



Trapped Key Interlocks for Aggregates and Mining



Applications Guide

www.castell.com



The Future of Safety is Here



Castell Offices



Castell Installations

**We Keep You Safe at Work
Worldwide**

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Why Choose Castell?



Founder:
James Harry Castell
1880 - 1953

Castells Expertise in Industrial Safety

For over 90 years Castell has recognised the importance of robust products in harsh environments. That makes Castell trapped key interlocks be the perfect choice for protecting personnel in areas such as mines, quarries, cement works and brick making facilities. Our experience of solutions to these industries ensure we provide safety solutions that last for decades.

Castell Offers:

- Expertise in providing the best possible trapped key solution whatever the industry
- 90 years of experience protecting people and assets in industry
- High quality innovative products
- ISO 9001: 2008 accreditation
- Global team dedicated to providing technical support and assistance in selecting the correct solution
- The widest range of rugged and reliable trapped key interlock products globally
- The ability to produce customised solutions to meet the demands of your specific application

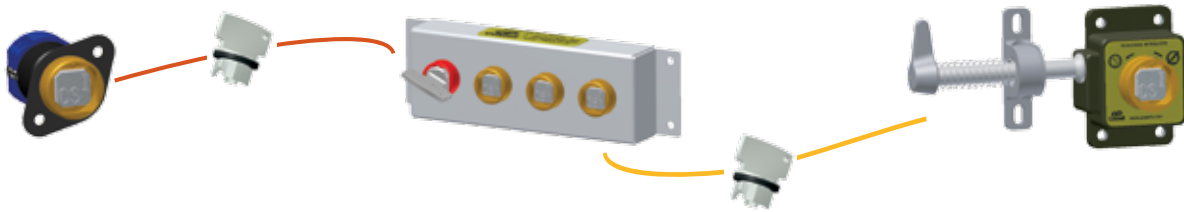
Through development and experience Castell have a number of methods to isolate machinery. This can be done mechanically, through control circuitry, through power circuitry or valve control. In complex operations a number of isolations may need to occur to ensure the plant is safe to work on. The isolation key(s) are then used to either gain direct access, are transferred to a time delay unit or for multiple entry points access through an exchange box.

The three points of trapped key interlocking

1 Isolation

2 Key Exchange

3 Access Control



Access and Personal Protection

Access to the hazardous area needs to be assessed as either part body, arm only, or full body access. Once this is determined an access lock(s) can be selected.

Part Body Access

A part body access lock has only one lock and the isolation key is used to open this. Whilst the access lock is open the key can not be removed and therefore the process can not be started. Only once the lock is closed can the isolation key be removed and the process restarted.

Full Body Access

Full body access locks have two locking mechanisms; the first step in the process is to insert the isolation key. This will allow the personnel key to be removed and then access can be granted by opening the bolt. The isolation key can only be removed once the personnel key has been inserted. Therefore whilst the personnel key is removed and the lock is open the process can not be started. Only once the lock is closed and the personnel key returned can the isolation key be removed and the process restarted.

Coding a System

Please refer to our Interlock and padlock integrity policy.

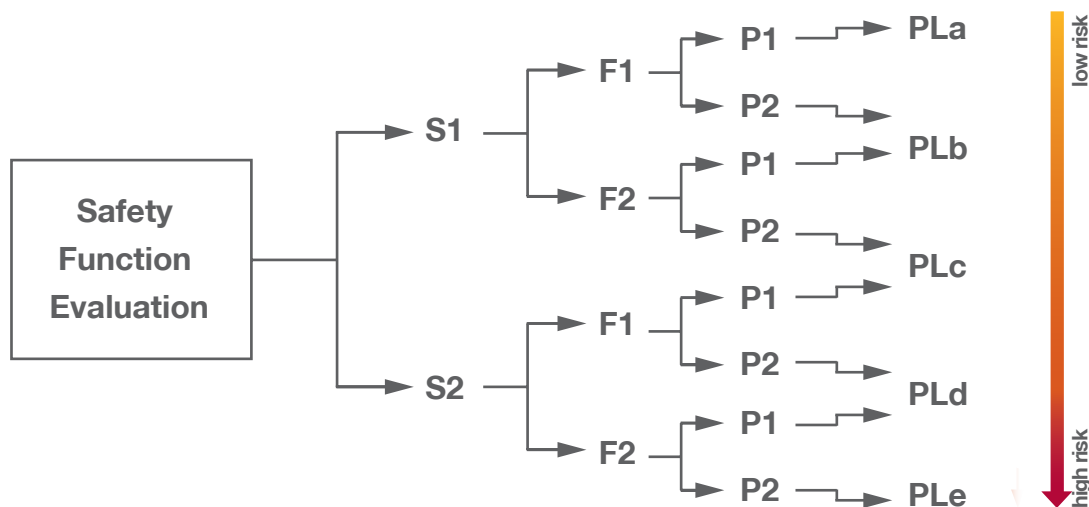
ISO EN 13849-1

The integrity of a safety system is paramount to the safe function of machinery and process. The elimination of risk and the safe operation of a process is ensured by using the appropriate level of functional safety. **ISO EN 13849-1 EN** is the latest standard used to identify risk and determine the minimum performance standards of a safety system. The performance levels (PL) range from a to e dependant on the severity, frequency and possibility of avoidance of an injury whilst operating a process. These performance levels have superseded the CAT ratings as described in EN 954-1.

Each Performance Level is defined not only by the level of safety but also by the probability of failure by the safety system. Therefore the safety system has to be assessed not only for protection but also for reliability. The performance safety system as a whole is determined by the performance and interaction of each component For each component the following data must be used in the calculation of the performance:-

- 1) The MTTFd mean time to dangerous failure,
- 2) The DC Diagnostic Coverage
- 3) The CCF Common Cause Failure management.

The actual performance level can then be compared to the required performance level. If the actual PL is higher then the system is deemed to provide suitable level of protection. The required PL can be achieved using the chart set out in the standards, this is shown below:



Severity of injury (S)	Frequency/Exposure (F)	Possibility of avoidance (P)
S1 - Slight injury	F1 - Seldom to less often or short exposure	P1 - Possible under specific conditions
S2 - Serious injury, death (irreversible)	F2 - Frequent to continuous or long exposure	P2 - Scarcely possible

Castell provided the required information on each of its products on the website under Quality section.

