



How to successfully install valve interlocks

Mounting a single valve interlock is relatively easy from a technical point of view. However, when installing large quantities of interlocking systems for a single project, the execution of such a project could be complex. Construction teams that lack appropriate experience with handling large interlock installation jobs often waste time and money and encounter common, critical technical issues, resulting in complete valve systems not being operable. Proper understanding of the scope of the installation job therefore saves valuable time.

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A valve interlock is added on top of a valve to ensure that the valve can only be operated in a predefined sequence with the other valves of the same system. For standard interlocks, installation is done by bolting only. Any type of hot work or amendments to the host valve is not required. The mounting of an interlock to a valve is not complicated. Therefore many users and contractors choose to install the interlocks themselves.

When large interlock quantities are to be installed however, the organization of the installation becomes challenging. Proper sorting of materials and arranging internal logistics are of vital importance. Quite often, non-specialized installation crews lack detailed knowledge about interlocking sequences and understanding of special interlocking products like Actuator Locking Systems or Mechanical Process Control Units. This article illustrates the complexity of an interlock installation project and helps to make a large interlock installation project run smoothly.

Always be prepared to deal with last minute complications

Since large installation jobs always happen under big time pressure, there's nearly any room for trouble shooting. However, as with all other types of installation jobs, valve interlock installation often require quick fixing of last minute complications.

Interlock mounting kits are designed based on specific valve topwork measurements. Incorrect measurements or a last minute change of a valve type or addition of a gearbox results in the interlock not fitting the valve. When the existing mounting kit cannot be adjusted according to the new valve's dimensions, a new kit is urgently required. New valve topwork measurements need to be collected and conveyed to the interlock manufacturer for urgent production.

Operating sequence requirements might be changed after supply of the interlocks, requiring multiple corrective actions like recoding interlocks, reordering key and lock tag plates, re-measuring of valve topwork details for ordering new mounting kits, re-arranging key cabinets, rebuilding mechanical process control units, etc. Most of this is highly specialized work that needs to be done within very short time and in close cooperation with engineers of the interlock manufacturer.

Train a few specialists or hire a specialist service engineer to supervise

The interlock installation team should either have a few specialist engineers who can take care of such work or cooperate with an experienced service engineer from the interlock manufacturer. A service engineer of the interlock manufacturer has the main advantage that he is able to:

- > make small adjustments himself locally





- > make an inventory of required corrective actions
- > make an inventory of required materials
- > communicate with the engineering team of the interlock manufacturer effectively

A service engineer can be kept on standby to guarantee urgent availability if necessary. He could also be hired as an installation supervisor. The service engineer can support a large installation team, offering guidance and instruction to the local crew. Since the experienced service engineer also checks whether the installation was performed correctly he assumes end responsibility of the installation quality towards the contractor. This makes supervision a cost effective way to ensure a smooth installation of high quality.

Train the installation team

Both end-users and contractors hardly ever hire real interlocking specialists with detailed understanding of the product and its application. Both the technical basics of installing an interlock, and even more the project management requirements described further down, are not common knowledge among the installation crew.

Assure a basic knowledge level by training the installation team

Interlock service engineers can train the installation crew on site, to teach them the basic skills of interlock installation and to trouble shoot when issues arise on their job. Training prior to installation is a low investment with a very high return on investment.

Commonly, various training levels are available:

- > Informative training; basic understanding of the function and operation of valve interlocks
- > Detailed training; how to set and assemble valve interlocks, how to disassemble interlocks if necessary, perform initial inspections and troubleshooting when problems occur
- > Service training; maintaining and resetting of valve interlocks, trouble shooting when problems occur, perform measurements on valves

Avoid damage and missing parts during storage

Especially in case of large projects, an entire interlock scope is sometimes stored up to 24 months in a warehouse prior to installation. Hence proper storage is vital to assure the scope is still in good condition and complete upon installation. Interlocks are supplied in separate parts that are combined in the field during mounting: lock body, mounting set, fitting materials and hand wheels and levers. These parts are often stored separately in different boxes that should be stored all together in one place.

