‘...for more than 29 years SFC has never failed to provide a viable technical solution to a client’s safety operating problem...’

Mike Smith - Founder & Vice-Chairman

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KEY INTERLOCK SYSTEMS

Smith Flow Control (SFC) was established in 1985 to provide engineered safety solutions for hazardous operations in the oil & gas and chemical processing industries.

In 1985 SFC introduced the coded-card linear-key concept in a range of modular key-operated interlocks to regulate operator execution of work procedures on any form of host process equipment. Typical applications include every form of valve (including motorised and instrument valves), switches, vessel closures, access guards, pressure and temperature sensing systems and rail/road/sea tanker loading systems.

SFC’s solutions in hazardous processes reduce the scope for operator error and ensure safe continuous plant operation.

OUR COMMITMENT

Smith Flow Control remains committed to providing quality assured products delivered on time at competitive prices. This maxim was first stated when we formed our company in 1985 and remains the guiding principle for how we conduct our business today.

We achieve these goals by relying on three core strands in our business culture - Innovation, Realisation and Dedication.

We remain committed to retaining the confidence of our clients by staying true to the ideals that have gained us the reputation we enjoy today.
As a general principle, it may be said that operations which are safe when performed correctly can have catastrophic consequences when performed incorrectly. The Oil & Gas and Chemical processing industries generally have a disciplined approach to design and operating practice - usually governed by well recognised international standards and enforced by regulatory authorities and certification bodies. Whilst good practice begins with good design, both are ultimately hostage to the ‘Human Factor’.

Modern process plants are highly automated and regulated by distributed software management systems which are simply monitored by ‘Production’ personnel - often remote from the physical location of the plant itself.

Indeed, some operations such as pig launching or receiving procedures can be effected in semi-automatic mode using push button controls (again often from a remote station).

Maintenance procedures however invariably involve human intervention and interrupt automated processes creating ‘abnormal’ conditions for the duration of the work.

Loading or unloading of pig traps, changeover of pressure relief valves, turbine servicing (requiring suspension of CO2 Fire Deluge), coupling or uncoupling of hoses for loading or discharge of tanker cargoes all involve human intervention and are hostage to the possibility of operator error.

Distributed control systems (DCS) cannot effectively regulate such procedures - the SFC ‘Coded Card Key Interlock System’ can!

Controlling the sequence of events in which process activities are conducted has been achieved historically using Permit to Work (PTW) systems accompanied by documented instructions.

However, this system is hostage to ‘human factor’ distractions. Failure to interpret instructions correctly or ignorance of the system can all lead the operator to make errors which can manifest themselves in industrial accidents of varying magnitudes.

Trapped key interlocks are simple mechanical devices which can be customised to implement a safe sequence of operation in any process activity.

In the following pages we show how our mechanical key interlock system ensures that work tasks executed by human intervention can be completely regulated by SFC’s coded-card key interlocks to prevent operator error or violations to protect plant, the neighbouring community and the environment.

In addition to our range of high-integrity coded-card key interlock safety products, SFC also offer a comprehensive range of valve security products for high and low-criticality applications.

‘The obligation to adopt best practice is a fundamental requirement of modern safety management’.

Mechanical key safety interlocking is a technology that has evolved to offer sophisticated technical solutions to complex and hazardous process applications which increasingly are being adopted by major OpCos worldwide to protect their people, their assets and the surrounding environment.
QL VALVE INTERLOCKS For lever operated valves

QL VALVE INTERLOCK (QLT & QLR)

QL valve (inter)locks suit all types of lever-operated quarter-turn valves - including Ball, Butterfly and Plug valves.

Installing the (inter)lock on the host valve is a simple procedure as described below and requires no modification or hot-work to the host equipment as the anchor and adaptors are custom-machined to suit the valve.

1. Install lock adaptor.
2. Install anchor.
3. Fit SFC nut.
4. Assemble QL lock, secure lever and tighten screw.

After removing the existing lever the QL is assembled as follows:

PRODUCT FEATURES

- 316 Stainless steel.
- Linear ‘coded-card’ key design.
- Robust construction.
- Proven reliability in all climates.
- Single or double key versions.

- No modification to host valve.
- Suitable for any valve type/model.
- Can be installed on ‘live’ plant.
GL Valve Interlocks For handwheel operated valves

GLM & GLS Valve Interlocks

GL valve (inter)locks suit all types of handwheel operated valves - including Gate, Globe and Gear-operated valves. Installing the (inter)lock on the host valve is a simple procedure as described below. Requiring no modification or hot-work to the host equipment, the anchor and adaptors are custom machined items. Universal Adaptors (UAS) may be supplied when precise valve topworks data is not available.

**Product Features**

- 316 Stainless steel.
- Linear ‘coded-card’ key design.
- Robust construction.
- Proven reliability in all climates.
- Single or double key versions.
- Suitable for all handwheel operated applications.

