Today’s Presentation

- Who is Kirk Key Interlock Company
- What is trapped key interlocking?
- Why use trapped key interlocks?
- How trapped key interlocks ensure safe sequential operating procedures
- Trapped key interlock applications
- Key Interlocks and LOTO
- Machine Guarding
- Access interlocking
- Valve interlocking
- Switchgear applications
- Interlock schemes in the industrial market place
- Demonstrations using trapped key interlocks
- Questions & Answers

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Superbowl 45
Provide a complete line of key interlock systems to **safeguard** personnel, equipment, and processes in industrial environments.

Build upon its reputation for offering excellent product **quality** and **customer service** with a continual goal of total customer satisfaction.

Educate consultants, manufacturers, and end users on the importance and **value** of our safety key interlocks.

Maintain accurate **records** for customers who need to coordinate with existing KIRK® products in the field, expand an existing KIRK® system, or quickly replace a single key or interlock.

Provide the expertise and equipment for prototyping of **customized** product to develop the right solution.
A **FRONT LINE SAFETY DEVICE** for protecting both personnel and equipment.

A key interlock is a safety device applied to two or more moveable parts, **PREVENTING (OR ALLOWING) MOVEMENT** or operation of one part only when another part is locked in a predetermined position.

An interlock system is a series of interlocks applied to equipment in such a manner as to prevent or allow operation of the equipment only in a **PREDETERMINED SEQUENCE**. The transfer of keys from one interlock to another ensures that the required condition has been achieved and all hazards have been eliminated.

A way of ensuring that a pre-determined sequence of operation is followed, without exception, via the transfer of **UNIQUELY CODED INTERLOCK KEYS**
Why use TKI’s?

- **Fact:**
  - In excess of *70% of reported accidents* world-wide in the industrial marketplace are attributable to human error, accounting for *90% of the financial loss*.

- **Fact:**
  - Written operating procedures and the ‘Permit to Work’ system alone, cannot prevent the inadvertent operation of equipment (switchgear, valves etc.) out of sequence.
Kirk Key Interlocks Prevent an authorized individual from making an unauthorized act

On high-voltage switchgear, the proper use of KIRK® Key Interlocks can prevent Personnel from being injured or killed
Service interruptions
Equipment from being damaged or destroyed
OSHA Std. 1910.147: The Control of Hazardous Energy; Subpart Number's.

1910.217 - Mechanical power presses.
1910.261 - Pulp, paper, and paperboard mills.
1910.262 - Textiles.
1910.265 - Sawmills.
1910.305 - Wiring methods, components, and equipment for general use.
1910.308 - Special systems.
1910.333 - Selection and use of work practices.
1910.66 - Powered platforms for building maintenance.
1926.405 - Wiring methods, components, and equipment for general use.
1926.406 - Specific purpose equipment and installations.
1926.408 - Special systems.

IEEE Std C37.20.2-1993 for Metal-Clad and Station-Type Cubicle Switchgear.
ANSI/IEEE Std C37.20.3-1987 for Metal-Enclosed Interrupter Switchgear.
IEEE Std C37.20.6-1997 for 4.76kV to 38kV Rated Grounding and Testing Devices Used In Enclosures.


ANSI Std C37.121-1989 Requirements for Unit Substations.

ANSI/IEEE Std C37.20.3-1987 for Metal-Enclosed Interrupter Switchgear.


**NEC Article 710-24 Metal-Enclosed Power Switchgear and Industrial Control Assemblies**

- NEC Article 440-33 Air-Conditioning and Refrigeration Equipment.
- NEC Article 440-34 Air-Conditioning and Refrigeration Equipment.
- NEC Article 460-24 Switching.
- NEC Article 490-21 Circuit Interrupting Devices, High-Voltage Fuses.
- NEC Article 490-22 Equipment Over 600 Volts, Isolating Means.
- NEC Article 490-42 Interlocks - Interrupter Switches.
- NEC Article 490-45 Interlocks - Circuit Breakers.
- NEC Article 665-22 Guarding, Grounding, and Labeling.
- NEC Article 710-22 Isolating Means.
- NEC Article 710-24 Metal-Enclosed Power Switchgear and Industrial Control Assemblies.
- NEC Article 810-71 Interior Installation - Transmitting Stations.
Levels of Protection

- **Low Cost**: Written Procedures, Padlocks & Tags (LOTO), Training
- **Medium Cost**: Trapped Key Interlocks
- **High Cost**: Distributed Control Systems (DCS), IT Based Process Control Systems
The OSHA standard for The Control of Hazardous Energy (Lockout/Tagout), Title 29 Code of Federal Regulations (CFR) Part 1910.147, addresses the practices and procedures necessary to disable machinery or equipment, … controlling hazardous energies—electrical, mechanical, hydraulic, pneumatic, chemical, thermal, and other energy sources.

29 CFR 1910.333

➢ sets forth requirements to protect employees working on electric circuits and equipment. This section requires workers to use safe work practices, including lockout and tagging procedures….exposed to electrical hazards while working on, near, or with conductors or systems that use electric energy.
In the United States and much of North America, the requirements for the safeguarding of industrial processes, OSHA 29 CFR 1910.

