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## Emphasis On Connectors

# Connection Selection: Identifying Fluid Connector Options

▶ **Selecting the right fluid line connector can boost performance and bring enhanced benefits to a medical device. However, with a variety of choices between fittings, luers, and couplings, it is difficult to know which offering would be best indicated for a specific application. This article reviews the available options for fluid connections and suggests which are best for specific uses.**



With so many different connector choices, working with the right supplier can ensure optimum performance for the equipment user.

By Jim Brown

In medical environments, human error or medical device failure can compromise the safety of patients as well as caretakers. It can also tarnish corporate reputations and result in major liability issues. For these reasons, medical device manufacturers need to take great care in securing reliable components that can ensure the integrity of their products and the safety of patients.

Tubing and hose connectors are

critical components in many medical applications, ranging from IV lines and tourniquet cuffs to compression therapy devices. Selecting the right connector can ultimately determine the success or failure of a device. More importantly, taking the necessary precautions with the connectors chosen can help prevent costly component failures and save lives.

### Assessing the Application

The key to choosing the right tubing connector is understanding the appli-

cation. Among the first considerations are the tubing size and flow rate. For example, what type and diameter of hose or tubing will be used to contain the fluid? What are the required milliliters/gallons per minute? What is the maximum temperature and pressure the connector will need to withstand during operation? Are leaks or spills detrimental to the application?

The viscosity and corrosiveness of the fluid flowing through the connector also need to be considered. It's important to make sure the media is chemically compatible with all connector materials, including o-ring seals and any internal springs. Any special requirements, such as sterilization, color-coding, or specific mounting configurations or terminations also need to be taken into

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account. Perhaps the most defining question that needs to be asked is, “How often will the connection be connected and disconnected?” The answer will play significantly into which type of connector will deliver the best performance.

### Evaluating the Options

Fittings, luers, and couplings are the most common connectors employed in the medical device industry today. While each is appropriate for certain types of applications, they are not necessarily interchangeable. Therefore, it’s important to specify the connector that satisfies the specific application requirements.

### Fittings

Fittings are inexpensive, with many different types, sizes, and material options from which to choose. They are a popular choice for applications that do not require the disconnection of equipment or parts at any point during use. These devices are most often used as a permanent connection since repeatedly removing tubing from them causes leaks or failure.

Tools are typically required to install and remove fittings. Instant fittings also are used as a permanent connection, but do not require tools for installation. It’s important to note that fittings—and instant fittings—do not have shut-off valves, so flow does not stop when the tubing is disconnected.

Another consideration is the speed and ease of the connection. If it is important that the equipment be assembled quickly, and if the fluid lines will not need to be disconnected again, then a fitting offers a viable, low-cost solution. If the tubing does not need to be disconnected but the flow needs to be stopped or regulated, a separate valve can be used. Of course, a separate valve is not automatic and requires an operator to activate it.

### Luers

The two types of luer connectors are slips and locks. A luer slip connector consists of a tapered “male” fitting that slips into a similarly tapered “female” fitting. They are typically held together by a simple pressure and twist fit. The luer lock connector has a threaded collar added to the “male” fitting and a threaded flange on the “female” fitting

that screw together.

If the application doesn’t need a valve to prevent spills, and may need to be disconnected only occasionally, a luer is often a good choice. Since constant reconnection can minimize seal effectiveness of a luer, this type of fitting was originally intended to be used as a disposable connection. Shut-off valves are not an option on male halves of a luer connection.

Standard luers are suitable for small-flow applications, typically not exceeding 3/16-in. tubing. Some manufacturers offer large bore connectors that are compatible with larger tubing sizes.

### Couplings

Designed for repeated connection and disconnection cycles, standard couplings—with or without valves—allow tubing to be reliably connected and disconnected without the use of tools. If the equipment needs to be assembled quickly, or includes fluid lines that will need to be disconnected for servicing or repair, then a coupling offers the most advantages.

For example, equipment designed in modules is usually assembled at various times and locations. To shorten assembly times, couplings can be used to quickly attach the component parts or subassemblies. Maintenance and service are also expedited since a coupling can make it easy to replace component parts.

