High-Containment Valves for **Powders**

Whether you are a small-scale lab, medium sized batch processor, or large manufacturer, chances are that you are using High-Containment Valves (HCV) for processing and transferring powders.

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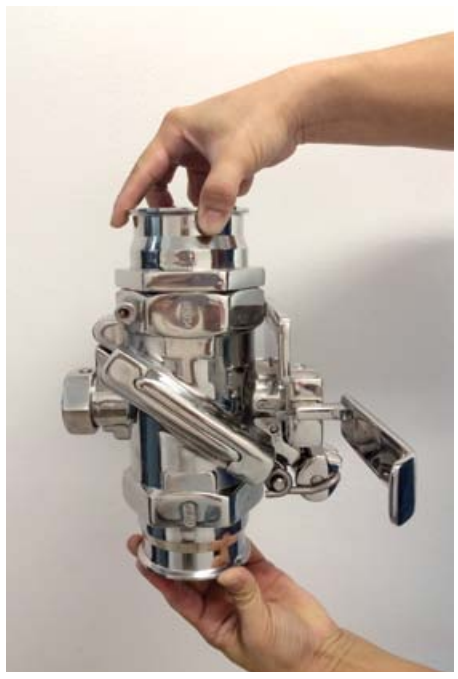
Powders are used in the pharmaceutical plants to make Active Pharmaceutical Ingredients (APIs) for formulations and pills. Powders are also processed in the biotechnology, cosmetic and food manufacturing. Some of these powders can be quite toxic and even carcinogenic requiring extreme caution while handling and processing. If inhaled inadvertently, they can pose health risks to the personnel working in the plant. R &D and Pilot plants work largely with the more potent APIs requiring stringent OEL - Occupational Exposure Level (OEL) limits. These groups are particularly concerned with operators not becoming injured by powder exposure due to high potency and toxicity in the API. Clinical batches are like full production batches ... APIs are mixed with "excipients" and "incipients" resulting in lower toxicity and potency; these operations are scaled up to full production.

Sanitary, High-Containment Valves are often specified to assure safe and secure transfer of hazardous powders. To understand how a typical transfer of powders in a batch works, here is an overview of the transfer process: A HCV consists of two halves that are "latched" together to form a connection to transfer powders. The top half is connected underneath a hopper where powder is gravity fed into the hopper. The bottom half is connected to a movable container into which the powder is deposited. To transfer powder, it is essential that the two halves are connected securely to each other. To start the transfer, the HCV is first opened and then closed using a flow control handle. Once the transfer of a batch of powder has been completed, the two halves are separated ("unlatched" from each other), and a new container is latched onto the bottom half of the HCV. This process of latching and unlatching is repeated over and over again until all batches are transferred. It is extremely important that during unlatching of the two halves, no spillage except a minute amount occurs.

HCVs are generally available in sizes 1" (DN 25) through 12" (DIN 200). The smaller sizes (1/2" through 3") are used in research and development (R & D) labs and pilot plants to produce clinical trial batches. Larger sizes (4" through 12") are used for large capacity batch production.

HCVs are available based on essentially three designs: poppet valve, ball valve, or a butterfly valve. The most commonly used HCVs are of split-butterfly valve design. By nature, valves based on poppet or a ball valve cannot be considered sanitary because they can trap powders during the transfer operation. A poppet valve will always contain some dead volume of powder, no matter what, and a ball valve design allows certain dead space between the ball and the body. Most user complaints with poppet and ball valve designs are leaky valves and requiring unacceptable high force for valve operation,



and high maintenance costs. Compared to valves used with liquids, powders do not provide any lubricity leading to higher operating force.

HCVs based on a split-butterfly valve design address many of the above deficiencies. One of the author's companies (Dry Link) is a pioneer in making such valves (dry-disconnect couplings) for the liquid market. They now offer the same split butterfly containment technology for dry powder transfers.

The High-Containment Valve features a split-butterfly valve design consisting of two halves of a body. Two identical, thin-profile disc halves rotate in unison to create an excellent flow path. A single flow-control handle opens both halves simultaneously. A patented triple sealing design ensures clean, secure and safe product transfer. Built-in safety interlocks prevent accidental separation. The smooth bore has no voids, dead spaces, crevices, or fillers to trap material. Efficient cleaning can be done using CIP/SIP methods. The Coupler half and the Adapter half are bidirectional meaning that either half of the valve can be used as Active or Passive. This valve is extremely tight and requires a low operational force.

High-Containment Valves are available in SS316 & Hastelloy C body materials; and seal materials such as PTFE, Viton (FKM), EPDM and Perfluoroelastomer (FFKM) with wide choice of end connections (female threaded end, butt-weld end, flanged end, Triclover end, etc.), although a sanitary Triclover end connection is the most common. We recommend all internal surfaces to be polished to 20 RA micro-inch (0.5 RA microns) smooth finishes to minimize adhesion of solids to the valve and to reduce operational force. These valves have fewer internal components resulting in low maintenance. Valves should also be specified with removable dust covers to keep them clean.

Conclusion

There are many types of HCVs available in the market. These valves must be selected based on seal tightness, low OEL, ease of operation, and low maintenance. Many companies make claims of unrealistic low OEL that are based on controlled testing by independent testing labs. The prototypes submitted for testing may not represent actual production valves. The user should be wary of such claims and conduct their own testing and evaluation to suit their application. Expecting and imposing unrealistic low OEL for HCVs can be disappointing.

ABOUT THE AUTHOR

Vinod Bhasin is the President of SigmaTech, a consulting engineering company. He is also the President of Dry Link Inc., a manufacturer of dry-disconnect couplings for liquids, and high containment valves for powders. He has over (40) years of professional experience in the design, application and manufacturing of piping, valves and actuators for several companies including Hills McCanna Company, Rockwell International, and Westinghouse Electric Corporation. Originally printed in Electricity + Controls magazine; this article has been updated for the purpose of this publication.