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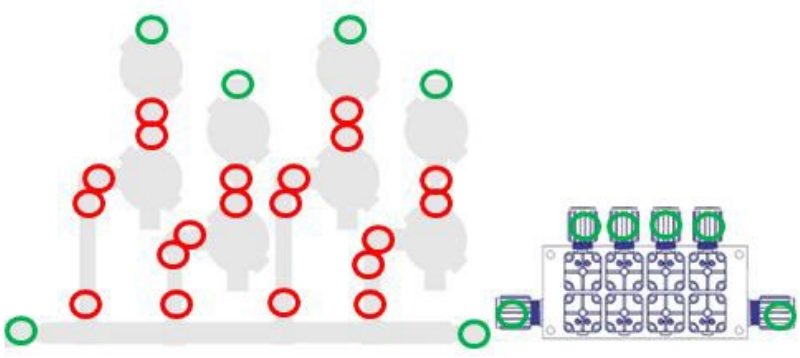
Using Manifold Technology to Optimize Safety, Cleanliness and Cost of Ownership in Fluid Systems for Microelectronics Manufacturing

By Stephane Domy

The management of fluid system is experiencing a drastic change on how a customer perceives the importance of the component. We have moved from only looking at the component as a standalone item, which has its own specification and benefits for the carried fluid, to looking at the impact of a set of components, which can also be called a manifold on the installation/application. This evolution has been a driving force in the micro-e industry and prompting it to embrace the co-development of products, which is something Saint-Gobain has recognized and supported for years. It is part of our DNA. To review what the manifold approach may bring to your installation/system, let's split the benefits provided by manifold into three main categories: Safety, Cleanliness and Cost of ownership.

One of the direct impacts that is inherited when you manifold a set of components is that you are reducing the number of leak points. You are not simply improving the sealing efficiency of a connection; you are totally getting rid of it. On average you can expect a leak point reduction above 60%. On some occasions it can be significantly higher than that, but that percentage relates directly to what you are manifolding. As an example, in the simple manifold illustration below we are moving from 26 connection points down to 6 (All red connection points are removed. We only keep the green ones).



As an example of this, please read our Case Study on Manifold-Based Designs.

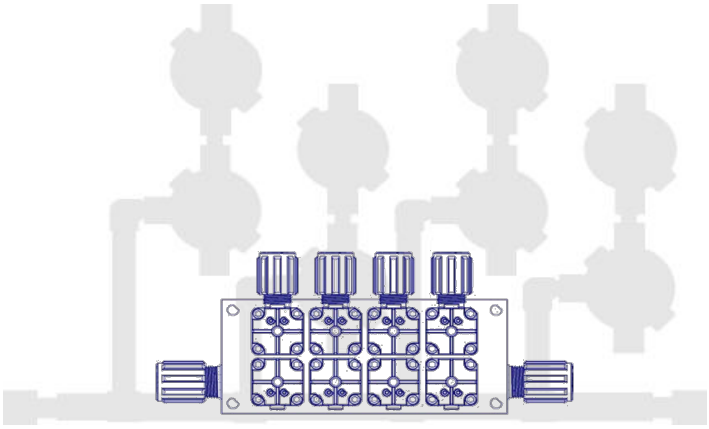
Another advantage related to safety, though less obvious than previously described, derives from the fact that when we are design these manifolds, we (under our hat of component experts) are able to choose products that have the same level of performance and operating factor. Generally, this specific selection offers longer life time for components as they are installed in proper condition of use.

Following the same logic as above, but this time related to cleanliness, when we design a manifold based on a customer-specific requirement, we also ensure that from a cleanliness and SEMI standard point of view we are using components that belong to the same category. Cleanliness of a system is also directly related to the number of connections that are present in your design, as all connection points are equal to a potential entrapment point regardless of how good a fitting may be or a welding may be. So removing connection points turns your system into a cleaner system even if you are using the best connection system on earth.

Additionally, given we are designing a custom component, we know how it will be installed (orientation), its purpose and most likely the carried liquid. Thanks to this information, we will be able to minimize entrapments zone (which is often a plague in slurry applications) as we will know how the fluid will have to flow through this given device. Based on the same logic but for a different application, we will be able to design the manifold in order to minimize potential dead volume, which is especially critical for analyzer systems.

A final comment regarding cleanliness, which will start to be more and more relevant as we go down in the printing node, is the opportunity to reduce the contact surface between the liquid and the component carrying it out, as it is the most efficient solution to limit the leaching/exchange phenomenon by simply reducing the contact surface by shrinking the component design.

As we have just seen above, the feature of being able to shrink the design of a given set of components actually provides a double advantage. Not only the one mentioned here above (with improve cleanliness) but also by allowing you to reduce your cost of ownership. If you manage to shrink down a design both at the facility level as well as in the cleanroom there is a straight translation to savings that can be achieved. At the facility level it allows you to protect your employees as well as the manifold itself by positioning it in compact valve box equipped with a proper sensing system and ventilation. In the tool present in the cleanroom, every square inch counts because of its high installation and operating costs. Going back to our previous example of a very simple/basic manifold, once again we may notice a reduction of over 60%, but this time in terms of the component's foot print.



Manifolds also provide you significant savings if you are an end user or if you are an OEM. For the end user, this is mostly related to the maintenance/service of your installation. The first reaction that we may have is due to the fact manifold prevent you to have discreet item, the cost impact on your maintenance may be larger. However if you look at the total cost of ownership, working with manifold may allow you to generate significant saving. Because it's only a few components that you have to keep in stock, you are sure to always have the right parts, whereas if you are running discreet components the one that you will need to replace will always be the one you are missing. In addition, when you are changing such a manifold it's like you are renewing the full subsystem at once and prevent to have multiple down time on component that are facing the same wearing phenomenon which may lead to potential need for replacement in a similar time frame period. For the OEM, you receive a full small sub-unit that has already been assembled and tested which saves time and money related to hook up & plumbing. Also it allows you to be more nimble to address fast installations for the customer when you have a full fab install to do, using manifold design vs discrete component may save you down the road hundreds hours of labors.

The benefit to using manifold design is it enables you to get a custom answer to your unique needs. Understandably that the initial cost difference between discrete component and manifolds might be seen as a

barrier to go toward this specific technology; however if you compare the cost of ownership of the two solutions inevitably you will realize that manifold systems are more economic and at the same time provides you premium benefits such as safety and cleanliness. At Saint-Gobain we have seen numerous customers who were reluctant to make the move but once they did, they embraced this different approach by looking at the overall benefits package provided by a manifold.

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About Saint-Gobain Life Sciences - Electronics

Dedicated to improving the quality of life, Saint-Gobain Life Sciences Electronics develops and manufactures a broad range of high-performance, high-purity fluid handing solutions for the semiconductor industry.

Along with material science expertise and collaborative design services, our focus on global quality and regulatory affairs allow us to be the trusted partner to organizations reaching every part of the globe. Combining our technical expertise, global manufacturing capabilities and research and development resources, Saint-Gobain Life Sciences is dedicated to meeting the evolving needs of semiconductor customers around the world. Saint-Gobain Life Sciences is part of Compagnie de Saint-Gobain.