Double flap valve maintenance

Double flap airlock valves are a common component in many cement plants that are used for highly-abrasive and demanding applications. A key factor to operating valves in these environments is a robust maintenance programme to implement monitoring and repairs prior to mechanical failure, and ensure reliable and predictable performance.

■ *by **Plattco Corporation**, USA*

Many people have heard of double flap airlock valves, often referred to as double pendulum valves or tipping valves, as they are a common component in many cement factories. Double flap airlock valves have a well-deserved reputation for being robust and long-lasting airlocks which can handle dry material applications that require extreme abrasion resistance and tight airlock sealing. They are typically installed when a new factory is built as well as retrofitted in established factories that can benefit from the valve's simple and reliable operation, replacing underperforming equipment.

One of the key advantages to a double flap airlock valve is reliable performance. This is due to the simple, maintenance-friendly design which provides the ability to quickly and easily maintain the equipment. However, reliable performance is not just a function of clever mechanical design, it also requires a robust maintenance strategy to implement monitoring and repairs prior to mechanical failure.

This article takes a look at industry best practices for maintaining a Plattco double flap airlock valve along with real life examples of customers who implement these strategies (see Figure 1).

Figure 1: example of a clinker cooler valve installation in Kentucky, USA, which is part of the Plattco yearly maintenance programme

Basic double flap airlock valve design

The double flap airlock valve in its simplest form is essentially a set of stacked isolation check valves that open and close, typically under power, to discharge dry material through the chambers while maintaining a pressure seal across the valve. Each "check valve" is stacked one on top of the other and they alternate opening/closing to ensure one check valve is always closed providing the airlock seal. The double flap valve was invented to be easily inspected and repairable so the main material handling components, or wear parts, can be inspected and maintained without the need to remove the valve's housing from service.

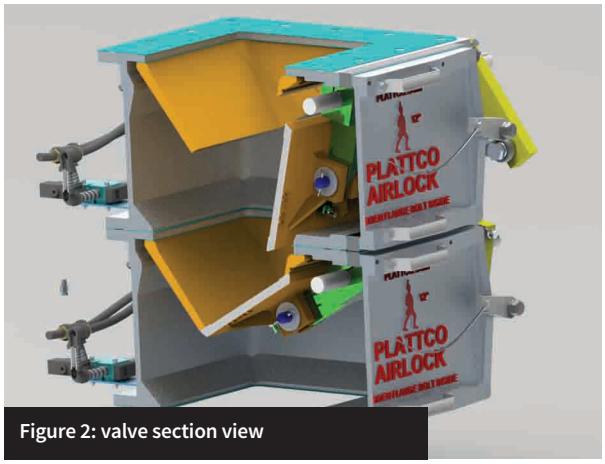

Figure 2: valve section view

Figure 2 is an example of a double flap valve showing the main components a plant operator or maintenance team will inspect and periodically repair. When considering the purchase or specification of a double flap valve, it is critical that the vendor and the design of the valve support future maintenance of the equipment.

Common cement plant applications

Cement plants have been using double flap valves for decades. Common applications for these valves are highly-abrasive and demanding applications critical to the overall performance of the plant. A key factor to operating valves in these environments is a robust maintenance programme to ensure reliable and predictable performance. The following is a snapshot of a few common applications.

Clinker coolers
Double flap valves can be used under grate-style clinker coolers. In this application the valve is used to remove clinker fines that fall through the cooler grates while maintaining an airlock on the fines collection hoppers. The critical performance objective is to create an airlock seal while moving material consistently out of the fines collection hopper, avoiding build-up under the grate. For many cooler designs, a properly sealing discharge valve ensures proper air flows through the material bed. The application is aggressive as the material is very abrasive.

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Kiln dust baghouses
Another common application for the double flap valve is its use as an airlock and pneumatic conveying line feeder on cement kiln dust baghouse systems. In this application the purpose of the valve is to provide an airlock while continually discharging material from the baghouse hopper outlets.