After removing the existing handwheel the GL is assembled as follows:

1. Mount lock adaptor and fix SFC nut.
2. Locate body to adaptor.
3. Tighten fixing screws (x3).
4. Tighten setting screws to set “Open” and “Closed” key release positions.

- No modifications to host valve.
- Suitable for any valve type/model.
- Can be installed on ‘live’ plant.
Access into pressure vessels is a potentially hazardous exercise. Residual pressure, volumes of residual liquids or gases all can be harmful - typical examples of these potential hazards include pig traps, slug catchers and filter housings.

Locking the vessel closure in the closed position ensures access into the vessel can be achieved only under controlled safe conditions. The operating key is held in a secure place - e.g. Control Room or Supervisor’s office or is retained (trapped) in some other related interlocked item of equipment.

Most international vessel design codes as a minimum require vessel closures to be interlocked with venting and draining functions - this interlocking arrangement can be extended to incorporate all other vessel functions (e.g. draining, purging or flushing).

Any type of closure can be fitted with the ‘DL3’ interlock, regardless of their method of operation. Design details can be provided on request.

The SFC ‘DL3’ interlock is adaptable to all types of vessel/access closures and is very simple to use in pig trap applications especially where the closure incorporates a bleed device.

The ‘DL3’ interlock will be designed to interface with the bleed function to ensure the bleed screw cannot be removed until the interlock permit key has been inserted to unlock the ‘DL3’ assembly. This key is usually obtained after opening and locking of the vent valve.

When the ‘DL3’ is incorporated into vessel access safety procedures, total equipment and personnel safety is assured.
The most common requirement for key interlocking of power actuated-valves occurs in Pig Launcher/Receiver systems, Scraper Traps and Sand Filter systems etc. where power actuated valves need to be interlocked with manually-operated valves and the vessel closure.

**DESIGN PRINCIPLES**

Because of the ultra-critical nature of such valves, special considerations arise which the design of a key interlock system must address:

Where such valves are part of an ESD system, the key interlock system must not compromise the valve’s fail-safe function.

Where pigging operations occur, the key interlock system must verify the valve’s absolute position (open and/or closed) independent of any on-board instrument indication.

On electrical actuators where the key interlock system de-energises the valve, any anti-condensation heating circuitry etc. must remain uninterrupted. Where actuators are equipped with a manual override facility, the key interlock system must permit operation of the valve in both modes (or in a combination of both modes – e.g. in the event of a power failure) while maintaining the integrity of the key sequence at all times.

**EQUIPMENT STATUS:-- VALVE OPEN**

- ‘SLU’ Switch Unit Locked in ‘REMOTE’.
- ‘HWL’ Handwheel Drive Locked ‘OFF’.
- ‘A’ Key in Control Room.

**TO CLOSE VALVE:**

1. ‘A’ Key into ‘AKE’ positional indicator unit.
2. ‘B’ Key is removed from ‘AKE’ - ‘A’ Key trapped.
3. ‘B’ Key into ‘SLU’ Switch Unit to unlock.
4. ‘SLU’ Unit switched to ‘LOCAL’ (‘B’ & ‘C’ Keys trapped).

Operate button to close valve.

5. ‘SLU’ Unit now switched to ‘OFF’ - ‘C’ Key is removed.

‘SLU’ Unit locked in ‘OFF’ position trapping ‘B’ Key.

6. ‘C’ Key into ‘AKE’ Unit - remove ‘D’ Key trapping ‘C’ Key.

‘D’ Key is then directed towards continuation of the procedure.

**NB** The ‘D’ Key will not release unless the valve has completed its full stroke to the CLOSED position.

**EQUIPMENT STATUS:-- VALVE CLOSED**

- ‘SLU’ Switch Unit Locked ‘OFF’.
- ‘HWL’ Handwheel Drive Locked ‘OFF’.
- ‘D’ Key in Control Room.

**TO OPEN VALVE:**

1. ‘D’ Key into ‘AKE’ positional indicator unit.
2. ‘C’ Key is removed from ‘AKE’ - ‘D’ Key trapped.
3. ‘C’ Key into ‘SLU’ Switch Unit to unlock.
4. ‘SLU’ Unit switched to ‘LOCAL’ (‘B’ & ‘C’ Keys trapped).

Operate button to open valve.

5. ‘SLU’ Unit now switched to ‘REMOTE’ - ‘B’ Key is removed.

‘SLU’ Unit locked in ‘REMOTE’ position trapping ‘C’ Key.

6. ‘B’ Key into ‘AKE’ Unit - remove ‘A’ Key trapping ‘B’ Key.

‘A’ Key is then directed towards continuation of the procedure.

**NB** The ‘A’ Key will not release unless the valve has completed its full stroke to the OPEN position.

**HYDRAULIC & PNEUMATIC ACTUATORS**

A range of comparable designs are also available for spring return and non-return hydraulic actuators and for spring-return pneumatic actuators.

SF’C’s range of special process products also includes needle valve locks, temperature and pressure sensing locks and a range of signalling options to meet most process operating requirements.