Aggregates and Mining - Applications

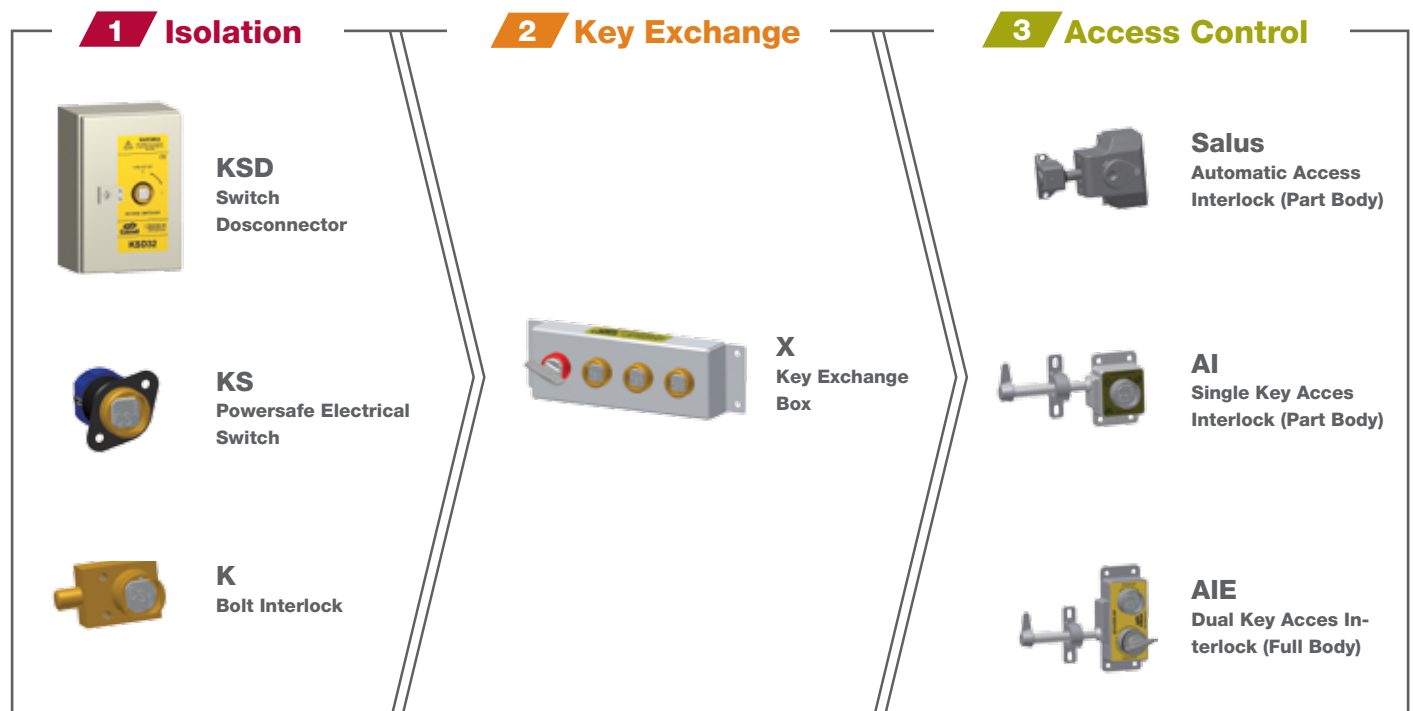
Application Tunnel Boring Machinery

Safety Issue Danger from rotating tunnelling head and head cutter platform collapse

Solution Interlock the power supply isolator with access guards, via key exchange (for multiple access points). There is a common key for the isolator and control lock in the key exchange box. The key remains locked in isolator whilst machine is running. Access keys are only released when the power is isolated and the isolation key is placed in the control lock in the exchange box.



Products To Provide Solution



FLIP CAP - a protective cap is recommended to be used to protect locks from dust and dirt ingress.

Please see our full product catalogue for more details on www.castell.com

Aggregates and Mining - Applications

Application Coal Conveyors

Safety Issue Danger from moving parts on chain drive at the directional change point

Solution Interlock power supply isolator with the access guard at the directional change point. The isolation key is common to both is either locked in isolator whilst machine is running or in access guard when machine stopped.



Products To Provide Solution

1 Isolation



KSD
Switch
Dosconnector



KS
Powersafe Electrical
Switch



K
Bolt Interlock

2 Access Control



Salus
Automatic Access
Interlock (Part Body)



AI
Single Key Acces
Interlock (Part Body)



AIE
Dual Key Acces In-
terlock (Full Body)



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Aggregates and Mining - Applications

Application Dragline Crane

Safety Issue Danger from live slip rings

Solution Interlock power supply isolator with manhole. Key common to both is either locked in isolator whilst machine is running or in manhole when machine stopped.



Products To Provide Solution

1 Isolation



KSD
Switch
Dosconnector



KS
Powersafe Electrical
Switch



K
Bolt Interlock

2 Access Control



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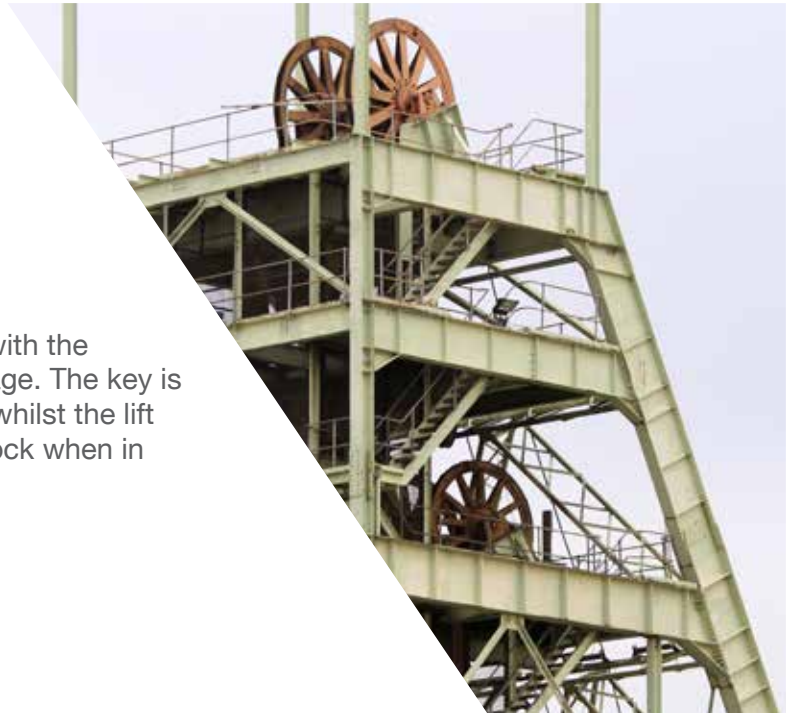
Please see our full product catalogue for more details on www.castell.com

Aggregates and Mining - Applications

Application Lifting

Safety Issue Danger from hand winding

Solution Interlock the power supply with the access lock on the safety cage. The key is either locked in the isolator whilst the lift is running or in the access lock when in manual mode.



