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# The Advantages of Ball Valves with Direct Mount Actuators

As one would expect there has been a significant increase in the sales growth and usage of automated valves over the last ten years. The Valve Manufacturers Association of America (VMA) numbers indicate a 49% increase in 1996 over 1987. The VMA numbers also indicate that automated valves comprise approximately 30% of all domestic industrial valves shipped in 1996. The growth of automated valves should continue as technology advances the capability of plants and end users to integrate all valving into their systems and processes leading to greater efficiencies and competitive advantages.

Automated valves are valves mated with an actuator to automatically stroke gate, globe, ball, plug, butterfly and other types of design. Specific valves are used for certain applications based either on tradition or often on subjective requirements from the user's personal experience. As discussed in previous articles in this magazine, actuator types are specified based on criteria such as type of valve used, tradition,

subjective input, motive force available, and site location. Today's market offers an enormous variety of designs in both valves and actuators. In addition there are large numbers of accessory items to complement the automated package, including position indicating limit switches, positioners for throttling control, solenoid pilot valves, manual overrides, local/remote push-button stations and tie-ins to distributed control systems. Many of these control accessories are available in various analog as well as digital signals.

Quarter-turn valves, such as ball, plug, and butterfly tend to be more easily automated. The same quarter-turn resilient seat and seal designs which deliver tighter shut-off and stem sealing in many services also requires less torque output from an actuator. Movement is a rotary 90 degrees or 180 degrees which is simple to automate. Low torque is encountered due to position seating into resilient seat materials. This in contrast to other types of valves which drive a wedge or other sealing

device into a mating surface using multiple turns of the stem or a linear jamming effect on the stem/plug to get a tight shut-off. Actuators for quarter-turn valves are more compact, energy efficient, and inexpensive.

## Problems Associated with Conventional Actuator Mounting

Current designs for quarter-turn valves incorporate a surface or pad for mounting holes to bolt to actuator brackets. Conventional mounting practice is to install a bracket and adapter between the mounting pad and the mounting surface of the actuator. The adapter or coupling is aligned with the valve stem and the drive sleeve or output stem of the actuator. The bracket is then bolted to the valve and bolted to the actuator. The size of the bracket is dependent upon whether the valve is coupled to an actuator with a male output or a female drive sleeve in the actuator. It is also relative to where the mounting holes on the valve are located; directly beneath and surrounding the valve stem or off to

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the side cast into the body of the valve. Sometimes mounting pads are integral to the top of the flange connections of the valve. All of which affects size and weight of the bracket. The length and size of the coupling/ adapter is subject to the same parameters. Generally, all the concern and attention is focused on the valve and actuator. Little consideration is given to the method of mounting the valve and actuator together. But, in fact, the bracket and adapter can often be the source of failure for valve/ actuator packages. If the bracket is warped, however slightly, or the bolt drillings are off, side-loading of the stem can occur. If the coupling is too long and bracket bolts are drawn down tightly the coupling can jam the stem of the valve into the plug, ball, or bearing surface of the valve resulting in higher torque than the actuator can provide. Stamped brackets are subject to memory reflex as the metal attempts to return to the original pre-bent configuration. Custom brackets made of heavy channel or tube are subject to metal twisting after being cut from a longer length. Surfaces of the channel may not be true. Drillings can lose center and become misaligned for bolt holes. All of these things can cause excessive wear and higher torque than expected. This can result in stem leakage or actuator stall due to simple misalignment of the bracket and adapter package.

Additionally, conventional mounting of actuators to valves using brackets and adapters leaves exposed moving parts. As the adapter/coupling turns it can become a pinch point and

injury can occur. Over time the exposed parts are subject to corrosion which can also increase torque as it binds up the valve stem by moving slivers of corroded metal into the packing or seal area of the stem. These exposed parts are also subject to accidental deflection from being struck or the purposeful attack by vandals. At best the result is side-loading; at worst a valve that doesn't respond to a signal to stroke. An inherent secondary function of valve/ actuator packages seems to be their use as steps up into a pipe galley. Everyone wants to stand on this piece of equipment. When the marriage of the actuator to the valve uses thin stamped brackets there is the possibility that the bracket will give and no longer be true. Again, this can cause side-loading on the stem as well as excessive torque.