**POWER FAILURE MODE**

In the event of a power failure at anytime during either of the above procedures, it is essential the integrity of the key sequence is maintained if the valve is operated manually. This is achieved simply by locking the ‘SLU’ Unit in the ‘OFF’ position thereby releasing the ‘C’ Key (Even if power is restored, with the ‘C’ Key free, the valve/actuator will remain disabled).

The ‘C’ Key is inserted into the freewheeling ‘HWL’ handwheel assembly - this lock functions on a ‘declutching’ principle. With the ‘C’ Key trapped, the ‘HWL’ drive mechanism may be engaged thereby enabling the valve to be operated.

While the ‘C’ Key can be removed from the ‘HWL’ assembly at any time, it has to be exchanged through the ‘AKE’ unit to secure the continuation key (e.g. the ‘A’ or ‘D’ Keys in the above examples)- these keys will only release provided the valve has completed its full stroke.

**ACTUATORS FOR GATE VALVES**

These same key sequencing principles can be applied effectively to the management of motorised gate valves.
Well designed interlock installations also include an effective and efficient key management system that will provide a continuous and reliable indication of the status of all interlocked process systems.

SFC ‘Visual Alert’ Key Cabinets provide an effective and infallible management control system against unauthorised or inadvertent operation of interlocked valves or associated process equipment by keeping the coded keys which initiate the operation of critical valves under secure supervisory control.

The SFC ‘Visual Alert’ Key Management System dedicates and maintains the operation of critical valve and process operations totally within the control of the Designated Authority and the Performing Authority, enabling Permit to Work (PtW) procedures to be carried out safely and efficiently. The system concept is totally flexible and is designed in each case to integrate with each client’s operating system and working practices.

**DESIGN FEATURES AND BENEFITS**

- Carbon or Stainless Steel construction available.
- ‘Glazed’ door provides key status without the need to open/un-lock.
- Ingress protection from IP55 to IP66.
- Lockable doors.
- Wall brackets provided.
- Total integrity by using dedicated key locations.
- Complete key status awareness.
- Can incorporate microswitch actuation to signal key movements.

SFC Key Cabinets can incorporate a Pin Code system which prevents the replacing of a system key incorrectly. A micro-switch option is available for signalling key removal/entry.

SFC Process Management Systems provide effective protection to clients’ investments in plant and equipment as well as improving employee safety and reducing the risk of damage to the environment.

**SFC PERMIT TO WORK (PTW) SYSTEMS**

Having adopted a good key control system, the next most important step is to apply a good key management system.

For storage, ease of access and issue, SFC key cabinets provide all that is required.

A key cabinet should be located in a secure place; typically a Control Room whereby initiating keys are issued by the Shift Supervisor, Offshore Installation Manager (OIM) or other person in authority.

Cabinets vary in size and can accommodate from 1 - 252 system initiating (or spare) keys. Keys can be located via means of hooks or holsters (the holster locator provides increased capacity).

Each interlocked system has a dedicated engraved tag location within the key cabinet. During periods of normal operations, all interlock system ‘permit’ (initiating) keys are visually displayed within the cabinet in dedicated locations.

Each key cabinet tag is engraved with the relevant piping package data – this same data is also replicated on each system key.

When the key is removed, a ‘Visual Alert’ tag is revealed providing details of the key which has been issued, its designated location, and the words ‘WORK IN PROGRESS’.

Control Room staff have clear and easy indication of work status at any time. Key cabinets can also accommodate mimic diagrams. These are extracts of the P&ID diagram engraved onto a Traffelite plaque and show clear details of all valves which are interlocked.
ATL (ANTI-TAMPER LOCK)

CONSTRUCTION
ATL is available in two sizes covering all valve sizes and is available in 316 Stainless Steel. For remote unmonitored or higher security risk areas, a carbon steel, case-hardened option is available, which will withstand the toughest forms of vandalism.

CODING
The units can be uniquely coded or coded alike, dependant on operational conditions/requirements.

OPERATION
With the unit fitted to the valve, the standard SFC tamper-proof coded card key can be inserted allowing valve operation. Depending on operational requirements, the valve can be operated to any position, once the key has been removed, the unit free wheels - preventing valve operation.

ORDERING
The units are available 'off the shelf' allowing customers to undertake the simple machining operation for fitting, thus reducing order times and offering an instant security/safety solution.

SECURITY PRODUCTS

INTRODUCTION
Many valves on site require a simple to use locking device to prevent accidental or unauthorised operation.

CONSTRUCTION
Many valves on site require a simple to use locking device to prevent accidental or unauthorised operation. The ATL has been developed to fit directly to valves in place of the normal handwheel or operating lever, with little machining which can easily be undertaken by the customer.

CODING
The units can be uniquely coded or coded alike, dependant on operational conditions/requirements.

OPERATION
With the unit fitted to the valve, the standard SFC tamper-proof coded card key can be inserted allowing valve operation. Depending on operational requirements, the valve can be operated to any position, once the key has been removed, the unit free wheels - preventing valve operation.