Products To Provide Solution

1 Isolation



KSD
Switch
Dosconnector



KS
Powersafe Electrical
Switch



K
Bolt Interlock

2 Access Control



Salus
Automatic Access
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Aggregates and Mining - Applications

Application Twin Boom Cutter

Safety Issue Access danger to the rotating heads

Solution Interlock the power supply isolator with the access for changing the cutting heads. The key common to both is either locked in the isolator whilst machine is running or in access lock when machine stopped.



Products To Provide Solution

1 Isolation



KSD
Switch
Dosconnector



KS
Powersafe Electrical
Switch



K
Bolt Interlock

2 Access Control



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Automatic Access
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Aggregates and Mining - Applications

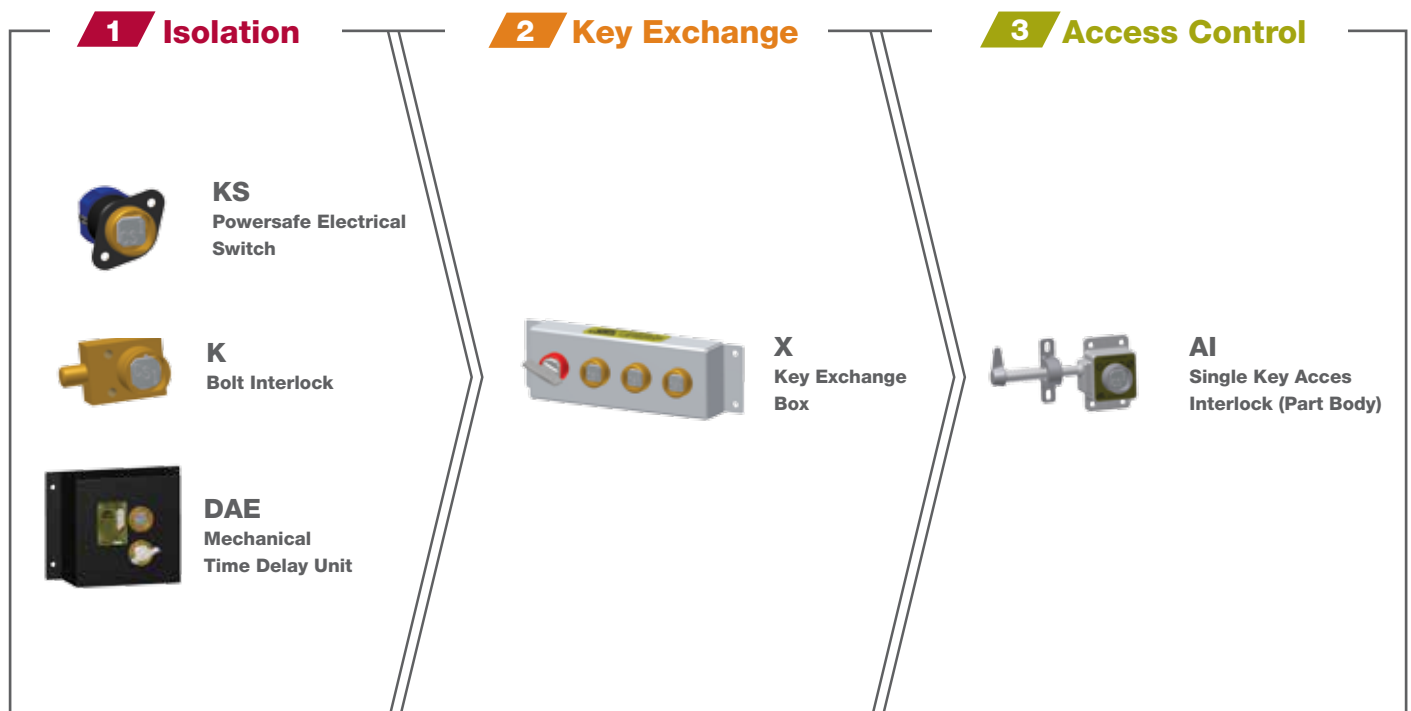
Application Cement Mixer
(Power Isolation)

Safety Issue Danger from an operational mixer

Solution Isolate the mixer by removing the key from the KS switch or K Bolt. Insert into the DAE time delay unit if there is a run-down time. If there isn't a run-down time, or regardless, insert the released key into the exchange box for multiple key release. Insert the released key(s) from the exchange box into the AI or Salus access locks to gain access.



Products To Provide Solution



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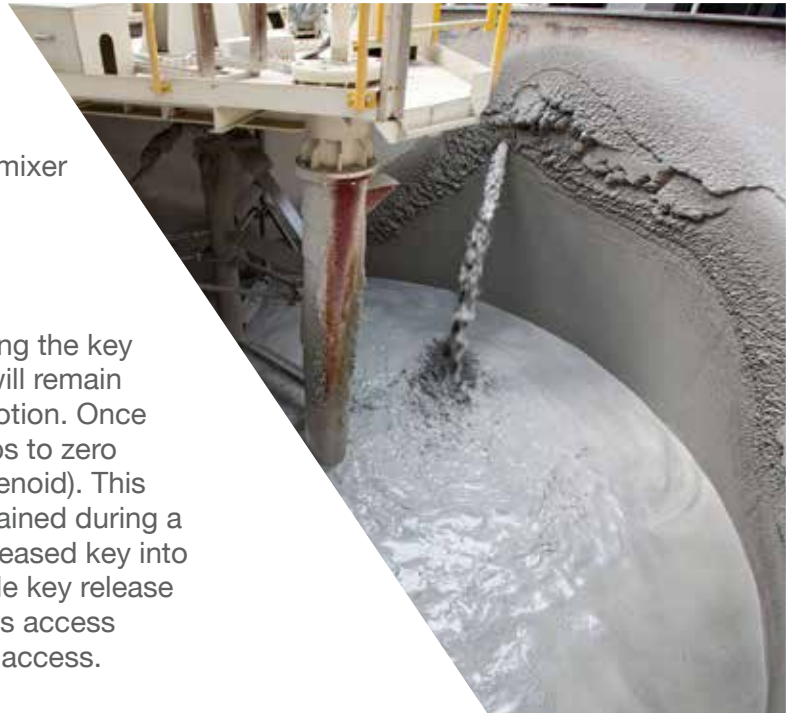
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Aggregates and Mining - Applications

