Colder Products Company®

New Generation Non-Spill Quick Disconnect Technology

White Paper

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White Paper

NON-SPILL QUICK DISCONNECT TECHNOLOGY

Abstract: *Traditionally, non-spill quick disconnect couplings have served the high pressure, industrial hydraulic market. Existing commercial designs are characterized by minimal air inclusion at connection and low spillage at disconnect. Common coupler package materials include machined brass, zinc-coated steel and stainless steel. Recent design innovations and improvements include advances in valve design, optimized flow area calculations and isolation of the valve actuation springs from the fluid flow path. These developments have led to new low pressure, thermoplastic quick disconnect couplings incorporating flush face non-spill valve technology.*

NS2 Series non-spill couplings.

For the purpose of this white paper and non-spill technology discussions, the following terminology is frequently used. As with any technical subject matter, it is important to understand and use common reference terminology.

Spillage: The volume of liquid between the valve faces that is released every time the coupler is disconnected. One drop of water = 5ml. A traditional valved 3/8" coupler has ~ 1-2 ml spillage per connection cycle; Colder Products Company non-spill technology reduces this volume to .01-.15 ml spillage per connection cycle with the same 3/8" flow area.

Inclusion: The volume of air that is put into a system every time the coupler is connected. A traditional valved 3/8" coupler has ~ 2 ml inclusion per connection cycle; Colder Products Company non-spill technology reduces this volume to ~ 0.4 ml spillage per connection cycle with the same 3/8" flow area.

Leakage: Media that leaks out of the coupler while connected or disconnected.

Flow Area: The areas through which the fluid or gas media travel. Used to specify coupling size to meet requirements of tubing size, pressure drop, flow rate, etc.

Traditional Non-Spill Couplings

High-pressure non-spill coupling.

Traditional non-spill quick disconnect couplings are used in high pressure, hydraulic applications. This has been accomplished through designs which utilize brass, zinc-plated steel and stainless steel. While these couplers and associated design technologies serve industrial hydraulic applications, there are other applications and markets that are better served by quick disconnect couplers, utilizing modern materials and new design strategies. In particular, the use of engineering polymers as a construction material extends the boundaries of usefulness to these new applications.

Engineering Polymers

Anyone who has recently looked under the hood of a new car has seen the extensive use of engineering polymers. Weight reduction and improved strength and rigidity, as well as reduced cost, make modern polymers a natural fit for many industrial applications. In quick disconnect coupler design, the use of advanced engineering polymers makes it possible to achieve complex part geometries, meet required chemical compatibilities, and reduce cost when compared to traditional machined components. Additionally, the use of reinforcing additives can further improve the strength, rigidity and operating temperature range of thermoplastics.

Expanding Fluid Handling Parameters

NS6 Series non-spill coupling.

In fluid handling applications, systems typically operate in the pressure range of vacuum to 120 psi. The use of a non-spill quick disconnect designed for 10,000 psi is overkill. In typical low pressure fluid handling applications, the specifier of non-spill quick disconnects may be limited in the available selection of weight, package size, flow performance, and cost in the process of selecting a traditional industrial non-spill quick disconnect. While non-spill valve technology is not new, recent design innovations and cost improvements bring flush face non-spill quick disconnect technology to applications whose budgetary restrictions prevented the use of a non-spill quick

Molded vs. Machined Couplings

Molded non-spill valve (left) and machined conventional valve (right).

A critical design decision is the selection of molded vs. machined components. This is true for several reasons: First, the geometries of the valve and housing components are designed to optimize flow performance through the non-spill coupling. Second, complex geometry requirements can be produced through high-tolerance injection molding for a fraction of the price of machining the same components. Another benefit of the molded components is the integral terminations (i.e., NPT, hose barb, elbows, compression, etc.) that eliminate a potential leak point found in other couplings with secondary adapters. An additional advantage is the superior aesthetics and easy-to-use, ergonomic function offered by the molded shape of the plastic coupling. One example of this is the application of soft-touch overmold material to the exterior of the coupling. The benefits of this include improved impact resistance, a more ergonomic shape, and color keying.

NS4 Series non-spill couplings, shown in available colors.