ORDERING
The units are available ‘off the shelf’ allowing customers to undertake the simple machining operation for fitting, thus reducing order times and offering an instant security/safety solution.

EXPANDED CHAINLOK

The Chainlok is a unique device which combines the best features of padlocks and interlocks.

A durable body and chain made from 316 Stainless Steel makes it suitable for use in the most hostile environments. Chainlok comes with 0.5m chain as standard (longer lengths available on request). Flag style ‘Colour Aware Key’ enables incorporation into interlock (key exchange) systems.

Operating condition;
Key Trapped – Chain Free
Key Free – Chain Locked
Flip caps prevent ingress of foreign matter when key is removed.

PRODUCT DETAILS

CAR SEAL

For ‘one-time-only’ securing of manual operators, including securing of manual valves, switches and enclosures. A simple ‘break-away’ screw secures the seal in place. Removal can only be achieved by cutting the seal cable.

Two body and cable sizes are available, along with varying lengths of cable. Cable breaking strains are available to 1750kg.

Re-usable car seals are also available.

Ideal for use in commissioning procedures.
The range of process applications to which SFC interlocks can be applied is unlimited. As clients begin to understand the immense operational capabilities of SFC interlock systems, they often request unique solutions to specific problems.

In this section we present some examples of 'specials' we have developed to meet clients' specific operating safety requirements.

SFC are always pleased to receive a challenge to provide unique solutions to clients' individual or special problems.

**SEQUENCE CONTROL UNIT**

**CUSTOMER PROBLEM**

To permit complex variations in operating sequences on launcher/receiver systems.

**SFC SOLUTION**

The simplest interlock systems will normally feature a 'linear sequence'. This is where the outward 'journey' (operating steps) are mirrored by the return journey. However, from time to time, non-linear sequences are necessary. A typical example of a non-linear sequence is a pig trap procedure where double block and bleed valves control complex nitrogen purging, pressure equalisation, venting and draining.

The sequence control unit is a mechanical key issuing/control device. It is normally placed locally to the valve system. It differs from a key exchange unit in that, upon inserting a permit key, a selector knob is rotated to a fixed position before the next key is issued.

**SFC DUST PLUG**

Key operated locking devices invariably feature a key entry aperture to facilitate locking and unlocking of the assembly.

Made from HDPE and fitted with a soft sealing aperture gasket, the SFC 'Dust Plug' is inserted by the operator to seal the key entry aperture immediately after he has removed one or the other of the operating coded keys from the lock assembly.

The SFC 'Dust Plug' is a tight-fitting component that positively seals the key entry aperture and will not become dislodged through vibration once properly fixed in position by the operator as he completes his scheduled work procedures.

Removal of a key from the assembly increases the scope for the ingress of dust and dirt through the key entry aperture which can contaminate the inner workings of the lock mechanism - leading ultimately to possible seizure and malfunction.

The SFC 'Dust Plug' is a simple and highly effective solution to prevent this happening.
To mechanically interlock an electrically operated device, within a hazardous environment - ATEX certified.

Where mechanical (interlocked) control of powered equipment is required in a hazardous area, the SFC switch lock provides the perfect solution.

In this illustration our ‘QL’ quarter turn interlock is fitted to the switch mechanism of an II 2 G D hazardous area control switch.

A single or dual key configuration can be supplied to lock in the ‘ON’, ‘OFF’ or both positions.

Solenoid key release units are available. These are commonly used around Pig Traps to receive a ‘low pressure’ signal to indicate it is safe to proceed to open the door.

Additional signalling required.

ATEX certified proximity switches can be incorporated into all SFC interlocks to provide signals to indicate:

A. Key entry or removal.
B. Valve open or closed, indicated by the removal of the key and locked in that position.

‘Off the shelf’ proximity & microswitches are integrated with our interlocks units.

The ISO pattern ‘IML’ intermediate lock that enables full mechanical control of any ISO pattern actuator.

Actuated valves in process operations are normally maintained in an energised state and may otherwise be part of a DCS managed system. During normal operations these valves will respond to process commands in a pre-determined manner.

However, during periods of planned maintenance the command architecture managing these valves may need to be suspended to facilitate prescribed work tasks. In these circumstances it may be essential to ensure that such valves are set to their failsafe position and are disabled both remotely and locally so that work may proceed safely.

The SFC ‘IML’ lock is a mechanical device that interfaces between the actuator and its host valve. It uses an operating key facility to lock the actuator in the desired open or closed position so that the valve is prevented from turning under any circumstances.

This key may be a part of an additional designed-in feature whereby the power source that energises the valve can be interlocked with the IML unit itself to provide a total failsafe solution by ensuring the power source and the actuator are mechanically interlocked and all functions are disabled.

With all ISO 5211 patterns covered from F05 to F16, the six models of the IML will interface immediately to any ISO pattern actuator and replaces the requirement for a valve mounting kit.

