WISH
Waste Industry Safety and Health Forum
FORMAL GUIDANCE DOCUMENT

PRACTICAL GUIDANCE ON SECURE ISOLATION ('LOCK-OFF') FOR RECYCLING AND RECOVERY MACHINERY

This guidance has been developed to help waste operators with the isolation and lock-off of recycling, recovery and similar machinery at 'typical' waste recycling and recovery plants (see section 1 for scope). The Health and Safety Executive was consulted in the production of this publication. It endorses the sensible, proportionate, reasonable, and balanced advice on managing risk set out. This document is aimed at managers/supervisors. The information is practical, should not be considered comprehensive, and you will likely need competent advice to supplement the information in this guidance. Where you have any doubt regarding any aspect of isolation and lock-off or any other aspect of machine safety, advice should be sought from a competent person.

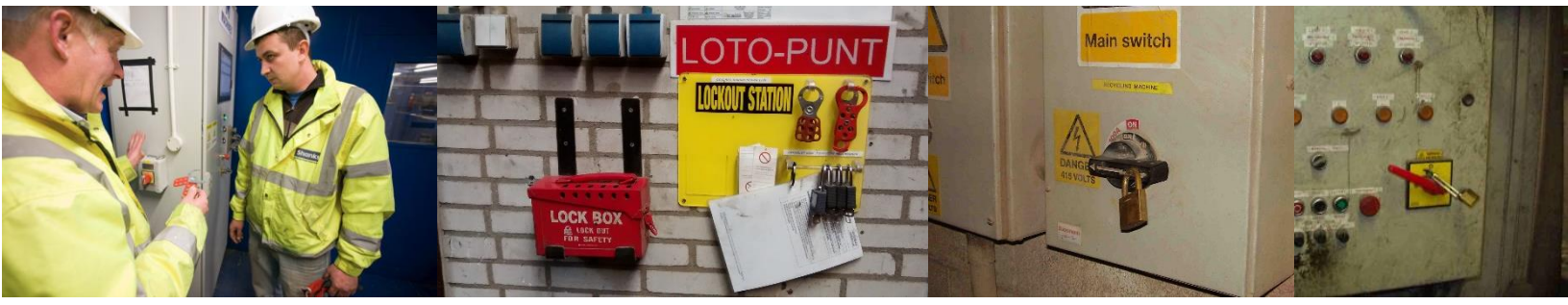
Contents

1. Scope and application

1.1 Waste recycling and recovery plants vary widely in size, complexity, sophistication, and degree of automation. This guidance provides simplified and practical advice on secure isolation/lock-off aimed at 'typical' smaller and medium to large sized plants, such as those comprising assemblies variously of conveyors, picking cabins, balers, screens, shredders, over-band magnets, optical sorting equipment and similar. It would also apply to stand-alone balers, shredders etc and simple machine assemblies.

1.2 This guidance is not primarily aimed at large, sophisticated, and complex plants, such as WtE (waste to energy) plants and large and automated MBT and similar plants, although many of the principles will still apply. Operators of this type of large and complex plant may wish to follow guidance such as BS 14100: 2020 and the principles in documents such as PD 5304: 2019 (see further reading and links section). Operators of smaller and medium to large sized plants might also consider following this route, provided they are confident that they have the level of competence to interpret and apply such technical guidance effectively and safely.

1.3 This guidance is also not primarily aimed at small and simple machines which can be isolated by the power plug being removed from its supply socket. For example, portable metal shears or a tyre bead-breaker which are not 'hard-wired' into their power supply. However, this does not mean that secure isolation is not required for such equipment and operators must ensure that plugs cannot be inadvertently reinserted leading to an unsafe situation.