Here material is often fed into a pneumatic conveying system and blown to storage silos in the plant. It is important the airlock valve provides a quality air seal with regards to the operation of the baghouse and the pneumatic conveying system. Too much air leakage through the valve can disrupt baghouse differential pressures, deteriorate baghouse bags and cause pneumatic conveying systems to lose air volume and potentially plug. Maintaining the airlock valve in this application is therefore critical to overall system performance. Figure 3 shows an installation in a cement plant in Florida, USA.

Coal mill feed
Coal mill feed systems are another popular application for double flap airlock valves. Here the valves feed raw coal material into the mill while providing an airlock seal to the mill. The seal on the mill's inlet is critical to maintaining proper pressures and temperatures inside the mill and can translate to direct costs of mill operations. Air leakage at the mill lowers the mill temperature and necessitates a higher mill fan drive speed to compensate for the ambient leakage. Therefore, maintaining the feed airlock valve is critical to controlling mill operation costs and mill performance.

Airlock valve maintenance
To meet the maintenance needs of these and other critical cement plant applications, industry leaders implement maintenance strategies that not only meet the needs of their applications but also their culture. Often this means implementation of a field inspection and repair schedule that is timed with major and minor plant-wide outages and often consists of either performing repairs/rebuilds in the field or in the shop. Regardless of the chosen repair strategy, the plant maintenance team needs to buy in and support the programme to ensure success.


Figure 3: kiln dust baghouse double flap valve installation

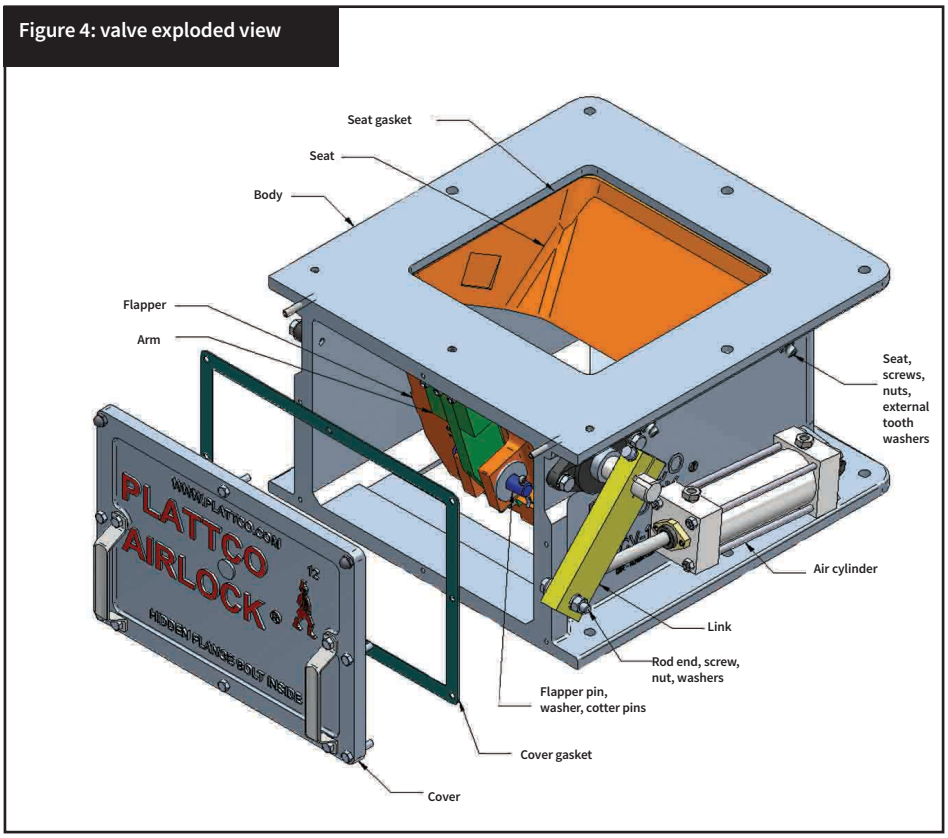
Valve repair strategies
The implementation of a successful repair strategy begins with choosing the type that fits a plant's maintenance culture and abilities. Below are examples of the most common repair strategies carried out by the majority of cement plants.

