion rings —Delrin™, and unpigmented polypropylene piping. This design offers complete interchangeability of pumps and spare parts. This translates into low maintenance inventory. In keeping with Boeing engineers' thoroughness, they also specified an organic stabilized grease for lubrication.

Boeing's manufacturing process facility is now replacing its diaphragm chemical metering pumps with self-contained metering pumps at 35 chemical metering stations. Also, Boeing is experimenting with a pumping system for its soluble machine coolant recycling center.