Left to right: Isolation/lock-off training at a recycling plant, example lock-off station (note – 'LOTO' is another term sometimes used for isolation/lock-off – 'lock-out-tag-out), two examples of isolation switches with lock-off padlocks inserted

2. Dangerous machinery – why we need good isolation and lock-off

2.1.1 The rise in waste recycling and recovery rates over the past decade has in part been achieved by an increase in the amount of machinery used. Unfortunately, this has also been accompanied by a rise in the number of machinery safety accidents.

2.2 Most common fatal accident in waste management

2.2.1 Waste recycling and recovery operations often use large, powerful, and potentially dangerous machines such as:

- Balers, shredders, and compactors
- Trommel, vibrating, finger and similar screens
- Conveyors of various types and other mechanical handling systems
- Over-band magnets, eddy-current devices, optical sorting, and similar specialist equipment

2.2.2 These types of machinery have the potential to cause serious injury or worse, and each year waste management workers are killed in machinery accidents. Latest Health and Safety Executive (HSE) data shows that 30% of fatal accidents in British waste management are caused by contact with moving machinery, equivalent to some 14 fatalities over the past five years (see statistics at https://www.hse.gov.uk/statistics/industry/waste-recycling.pdf). In the majority of these cases a failure to securely isolate/lock-off effectively was a primary cause.

2.2.3 The consequences of contact with the moving parts of large and powerful machinery, such as in-running nip-points at the end rollers of a belt conveyor, chain and wheel drive elements of conveyors and screens, moving elements of a shredder or ram face in a baler, are obvious, serious, and foreseeable. Isolation and lock-off has a critical role in avoiding these consequences.

Throughout this document green tint boxes are provided. These are not a formal part of this guidance. They provide additional information which may be of use to operators when making their own decisions about their secure isolation/lock-off processes.

3. What is isolation and lock-off (and what it is not)

3.1.1 Isolation is making a break in the energy supply to a machine in a secure manner so that it cannot be reconnected inadvertently. Such isolation and lock-off is most commonly achieved at recycling and recovery plants by turning an 'isolation switch' to the 'off' position and securing it such as by inserting a padlock, hence the common name of 'lock-off' often used to describe the process of achieving secure isolation. The critical point is that the energy supply cannot be reconnected until it is safe to do so.

While electricity is the most common and obvious energy supply to most recycling and recovery machinery, other energy sources may also be relevant, such as hydraulic systems. All energy supplies need to be securely isolated (see section 6 below on retained energy). In addition, more than one isolation switch may be needed to remove all energy supplies (see section 6 below on isolation switches). This type of issue is critical to your planning for interventions (see section 5 below).

3.1.2 Secure isolation/lock-off is **NOT**:

- Simply turning the machine off at the control panel or similar – someone could turn it back on while you are working
- Using an emergency stop. Emergency stops are intended to stop movement quickly and using one does not mean that all power sources have been shut in the correct sequence or that all forms of energy have been removed
- Relying on an interlock or similar – interlocks may be safety or process devices and not provide a secure break in the overall energy supply. They may fail and can be defeated
- Putting a sign or tag on the switch or control panel warning that someone is working on a machine or stating 'do not use' or similar – someone could remove the sign or tag and turn the machine back on while you are working. Signs can be discarded, or someone could think that they have been left in place accidentally (warning tags and signs may be used to back-up lock-off but must not be used on their own)

3.1.3 Typically, secure isolation/lock-off involves a unique key or unique tool needs to be used to reactivate the machine – if the machine can be turned back on without using a unique key or unique tool it is **NOT** isolated and locked-off.

Some smaller items of machinery have a key in the control panel which can be turned to an 'off' position and removed. Typically, this type of key is in a control safety circuit and the same approach should be taken as for interlocks (see section 6 below on interlocks). Unless you have gained absolute competent advice, such systems should not be used as a replacement for secure isolation/lock-off.

