Insight: Line Blind Valves – Inherent Hazards

The inherent hazards associated with line blind valves and the steps to consider in mitigating risk

Recognizing the Risk

Line blind valves are specific equipment designed to eliminate time consuming manual blinding activities. This equipment enables the task of line isolation to be accomplished much faster than traditional manual methods (spectacle/figure 8, slip blinds etc.) and with considerably fewer people. While they take less time to operate, they do however add an extra dimension to risk that is not always readily apparent. As a consequence, serious loss events can occur that are directly attributable to the installation and operation of this equipment. This article highlights the inherent hazards associated with line blind valves and the procedures that should be considered in order to mitigate these risks.

Risk Characteristics

Inherent Hidden Hazard: Most process plants contain a multitude of process valves that are operated by plant personnel on a routine basis. Most of these valves look very similar; having two flanges, a valve body, and stem attached to a hand wheel. Operating the valve involves turning the hand wheel, which then moves the internal mechanism, either opening or closing the valve. When operated, the typical process valve does not open the pipe to atmosphere. In comparison, line blind valves, even though they appear to function in the same manner as a normal operating valve, provide an opening that can allow the pipe contents to escape to atmosphere.

Figure 1 Typical Operating Valve compared to a Typical Lind Blind Value

This hidden hazard is not immediately revealed when you look at the line blind valve. The design allows the equipment to be unintentionally opened to atmosphere without this hazard being apparent to the average plant operator. This would be known as a population stereotype design issue which would increase the probability of human error and could set the operator up for failure.

Single Point of Failure: A single point of failure (SPOF) is a part of a system that, if it fails, will stop the entire system from working or result in an immediate loss. When a line blind valve is installed without additional layers of protection, opening the line blind valve under pressure would result in a single point failure since doing so results in an immediate loss of containment.

What is the probability of a line blind valve resulting in a release if operated under pressure? The answer is 100%. Due to the inherent design hazard, a site will experience a loss of containment event 100% of the time when a line blind valve is operated while under pressure.

This inherent design hazards has been known by the line blind valve manufacturers for some time. As result of this, most manufacturers recommend extra layers of protection to help mitigate this hazard. Due to the added cost, not all companies elect to add additional layers of protection citing they have very well trained operators.

As a result of the inherent hazards, some line blind valve manufacturers have designed a new style of slide block (figure 2) that will prevent the valve from being locked in the partially open position. This does not completely eliminate the inherent hazards; however it does reduce the potential for a valve to be locked in a partially open position to the atmosphere. This improved design will be available for use on new blinds and in some cases for retro-fitting some of the existing valves.

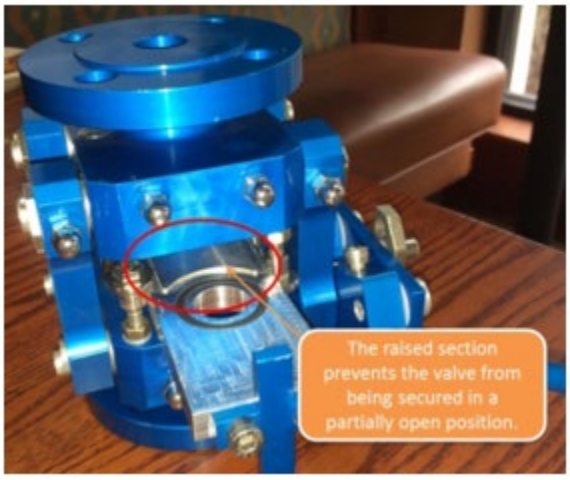

Figure 2 Raised Section Safety Features

According to industry studies and published documents, when a single point failure has the potential to result in a catastrophic event, it is a Recognized and Generally Accepted Good Engineering Practice (RAGAGEP) for companies to install additional layers of protection. This reduces the risk by not placing too much responsibility on human performance.