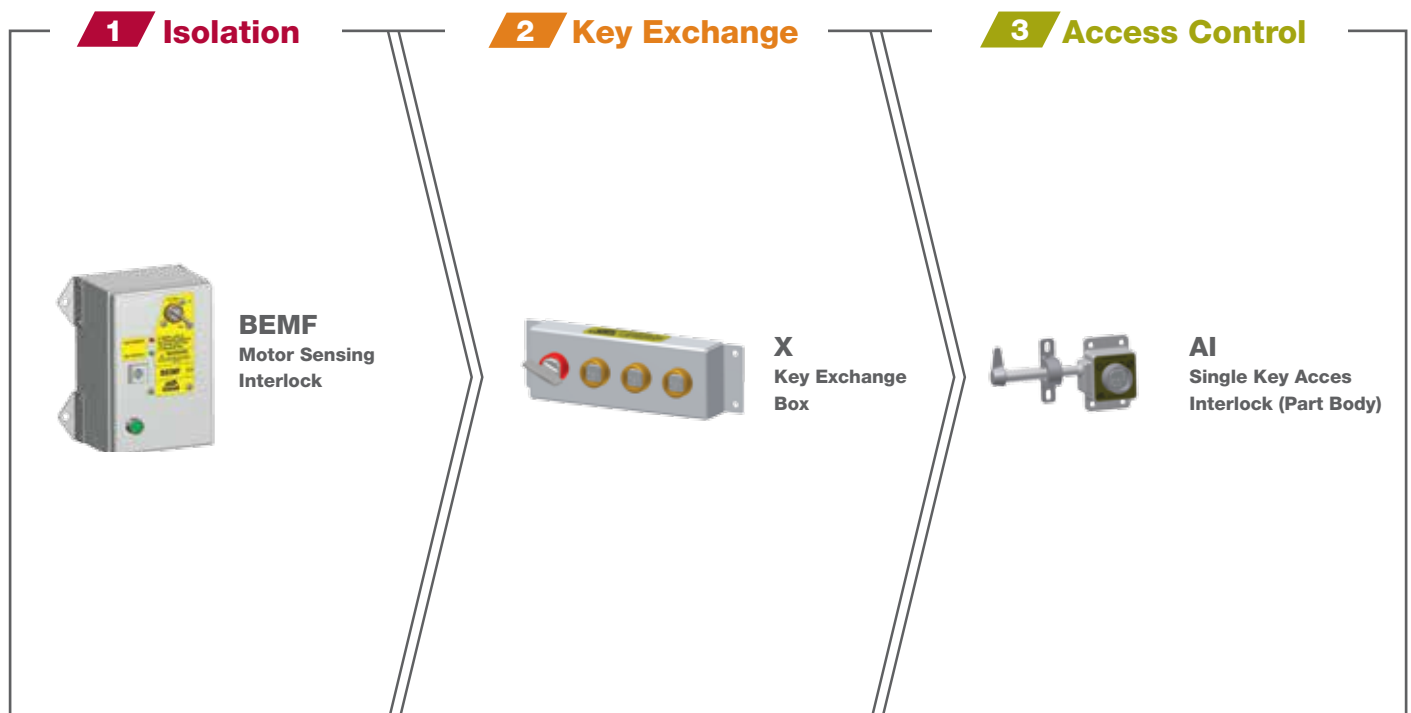
Application Cement Mixer (BEMF)

Safety Issue Danger from an operational mixer

Solution Switch off the mixer by turning the key on the BEMF unit. The key will remain trapped whilst motor is in motion. Once the BEMF on the motor drops to zero the key is released (via a solenoid). This ensures no access can be gained during a run-down time. Insert the released key into the exchange box for multiple key release or directly into the AI or Salus access control units for single point access.



Products To Provide Solution



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Aggregates and Mining - Applications

Application Cement Mixer
(Time Delay)

Safety Issue Danger from an operational mixer

Solution Isolate the mixer by turning the switch to the off position on the TDI time delay isolator, which changes the contacts to the switch and initiates the timer. The time set would be greater than the duration the mixer takes to stop. When the time has elapsed the solenoid is energised, which releases the keys preventing the mixer from restarting. Insert the released key(s) into the AI or Salus access interlocks to gain access.



Products To Provide Solution

1 Isolation



TDI
Electronic Time Delay
Isolator

2 Access Control



AI
Single Key Acces
Interlock (Part Body)



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Aggregates and Mining - Applications