4. When to use secure isolation/lock-off

4.1.1 All machinery requires some form of 'intervention' at some point. This may be for maintenance or repair, for cleaning or to clear blockages and debris or similar. In particular for waste recycling and recovery machinery the issue of blockages and debris clearance is a known problem, often because of the nature and volume of the material being processed. Many of these interventions can potentially expose a person/persons to a 'dangerous part' of a machine. Recycling and recovery machinery often has no shortage of dangerous parts/danger zones. Examples include:

- In-running nips at the tail, head, and deflection (also called change-of-direction) rollers on belt and similar conveyors
- Baler and compactor ram areas and bale/compaction chambers
- Baler wire, ruffler, wrapping and similar mechanisms
- Moving elements on shredders, bag-openers, screens and similar
- Chain, wheel, rotating shaft, cam etc drive components for conveyors, screens and similar
- Trap and shear points between moving elements, such as the slats on a slat conveyor, and the fixed structure of a machine

4.1.2 Machines must be securely isolated/locked-off for **ANY** intervention which may expose a person to a dangerous part/danger zone.

4.1.3 For example, during interventions such as maintenance, repair and adjustments, cleaning and clearing blockages and 'bridges' and similar, where:

- A fixed guard which allows access to a danger zone needs to be removed or opened **OR**
- A hinged, sliding, or similar guard, gate, door, or panel which allows access to a danger zone needs to be opened – **EVEN** when fitted with an interlock, including retained/exchange key systems, unless you have gained absolute competent advice to the contrary **OR**
- Where access into a machine enclosure or similar containing unguarded dangerous parts/danger zones is required **OR**
- Access needs to be made to an unguarded chute or similar leading to a residual risk danger zone – **EVEN** when fitted with sensors or similar equipment

4.1.4 For descriptions and information on the terms used above, such as guards, interlocks, residual risk danger zones etc see section 6 on factors for intervention planning.

5. Planning for interventions

5.1.1 Interventions involving potential access to danger zones are foreseeable and must be planned for. This section gives an overview of how you may want to plan your interventions. Section 6 provides further information on some of the specific issues you need to consider during your planning. You also need to consider people's motivations. Blocks etc are usually unplanned and people might intervene quickly and without thinking to try and solve the problem without considering their own safety. Apply this foreseeability when assessing machinery safety.

5.1.2 You should identify all the dangerous parts/danger zones on your plant, such as listed above. Then, identify any interventions requiring access to each of these danger zones. For example, you may have identified the tail roller of an inclined belt conveyor as a danger zone and that interventions are required for cleaning and to clear debris. Or you may identify that blocks/bridges are occurring in the feed chute to a baler which need clearing. Or that a bearing on a drive wheel for a screen needs frequent oiling. Having identified all of your danger zones and what interventions involving access are required for each you should then, for each, undertake good risk assessment before moving to the issue of secure isolation/lock-off:

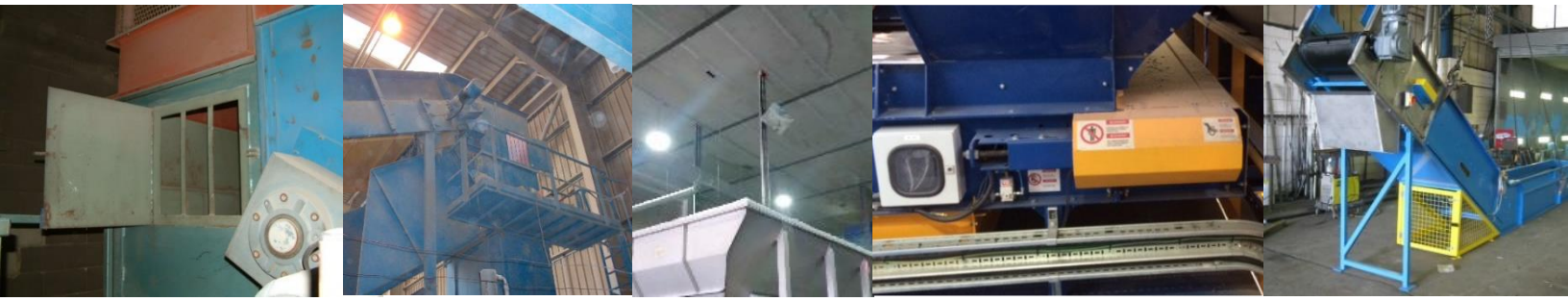
- Can you eliminate the need for access, or at least reduce its frequency? For example, could a drop-out chute be fitted at the tail roller of a conveyor to reduce the need for debris clearance or would the installation of a scraper bar or redesign of the fit of a feed chute to the conveyor reduce the build-up of debris? For blocks/bridges in the feed chute of a baler could the size of the chute be increased to reduce the problem (and are you using the right type of baler)? For a drive wheel bearing could an automatic oiler be installed
- If you cannot practically eliminate or reduce the need for an intervention, could you remove the need to access a danger zone during intervention? For example, could the design of guarding at a conveyor tail roller be changed to allow safe debris clearance without removing the guard? Could a fixed access platform with 'jailers bars' be fitted at the top of the feed chute to a baler so that blocks/bridges can be cleared safely using reach tools? For a drive wheel bearing could remote oiling from a safe location be an answer?