Mitigating the Risk

Certain procedures and actions may mitigate the inherent risk of operating with line blind valves. The following recommendations could help provide additional layers of protection. (Note: these are not necessarily in order of priority)

1) Only install line blind valve if you have very mature Safe Work Permitting and Line Break program(s). This should be verified with a mature and proven auditing process for ensuring this management system is in place and inherently a part of your process safety culture.

    a) If you already have line blind valves installed, ensure that you are auditing your Safe Work Permit and Line Break programs. Include an aspect on operators understanding how the valves function and the risk of being opened to atmosphere.

2) Ensure that all line blind valves are properly documented on the P&ID's as part of your formal Line Break Isolation and Blind List procedures.

3) Ensure that each line blind valve is properly equipped with isolation, bleed and pressure indicators upstream of the line blind valve in the same manner that you would for a conventional line break activity. Best practice is to have a double block and bleed (DBB) configuration for all line breaks where large volumes of flammable or hazardous materials can be released.

4) Identify situations where multiple line blind valves may be located in a common area where an operator could open or close the wrong isolation valves, then open or close the wrong line blind valve. Ensure multiple valves located in a common area have unique labelling system which clearly communicates their relationship.
5) Consider installing one or more of the following protection layers as part of the installation design associated with line blind valves:

    a) Pressure sensing interlock on valve where if pressure is seen upstream, the valve will not operate (only for valves installed with motorized controls).
    b) Dual Key locking system where more than one person is required to be notified when opening or closing a line blind valve.
    c) Single Key locking system requiring an operator to obtain a key under a formal document request in order to operate a line blind valve. This provides less protection than a dual key option.
    d) Chain the line blind valve wheel open or closed and require a key to remove the lock.
    e) Consider requiring a secondary verification of isolation before line blind valve can be operated.
    f) Consider painting all line blind valve and the handles a unique color to increase awareness regarding these valves.
    g) Consider providing individual unique number and tagging system for field identification and awareness that valve is not a normal operation valve.

6) Install very prominent signage on each line blind valve with the following or similar verbiage, “DANGER – THIS LINE BLIND VALVE OPENS TO ATMOSPHERE WHEN OPERATED”
7) Include caution statement in all SOP and Blind Isolation List with unique DANGER statement.
8) Consider re-evaluating the Management of Change documentation and risk evaluation for the original installation of the existing line blind valves to ensure proper isolation valves exist and training was conducted to include updating procedures to reflect the inherent hazards.
9) Consider implementing a “Special Project” initiative to evaluate the risk of unit specific line blind valves as part of the next scheduled HAZOP by conducting awareness training on the unique hazard associate with these valves for the HAZOP participants prior to the HAZOP.
10) Place the line blind valves on a regular preventive maintenance and inspection program, which includes the overall condition, the operating mechanism, slide plate surface and the O-rings. Replace O-rings per manufacturer’s recommendation.
11) Thoroughly investigate all near misses related to line break procedures.
12) Consider performing a Critical Task Analysis on the operation of line blind valves and conduct annual training on the inherent hazards associated with line blind valves.
13) Consider adding a unique checklist to the Pre-Start-Up Safety Review (PSSR) process for line blind valves to fully evaluate the field installation for opportunities for operator error.
14) Consider adding a specific line item on your Safe Work Permit, Lock-Out Tag-Out and / or Line Break Permit to address line blind valves.
15) Consider limiting the usage of line blind valves to low hazard, non-corrosive and low pressure processes.
16) If the manufacturer of the line blind valve offers a design which prevents the line blind valve from being locked in the partially open position, consider this feature.

Conclusion

Line blind valves may provide a quick and easy solution to the problem of line isolation but at the same time they pose a significant loss of containment risk to the unwary. This has been demonstrated by serious loss events that have occurred through inadvertent operation of line blind valves on live, pressurized process lines. This article indicates that there are a range of actions that may be taken in order to add extra layers of protection, thereby helping to mitigate this inherent risk. If you are utilizing line blind valves carefully checking their design and operating procedures could help to ensure that you

recognize the inherent hazard associated with line blind valves and that appropriate practices are in place in order to minimize this risk.

References & Resources

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For more information, contact your local AIG Risk Engineer.