Process safeguarding is substantially different than machine safeguarding in its approach and implementation. While, machine safeguarding is concerned with the safety of human access to machinery in operation, process safeguarding is concerned with the safety of machinery and industrial processes during periods of service and maintenance.

ANSI/ASSE Z244.1-2003, the revised Lockout/Tagout (LO/TO) standard, defines a comprehensive safety program... Trapped-key interlock Safety switches using a trapped or captive key system ensure that a predetermined sequence of events takes place. For example, ... turning electrical power switch ... opening mechanical ... closing pneumatic valve ... unlock the machine access door.

... dual relief valve piping...

EHS Today
Levels of Protection

- DCS (Distributed Control System) is a computerized control system used to control the production line in the industry.
- DCS was introduced in 1975 by Honeywell (TDC2000) and Yokogawa (CENTUM).
- Other vendors: ABB (Bailey etc.), Foxboro, Emerson (Fischer, Rosemount etc.).

High Cost

Distributed Control Systems (DCS)
IT Based Process Control Systems

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TKI Advantages

- Safer than “lock-out” … fix mounted
- Trapped Key allows for integration of a proper shut-down or isolation procedure
- Sequential Key exchange forces a safe condition before access is permitted to any potentially hazardous area
- Avoids incorrect shut-down
- Eliminates operator error
- Reduces downtime
Risks Expand Beyond Electrical

- Pressure
- Chemical
- Kinetic Energy
- Flammable
- Unauthorized Personnel
- Financial
Key A is in limbo and both A and B switches are open. In this scheme only one switch can be closed. When key A is inserted into the interlock on switch A and the key is rotated, switch A can now be closed trapping the key. Switch B is still locked open.

Next slide shows picture.
In the example above, the lock bolt can only move past the operating handle when the breaker is in the off position thereby only releasing its key when the breaker is in the off state.
A FRONT LINE SAFETY DEVICE for protecting both personnel and equipment.

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An interlock system is a series of interlocks applied to equipment in such a manner as to prevent or allow operation of the equipment only in a PREDETERMINED SEQUENCE. The transfer of keys from one interlock to another ensures that the required condition has been achieved and all hazards have been eliminated.

A way of ensuring that a pre-determined sequence of operation is followed, without exception, via the transfer of UNIQUELY CODED INTERLOCK KEYS.
SD switchgear, clean environments indoors or out
MD all of above, and in dirty environments
HD all above corrosive high temp environments

The first set of slides will focus more on the SD Series then we’ll get into the other Series
Interlock Transfer Panel

* For key exchanges of 15 or more keys we recommend transfer panels.

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The Power Panel Switch (PPS) is a key actuated, rotary, two-position switch designed for isolation or switching of control circuitry. It is available with switch ratings of 20, 25, 40, 63 or 100A. (SD Only goes to 63amp).

Perfectly suited for applications requiring temporary off-load isolation. The switch is UL & CSA approved.

The PPS is designed so that the key will rotate 90 degrees clockwise to the trapped position. Rotation of the key to either the trapped or to the released position will cause the switch contacts to change state.

The standard PPS can be panel mounted with 1/4” diameter (7mm) mounting bolts. An optional IP65 Polycarbonate enclosure allows surface mounting of the PPS using four bolts suitable for your specific application.

Switch ratings and specifications are outlined on HD Series Data Sheet 2.8a.

Mounting Options—Panel Mounting (standard) or Enclosed in an IP65 Polycarbonate enclosure. The enclosed version is supplied with an (M20) .20-.35” cable gland and lock nut.

Stamp Key Interchange—Specify an alphanumeric code to be stamped on the key and optional cylinder cover (if specified). Can be up to five characters—e.g. A1, A2, K1, (etc.). See HD Series Data Sheet for Keys (3.4) and Terminology (4.1) for details.
The contact blocks are U/L listed. The PPS has 2 N.O. and 2 N.C. contacts. Additional contacts are available, see data sheets 2.8 & 2.8a (switch ratings).

The switch rating is:
The Type DM access door interlock is designed for hinged doors, manhole covers, sliding doors or any sort of hatch or lid. It is well suited for loose fitting doors or hatches that will not accommodate a precise fitting door lock.

The Type DM consists of a main body and a latch bolt with 12 links of 316 stainless steel chain. The lock body can be mounted to the equipment and the chain can be bolted or welded to the door or hatch with the proper amount of “slack” for the latch bolt to reach the DM lock body.

Under normal conditions, the key is upstream in the interlock scheme and the chain/bolt is trapped in the lock securing the door in the closed position. The latch bolt cannot be released until the key is inserted and turned. Only then can the latch bolt be rotated ¼ turn and released from the lock, thereby trapping the key. The door or hatch must be closed and the latch bolt must be returned to the lock body in order to free the key.