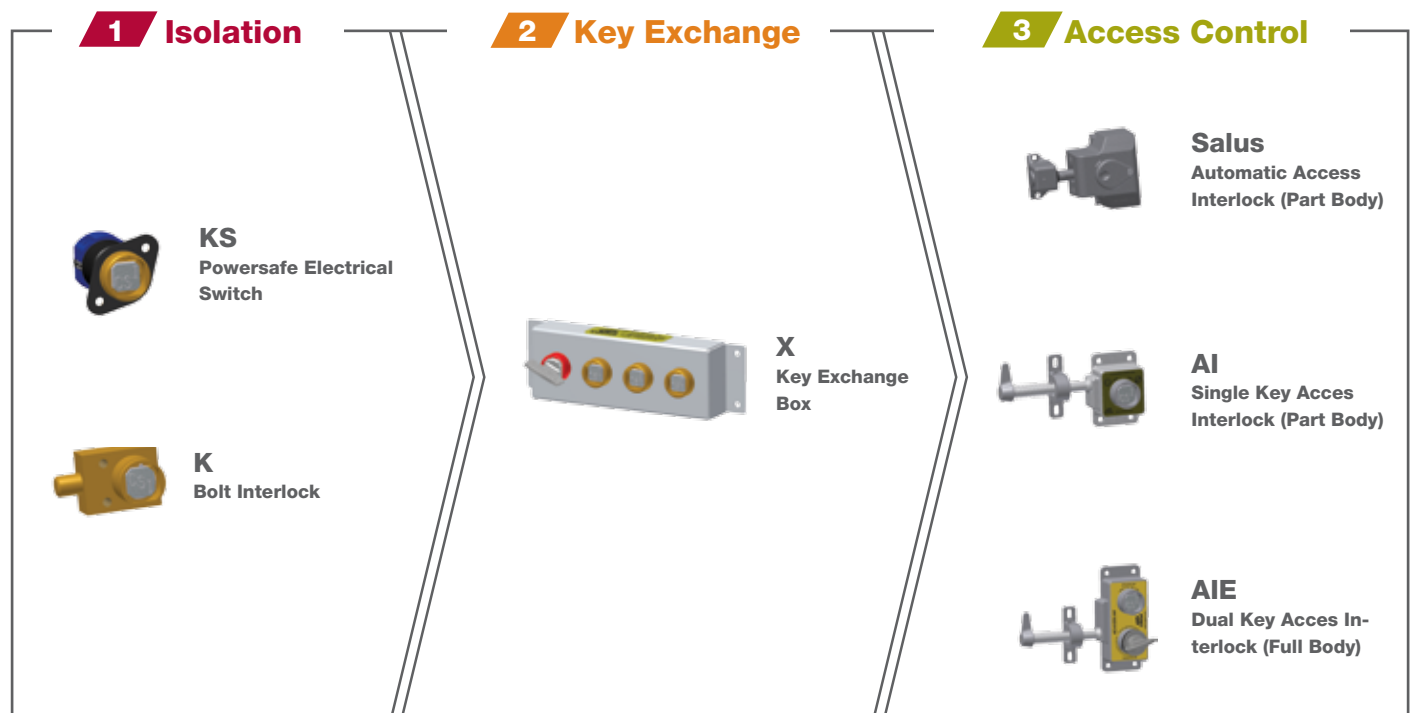
Application Extruders

Safety Issue Danger from large gearwheels

Solution Interlock the power isolator with the access gate. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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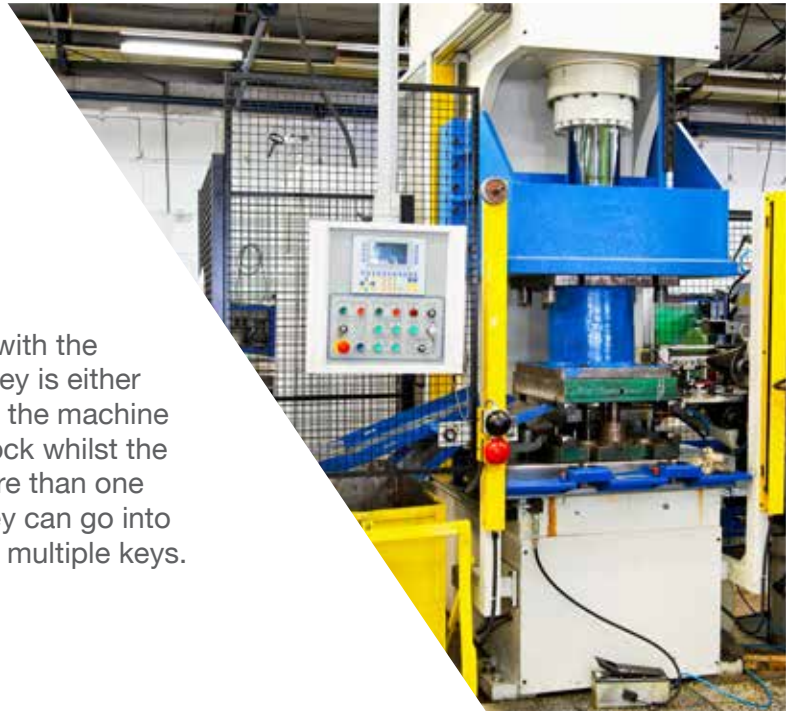
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Aggregates and Mining - Applications