The maximum flange torque for each hole pattern in line with ISO 5211 is:

- F05: 125Nm
- F07: 250Nm
- F10: 500Nm
- F12: 1000Nm
- F14: 2000Nm
- F16: 4000Nm

The ‘IML’ is available in two compact mechanical configurations:

- A key-operated system managed from the Control Room as part of a structured ‘Permit to Work’ (‘PtW’) management system.
- A simple stand alone lock-out system which satisfies OSHA Standard 1910.47 – ‘Control of Hazardous Energy’
CONSTRUCTION

The SFC ‘ComKey’ provides a simple effective solution to this problem and enables all parties to complete their respective work responsibilities without compromising the designed ‘logic’ of the installed interlocks and without the interlocks impeding final completion tasks.

SFC Interlocks are supplied as standard with one key trapped and one key free. However, for situations where any of the above issues are relevant, SFC interlocks can be supplied with factory-fitted ‘ComKey’ that permit random operation of the installed interlock irrespective of the coded logic of the interlock system.

CODING

The SFC ‘ComKey’ is a ‘one-time-only’ design facility feature – once the key is removed after all testing/commissioning tasks are completed it cannot be re-used – the installed interlock will only then accept its dedicated coded key for normal operations.

The SFC ‘ComKey’ eliminates the necessity for commissioning master keys, saves time and simplifies site logistics related to the distribution and control of system operating keys.

‘ComKey’ – another innovative simple safety solution from SFC.

Installation of key interlock systems is usually one of the final tasks to be performed before final commissioning and handover of a project to the client.

However, interlocks can impede final commissioning procedures by preventing valve settings necessary to create the process conditions for commissioning (hydro-testing) of piping systems.

One solution is to defer actual fitting of the key interlock systems until all mechanical completion tasks are accomplished.

This arrangement is seldom satisfactory – particularly as there may be a number of different contractors involved in the final commissioning programme.

Commissioning of mechanical key interlock systems ideally must be undertaken and completed by one responsible party – particularly with regard to management of the control keys.

PRODUCT DETAILS

The SFC ‘ComKey’ is available to suit all type of Smith Flow Control key operated products.

All ‘ComKey’ systems must be specified at the time of order placement, as each lock is assembled with the system pre-installed.

FLEXIDRIVE

If your valve is:

- In a hazardous area, below water, in a confined space, in a pit, where noxious fugitive emissions prevail.
- Or where valves are just simply out of reach – FlexiDrive is the answer.
The cable system can be passed through walls, bulkheads, floors and any other obstacles to reach the valve.

DESCRIPTION

FlexiDrive is a very versatile product consisting of two stations, joined by a unique patented linear drive cable. This equipment enables valves and other wheel operated devices in remote, hard-to-reach or hazardous locations to be operated easily from a conveniently located handwheel.

Developed to operate valves in inaccessible locations, FlexiDrive can be applied to any conventional wheel-operated valve/device, in oil, gas and chemical processing plants, or any other industrial application. It is suitable for underwater use and will function reliably in all climatic conditions.

The cable system can deliver adequate torque output for most manual valve situations and can transmit drive to a valve up to 30 metres from the operator station. The flexible cable system facilitates up to 540° of bends in the cable run.

FlexiDrive is available in two sizes: LV for large valves and SV for small valves. SFC will select the most appropriate system for your application.

SFC systems comprise of four basic elements:

1. Operator Station Actuator.
2. SV System Position Indicator.
3. Valve Station Actuator.
4. Valve Drive Coupling (designed to suit the host equipment).

Operator stations are available in a variety of different gear ratios, providing a wide range of torque capabilities. A helically wound steel cable has a pitch the same as that of the cable gear. The precision gear-cable interface provides a positive force to the helix cable, which travels through the flexible conduit to the valve station actuator.

BASIC MATERIAL SPEC

316 Body Castings
PBI Bronze Bearings
IP65 Rating
Capability Over 30 Metres
Can Accommodate 540° Bends
Min Cable Bend Radius 300mm
High Torque Capacity
Totally Maintenance Free
Adaptable To Any Conventional Valve
REMOTE CABLE DRIVE VALVE OPERATORS

WHAT INDUSTRY?

Practically any industry where valves are used would benefit from the EasiDrive System. SFC can design and install EasiDrive to meet strict safety guidelines and regulatory body requirements. Additional details of all products illustrated are available on our website at www.smithflowcontrol.com.

EASIDRIVE - PORTABLE VALVE ACTUATOR SYSTEM

Typical handwheel operated gate valve, pneumatically driven using a universal, ‘bolt-on’ handwheel drive plate and reaction device.

EASIDRIVE

- Low cost alternative to permanent dedicated actuators.
- No requirement for a permanent power supply.
- Ideal for minimum facilities installations.
- Suitable for all climatic conditions.
- Wide band torque capability with variable torque adjustment as standard.
- Ideal for moving tight or partially-seized valves.
- Adaptable to any size/type of valve.
- Eliminates operator fatigue and greatly reduces the risk of injury.
- Reduces work crew tasks to one-man operation.
- Fully portable - can manage banks of valves with a single drive tool.