5.1.3 Secure isolation/lock-off is a procedural control reliant on those involved doing the 'right thing' first time every time. No matter how good your lock-off process is, the more frequently it is required the greater the risk that it will fail at some point. You should first consider physical means, such as the examples given above, to eliminate or reduce the need for an intervention involving access to a danger zone or if an intervention can be achieved without the need for access before relying on lock-off. Any such instructions or systems of work will need to be cascaded **AND** effectively monitored, to ensure that procedures are effective and followed.

5.1.4 You should review the results of your risk assessment periodically and whenever something significant changes. For example, if you change the waste type you are processing the locations where blocks and debris occur around your plant may change, or their frequency may increase.

5.1.5 Once you have eliminated or reduced the need for interventions requiring access to danger zones through physical means, as outlined above, you should then ensure that your lock-off process is as robust as it can be. The sections below describe the issues you may need to consider, how to produce your lock-off procedure and how to ensure it remains effective through training, enforcement, and monitoring.

This guidance is about secure isolation/lock-off. There are other risks associated with interventions at waste recycling and recovery sites, such as safe access, tool use, manual handling, exposure to biological agents and other materials etc. You should also include these in your intervention planning.



Examples of elimination or reduction of risk. Left to right: Jailors bars at an access gantry to the top of a feed chute to a baler allowing tool use without access, longer view of same type of arrangement, mirror over shredder to allow vision to determine if reversing the shredder elements has cleared a blockage without access being required, conveyor guard designed to allow adjustment without removal, drop-out chute at tail roller of an elevating feed conveyor to reduce the need for debris clearing.

6. Factors for intervention planning

6.1.1 Section 5 above gives an overview of planning for interventions. This section outlines some of the specific issues you need to consider in your planning.

6.2 Guards, interlocks, and residual risk zones

6.2.1 All machinery should have safeguarding provided to prevent persons entering a danger zone and accessing dangerous parts. For example:

- Fixed guards which are fastened or otherwise permanently fixed in place, such as by being welded or secured in place so that a tool is required to remove them
- Locked guards, such as secured by a lock or padlock requiring a unique key/tool to remove (dependent on the frequency of removal interlocking such guards might be better)
- Interlocked guards, either using a switch type interlock or a retained/exchange key interlock (where a master key needs to be removed from a control panel to open the guard or hatch)
- Machine fencing/enclosures, often fitted with interlocked or locked gates to allow access

6.2.2 Removing a fixed guard, opening a locked guard or hatch, or entering a machine enclosure potentially exposes a person to any danger zone being safeguarded. Interlocked guards are designed to stop the machine/prevent it from starting if a guard is opened. However, interlocks are fitted into safety control circuits and do not turn the power off direct. Depending on the safety rating of the device, interlocks can and have failed and can be damaged (or defeated) rendering them inoperative. This includes retained/exchange key interlocks. Unless the safety circuit on your machine is of a high 'safety performance level' you must not rely on interlocks. If you are at all unsure about the safety performance level of your machine's safety circuit you should gain competent advice, or at the very least play it safe and never rely on interlocks.