Store a complete interlocking scope together, in the supplied boxes with a closed lid

- > This way the contents are not unnecessarily exposed to environmental conditions prior to usage, while keeping the materials clean.
- > Boxes usually contain materials that come in handy for other purposes and get lost easily. Hand wheels and many small fitting materials are easily taken from the stored boxes. Upon installation such materials will then be missing.
- > After the incoming goods are checked, parts are often stored in the warehouse based on common warehouse categorization, e.g. hand wheels are stored separate from the interlock devices. This way an interlocking scope gets spread throughout the warehouse. When stored separately, it takes a lot of effort to re-combine locks, mounting kids, fitting materials and hand wheels back into one scope later, upon commencement of installation.

Sorting of materials gains time during installation

Upon commencing the installation job, sufficient time should be invested in sorting. For a large scope, proper sorting and preparing easily takes 1 to 3 weeks. This investment pays back quickly by a strong increase in efficiency of the installation job





performance. Commonly, interlocks are ordered for different plant areas at the same time, so a clear division of materials per area is vital.

Sorting is to be carried out in a dedicated workplace. A container placed in the field will serve well. Since valve interlocks are generally utilized throughout the whole facility, the workplace should be situated near the various areas of installation. From this workplace the materials are distributed into the field and returned items can be stored again in the same place. An experienced interlocking service engineer carefully assures that all items that leave the workplace will either be installed or properly returned to the workplace.

Prior to starting the actual installation of the interlock scope, the materials should be carefully sorted.

- > Break down the scope into Areas/Units/Skids/Systems. This strongly improves efficiency of onsite transport of the materials. In the end, the locks should be sorted into systems that are interconnected into one operating sequence. An interlock is dedicated for a specific field item due to its place in the operating sequence. Each interlock tag belongs to a dedicated valve tag. It is therefore vital that interlocks are sorted based on their actual position in the field, to avoid any incorrect placement of interlocks.
- > In the supplied LOIS (Lock Order Information Sheet) inside the IOM, the appropriate field

locations and valve tags are registered for each interlock tag. Based on this the interlocks are sorted. Using the plot plans and P&ID's the exact locations in the field are identified for each area and system where the interlocks are to be installed. Find the respective valve tags and link those to the interlock tag numbers to determine where each interlock is to be installed.

- > The LOIS provides all further required information about each individual interlock, like lock type, key codes, reference to the mounting kit technical drawings and the size of the hand wheel or lever. Also valve specifics are registered, like valve type, size, pressure class and manufacturer.

Prepare for a safe and efficient installation

In order to have the installation job run smoothly, make sure that the following final preparations are finished.

Before the materials are brought into the field for installation, arrange all documents, including permits and risk analysis reports

- > Make sure you possess and have read the IOM. An IOM comes standard with all interlocking orders. It happens often that the IOM is taken out of the box in the warehouse upon reception and stored elsewhere. If the IOM cannot be retrieved, a copy can be easily obtained via email.





- > An IOM contains complete technical information about the entire scope of supply. It includes the **Lock Order Information Sheet (LOIS)**, parts drawings, certificates and installation guidelines.
- > Interlocks are added onto valves or actuators. Hence, these field items must be ready and available. Therefore, the construction or commissioning progress is verified beforehand and it is checked whether the systems in the field are ready for interlock mounting.
 - > Are the valves installed? If not, installation of the interlocks cannot be performed.
 - > Do the valve types correspond to what is mentioned in the LOIS? If not, the supplied mounting sets most likely do not fit and need to be adjusted or reordered, since they were designed according to the specified valve dimensions.
 - > Are the valves available? Possibly obstacles must be removed or scaffolding must be arranged.
 - > Can the valves be operated during installation? Most interlocks require operation of the host valve for setting.
 - > Are there potential clashing issues? Is there no piping in the way of the interlock mounting? Is there sufficient space between interlock hand wheels and walls or piping?
- > Work permits and sometimes additional clearances are required before installation. Generally cold work permits are sufficient, but for certain special applications a hot work permit is needed.
- > A *Task Risk Analysis* and a final Last Minute Risk Analysis are always necessary to make sure that the job can be performed safely. Since installation requires working with valves, it is to be ascertained that no exposure to hazardous pressures or dangerous media is possible, due to other work performed simultaneously further upstream.

