

The standardization of single-use components for bioprocessing

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As single-use systems become more widely adopted, the focus in the bioprocessing industry is shifting from acceptance of the technology to standardization. While the standardization discussion encompasses many topics (including how products are tested, assembled, etc.), components are a critical area for improvement. With so many ways to apply single-use and hybrid bioprocessing systems, organizations must take action to standardize equipment in order to streamline operations and help reach the full potential of the technology.

LACK OF SINGLE-USE STANDARDIZATION

Different manufacturing companies, and even different suites in the same organization, have their own methods of utilizing single-use technology. Though the ability to customize processing steps brings with it benefits, there are also inefficiencies and waste stemming from a general lack of communication about the way single-use is implemented across sites, both within a company and across the industry.

Critical to fluid handling, the tubing connector is essential for secure, sterile, leak-free connections between various single-use systems and processes. Connectors can be the last line of defense for a single-use system. A user can have the best filter, bag and tubing, but this is all pointless if the connector is not reliable, easy-to-use or robust. With the importance of connection technology, it has become obvious that a great opportunity for standardization lies in improving connector compatibility (e.g., interchangeability), particularly because of complications related to mating connectors and managing inventories.

Mating issues

Gendered connections can lead to problems if different single-use systems running in series have connectors of the same gender. The incompatibility can be especially problematic because it is often not discovered until the point of use, at which time the user must quickly create an adapter in order to avoid downtime. If, for example, two separate single-use systems each have male connectors, then the user would need to create a makeshift adapter by attaching two female connectors (if available) on each end of a length of tubing (with something to secure the tubing to the connectors). They would then need to autoclave the adapter and secure the connection in a limited amount of time, leading to increased labor and material costs, as well as increased potential for process delays, leaks and contamination risks.

Back-to-back adapters do exist for open quick connects (like CPC's MPC and MPX product lines), which allow a user to join two connectors of the same gender without the hassle of building a makeshift assembly (Figure 1). However, this solution works if the user has anticipated the problem and has the adapters in inventory at the time of use. At this time, adapters are not available for gendered sterile connectors.

Inventory Issues

When a connector requires a specific mating component, a site's finished-goods inventory needs can double — or even triple — because of all of the possible systems configurations gendered connectors create. As an example, consider an assembly as simple as a basic transfer line with sterile connectors on each

end. There are three possible configurations depending on the application setup: a female-to-male version, a male-to-male version and a female-to-female version (Figure 2). Not only are there more finished goods needed, but manufacturers must also pre-plan and define which tube set works with which part of a system, leading to increased design and ordering complexity.

In all, several inventory issues arise from lack of connector standardization:

- Increased ordering complexity because the user must define which tube set or assembly works with which part of the application.
- Greater risks of specifying the wrong system or connection, resulting in downtime and last minute adjustments at the end user site.
- Longer lead times because systems suppliers are manufacturing lower volumes of multiple SKUs as opposed to higher volumes of fewer SKUs. This lowers the incentive and likelihood for a manufacturer to stock of these items.
- Increased stocking requirements for end users, including connectors of different genders and other components needed to create make-shift adapters.

STANDARDIZING WITH GENDERLESS CONNECTORS

Incorporation of genderless connectors is a fast and effective way to help standardize the use of single use systems. With one product to stock as opposed to many different types, there are fewer SKUs to order and manage. Issues of receiving single-use systems with incompatible types of connections (i.e., both have a male connector) can be eliminated with the use of a genderless connector. This means that engineering or procurement can be confident that they are ordering the right connector each time, and that the process will not be held up by unexpected connector mating problems. According to Dr. Mark Petrich, Director of Component Engineering at Merck, “Genderless connections reduce the number of unique SUS designs required

and eliminate the need for most ‘jumper’ pieces. Operations staff find the genderless designs easier to use and understand.”

