



Safe access to machines  
and systems



Key transfer system:  
Functionality and areas of application

In a world of increasing digitalisation and more reliance on the Internet of Things, a mechanical solution for machine safety and systems seems to have fallen out of favour. Arthur Aartsen, Business Development Manager at E. Dold & Söhne, gave a presentation at the SPS show on how key transfer systems, which primarily safeguard machines and systems mechanically negate the risk. The GIT SICHERHEIT editorial team took this as an opportunity to speak to Arthur Aartsen.

**GIT SICHERHEIT: Mr Aartsen, you gave a presentation on key transfer systems at the SPS show. Where are these systems used?**

**Arthur Aartsen:** Key transfer systems are mainly used in rough and very rough environments to protect guards on machines and systems. The reason for this is relatively simple: key transfer systems work mechanically. The use of electrical components are largely unnecessary, electrical components in particular often cannot withstand rough environmental conditions whereas a mechanical operating system has a clear advantage.

**GIT SICHERHEIT: In your presentation, you mentioned that we are possibly dealing with the oldest form of industrial safety technology. Can you explain this further?**

**Arthur Aartsen:** Key transfer systems date back to the time of the first electrification of industry. We are talking about the period around 1900 to 1920 - possibly even earlier. As far as I know, the oldest publicly accessible document relating to key transfer systems is dated 1921. This is a patent document describing a lock and key mechanism for use in safety-related systems. Safety systems based on the key transfer method were cutting edge at that time.

**GIT SICHERHEIT: Why is this technology still in use so frequently even after a century and still has its right to exist in the age of digitalisation?**

**Arthur Aartsen:** As I mentioned at the beginning, key transfer systems work without, or almost without, wiring. Faults in the wiring are often the cause of machine and system failures, especially in rough environments. Key transfer systems eliminate this problem because they work mechanically. In addition, these systems can enforce operating procedures. These are tasks that today can usually only be completed by means of a control system. But that would mean that wiring is needed again.

**GIT SICHERHEIT: You say 'enforce operating procedures'. How does that work?**

**Arthur Aartsen:** Key transfer systems work by the exchanging of keys. Requirements must be met in order to be able to remove or insert one or more keys. Let's assume that we have a machine with an access hatch for inspection purposes. It must only be possible to open this access hatch when the machine is at a standstill. When the machine is switched off, it comes to an immediate stop. The access is locked by means of a mechanical lock that can be opened by inserting a key. When the machine is running, this key is inserted in a key-operated switch. When the key is removed, the machine stops and the operator can insert the key into the mechanical lock. If the access for inspection is then opened, the key can no longer be removed. This ensures that the access can only be open when the machine is switched off. If the operator wants to restart the machine, the access hatch must be closed and the operator can remove the key from the mechanical lock. When the key is reinserted into the key-operated switch, the machine can start up again.

## GIT SICHERHEIT: What exactly is a key changer?

**Arthur Aartsen:** A key changer is a key transfer system component that multiplies keys or collects several keys and then releases others. These originate from the early days of key transfer systems. At that time, machines were not switched off via a control level as they are today, but directly via a main switch. This was locked with a bolt lock. Since this combination of main switch and bolt lock could only release one key, the problem of safeguarding several entrances arose. A key changer solves this problem by releasing several keys when one key is inserted. It thus multiplies the individual key from the switch, which in turn can then safeguard several entrances. In a further development of the key changer, several keys can be collected before one or more keys are released. A typical example of this is when a machine must not only stop, but a valve must also be closed before access to a machine is possible.

## GIT SICHERHEIT: Are we still talking about machines, since you just mentioned 'bolt lock' and 'valves'?

**Arthur Aartsen:** Yes, of course. In addition to switching off the machine, it may also be necessary to disable other energy sources before entering a machine. Bolt locks can be used for this. A bolt lock is also a key transfer system component that extends a bolt when the key is removed. This bolt can be used to lock valves or main switches, for example. The functionality is explained in detail in ISO/TS 19837 and will soon be explained in the latest edition of EN ISO 14119.

## GIT SICHERHEIT: Dold has been producing key transfer systems for several years. Do you also have bolt locks in your programme?

**Arthur Aartsen:** No, because the combination of a bolt lock and valve, or a bolt lock with a main switch – or rather, I should say 'load break switch' – is single-channel in structure. According to EN ISO 13849-1, a maximum performance level of C is achieved with this type of architecture. PL d would only be achievable by means of fault exclusions.

## GIT SICHERHEIT: If you don't have any bolt locks available, how do you switch the machines then?

**Arthur Aartsen:** Switching a machine using a load break switch is called 'Power Interlocking'. In the German version of EN ISO 14119, this is referred to as 'Switching in the power section'. This means that the machine is switched on and off without a separate control level. However, for modern, highly automated machines, this method is problematic from a control point of view. We prefer to switch via the control level and can thus evaluate further functions, such as speed and standstill monitoring, level measurement and other safety-relevant signals, and integrate them into the key transfer system. Although we can also offer Power Interlocking, we prefer to equip our key transfer systems with safe key monitoring so that a 2-channel architecture is possible and fault exclusions are unnecessary.



Example of a key changer: The sign on the door also indicates that access to the secured area is only permitted with one key per person

**GIT SICHERHEIT:** You have already mentioned a few standards several times. You also work on several standardisation committees. Can you tell us more about your work in standardisation?

**Arthur Aartsen:** Yes, I have been a member of the standardisation committee NA 060-40-30 AA Balers and NA 095-01-04 GA for Safety interlocks since 2011 and for ten years in ISO/TC 199 WG7 and, in 2013, after the publication of the then EN ISO 14119, I presented a proposal for a technical report regarding key transfer systems in DIN. This proposal was initially rejected by the German standards committee, but a short time later another New Working Proposal for key transfer systems was submitted to ISO/TC 199 WG7. Ultimately, both proposals were combined and ISO/TS 19837 was created on this basis. Key transfer systems must always be adapted to the application and the respective conditions and require a certain amount of engineering and planning. The respective standards and DGUV Information 203 087, to which I also contributed, provide assistance in this regard – for manufacturers as well as for system integrators and operators.



Key transfer system as locking device