Three simple steps to EasiDrive installation and use:

1. Decide if you want to retain the option of manual valve operation via the handwheel.
2. Install the relevant EasiDrive equipment.
3. Connect torque tool to power supply (pneumatic, electric or battery).

Typical gear-operated valve, pneumatically driven using a universal ‘bolt-on’ handwheel drive plate and bespoke (custom made) reaction device.

STANDARD EQUIPMENT & BASIC SPECIFICATIONS

- Pneumatic, electrical and battery ‘torque tools’ available.
- ‘Local’ pistol grip type tools available.
- Barrel type tools.
- Customised valve drive adaptors.
- Standard hose length supplied: 3 metres.
- Air supply recommendations: 840 l/m (30cfm) @ 5.5 bar (80psi).
- Drive tools available with a range of torque.
- Outputs: 100 Nm (74 lbf ft) to 100,000 Nm (73,700 lbf ft).
- Torque safety cut out facility.
- Continuous run and ‘dead mans handle’ options.
- Calibration certificates supplied as standard.

* Installing Bulkhead and wall penetration systems may require final assembly and approval by qualified SFC engineers.
TECHNICAL DATA REQUIRED
FILTER, REGULATOR & LUBRO (FRL) PACK

MAIN DIMENSIONS

![Diagram of FRL Pack Dimensions]

- Unit Weight (oil filled) - 4.5 Kg

SFC EASIDRIVE AIR SUPPLY RECOMMENDATIONS

650 l/m (litres per minute) = 23 cfm (cubic feet per minute) at a constant supply pressure of 5.5 bar = 80 psi (pounds per square inch).

(Failure to meet these recommendations will result in the air ‘gun’ not working to maximum efficiency).

Recommended air supply hose to the FRL pack is 1/2” bore. Again failure to meet this recommendation will result in the air ‘torque tool’ not working to maximum efficiency.

PORTABLE VALVE ACTUATORS

PNEUMATIC TOOL

EasiDrive is an efficient and cost effective alternative to a dedicated valve actuator. Wherever you have manually operated valves that have high operating torques, hundreds of handwheel turns to open/close or are just difficult to operate then EasiDrive is your solution.

Options

Smith Flow Control can also supply an electrical version of the EasiDrive with features including:

- Pistol grip.
- Range of voltages.
- Customised valve drive adaptors.
- Switchable maximum torque level feature.
- Current maximum torque.
- Output feature buttons to adjust torque.
- CE and EMC certified.
- Calibration certificate.

A battery version of the EasiDrive is also available:

- Soft start trigger.
- Ergonomically positioned forward and reverse switch.
- High torque to weight ratio.
- Quick change battery pack, reducing downtime.
- Customised valve drive adaptors.

Each drive tool has a unique serial number and is supplied with it’s corresponding certificate of calibration.

By adjusting the air pressure you can easily restrict the torque output of the drive tool for your precise requirements. (As shown on page 28.)
### APPLICATIONS PSV Interlocking

Whether onshore or offshore, maintenance procedures to Safety Relief Systems on live plant cause concern in ensuring that an open path to relief is maintained at all times during the work exercise.

Most modern piping arrangements include spare relief capacity enabling continuous production while maintenance procedures are conducted on live plant eliminating the requirement to isolate and shut down the process.

Twin or multiple safety relief valve systems are usually fitted with isolation block valves upstream and downstream of each safety relief valve - it is essential to ensure that the block valves isolating the spare relief valve are opened BEFORE the block valves of the work piece relief valve are closed.

This issue is a more acute problem if the respective relief valves and isolating block valves are distant or out of sight of each other.

Various API and ASME codes recognise this hazard and recommend the use of interlocks to eliminate this possibility. API RP 520 (Pressure Relieving Systems for Refinery Services - Part II Section 4 - Isolation Valve Requirements) and API RP 14E (Design and Installation of Offshore Production Platform Piping Systems - Para 5.8b[2] - Relief Device Piping) specifically recommend interlocks in this situation to ensure that (over) pressure protection of the vessel is not compromised.

Otherwise, many leading OpCos have their own written engineering design standards that specify similar safety design requirements.

Fitting a valve interlock to the upstream and downstream isolating valves on each safety relief valve (PSV) will ensure these recommendations are implemented.

An initiating key, issued from a secure location (Control Room) commences the PSV changeover. Follow the step-by-step procedures in the diagram.