Of course, any change to established operating procedures can be an obstacle in biopharmaceutical manufacturing. Implementing a new type of component involves change control and validation, which can be quite time-consuming depending on the organization. CPC helps to ease the transition by offering validation packages, which include a detailed summary of the tests that were performed on the connectors. Once a company overcomes the change control hurdle and makes the switch from gendered to genderless connectors, they can instantly begin reaping the benefits of increased operational efficiency and inventory management, and decreased overhead costs, quality issues and risks of operator error.

REDUCING OVERHEAD COSTS: LESS IS MORE

While overhead cost reductions might be difficult to quantify, they cannot be overlooked. Reduction in SKUs and inventory lowers the cost of managing and maintaining that inventory, which allows capital to be allocated to additional process improvements.

Another way to help simplify and reduce inventory is to use genderless connectors that enable transitions between tubing of different sizes. CPC’s interchangeable AseptiQuik® G connectors accommodate tubing from 1/4” to 3/4,” eliminating the need for reducer fittings elsewhere in the process as the connectors can act as reducers.

Figure 1: MPC/MPX back-to-back adapters give end users the flexibility of connecting single-use systems that feature identical coupling connections at the end of their tubing.



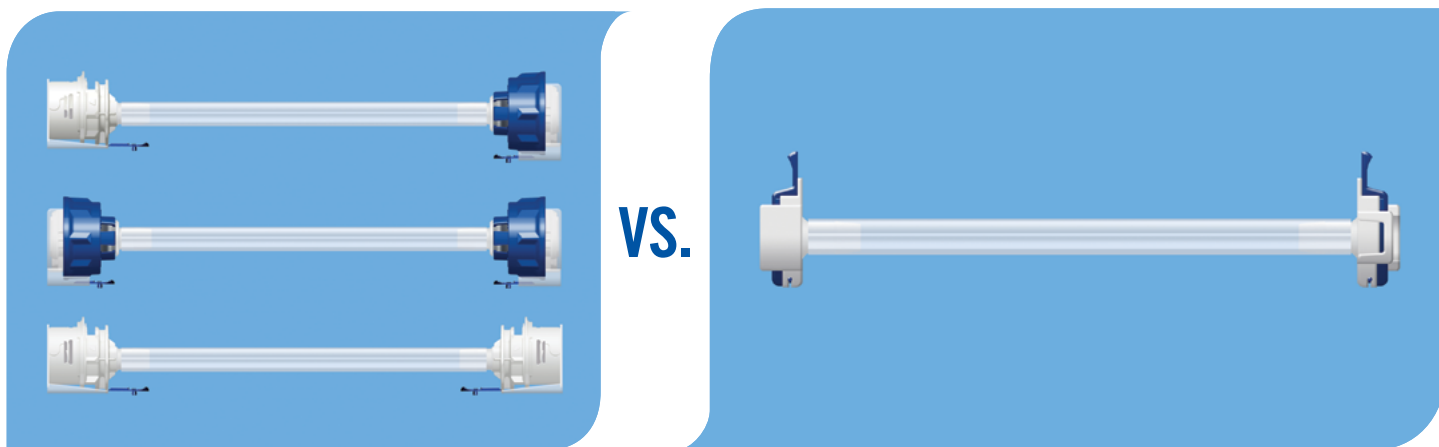


Figure 2: Female-male, male-male and female-female tube sets generate three times the SKUs as genderless tube sets, adding inventory costs and increasing complexity. In contrast, genderless connectors enable stocking just one tube set.

Spotlight: Modular Systems Reduce Sub-Assemblies by 85%

As genderless connectors have been quickly adopted in the industry, end users have been figuring out ways to further improve their single-use systems efficiencies. One way to do this is to incorporate a modular systems approach. Historically, manufacturers have specified a single-use system that incorporates all of the features they need in one finished good assembly. This results in a very large, complex assembly that is difficult to source and to handle (some manifolds have been compared to an octopus). An end user ordering a fully assembled complex tubing manifold may have to wait up to ten weeks (or more) for fulfillment because suppliers do not stock that particular configuration. There are multiple complex assemblies like this throughout the end user's global network, with each site and suite having their own configuration preference. Forward-thinking manufacturers figured out that several of these assemblies had common components and that if they broke up the assemblies into smaller assemblies (that can attach to each other), they could create any larger assembly they needed (i.e., a "plug and play" concept).