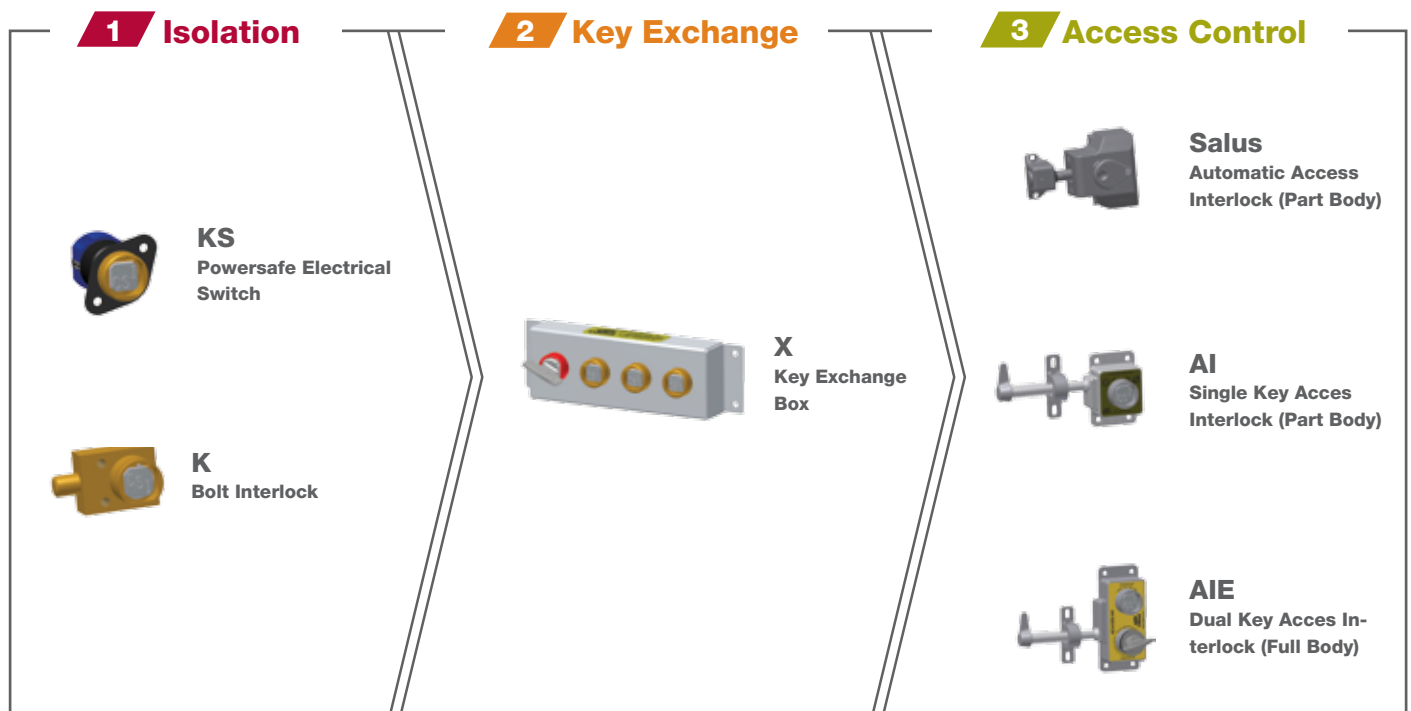
Application Hydraulic Paving Press

Safety Issue Danger from rollers

Solution Interlock the power isolator with the access gate. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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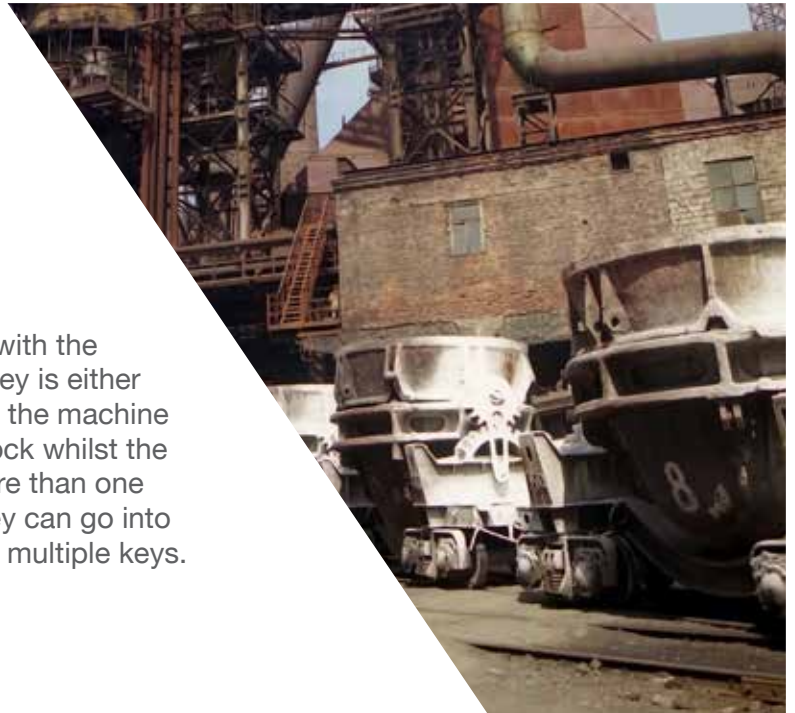
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Aggregates and Mining - Applications

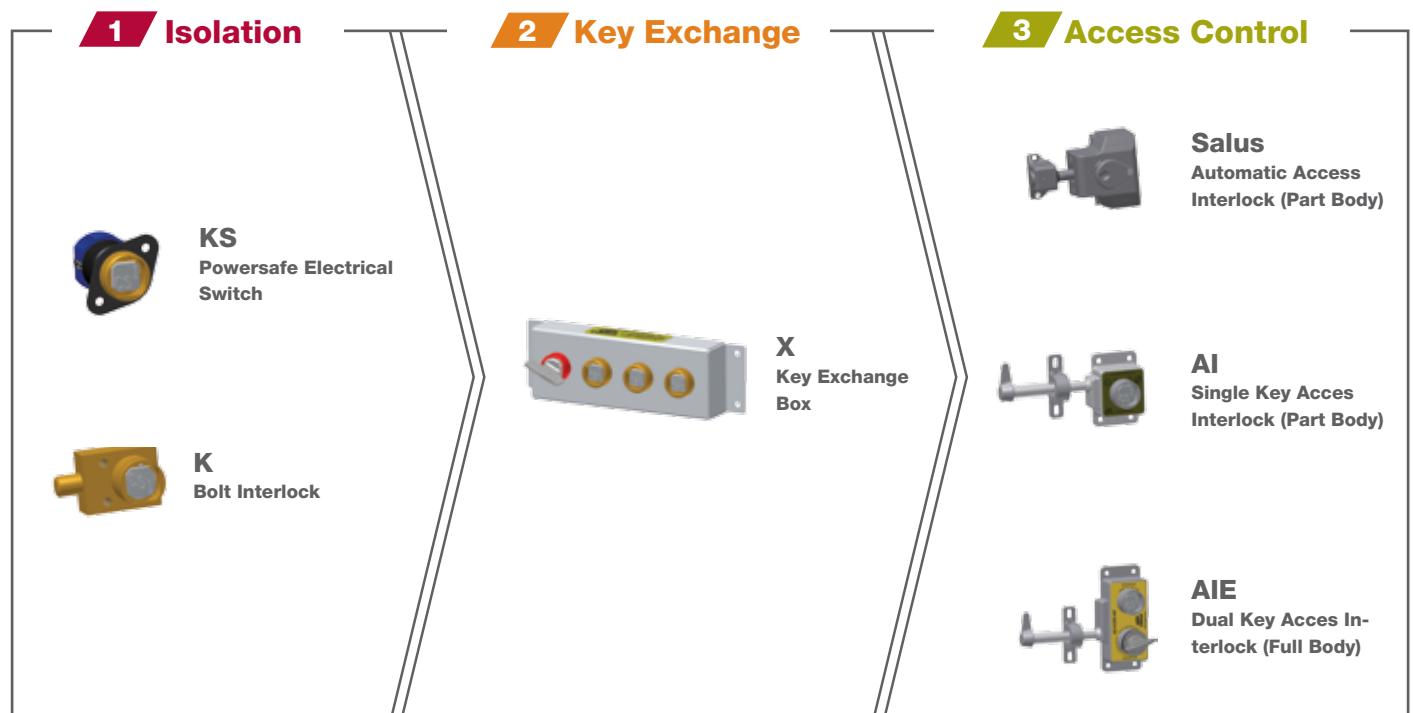
Application Rolling Mill

Safety Issue Danger from rollers

Solution Interlock the power isolator with the access gate. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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Aggregates and Mining - Applications