Left to right: Removal of a fixed guard at the end roller of a conveyor, interlocked access hatch in a baler feed chute, retained key interlock at a machine fence gate, defeated 'tag' switch interlock (scene of an accident – red dots are blood), retained key master key in control panel with door of panel open to show control circuit wiring behind it (that is power is not turned-off direct)

6.2.3 Some machines cannot practically have guards fitted at all danger zones. For example, a baler with a feed chute/hopper down which waste falls to feed it. If the particle size of the waste is large (such as cardboard sheet) the chute needs to be large enough for these wastes to pass. In this case the chute may also be large enough to allow full-body access – that is a person could access the danger zone via the chute/hopper without needing to open a guard or similar.

6.2.4 Where all practical safeguards have been considered and residual risks remain (see section 5 above on planning for interventions) other systems should be considered, noting a higher reliance is placed on training, supervision and following formal systems of work. This may involve personal detection systems, such as transceiver or radio frequency tagging devices worn by workers with a sensor loop at the chute or feed conveyor. However, these cannot be considered a primary safeguard and should not be relied on – persons need to be wearing the devices, their batteries need charging etc. They are a support to good physical control and lock-off and not a replacement. Interventions requiring access to residual risk danger zones must be considered the same as removing or opening a guard - secure isolation/lock-off must be in place because the consequences are the same.

6.3 Isolation switches and how to lock-off

6.3.1 It sounds simple – turn the isolation switch to the ‘off’ position and secure it with a padlock. However, some machinery accidents have occurred because isolation switch provision was not configured to include all moving parts, or does not isolate upstream/downstream components, the person locking-off may be unaware of how the switch works, what the switch isolates and what it does not, or because the switch was damaged and/or did not work correctly. Other accidents have occurred because of incorrect use of lock-off padlocks and keys.

6.3.2 For most machines there will be a main switch through which a padlock can be inserted stopping the switch being turned back on until the padlock is removed. However, the design of isolation switches varies. Some have a flap which ‘pops-out’ when the switch is turned to off, others have holes which line-up allowing a padlock to be inserted. Make sure you know exactly how your machine locks off and where and how to place a padlock, and that the process is described in your lock-off procedure (see section 7 below).

6.3.3 Many isolation switches consist of a plastic lever or barrel on a square or similar steel shaft, either as a push-fit or secured with a grub screw or similar. Switch levers can and do wear and can be damaged or crack with use. In these cases, the lever or barrel can rotate around the shaft making it ‘feel’ like the switch has worked when in fact the shaft has not turned. Or, if the connecting steel shaft is displaced it may indicate the isolator is switched off, but it is not. This type of fault is one reason why a test restart is a critical part of a lock-off procedure.

6.3.4 Note – isolation switches are often located in control panels/switchgear panels. **ONLY** authorised electrical personnel should open switchgear panels.

6.3.5 You must be sure that the isolation switch you use to lock-off removes all energy from the machine. Beware multiple switches required to isolate/lock-off a machine, assembly or process line, or switches which do not remove all power – if in doubt get competent advice and do not assume. For example, machinery may be modified or added to over time, such as a shredder added to an existing sorting system. If practical additions should be integrated so there is only one main isolation switch. If they are not, more than one switch may be needed to isolate the machine. This adds complexity and has been a contributory factor in serious accidents.

6.3.6 To assist in avoiding any confusion, make sure individual machines/components are identified, any asset numbers are unique, and that identification is clear and unambiguous. For example, terms such as left and right are interchangeable depending on which side of the machine you are facing – make sure identification is clear.