One end user recently claimed that

applying a modular system design and adopting genderless connectors made a considerable difference in their finished goods inventory. The facility, which utilizes over 2,000 single-use systems (many in small quantities), reduced their sub-assemblies by one half with the modular approach and then reduced it by another two-thirds by adding genderless connectors to the modular designs. In total, standardization resulted in a decrease from over two thousand sub-assemblies to a few hundred, for a reduction of approximately 85%.

CONTROLLING PRODUCTION SCHEDULES: ASSEMBLY FLEXIBILITY

New genderless connection technologies are providing manufacturers with enhanced modular system flexibility by enabling onsite connection of standard sub-assemblies to create a wide array of customized single-use systems. CPC's new Genderless AseptiQuik® Tee and Cross manifold adapters act as modular components that can greatly aid end users who have adopted the modular single-use systems approach (Figure 3). By storing pre-sterilized modular components such as these in the warehouse, the user can quickly obtain parts as they need them, assemble the connection at the point

of use, maintain sterility and have the connection available for use in minutes. As Dr. Petrich says, "Fewer unique SUS designs mean less engineering and procurement work. Inventory management is simplified with fewer SKUs. A move to any standard connection technology will help improve the speed of system assembly prior to manufacturing."

"Build-your-own" assemblies enable users to have more control of their production timelines, which has a tremendous impact on efficiency. And because two finished goods can create a multitude of configurations, demands on ordering and inventory management are greatly reduced. It should be noted that an important part of achieving flexibility is finding components that are neutral in the marketplace (i.e., equally available through any suppliers' systems). End users should be sure that their connectors are compatible with any system they use in their process, not exclusively with the connector supplier's products.

CLOSING THOUGHTS

By focusing on the most versatile genderless connectors, component standardization will help bioprocessing companies make the best use of single-use technology. The right connectors

will enable end users to:

- Streamline operations with easy-to-use, robust sterile connections
- Eliminate potential ordering mistakes and reduce inventory demands related to gendered connectors
- Maintain more flexibility and lessen production bottlenecks with onsite connector assembly
- Reduce overhead costs, freeing up capital for other projects

End users have seen the benefits of implementing genderless connectors at the manufacturing level. “Anything

that helps operations staff focus on making biopharmaceuticals rather than assembling systems is a good thing,” explains Dr. Petrich. “The currently available genderless connection offerings have been well-received on the shop floor, and their use has had a positive effect on operations staff attitudes about single-use technology.”

Ultimately, standardizing components by incorporating single-use genderless connectors lets end users accomplish more with fewer finished goods, saving time and money, and getting their biopharmaceutical products to market more efficiently.

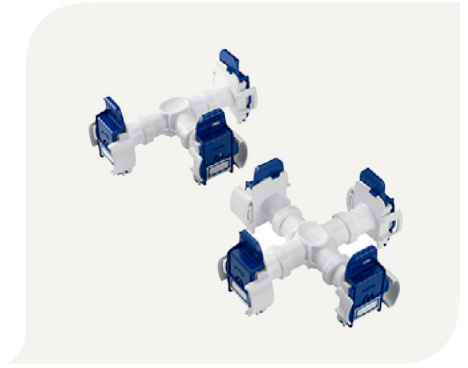


Figure 3: Genderless manifold adapters act as modular components that can greatly aid end users who have adopted the modular single-use systems approach.



About CPC

CPC (Colder Products Company), the leader in single-use connection technology, offers a wide variety of bioprocessing connection solutions. Our innovative designs offer flexibility to easily combine multiple components and systems including process containers, tubing manifolds, transfer lines, bioreactors and other bioprocess equipment. Sterile fluid connections from CPC are available in a complete range of 1/8- up to 1-inch flow configurations.

Smart fluid handling to take you forward, faster.