### PSV INTERLOCKS

#### 4 VALVE PSV INTERLOCK SYSTEM

**Sequence of Operation:**

**Change - Over Sequence from PSV A Operational to PSV B Operational**

a) Obtain Key ‘4’ from Control.
b) Insert Key ‘4’ into Valve A. Open Valve A and lock open by removing Key ‘3’.
c) Insert Key ‘3’ into Valve B. Close Valve B and lock closed by removing key ‘2’.
d) Return key ‘2’ to Control.
   (Change - Over complete)

**Complete isolation of PSV A**

e) Obtain Key ‘4’ from control.
f) Insert key ‘4’ into Valve A. Open valve A and lock open by removing key ‘3’.
g) Insert ‘3’ into Valve B. Close Valve B and lock closed by removing key ‘2’.
h) Insert Key ‘2’ into Valve C. Close Valve C and lock closed by removing key ‘1’.
i) Return Key ‘1’ to Control.
   (Isolation of PSV A complete)

**Complete Isolation of PSV B**

j) Obtain Key ‘4’ from Control.
k) Insert key ‘4’ into Valve D. Close Valve D and lock closed by removing key ‘5’.
l) Return Key ‘5’ to Control.
   (Isolation of PSV B complete)

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**Key Marking and Colours**

Front and Rear view of Key(s) - Example of Key Marking and Colours

- Key 1
- Key 2
- Key 3
- Key 4
- Key 5

**Legend**

- Valve Locked Open
- Valve Locked Closed
- Key Free
- Key Trapped
Pig traps involving operator intervention can be prevented by SFC coded-card key interlock systems. ASME and API codes recognise pig trap hazards – especially in relation to the risk of opening closures while the vessel remains under pressure. The Pipelines Safety Regulations 1996 enacted into UK law in April 1996 requires operators of pipelines to provide safety systems that ensure persons are protected from risk to their health and safety – again describing the hazard of opening pig trap vessels under pressure.

Many major OpCos also have their own written design standards specifying safety interlocks as an essential feature in their pig trap designs.

SFC interlocks can be specified to ensure the minimum safety arrangement of interlocking the vessel vent valve with the pig trap closure. This arrangement ensures (to the exclusion of all other methods) the vessel VENT valve is OPEN before any attempt can be made to open the closure.

With interlocks fitted to both the vent valve and pig trap closure, a key is released when the vent valve is opened - removing the key from the vent valve locks the valve in the open position. This key is coded in common with the closure lock – only by opening and locking the vent valve can the operator secure the correct key to proceed to unlock and open the closure.

### Applications Pig Trap Interlocking

**To Load Pig(s)**
1. Insert Key 1 into V1, unlock and open, lock open by releasing key 2.
2. Key 2 into V2, unlock and open, lock open by releasing key 3.
3. Key 3 into door lock. Unlock and open the vessel door, key 3 is retained all the time the door is unlocked and/or opened.

**Load Pigs**

**To Re-Isolate, pressurise then launch**
1. Close and lock closed the vessel door, key 3 is released.
2. Key 3 into V2, unlock and close, lock closed by releasing key 2.
3. Key 2 into V1, unlock and close, lock closed by releasing key 1.
4. Key into V3, unlock and open, lock open by releasing key 4.
5. Key 4 into V4, unlock and open.

**Pig(s) Launched**

**To Leave Trap in “Dormant/Start” Condition**
1. Key 1 is returned to the Control Room Key Cabinet.

**Proposed Sequence Ends**
PIG TRAP INTERLOCKING

‘...Imagine the consequences of opening a Pig Trap closure with product and or pressure in the barrel’

‘...Imagine the effect of attempting to pass a pig through a partially open outlet valve’

‘...Imagine being exposed to H₂S’

...These things can happen - have happened!

MECHANICAL KEY SAFETY

Mechanical key safety interlocking is the ONLY technology that can assure the universally accepted requirement in the loading and unloading of pig traps that the vessel is vented BEFORE it is possible to open the vessel closure. A key is released when the vent valve is unlocked and opened which then enables unlocking of the closure mechanism. This imperative is defined variously in the following standards and regulations:

ASME VIII - Appendix M

1996 No. 825 – (UK) Pipeline Safety Regulations (Section 6 - Para. 37 of Guidance on Regulations - UK Health & Safety Executive).


Other major OpCos including StatOil, Hydro, ADCO & BP among others have well defined specification requirements for interlocking of their Launchers and receivers.

Various switch options are available for the SFC DL3 interlock, should additional indications of the door/closure status be desired.

TECHNICAL DATA REQUIRED SECTION

The type & nature of our products means that we require very specific/bespoke information to be able to design/manufacture them:

This section covers the common details required by SFC to ensure a swift transmission from order placement to actual production.

VALVE TOPWORKS DIMENSIONS

In order to design & fabricate our valve interlocks we require some very specific dimensional details of your host valve(s).

The next few pages provide some specimen drawings of different valve types and the dimensions typically required by SFC.

*Please note.

The more accurate the information provided, the better fit and function of your SFC valve interlocks.

We of course do have available skilled technicians who would be able to assist and if needed can travel to the yard or site to carry out measurements and or installation services.
TECHNICAL DATA REQUIRED
GATE VALVE FILL IN SHEET – (Specimen only)

MAIN DIMENSIONS

Ba (Pitch) = ....
\( a_A = \ldots \) \( a_B = \ldots \)
C = \ldots, D = \ldots
E = \ldots, F = \ldots
G = \ldots, \( a_H = \ldots \)
I = \ldots, J = \ldots
K = \ldots, L = \ldots
M = \ldots, N = \ldots
O = \ldots, \( a_I = \ldots \)
S = \ldots

Size:
Pressure Rating: ....
Make: ....
Handwheel size: ....