An area of great concern with conventional bracket/adapter actuation is the slop that can occur with the connections between the adapter and the valve stem and the adapter and the drive sleeve of the actuator. This is known as hysteresis. As an example a valve stem is often rectangular as is the male output drive of an actuator. The adapter/coupling is then machined on each end with a female slot to fit over each of these male rectangular shafts. If care isn't taken in the manufacture of these connecting surfaces for a tight fit the looseness can cause the valve to not fully open or fully close. If intermediate positions are required for control purposes a sloppy adapter fit can cause the controller to "hunt" or search for the correct position. This can lead to ruined batches or poor

mixing and a multitude of problems.

### **Advantages of Direct Mount of Actuators**

Another method of mounting actuators to valves is the direct mount configuration. In this design the manufacturer's valve can accept an actuator bolted directly to the mounting pad of the valve. No external brackets are required. The bottom of the actuator is flush with the mounting pad of the valve. This design alleviates a number of problems mentioned above. There are no external moving parts. The coupling (if used) is less subject to corrosion. An external bracket does not exist to create surfaces that may be untrue. There are additional advantages to direct mount valve/ actuator packages:

1. Strength of mount between valve/ actuator: No brackets that can bend after installation.
2. Safety: No pinch points.
3. Compactness: Smaller/shorter package takes up less space in pipe galley. Low profile.
4. Actuator/valve stem alignment: Shorter distance between valve/ actuator allows closer tolerances.
5. Modular: Simplicity: No confusion as to how bracket bolts to equipment or how to install adapter.
6. Lighter weight: Package no longer includes bracket and large adapter.
7. Lower cost: Fewer parts in complete actuator/valve package. Fewer pipe hangers required.
8. Direct valve stem/actuator connection: Less chance for

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hysterisis. One less connection with no adapter involved.

- 9. O-ring stem seals: Lower torque and smaller actuators are required.
- 10. Maintenance: Often no packing to adjust. Less corrosion in the valve stem area from atmosphere.

### **Ball Valves and Direct Mount Capabilities**

Historically, quarter-turn valves, such as ball, plug, and high performance butterfly valves have not been designed for direct mount actuation due to the size of the packing gland. Additionally, the packing needs regular adjustment and so it is not feasible to have this area covered and difficult to get to for maintenance reasons. However, due to the increased interest in worldwide standards and recent innovations by a few ball valve companies there are now ball valves on the market that take advantage of the benefits of direct mount actuation. State of the art designs feature configurations to International Organization of Standardization (ISO) or Deutsche Norm (DIN) dimensions as well as others. These are international standards for bolting dimensions, shaft dimensions, torque as well as other parameters associated with uniformity in valves and actuation. Conformity to these standards insures strength and integrity in design of bolting and stem/actuator shaft sizing and configurations relative to torque requirements and output. As an example, DynaQuip Controls manufactures brass and stainless ball valves for direct mount actuation with an ISO bolting pattern that matches the ISO bolt pattern and shaft

receptacle size of their actuators. The few manufacturers of these ball valves use O-ring or special O-ring/packing designs that need little maintenance and require less torque at the actuator. Low and uniform torque translates to extended cycle life. These valves are suitable for most services , and are available in full port up to cold working pressures of 1,500 p.s.i.g. as manufactured by DynaQuip Controls. In most cases the valve stem is a direct connection to the female output of the actuator drive sleeve without the use of adapter/couplings. Potential hysterisis is kept to a minimum .

These direct mount ball valve packages are available with a total modular concept. Not only are pneumatic and electric actuators capable of direct mount but the solenoid pilot valve and limit switches are also a modular concept with no exposed linkages or air line tubing between pilot valve and actuator. The whole package can be supplied with low profile and ease of installation built in.

Direct mount ball valves offer many advantages over conventional automated valves. This technology is now available and being aggressively pursued. They will become a larger proportion of automated valve packages in the field as end users consider the benefits to be gained.

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