Knowledge of valve operating sequences vital for successful installation

Most critical to a proper installation of valve interlocks is to install strictly according to the operating logic, or 'sequence'

Interlocks must be installed strictly according to the operating sequence. Each interlock has unique key codes, which should be mounted on one specific valve tag only. If interlocks are not mounted on their designated valve, the respective system cannot be operated in a safe manner, which will cause serious problems once the system is taken into operation. The sequences can be found in the LOIS, where for each interlock tag, the dedicated valve tag is mentioned. Make sure that the tag numbers and descriptions on the lock correspond to the host valve in question.

Once set, the systems are in operational mode and the interlocking sequences are in place. Any deviation to a sequence now requires the use of a master key or





the total removal of the interlocks from the valves. An experienced valve interlock service engineer has extensive experience in reading and understanding interlocking sequences. He is trained to understand the sequence path from a LOIS and translate that to the situation in the field. Third party installation teams should receive proper training on reading sequences prior to their installation job.

Use commissioning keys

Valve interlocks can only be installed after the installation of valves and often even after mechanical testing. In this phase of the project, time is short. Hence the installation of interlocks always takes place under high time pressure. With the use of commissioning keys, valve interlocks can be installed before steam blowing and hydrostatic testing.

Commissioning keys increases the timespan in which interlocks can be installed and reduce the risk of critical delays at the end of the project.

Valve interlocks installed without the use of commissioning keys form a hindrance during these tests. They enforce an operating logic of the valves that are to be tested, that should not yet be adhered to in the testing stage. This causes for interlocks to be removed again or tempered with, using master keys or inappropriate means, in order to continue the test. Commissioning keys avoid this hindrance by interlocks during testing. Commissioning keys are ordered

separately as an extra item, but form a necessity for a smooth commissioning phase. When ordered, the interlocks are supplied with the commissioning keys readily installed within the interlock. Commissioning keys temporarily override the interlocks, until the keys are replaced by the normal operating keys. After the commissioning keys are removed from the lock, they cannot be re-inserted, so commissioning keys should be removed after all testing is finished. When the commissioning keys are removed, the operational keys are inserted and the interlocked systems are put into operational sequence.

Ensure an up-to-date administration

Record the progress of the installation in the LOIS in order to keep an overview and to ensure the information about the interlocked systems in the MRO database is up-to-date.

During installing and commissioning the LOIS should be continuously updated with installation status, commissioning status and any technical comments that may apply. Add system names, areas, units and valve information like brand name and pressure class whenever this is missing in the original document. And make sure to bring back locks and fitting materials to the warehouse that are not installed and clearly mark this in the LOIS as well.





By doing so, an in-depth document is being created that gives a clear overview of the installed interlock scope for future reference. The updated LOIS is to be inserted into the MRO database, which will be very useful during upcoming stops or repair issues. Ideally, the updated LOIS is fed back to the interlock manufacturer, who keeps a global administration of all installed serial numbers. Complete information about the installed base allows the interlock supplier to offer proper advice about replacements or how to handle possible issues during use.

Summary

Having the right knowledge available, either through training or through hiring specialists for assistance, avoids critical delays when difficulties arise during the installation job.

Correct storage upon reception of the goods and a thorough planning of the installation job will certainly make large interlock installation jobs run much more smoothly and efficiently.

Furthermore, proper understanding of the key characteristics of interlocks avoids further mistakes:

- > **an interlocking device consists of various parts that may be delivered in separate boxes**, so make sure to store the scope with care
- > **each valve interlock has a unique position in**

the field which cannot be interchanged, so make sure to cross check the interlock tags with the valve tags

- > **each mounting set for a valve interlock is designed to a specific valve design**, so improper design info or last minute valve changes will lead to non-fitting interlocks

Since this remains specialist knowledge, it is advised to consult an experienced valve interlock service engineer for training and for supervision of installation and commissioning of large interlocking installation jobs.

