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The Basics of Quick Disconnects

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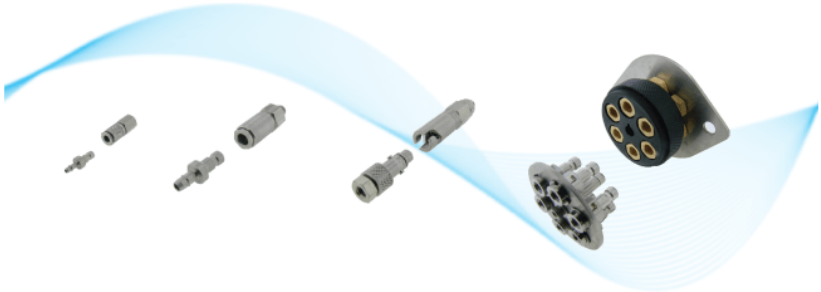
Quick disconnect fittings (abbreviated as "QDCs" or "QDs") are used to provide fast and easy connection and disconnection of fluid lines. These fittings are also known as quick connects or quick release couplings. Typically quick disconnect fittings are operated by hand. They often are used to replace fitting connections which require tools to assemble and disassemble. There are a myriad of quick disconnect fittings types and they are found in all industries.

Quick disconnects greatly improve the end user's experience by simplifying connections/disconnections and preventing fluid leakage. Engineers can use quick disconnects to enhance the serviceability of their design and add to the value to their product. The design engineer will also find the ease of connection and disconnections will also save valuable time during testing and development.



To ensure success, many design considerations need to be taken into account before specifying a quick disconnect. Since these fittings have a number of components in the waterway (fluid path), they often have higher pressure drop than simpler fittings. Designers should confirm that the fitting can deliver the flow performance required by their design. Quick disconnects can also have pressure limitations so be sure the specified fitting can handle the maximum service pressures in the application. Material selection is vitally important. All materials of construction must be compatible with the working fluid. The same goes for temperature compatibility.

Other important questions to ask prior to specifying a quick disconnect are: Does the fitting need to operate with the use of only one hand? Do you need a shut-off mechanism in either or both ends of the connector? Or is no shut off mechanism(s) preferred to maximize flow capacity when connected? Is "dry breaking" (discussed later in this tutorial) required? Is a non-latching disconnect required? Are there multiple fluid lines that require simultaneous connection/disconnection? Will the disconnect have to operate under vacuum? What type of tubing or hose will be connected to the quick disconnect?

Beswick offers a wide range of quick disconnects to meet many challenging applications. Beswick quick disconnects are available in ball latching (also known as snap type), bayonet, threaded and non-latching connection styles. In addition, many of these styles are available in single and double shutoff, non-shutoff and dry break sealing. Available materials are brass, electroless nickel plated brass, 303 and 316 stainless steels for metallic components and Buna-N, EPDM, Viton®, silicone and Perfluoroelastomers (such as Chemraz® and Kalrez®) for elastomers.

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Snap style quick disconnects are the most common design available from Beswick

SNAP TYPE (ball latching)

Snap type (ball latching) quick disconnects are the most common style. They are designed with a spring loaded ball latching mechanism which automatically locks the two halves of the fitting together when they are pushed together. When the releasing sleeve (knurled for easy handling) is pulled back, the internal end and external ends quickly disengage from each other. This quick release feature is advantageous in designs that require numerous connections throughout the life cycle of the product because they are so simple to operate. Also, they can be disconnected one handed. These QDCs can handle pressures up to approximately 500 psig.

NON-LATCHING

Non-latching quick disconnects are used in applications where quick serviceability in a compact envelope is required. Typically, a non-latching quick disconnect will be selected when a portion of the device requires frequent change out, when the releasing sleeve may be inaccessible, or when the customer wishes to integrate the quick disconnect directly into a mounting plate of their own design. Test trays, animal cages, and umbilical lines are examples of applications that benefit from non-latching quick disconnects. Many types of quick disconnects can be supplied as non-latching so inquire with the manufacturer.

Often these fittings are equipped with self-sealing valves so that upon disconnection they will automatically contain the fluid in at least one of the lines. Snap type quick disconnects are commonly specified with no shut-off, a single shut-off, double shut-off, or as a dry break:

NO SHUT-OFF

Quick disconnects without shut-offs are often used when high flow rates are required. They are generally limited to applications involving low pressure air or other non-hazardous gases because the fluid is not contained in either half of the assembly upon disconnection.

SINGLE SHUT-OFF

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SINGLE SHUT-OFF

The internal half of the assembly contains a valve preventing flow from escaping. This design is advantageous when you wish to fill or evacuate pressure from a chamber or portable device and then disconnect the fill line. When using single shut-off connectors, be sure the end users are cautioned to wear eye protection when connecting and disconnecting these fittings to avoid possible injury from an energized fluid line or exposure to the fluid.