\( a_1 = \ldots, 2 = \ldots \)
3 = \ldots, 4 = \ldots
\( a_5 = \ldots, 6 = \ldots \)
7 = \ldots, \( a_{10} = \ldots \)
11 = \ldots, \( a_{15} = \ldots \)
\( a_{15} = \ldots \)

HANDWHEEL DRIVE FORM

\( B = \ldots \)
\( \phi B = \ldots \)
\( 3 = \ldots \)
\( \phi 5 = \ldots \)
\( 7 = \ldots \)
\( 11 = \ldots \)
\( \phi 10 = \ldots \)
\( \phi 11 = \ldots \)

TECHNICAL DATA REQUIRED
GEARBOX FILL IN SHEET – (Specimen only)

MAIN DIMENSIONS

Screw thread size: ‘T’
Pitch: ‘T’
Screw length: ‘T’
Screw AP ‘T’

Handwheel size: ....
Number of Turns: ....

A = \ldots, M = \ldots
\( bA = \ldots \) \( bM = \ldots \)
C = \ldots, M1 = \ldots
\( bC = \ldots \) \( bM1 = \ldots \)
D = \ldots, M2 = \ldots
\( bD = \ldots \) \( bM2 = \ldots \)
E = \ldots, M3 = \ldots
\( bE = \ldots \) \( bM3 = \ldots \)
F = \ldots, N = \ldots
\( bF = \ldots \) \( bN = \ldots \)
G = \ldots, P = \ldots
\( bG = \ldots \) \( bP = \ldots \)
H = \ldots, Q = \ldots
\( bH = \ldots \) \( bQ = \ldots \)
I = \ldots, S = \ldots
\( bI = \ldots \) \( bS = \ldots \)
J = \ldots, T = \ldots
\( bJ = \ldots \) \( bT = \ldots \)
K = \ldots, U = \ldots
\( bK = \ldots \) \( bU = \ldots \)
L = \ldots, V = \ldots
\( bL = \ldots \) \( bV = \ldots \)
M = \ldots
\( \phi M = \ldots \)
N = \ldots
\( \phi N = \ldots \)

HANDWHEEL STEM FORM

\( X = \ldots \)
\( Y = \ldots \)
\( Z = \ldots \)
\( A = \ldots \)
\( A1 = \ldots \)
\( AA = \ldots \)
\( B1 = \ldots \)
\( KW = \ldots \)
**MAIN DIMENSIONS**

**HANDWHEEL STEM FORM**

**FLOW DIRECTION**

(See drawing on the left)

**SITE SERVICES**

The vast knowledge and experience of our Site Service Team cannot be over stated.

Our team have visited many Oil, Gas and Petrochemical facilities worldwide.

Collectively SFC’s staff have over 250 years of experience of site working all around the world. We have surveyed valves, fitted and commissioned Interlock systems and undertaken design and consultancy work for most major Engineering Contractors and End Users since our inception.

We very much look forward to being of assistance to you at your facility.

**SURVEY**

To ensure that your Interlocks fit and function without any problems, it strongly recommended that SFC’s Site Service team are employed to obtain the detailed valve ‘topwork’ dimensions. The physical taking of these crucial details will ensure that you have a job that is ‘right first time’.

**COMMISSIONING**

Your safety Interlock systems have been designed and manufactured to bespoke specifications, so why would you use a third party to install and commission them?

SFC’s experienced team of Site Technicians will ensure your equipment is installed, commissioned and handed over to the final client fully operational.

**MAINTENANCE**

As any mechanical equipment ages, it becomes inevitable that routine maintenance and adjustment will be required.

SFC’s Interlocks are not ‘maintenance intensive’, but an annual inspection for overall condition is always a good idea and any minor adjustments can be made at the same time.

We have several annual inspection contracts (mostly for Offshore platforms) that use this service to keep their equipment in the best possible condition in a harsh environment.
VALVE INTERLOCKS

The information that we need is relatively straightforward, and is listed below (A-E). Please Note! All despatch/lead times provided are from receipt of all the engineering data listed at the bottom of the page. Therefore, if a particular date must be met, it is in your interest to obtain this information at the earliest opportunity.

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SFC REPRESENTATION AROUND THE WORLD

We supply and support some of the world’s biggest companies involved in the Oil & Gas and Petro-Chemical industries. Since our formation in 1985 we have partnered most of the world’s leading Oil & Gas producers and chemical processors by developing and delivering innovative engineering solutions to manage and protect their multi-billion dollar field asset investments.

Our clients rely on our engineering expertise and product reliability to assure standards of operating safety demanded in modern society. We remain focused on the continuous task of meeting and exceeding those demands.

As part of a process of on-going product development, Smith Flow Control reserves the right to amend and change specifications without prior notice.

Published data may be subject to change.

For the very latest version release, visit our website at www.smithflowcontrol.com