6.3.7 If your machinery/assembly/production line has multiple isolation switches, you MUST ensure that detail of what switch isolates what machine/component is included in your lock-off procedure and safe system of work.

In addition to a ‘main’ isolation switch, many items of machinery also have local isolation switches at specific components (typically ‘barrel’ type). For example, a local isolation switch which removes energy from a drive motor for a conveyor but not from any other part of the machine. You need to consider if, when and under what conditions you use local isolation switches (for most general interventions you will likely only use the main isolator switch), and at least consider the up and down stream implications for your process and any safety impacts. Local isolator switches may be in the main ‘power feed’ to a component, or for larger components they may be in a safety control circuit and should be treated the same as for interlocks. In other cases a separate isolation switch may have been provided deliberately, such as to keep a powered ventilation system running during interventions. You need to know this type of detail and include it in your planning for interventions.

Left to right: Various different types of isolator switch – make sure you know how your switches work and what they isolate

6.4 Lock-off padlocks and keys and missing persons

6.4.1 Effective lock-off relies on a machine not being turned back on whilst somebody is working on it. To achieve this, personal padlock keys (or multiple keys – see section 6.5 on multiple person working) **MUST** be retained by the person doing the work. Lock-off padlock keys need to be kept secure on the person/s doing the work, such as in a zipped and secure pocket.

- Padlocks must be of a suitable quality, robust and capable of being inserted into isolation switches and lock-off plates or boxes
- When purchased padlocks should be checked to ensure that they can only be opened by their individual key – one-key-one-padlock is the rule
- Damaged, worn, and missing padlocks must be replaced
- Lock-off padlocks should only be used for lock-off and not 'borrowed' for any other purposes
- Combination padlocks must not be used
- Padlocks with a 'master' key which can open multiple padlocks must not be used
- Spare keys must be kept secure with access only by a manager or similar responsible person. Or a simpler and effective method is that when new padlocks are purchased that all but one key for each padlock are disposed of – that is there is only one key available for each padlock. If a padlock needs to be cut-off because of a lost key, then padlocks are cheap to replace

6.4.1.1 There may be additional controls necessary – such as supervisory padlocks that are used in addition to personal padlocks, kept by a supervisor/manager that are placed on isolators to prevent the machine being inadvertently turned back on, until all work is completed.

6.4.2 Padlock keys can be lost, and persons may leave site or the work area without releasing their padlock. In these situations, 100% care **MUST** be taken. There have been fatal accidents caused by assumptions that a person has left site when they were really still working on the machine or have returned to the work area unseen.

6.4.3 If a lock-off padlock key has been lost, padlocks must not be cut off or a duplicate key used:

- Until after a thorough search has been made for the missing key
- The person who lost the key must be physically present or confirmed absent (see below)
- If there is only one key for the padlock (such as if all duplicate keys are disposed of when a padlock was purchased), then the padlock for the lost key will need to be cut-off and disposed of, and a new padlock purchased in replacement
- If a duplicate key is used to open the padlock, then the padlock should still be disposed of. The risk is that the lost key is subsequently found resulting in there being two keys for the padlock

Padlock keys can be lost. This is less likely if the key is really secure on a person such as in a zipped pocket. Large and brightly coloured key fobs can also help making keys easier to spot if dropped.

6.4.4 If a person working under lock-off is unaccounted for, such as left site with their key accidentally or left the work area because they were feeling ill, padlocks must not be cut off or a duplicate key used:

- Until the missing person returns to site and is physically present to remove their padlock
- **OR** it is absolutely confirmed that they have left site such as by a direct telephone call in person (not to a spouse, partner, friend etc) and only then after a thorough search has been made of the work area, including inside larger items of machinery such as inside baler chambers, trommel screens, shredder feed chutes and similar
- Word-of-mouth statements such as 'they have gone for a cup of coffee, or to the shop for a sandwich', or 'they felt ill and had to leave suddenly' should not be relied on

Padlocks, lock-off plates and similar can all be lost, damaged or just 'go missing'. If padlocks, plates etc are not easily available the temptation may be for workers to just go ahead without locking-off. Consider including lock-off padlocks, plates and similar in your daily/weekly checks to make sure they have not gone missing and are easily available for use.