DOUBLE SHUT-OFF

Double shut-off quick disconnects have shut-off valves within both the internal and external ends. These shut-off valves retain pressure in both fluid lines when the assembly is disconnected. This is ideal when the fluid is a liquid, an expensive gas, or flammable gas (also consider a “dry break” quick disconnect). While double shut-off quick disconnects are provided with shut-off valves in both ends of the connector it is important to understand that fluid can still leak out, usually from the external end, when connecting or disconnecting if the fluid lines are under pressure.

DRY BREAK

If a level of sealing beyond that provided by a double shut-off quick disconnect is required, “dry break” quick disconnects should be specified. “Dry break” quick disconnects ensure that the shut off valves in both the internal end and external ends are fully shut-off prior to disconnection. Also, the two halves of the disconnect make a seal before the shut off valves are opened during connection. “Dry break” disconnects (often termed “no spill”) typically have very low dead volume to prevent trapped fluid from escaping or dripping when disconnected. This “no spill” feature is especially important when the fluid is a liquid, an expensive gas, a toxic gas, or a flammable gas where minimal leakage is paramount.

1/4 twist bayonet style quick disconnects are suitable for up to 3,000 psig

EFFECTIVE ORIFICE RATING

Where high flow requirements are a major design consideration, be sure to specify a quick disconnect with an adequate Cv or effective orifice rating. Beswick miniature quick disconnect assemblies have effective orifices ranging from 0.035 inch (0.89 mm) to 0.180 inch (4.6 mm) diameter. Predictably, the size of the fitting gets larger as the effective orifice rating increases. The M3 sized quick disconnects (with a 0.035 inch diameter effective orifice) have a maximum hexagonal section of 0.25 inch (6.4 mm). The Beswick high flow dry break quick disconnect, with a 0.180 inch diameter effective orifice, has a maximum hexagonal section of 0.563 inch (14.3 mm).

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PRESSURE RATING

It is important to choose a quick disconnect with an adequate pressure rating. The Beswick snap type and screw type quick disconnect designs are rated up to a maximum of 300 to 500 psig. For higher pressure applications, up to 3,000 psig, consider using a bayonet quick disconnect. The bayonet style quick disconnect has the advantage of being able to disconnect one handed by turning the connection a ¼ turn. The bayonet design features add extra strength to accommodate higher pressures and maintain a clean environment.

The designer should however keep in mind that connection at these higher pressures can be difficult or impossible when the user must overcome the forces (force = pressure x area) acting on the shut-off mechanism(s) as well as the forces generated by the shut-off springs.

Each end of a double shut off quick disconnect seals when disconnected.

USE WITH VACUUM

High pressures are not the only pressure related issue with quick disconnects. Vacuum applications can often be challenging to reliably seal, particularly on double shut-off and “dry break” assemblies. Often, the internal side of a double shut off can handle full vacuum while the external side can only handle “light” (a small amount of) vacuum. Don’t take it for granted, be sure the quick disconnect you specify offers the level of sealing your vacuum application requires.

When choosing a quick disconnect for your application, be sure the materials of construction are appropriate for the intended application. Carbon steel and C36000, which is a free machining grade of brass, are cost effective material options that provide increased strength and temperature resistance compared to plastic components, while offering increased service life. If corrosive fluids are flowing through the quick disconnect, consider specifying stainless steel. 303 and 316 stainless steels are ideal choices for corrosion resistance and increased strength. Plastic quick disconnects can also be selected for corrosion resistance and lower cost however the trade off is increased package size (plastic has lower strength than metal and therefore thicker wall sections are required) and reduced impact resistance and reduced long-term durability. For these reasons, plastic is often not an option in miniature quick disconnects.

SEAL MATERIAL

Elastomeric seal materials must also be carefully chosen for the application. Beswick quick disconnects are designed with O-ring seals to ensure leak tight operation. Buna (also known as Buna-N or Nitrile) is our standard O-ring material since it is cost effective and offers compatibility with the majority of

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MULTI LINE QUICK DISCONNECT

In complex machines it is often necessary to simultaneously disconnect multiple fluid lines. As you can imagine, it is vital that each fluid line be properly connected to prevent misconnections of the flow paths. Beswick multiple line quick disconnects, known as a “MLQDCs”, offers this capability. The MLQDC are available in 4, 6 and 8 line configurations and incorporates features to ensure correct orientation of the fluid lines during operation. Often it is possible to connect and disconnect the multiple line quick disconnects with one hand. They are available in single shut off and double shut off (dry break varieties are possible too) with the same choice of materials as our single line disconnects.