Field repairs
Field repair strategies are common in the cement industry as they allow plants to coordinate repairs with plant-wide outages and various contractors on-site. Contracting groups often include the double flap airlock valve manufacturer's field service repair team. The field service repair team performs the repair work, trains the maintenance personnel on proper repair procedures, or a combination of both. Leading airlock valve manufacturers offer in-depth training programmes that allow cement plant personnel to be cross-trained on the various common inspection points, as well as critical maintenance items.

Best practice for the field repair strategy is to implement the use of repair kits. Repair kits come as prepackaged parts kits to accommodate various levels of repair, external and internal to the valve.

The advantage of performing field repairs is the valve does not need to be removed from service. Actuation components are on the outside of the valve and can be easily replaced if necessary and internal parts can be easily maintained through access doors. These design features save significant time and money with rigging and removal of larger valve units. However, the disadvantage of this strategy comes down to the ability of having the right parts on site at the time of the repair. Not having the right parts at the right time often means not changing a part that requires replacement or using the wrong part to just "get by". This situation

Figure 4: valve exploded view



"Double flap valves can be used under grate-style clinker coolers. In this application the valve is used to remove clinker fines that fall through the cooler grates while maintaining an airlock on the fines collection hoppers. "

highlights the need for repair kits to ensure proper repairs are carried out and the valve's ability to perform through the next production campaign.

Successful implementation of this strategy can be found at several cement plants. It has been especially successful at a long-running cement plant, and Plattco customer, in Louisville, Kentucky, USA. Here Plattco Corp has been performing on-site maintenance since 2014. Since this time the facility has recorded a decrease in annual maintenance costs directly contributed to Plattco double flap airlock valve repairs. Once repaired, the occurrences of valve breakdown during production campaigns have been minimal and the equipment where valves are installed have been operating more efficiently. Areas and equipment within this Kentucky plant that have benefitted from airlock valve field repairs include:

- clinker coolers
- alternative fuel feeds
- nuisance dust collectors
- conditioning towers
- pneumatic conveying systems.

Valve rebuilds

The second major repair strategy is to perform valve rebuilds in a certified service centre. To implement this strategy a plant will typically keep spare valves in stock and replace failing units during outages. Once valves are removed, they are sent to a service centre for rebuild, rebuilt, then returned to the customer with a like-new warranty. This repair strategy works well for plants with numerous smaller style valves or valves that require frequent repair outside of the normal annual repair. The key element of this strategy is the ability to quickly and easily replace the entire valve unit.

The advantage of rebuilding valves is performing repairs offline. This ensures all necessary repairs are completed and no compromises are made during the rebuild process. It also helps limit the number of contractors on-site during an outage, reducing congestion at the plant. The clear disadvantage here is the need to remove the valve from service and ship to a certified service centre. This can sometimes be more costly than the alternative of repairing in-line.

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Inspection programmes

Regardless of which repair strategy is set in motion, the key to making it successful is the implementation and enforcement of a robust inspection programme. The importance of proper inspections cannot be overstated as this is what is used to plan for future repairs. Plattco Corp can provide a comprehensive inspection checklist for this purpose.

Inspections consist of an external and internal review of the valve, its actuation components and its critical wear components. They are typically carried out on regular intervals coordinated with plant outages that allow access to the valve's internal components.

Figure 4 illustrates a brief overview of inspection points on a double flap airlock valve's external and internal parts.

Conclusion

The justification for properly maintaining a double flap airlock valve, whether through on-site field repair methods, or off-site rebuild methods, can best be seen in the performance of the systems and equipment the valves are operating within. In a cement plant, airlock valves can directly affect the performance of the clinker cooler, baghouse and coal mill operations, to name just a few critical plant processes. Finally, to ensure the airlock valves simple, maintenance-friendly design is properly maintained, it is essential to choose, and enforce, an inspection and maintenance strategy that fits the plant's maintenance personnel's culture and abilities. ■