Design Process and Results

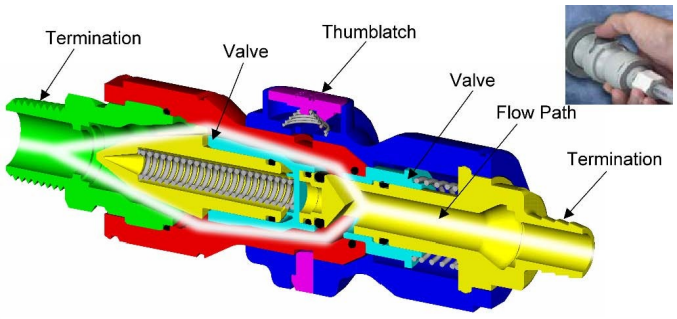
A review of existing non-spill coupler designs indicated little was available in the way of compact, chemically resistant, non-spill couplers for low-pressure fluid handling and transfer. Based on identified industrial market needs, two valve technologies were designed and developed. Differences between the valve technologies developed have to do with the valve design and actuation springs.

Buna-N and Fluorocarbon (FKM) are often recommended choices in o-ring compounds.

The first valve design includes the valve springs in the flow path, which yields a compact package size with exceptional fluid flow characteristics. The second design utilizes valve technology which isolates the springs from the flow path through the use of o-rings. This design results in the metal-free flow path required in specific chemical handling applications where metal can act as a system contaminant.

Chemical Handling Applications

Recently designed non-spill couplings (models NSH, CQG and CQN) offer a patented non-spill valve design. This design isolates the valve actuation springs from the fluid flow path. The new couplings for chemical handling applications feature one degree of separation between the fluid and any metal. The o-ring seals separate fluid flow from the valve actuation springs. The benefit of this design feature is a chemically inert, high purity flow path. The result is a flush-face non-spill coupling that is well-suited to high purity and chemical applications.



NSH non-spill coupling.

Additionally, the CQN coupling is designed for ultra high purity applications, such as semiconductor manufacturing. With materials of construction including PTFE, perfluoroelastomeric o-rings and PTFE- jacketed springs, the CQN offers the same metal-free flow path with two degrees of separation between the fluid and any metals. The benefit of this second degree of separation between the fluid and any metal is peace of mind that the flow path maintains exceptional purity for the most demanding applications.

Industrial Applications

The Colder Products Company Industrial Non-Spill Couplings (models NS4, NS6 and NSH) are designed for low pressure fluid transfer applications up to 120 psi. In addition to offering extremely low spillage, the molded valves have balanced flow areas to achieve high flow performance in a compact size. When combined with a familiar and easy-to-use thumb latch, the non-spills offer users many new coupling options. Some of the many applications identified to benefit from the non-spill quick disconnect technology described in this white paper include:

Chemical Handling and Transfer—Personal Safety

The handling of hazardous chemicals is made safer through the use of non-spill coupling instead of a traditional coupling or fitting. By keeping the often-dangerous and costly media inside the system, personal safety can be improved and costs reduced. Applications include: semiconductor manufacturing, institutional cleaning solutions, photo processing chemicals, plating solutions, and bulk chemical transfer.

Liquid Cooling of Electronics—System Safety

The heat density of electronics has risen to the point that traditional forced convection cooling is no longer sufficient. Liquid cooling is becoming the method of choice as cooling technology increases in efficiency and decreases in size. Cooler operating temperatures can also translate into significantly lower failure rates among electrical components. Applications include: Cooling PCs, servers, chillers, lasers, medical equipment, and chip testing equipment.

Ink Management—Convenience & Cleanliness

Whether ink is water-based, solvent-based or UV curable, spillage is always a problem. Like water-based inks, solvent-based inks leave a mess but can also have noxious fumes. Because UV inks only dry under exposure to UV light, small spills wiped up by rags continue to stay wet long after cleanup. By keeping the ink in the system, the media never gets into contact with users and eliminates the mess at the source. Applications include: Labeling equipment, wide format printing, high speed digital, and many more ink handling and transfer applications.

About the Author:

Grant Wilhelm works in Research & Development for Colder Products Company. He graduated with a B.S. in Mechanical Engineering from the University of North Dakota and an M.S. in Industrial Engineering from the University of Nebraska-Lincoln.

For additional information on Colder Products Company non-spill technology and couplings visit www.colder.com.