# Transfer Panels - The Key to Effective Fluid Distribution in Process Systems

Controlled distribution of fluids within complex process systems is important to many of the processing industries, e.g., the chemical, pharmaceutical, dairy, food and beverage industries and in water treatment facilities. There is also a growing demand for production to be completed under controlled, hygienic conditions and to incorporate CIP (clean-in-place) and SIP (sterilize-in-place) systems. The stainless steel transfer panel (often referred to as the "routing station") is the component that controls the distribution of fluids to multiple sites within the manufacturing plant, providing added flexibility and capabilities to the process system. The "make or break" connections used in the transfer panel essentially eliminate the potential for cross-contamination.

The effectiveness of the transfer panel in a given system will depend on its' design and fabrication. The production of "make or break connectors" that are reliable over extended periods of operation requires the ability to manufacture the units to close tolerances and with superior quality. It is well recognized that these capabilities are the trademarks of the engineers, welders and fabricators at A&B Process Systems, particularly when stainless steels are the materials of construction.. The certified craftsmen, together with the process engineers at A&B, will design and fabricate transfer panels to provide economical solutions to both existing and future production and CIP distribution requirements.

## Why has the transfer panel gained importance in the processing industries?

The growing demand for production under controlled, hygienic conditions and the incorporation of CIP systems fueled the development of the transfer panel with "make or break" connections that avoided cross-contamination problems. Recent advances in sensors and switches have been incorporated with the transfer panel to provide automated distribution systems. This combination of the transfer panel with automated "sub systems" provides flexibility to the production function and at the same time, allows controlled cleaning and/or sterilizing of the process system.

The present day, stainless steel transfer panel is largely the result of the modification and development of the "flowverters" and "cleaning hook-up stations" used to distribute the various solutions in the early CIP systems. Indeed, in the food industry, transfer panels are often referred to as " product hook-up stations (PHS)" and "CIP hook-up stations (CHS)."

## Is there a basic design for the transfer panel?

A transfer panel may be designed and fabricated as a single plate or as a box, with ports for connections to lines in the process system. The box design allows sensors to be easily included or added if required.

More complex designs of transfer panels may include horizontal headers and/or vertical internal manifolds to eliminate "dead ends." A&B Process Systems offer a series of specialty transfer panels that can be custom designed to meet the most demanding requirements. For example, the

double-tube full flow manifold assembly prevents static flow conditions from developing. Valves can be added, in conjunction with the manifold, to provide more flexibility to the process system.

Specific processes may require a totally enclosed transfer panel to comply with NEMA regulations. The absence of penetrations in the face of the panel minimizes the access of moisture to the hard-wired terminal strips of the proximity sensors.

## How is the transfer panel constructed?

There are several approaches to the design and construction of the panel itself. In its' simplest form the transfer panel is a flat plate, with square breaks on each side to add stiffness and strength. Early designs, fabricated from 10- or 12- gauge stainless steel plate, included flanged surfaces at the top and bottom of the panel. However, it was found that the flanged areas tended to act as collection sites for condensate and for particulate materials. Improved flat panel designs utilized a 45˚ bevel flange to allow better drainage and therefore more effective cleaning cycles. The advent of laser cutting technology has allowed thicker stainless steel plate to be used for the flat transfer panels. With these substrates (ranging from 0.25 to 0.5 inch in thickness) the need for flanged surfaces is avoided and the port nozzle is afforded a broader support.

A problem that was identified with long time U-bend fit-up was the "bending" or "deflection" of the ports. Early efforts to correct this problem led to both the thicker plate designs as well as the present-day double-wall transfer panel. This design provided two-point support for the nozzle connection and significantly reduced the tendency for the ports to bend.

## How are the ports arranged?

Several configurations of ports are used in today's transfer panels:

(1) Two Ports inserted into the panel in a simple, linear arrangement.

(2) Three Ports arranged in the form of an equilateral triangle providing three different flow paths at the junction of four lines.

(3) Four Ports, which may be inserted in the panel in either a diamond configuration or as two equilateral triangles, to establish five flow paths at the junction of four lines.

(4) Six Ports, in a hexagonal array, is a configuration that was initially used to control the spray units in a group of tanks, but has since found applications in small product transfer panels requiring connections to a central port. Today, the basic hexagonal array is often preferred when the primary port must be connected to multiple "sub-ports" with U-bends.

(5) Custom Configurations with as many as 100 ports were common to the beverage industry prior to the development of the "Mix-Proof" valve technology. These transfer panel configurations provided extensive flexibility and eliminated the numerous hose assemblies connecting tanks to pumps and pumps to filler lines. The addition of the transfer panel thus improved both safety and overall hygiene in the plant.