6.5 More than one person working

6.5.1 Some intervention tasks which require entry a danger zone only require one person, such as clearing a simple block in a baler feed chute. However, others may require more than one person, such as daily clean at a recycling plant or clearing debris from a conveyor end roller. During such multiple person working all those working need to be safe.

There have been numerous serious accidents when more than one person has been working on a machine. For example, a worker was killed when lock-off was released while he was still working on a shredder. Six people were involved in the work, but only one 'supervisor' padlock was used. The supervisor removed the padlock because one of the person's workmates said that he had finished and gone for a coffee. Unseen, he had returned and was still in the shredder when it was turned back on.

6.5.2 For multiple person working each person must have their own padlock and key, so that all padlocks need removing before the machine can be turned back on. Some designs of isolation switch allow more than one padlock to be fitted, but many do not, and even those designed to accept more than one padlock rarely accept more than three. There are two basic methods which can be used: lock-off plates and lock-off boxes.

6.5.3 Multi-hasp lock-off plates allow more than one padlock to be used (see photographs below). For example, if six people are working on a machine six personal padlocks can be used – one for each person. Each person keeps their own padlock key with them secure in their pocket or similar, and all six keys are needed to remove all six padlocks to unlock the plate and allow the machine to be restarted.

6.5.4 Where a larger number of people are working on a machine, such as during daily cleaning of a plant, the use of multiple lock-off plates may become a problem and may damage the switch because of the weight of padlocks used. In these cases, a lock-off box can be used (see photograph below). Lock-off boxes allow the main switch padlock key to be locked into a secure box which is then closed and locked using the personal padlocks of all those who will do the work. All the personal padlocks need to be removed before the box can be opened and the main switch padlock key accessed.

6.5.5 Whatever system is used the principle is the same: Each person working must have their own padlock and all padlocks must need to be removed to allow the machine to restart.

For workers who use lock-off regularly, such as maintenance staff, sometimes personal lock-off padlocks are issued. This has the advantage that the worker has his/her padlock with them but has the disadvantage that this is not easily seen (have they lost their padlock and may be tempted to just turn a machine off rather than lock-off). Lock-off stations/boards can also be used (see photographs below). These are typically placed next to the isolation point, or in an easily accessible position such as in a control room. The advantage of lock-off stations/boards is that it is easy to see when padlocks, plates etc are missing so they can be replaced.




Left to right: A 'crab's claw' lock-off plate in use (only one padlock fitted- open - holes for six locks), crab's claw plate – claw closes through isolation switch and padlocks are inserted – all need to be removed to open the plate, example lock-off station/board, example lock-off box – main key in box and personal padlocks secure the box shut, example alternative type of lock-off plate, another example lock-off station/board

6.6 Retained energy

6.6.1 Most recycling machinery is powered by electricity, but often has other energy sources such as hydraulic or air systems. Whilst isolating the electrical power and securing it so it cannot be turned back on is a relatively straightforward, for mechanical power systems there may also be 'retained energy'. That is, some types of machinery may still be capable of moving or still move after lock-off is in place. This is called retained energy. Examples include:

- Hydraulic/air systems which retain pressure – parts could move under pressure after lock-off
- Sprung parts which could move after lock-off as the spring expands
- Parts which could move under gravity or weight after lock-off such as a conveyor which may move backwards if it is loaded, a trommel screen which may rotate under the weight of persons in it clearing a blockage, or a vertical baler plate which could move under gravity
- Spinning and other moving parts, such as the blade components of a fast-moving shredder, which could continue to rotate for some time after the power has been turned off

6.6.2 When writing lock-off procedures the issue of retained energy must be considered. Some circumstances will rely on keeping the stored energy in the system, whilst other tasks may require its removal. Scotch bars or pins may need to be inserted to prevent parts moving after lock-off or hydraulic or air systems depressurised before work starts. Or, for items such as trommel screens ensuring at least one drive motor is braked to prevent rotation during work.