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Available in 4, 6 and 8 line configurations.

Lastly, be sure to specify the proper connection on the quick disconnect. Beswick QDCs are available with M3, M5, 10-32, ¼-28, M8 and 1/8 NPT threaded connections. Tube barbs are available for 1/16 inch, 5/64 inch (2.0 mm), 3/32 inch (2.5 mm), 1/8 inch, 0.170 inch and ¼ inch inside diameter tubing. For higher pressures, higher temperatures, or for rigid tubing integral compression fittings are also available. Manifold mounting designs are offered for applications which require mounting one or both halves of the quick disconnect to a panel.

COMMON QUICK DISCONNECT APPLICATIONS

Quick disconnects can be found in many types of machinery, such as: food packaging equipment, semiconductor production machinery, drug and explosive detection devices, toxic gas detection monitors, analytical instruments, pneumatic tools, air compressors, hydraulic power equipment such as snow plows, medical devices, automated assembly machinery, and dental equipment. The applications are almost endless.

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PNEUMATIC AND HYDRAULIC TOOLS AND COMPRESSORS

Probably the most well known use of quick disconnects is on pneumatically and hydraulically powered tools and machinery. If you've ever visited an automobile repair shop or seen a snow plow up close you likely noticed a quick disconnect positioned at the end of the fluid lines. Quick disconnects make tool change over a breeze.

FOOD PACKAGING MACHINERY

Packaging machinery up-time is critical to the food packaging industry. Money is lost when machinery is down for repair. Packaging equipment often runs around the clock with an operator or service technician standing nearby to make sure the equipment is running smoothly and without fail. Quick disconnects ensure that the operators can perform changeovers rapidly thereby minimizing down time and fluid leaks. Quick disconnects help the operator maximize machine up-time and profit for the company.

SEMICONDUCTOR PRODUCTION MACHINERY

The semiconductor manufacturing process involves the handling of chemicals, de-ionized water, gases, heat transfer fluids, and frequently the use of pneumatics and vacuum. There are also demanding temperature and pressure requirements in the lengthy manufacturing and test processes used to turn a silicon wafer into finished IC (integrated circuit) chips. The fluid handling equipment must be highly reliable, compatible with the fluid, durable, fast and leak free.

DRUG AND EXPLOSIVE DETECTION DEVICES

Since the 911 terrorist attack explosive detection equipment and toxic gas detection equipment has become common place in public places such as airports, government buildings, military facilities, and arenas. Airports and entry ports use this equipment to scan passenger, luggage, and freight for explosives and narcotics. Most of the detection equipment used for this purpose incorporate quick disconnects for improved serviceability.

GAS DETECTION DEVICES

Before a worker enters a confined space such as a manhole or mine shaft it is necessary, for safety, to sample the ambient air prior to entering the enclosed space. Gas detection devices come equipped with long sampling probes to allow workers to test for gases such as CO_2, CO, Hydrogen Sulfide, Methane, Oxygen, and other toxic and flammable gases. These detectors must be user friendly. Often quick disconnects are specified so that probe lines can be easily switched. Gas detection devices are also used the aerospace, semiconductor, chemical processing, medical, and pharmaceutical industries.

MEDICAL BLOOD ANALYZERS

Medical laboratories use blood testing equipment for running high volume medical tests. These analyzers operate rapidly around the clock. Internal connections are usually fixed in place but when a service call is needed, the machines may need to be quickly disconnected from supply lines and then disassembled for troubleshooting.

ANALYTICAL INSTRUMENTS

Instruments are used to test water and air for purity. They are also used to test the composition of pharmaceuticals and other compounds. Many gases and liquids are involved in the testing procedure and often the fluid lines must be quickly connected and disconnected without loss of the gas or liquid.

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DENTAL EQUIPMENT

Dental devices such as dental chairs, drills, ultrasonic descalers, and anesthesia machines are designed with various types of tubing to carry water, compressed air, and anesthesia gases. The functionality of this dental equipment is greatly increased by the use of quick disconnects especially when tools, or portions of the machine, must be removed for cleaning, repair, and/or sterilization. The productivity of the hygienist and dentist is improved with quick disconnects, as connections do not have to be unthreaded, and sections of a malfunctioning machine can be easily removed when repair work is required.

In summary, quick disconnects greatly improve the user's ability to accomplish work by minimizing the time spent to make and break fluid connections. There are several types of quick disconnects as well as various shut-off configurations to consider for each application. Material selection is also important especially if the fluid is aggressive or if wide temperature swings are anticipated. Consult a trusted fluid power manufacturer or fluid power expert to insure you select the best quick disconnect model for your product.

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