(6) "Multi-common"Transfer Panel Designs further enhanced routing flexibility. This design included the addition of "common ports" that were positioned, via off-set piping, on a common radius. Hence multiple products and/or CIP solutions could be directed to a given set of routing ports.

## What types of fittings are used to make the connections?

There are a variety of stainless steel port fittings available to the engineer when considering the design of a transfer panel and the choice made largely depends on the application and the requirements of the process. The "operator friendly" reputation of the "John Perry" (JP) fitting has made it a preferred choice for several years. However, misalignment is a fairly common problem with the JP fitting, leading to "galling" and subsequent replacement. Another design that has gained favor in the process industries is the "Sanitary Clamp" (SC), or "Tri-Clamp®," particularly if the particular process operates at either low or moderate pressures. This fitting utilizes an O-ring gasket, with the union completed by a hinged assembly. The "Bevel Seat"(BS) fitting is an ASME threaded fitting, which includes male/female ferrules. Although this fitting is capable of operating under high pressures, e.g., in the feed lines to spray dryers, it is the least hygienic of the available fittings. "HDI" or "I-line" fittings, in which the male/female ferrules are secured by a heavy-duty, hinged clamp assembly, offer excellent performance under vacuum, but have proven to be less hygienic than the "Sanitary Clamp." An ACME threaded fitting, the "DeLaval Canada," a modification of the "BS" fitting, provides improved hygienic conditions. It contains a redesigned male "BS" fitting to allow use of a more hygienic gasket design. The "DC" fitting is capable of operation at high pressures and is truly "operator friendly." The "Swagelok/Jensen®" fitting is the most recent development and is primarily intended for use in the pharmaceutical industry. This clamp-type fitting effectively controls the compression of the gasket assembly to ensure a smooth transition between the ferrules and the gasket. The design avoids problems of either "over compressing" or "under compressing" the gasket material, conditions that lead to the formation of "dams" or "pockets" and the inability to clean the connectors.

## What is the role of the sensor in the transfer panel?

Advances in the capabilities and the reliability of sensors have led to their incorporation into the transfer panel to verify the presence or absence of a connection between selected ports. The placement of a proximity sensor (in the process industry it is also referred to as a proximity

switch) in a transfer panel to establish the integrity of a given flow path has become an industry standard.Proximity sensors are available in several different "packages" and the type of sensor used is generally customer-driven. However, certain factors should be considered when selecting the sensor, e.g.,

What is available at the customer's site?
What is the sensing distance required to meet the fittings on the transfer panel?
Is a quick electrical disconnect required?
Can the sensor protrude from the transfer panel?

The sensor is also capable of interfacing with the process control system. By programming the sensors into the control system it is possible to verify that the proper jumpers have been installed and that the required connection has been made. Thus, in the operating plant, the presence of the sensors provides safety for the operators and reliability to the process.

### How is the panel installed into a manufacturing facility?

The transfer panel is typically a "freestanding" component, having legs at each side to allow it to be anchored to the floor of the plant. Occasionally, to meet NEMA regulations a "pedestal" mounting is provided if there is adequate surface area on the bottom of the panel to accommodate the pedestal. Drainage pipes may be added, particularly to meet the current good manufacturing practice guidelines (cGMP). Recent panel designs often include a drain basin to collect residual fluids when the connections are removed or relocated. The residual fluid may be product, clean-in-place solutions or water (potable, USP or WFI), which then drains into the basin and out to a drain point.

### Who is A&B Process Systems? Why would one choose them to design and fabricate transfer panels?

A&B Process Systems is recognized throughout North America for the design, fabrication and installation of stainless steel process equipment and piping, including the high purity and hygienic piping required by the food, pharmaceutical and bio-pharmaceutical industries. The company's reputation has been built upon the capability to manufacture high quality products to meet the performance requirements in a timely manner. A&B's success is a direct result of the in-house resources, the design engineers, fabrication engineers, welders and QA/QC professionals. The company has four plants in Stratford, Wisconsin, with approximately 80,000 square feet of manufacturing facilities. Plasma cutting, automated seam welding, GMAW, GTAW and orbital welding capabilities are available when needed. An extensive range of processing equipment, including a variety of transfer panels, may be fabricated in these facilities to meet customer requirements. The Automation and Controls Group at A&B Process Systems designs user-friendly controls in concert with the design and fabrication of the process system. This group has extensive experience with the selection and installation of the proximity sensors used in today's transfer panels.