In many cases, the integral shut-off valves available in couplings are a primary driver in the decision to specify a coupling over a simple fitting or luer. For a fitting installed with a separate valve, operators must remember to manually close the valve prior to disconnecting tubing. This can be risky, exposing health-care workers and patients to hazardous fluids if the valve is accidentally left open. Quick-disconnect couplings with integrated non-spill shut-off valves save time by eliminating spill clean-up and provide the added security of virtually drip-free connection and disconnection.

Couplings offer a choice of single- or double-sided shut-off valves. Quick disconnect couplings feature an o-ring seal, which allows them to be connected and disconnected hundreds or thousands of times. This makes couplings ideal for reusable applications where you need assurance of a leak-free connection every time over the life of the product. In disposable applications, couplings are preferred

when it is important to avoid leakage.

Couplings are available in larger flow sizes. In applications where a larger flow path is required, a variety of coupling options are available that will deliver more flow than a standard luer connector. Couplings are also available in a wide variety of material and hose barb options and mounting configurations, including panel mount or direct mounting into NPT threads or ports.

Most quick disconnect couplings are very intuitive and easy to use. For example, Colder Products Company couplings feature a latching mechanism with an audible “click” that notifies users of a secure connection. This is much different than the connection process for luers, which involves screwing or pressing the two lines together with no mechanism to indicate when it’s been threaded tightly enough. As a result, it can be difficult to determine if the luer has been properly secured. This can lead to over- or under-tightening and ultimately splitting, cracking or leaking.

Also, because luers are threaded together, whenever the tubing is twisted or rotated as part of normal use of a device, it can actually twist the luer apart. With a coupling, however, the two halves of the connector can rotate independent of each other, maintaining a more secure connection.

### Preventing Misconnections

The inherent risks associated with misconnections cannot be overstated. According to a *Sentinel Event Alert*<sup>1</sup> from the Joint Commission International Center for Patient Safety, tubing and catheter misconnection errors are a serious and under-reported problem in healthcare organizations.

Many fittings and connectors offer “keying” or color-coding capabilities for use in applications where it is critical that multiple lines are not cross-connected. Still, the single most important practice for preventing misconnections is to trace all lines back to their origin before connecting or disconnecting any devices or tubing. Some of the newest couplings are available to help do just that.

For instance, Colder’s IdentiQuik technology integrates RFID into coupling halves, which allows users to automatically verify connection accuracy. This enables equipment to electronically identify the device type or connected media and prevents mis-

connections. It also offers an added assurance that equipment is set up correctly thereby limiting liability.

### Evaluating Performance

One of the biggest challenges in selecting the right connector is balancing cost with the performance and functionality needs of the application. While cost is important, selection considerations should go beyond initial component price and take into account system benefits, such as enhanced safety and long-term return on investment. Disposable luer, for instance, typically cost less than couplings, and that has helped propel their usage in the medical industry. However, couplings can bring increased overall value to the application by offering features that make operations simpler and safer.

Though sometimes more expensive, couplings are a popular choice because of their reliability and the assurance of a secure and virtually leak-free connection. The availability of special features, such as keying and

RFID technology, further enhance the overall value of couplings. The robust design features of couplings bring additional benefits to applications, such as lower maintenance costs, reduced equipment downtime, less chance of misconnections, and above all, enhanced safety.

### The Role of the Supplier

Before making a final connector selection, consult with several suppliers. Review safety needs, cost considerations, specifications, such as material and termination type, as well as media compatibility and flow requirements. Select a supplier with the experience to help make the decisions. By choosing one with a full range of products, they can work with a company to select the connector that truly works best for a situation, balancing all the different application requirements.

### Conclusion

Fluid line connectors are available to suit vir-

tually any type of application. If no existing product is available for a specific need, consult with a supplier for a customized solution. The connection choice made not only impacts the bottom line, but also the effectiveness and safety of medical procedures that depend on the product. The credibility of the brand and organization also may be adversely affected by the wrong choice. By working with a knowledgeable partner in the early design stages, a company can ensure the optimum connection is specified for an application and prevent functionality and safety issues down the road.

### References

<sup>1</sup>*Sentinel Event Alert*, Issue 36, April 3, 2006.

### ONLINE

For additional information on the products and technologies discussed in this article, see *Medical Design Technology* online at [www.mdtmag.com](http://www.mdtmag.com) or Colder Products Co. at [www.colder.com](http://www.colder.com).

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