

# Non-Spill Quick Disconnect Technology

**By**  
**Grant Wilhelm**  
Intellectual Property Manager - Engineering  
Colder Products Company

## TERMINOLOGY

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.

**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 non-spill valve technology.

## TRADITIONAL NON-SPILL COUPLINGS

Traditional non-spill quick disconnect couplings are used in high pressure, hydraulic (fluid power) 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 fluid transfer markets that are better served by quick disconnect couplers, utilizing modern materials and new design strategies. In particular, the use of engineering grade polymers as construction materials extends the boundaries of usefulness to these new applications. The medical and specialty industrial segments were among the first to implement completely closed systems, not only to minimize the risk of workforce chemical exposure, but also to prevent contaminants from getting into the manufacturing process.

## 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



Figure 1: NS2 Series non-spill couplings.



Figure 2: High-pressure non-spill coupling.

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

In fluid handling applications, systems typically operate in the (relatively low) pressure range below 120 psi. The use of a non-spill quick disconnect designed for 10,000 psi is overkill in these applications. 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, design innovations and cost improvements bring flush-face non-spill quick disconnect technology to applications where budgetary restrictions had prevented its use.

### MOLDED VS. MACHINED COUPLINGS

A critical decision during the design process 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.

### 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.

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. 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

CPC's NSH, CQH, and CQG Series Non-spill couplings offer a novel non-spill valve design that isolates the valve actuation springs from the fluid flow path. The 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 specialty chemical applications.



Figure 3: Non Spill Series couplings from CPC



Figure 4: Molded non-spill valve (left) and machined conventional valve (right).



Figure 5: NS4 Series non-spill couplings, shown in available colors.

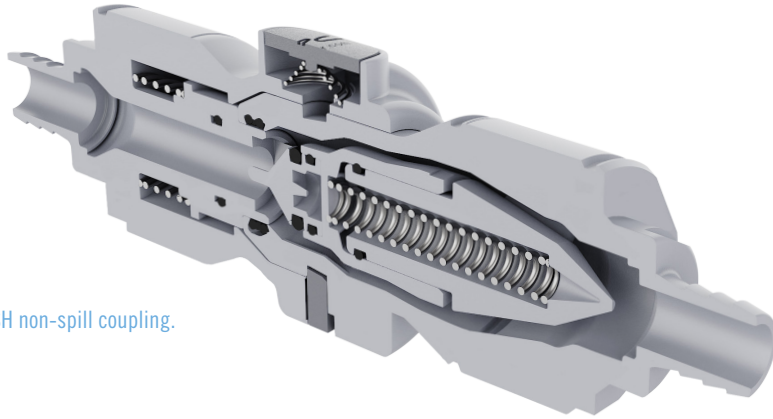


Figure 6: NSH non-spill coupling.

Additionally, the CQG coupling is designed for ultra-high purity applications, such as semiconductor manufacturing. With materials of construction including perfluoroelastomeric, polypropylene, fluoroelastomer, o-rings and the CQG 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

Non-Spill couplings from CPC 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-spill couplers 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 a nonspill 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: institutional cleaning solutions, additive manufacturing, plating solutions, and bulk chemical transfer.

### INK MANAGEMENT — CONVENIENCE & CLEANLINESS

Whether ink is water-based, solvent-based or UV curable, spillage is always a concern. 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: wide format printing, high speed digital, and many more ink handling and transfer applications.

### About the Author:

Grant Wilhelm works in Engineering for CPC. 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.cpcworldwide.com](http://www.cpcworldwide.com).

### About CPC

CPC is the leading provider of quick disconnect couplings, fittings and connectors for use with tubing in low-pressure fluid-handling applications. Employed in a broad range of applications, CPC's 10,000+ innovative standard products allow flexible tubing to be quickly and safely connected and disconnected. CPC also engineers custom solutions to improve the overall functionality and design of equipment and processes for life sciences, bioprocessing, specialty industrial and chemical-handling applications.

We Inspire Confidence at Every Point of Connection