The interlock housing is made from brass. The latch bolt is made from 316 stainless steel and has a gasket to protect against the introduction of dust and dirt into the lock body.
The Type SKRU consists of an interlock, a solenoid, and an auxiliary switch. The solenoid is designed to permit removal of the interlock key in response to an external electric signal. The auxiliary switch is a quick-make, quick-break device, which operates when the interlock key is rotated. Normally, the key is trapped in the SKRU and the solenoid is de-energized. To release the key, a signal must be sent to the solenoid from an external source.

The SKRU is typically used in combination with other KIRK® key interlocks. The SKRU can be manufactured with various mechanical and electrical options. The push button and/or the signal lamp are the most popular options. All components are UL recognized. The solenoid, optional signal lamp and optional push button are wired out to a terminal block along with some of the aux contacts. Please reference the wiring diagrams on our website for specific details.

The main body of the SKRU is constructed of brass. The optional cover plate and optional housing are aluminum.
Key A is in limbo and both A and B switches are open. In this scheme only one switch can be closed. When key A is inserted into the interlock on switch A and the key is rotated, switch A can now be closed the trapping the key. Switch B is still locked open.

Next slide shows picture.
KIRK® Interlock Schemes

- Switch and Breaker
- Substations
- Grounding Switch with Main Switch
- Isolating Switches and Breaker
- Isolating Switches and Breaker or Regulation with By-Pass Switch
- Prevent Paralleling of Lines
- Interrupter Switch
- Motor & Machinery Guard
- Motor & Machinery Guard with Time Delay

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KIRK® Interlock Schemes (con’t)

- Breakers and Generators
- Capacitor Bank Access
- Uninterrupted Power Sources
- Precipitator Access
- Rectifier Access
- Tanker Loading/Unloading
- Pressure Relief Safety Valve
- Dual Line Valves
- Motor Pump Start Up

**NOTE: Visit our website to view our entire scheme book**

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Key interlocks is all we do. Let us assist you in developing an application interlock scheme.
An interlock is required for all back doors or rear sheets on medium voltage metal clad switchgear coordinated with interlocks mounted on the corresponding circuit breaker(s) such that the back door or sheet cannot be opened or removed unless the breaker is key locked in the open position.
The Type F interlock is generally flat or face mounted with bolts through the front of the housing. The body of the lock is brass and the locking bolt is made of 5/8” diameter stainless steel. The throw, or travel, of the locking bolt is 3/4”.
Type DM Applications
SD switchgear, clean environments indoors or out
MD all of above, and in dirty environments
HD all above corrosive high temp environments

The first set of slides will focus more on the SD Series then we’ll get into the other Series
Eagle Series Valve
Trapped Key Interlock

- Eagle Lock Type EMT to suit multi-turn, hand wheel operated valves or gearboxes. Available in single or dual key versions (SKI/DKI).

- Eagle Lock type EQT to suit quarter turn, lever operated valves. Available in single key or dual key versions (SKI or DKI).

- Eagle Valve Lock Series can be included with existing Mechanical and Electromechanical Kirk trapped key interlocks.

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Control Room Key Cabinets

- Eagle ‘Eye’ - Control Room Key Cabinets with lockable glazed door complete the interlock package

- Giving visual indication of status of keys and interlock systems
Typical Valve Interlock Applications

- Typically fitted to valves (manual or actuated), vessel closures, switches, plant access points, instrument manifolds, and any other form of equipment involving manual operation.

  - Single Valve Locking
  - Interlocking a Pair of valves
  - PSV (Pressure Relief Valve) Interlocking
  - Motor Pump Control
  - CO₂ Fire Control Deluge System Interlocking
  - Road/Rail/Sea Tanker Loading/Unloading System Interlocking

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Dual line valve interlocks are one of the most common forms of valve interlocking where only one valve can be opened at any one time – eliminating the risk of mixing two products together.
PSV Interlocking
(Pressure Safety Relief Valve)

- To ensure that at least one Relief Valve (PSV) is always open to flare or header.

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To that pump is shutdown before valves are closed for maintenance and vice versa.
CO₂ Fire Control Deluge System

- Ensuring that potentially fatal Carbon Dioxide (CO₂) fire extinguishing medium is isolated prior to entering an enclosure.

- Typical enclosures are: turbine/generator housings, plenum chambers, computer rooms, and any other enclosed areas protected by a fire extinguishing system requiring occasional access.

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Loading/Unloading Systems
(Road / Rail / Sea Tanker)

- Controlling the safe loading and/or unloading of bulk carriers.
Non Linear Key Systems

- Use of Transfer Panel, Key Transfer Block or Key Selector Sequence Box allows non linear key movements
- Controls issuing of keys to meet required logic

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Typical Valve Installations

Eagle Multi-turn
Lock on Floor
S tand Operated
Valve & Lever Lock
on Plastic Ball Valve
T reatment Water
T reatment Plant

'S' Pipe Layout and
Eagle Air Valve
Buyer Chemical
LOTO – TKI Combination

Finally for those who still need to incorporate LOTO in a safety system we offer the enhanced lock versions with padlock / hasp facility.

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Kirk Key Interlock Company

WORK Safe FOR Life™

THANK YOU

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Or contact your local representative

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