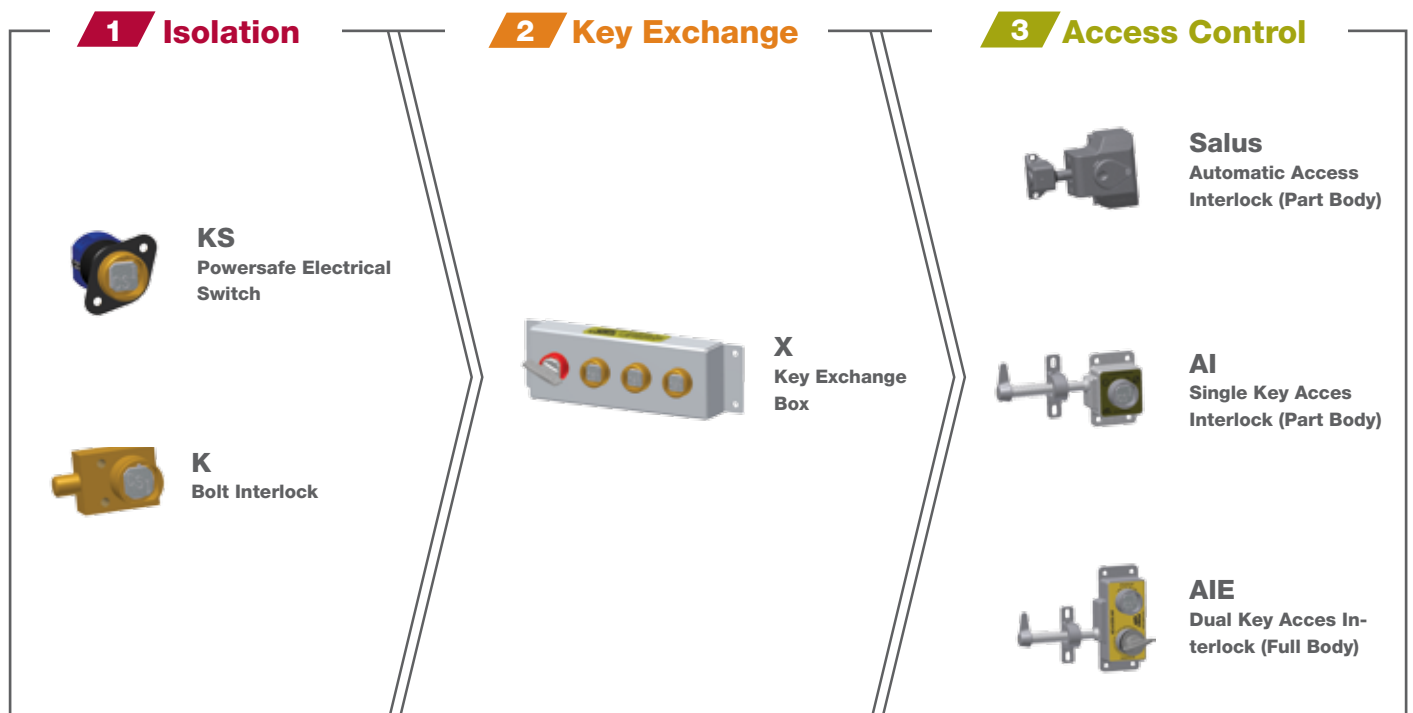
Application Steam Autoclave

Safety Issue Danger from steam and risk of explosion through build-up of pressure

Solution Interlock the power isolator with the perimeter guard. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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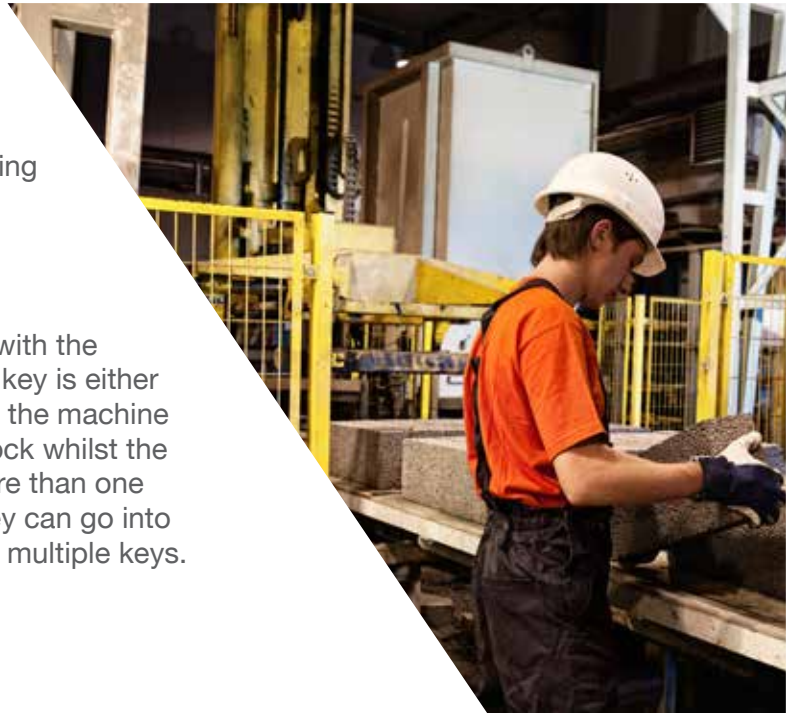
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Aggregates and Mining - Applications

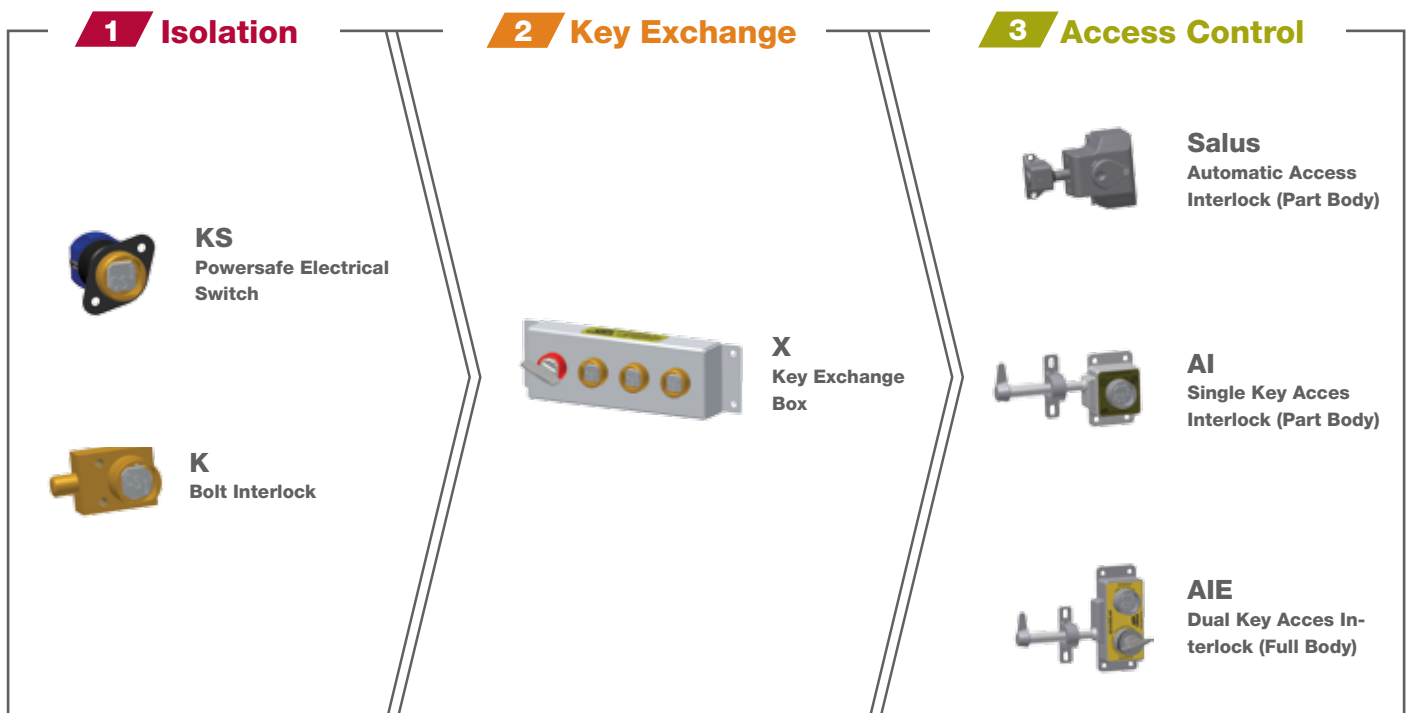
Application Brick Making Machine

Safety Issue Danger from die table in mixing process

Solution Interlock the power isolator with the access guard. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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Aggregates and Mining - Applications

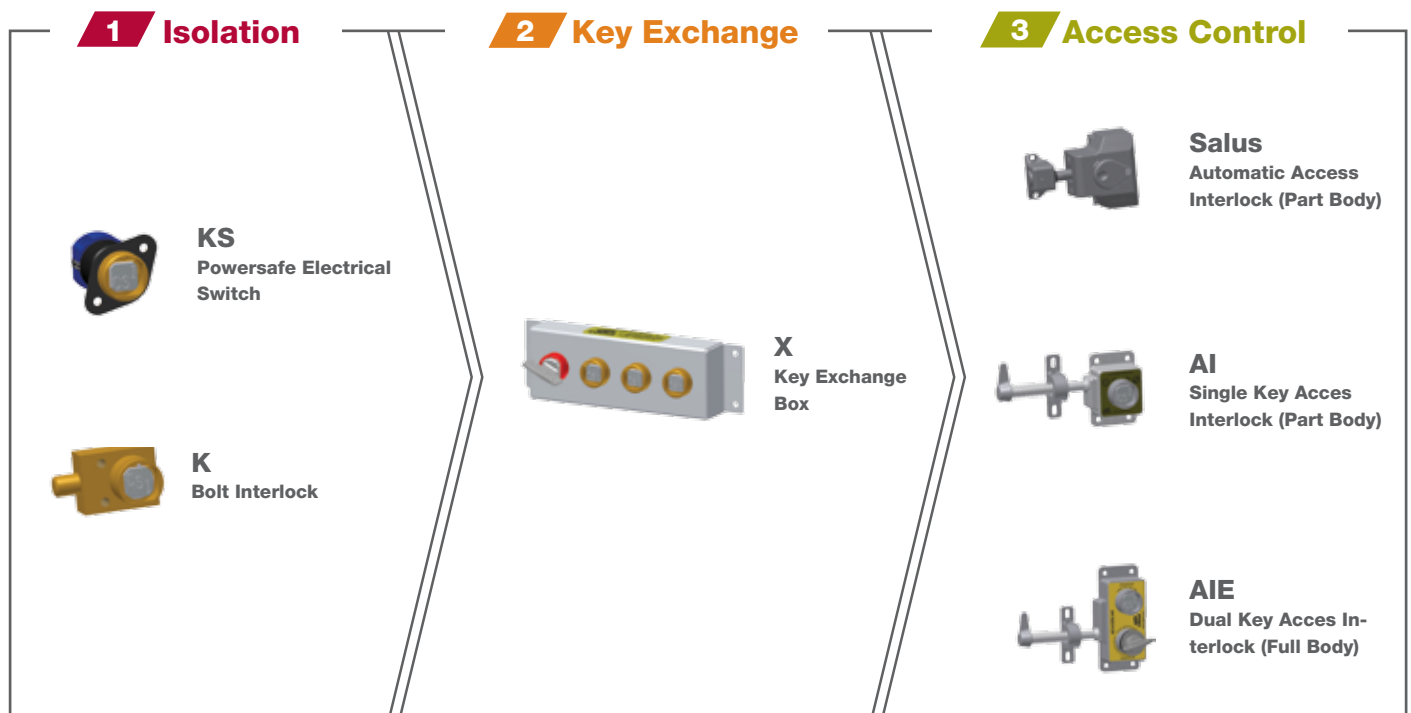
Application Block Cutting Machines

Safety Issue Danger from cutting blades and driving gears

Solution Interlock the power isolator with the access guard. The common key is either trapped in the isolator whilst the machine is running or in the access lock whilst the machine is stopped. For more than one access point the isolation key can go into the exchange box to release multiple keys.



Products To Provide Solution



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