6.6.3 For spinning and other parts which may continue moving, a time delay may be needed to allow them to stop fully before work starts. Some retained key systems and other interlocks have a built-in timer to allow for this. On other systems a motion sensor may be used which will not allow a guard, hatch etc to be opened until all motion has stopped. As with all lock-off issues if you are unsure about retained energy you must seek advice from a competent person.

6.7 Test restart

6.7.1 Interlocks can fail or be defeated, or isolation switches can be damaged and not operate correctly and other faults may mean that lock-off could be ineffective. The best defence against this type of issue is to prove isolation by completing a test restart before work commences.

6.7.2 The person who carries out isolation is best placed to try a test restart **BEFORE** working. Any person carrying out an isolation should have suitable understanding of what equipment is involved, how it is powered, and the details of the intervention work to be completed. Test restarts only take a few seconds – seconds which could save lives. Some control panels have a test function built in. If this is the case, you must ensure you know how the system works.

7. Writing your lock-off procedure

The principles of secure isolation/lock-off are simple but often the detail is more complex. Relying on word-of-mouth or someone's memory for a critical control such as lock-off risks a vital component of the lock-off procedure being missed-out. Writing your procedure down reduces the risk of this and makes training on lock-off easier – your procedure provides the syllabus for the training.

7.1 Gather information

7.1.1 When writing your lock-off procedure, first gather information from the operating manual, interviews with workers, from your competent advisor etc. Inspect the actual machinery or process system to make sure it is the same as is recorded on drawings and paperwork. Do not assume that all machines are the same and that you know all of the tasks people carry-out on them. Make sure you:

- Identify the machine the lock-off procedure applies to clearly
- Identify all the interventions carried-out which involve removing guards, opening access hatches or any other work which involves accessing a danger zone (ask your workers)
- Identify all of the danger zones which removing guards, opening hatches etc or entering a residual risk danger zone may result in workers being exposed to risks
- Identify any other issues such as retained energy, multiple isolation switches etc and take account of them

7.2 Writing your procedure

7.2.1 Then write your lock-off procedure:

1. List the tasks lock-off is required for (different tasks may require different procedures)
2. Identify who is authorised to carry-out lock-off
3. List what equipment is required such as single key padlocks, lock-off plates etc and that work **MUST NOT** be carried out if any equipment is missing
4. Detail where the lock-off switch is and how it works (photographs can be useful)
5. Detail how lock-off is carried out such as: "turn isolator switch to off position and pull-out tag at end of switch lever. Put padlock through the tag and close the padlock etc" Never assume what is obvious to you is obvious to everyone (again, photographs can be useful)
6. Identify if machinery needs to be in a special position. For example, retracted or extended hydraulic cylinders, flywheels at top/ bottom dead centre etc
7. Include any retained energy arrangements and the control measures

8. Include any multiple isolation switch issues and make it clear if more than one switch needs to be turned-off and locked-off
9. Include a test restart before any guards are removed, gates opened etc and work commences to ensure that the machine really is off
10. Include where the lock-off key/s is to be kept – with the person working in their pocket and include warnings that keys should **NEVER** be left with someone else or just left around, such as on top of a control box etc
11. Include any information for when more than one person is working such as using a lock-off plate and multiple padlocks or a lock-off box
12. If a permit to work system (including gas test or hot-work permits) is being used include details of this, when a permit should be used and that it forms a final check before work commences
13. After work has been completed include a check instruction to ensure that all those working are clear of the machine and that it is safe to restart
14. After work has been completed include a check that all guards etc have been replaced and that all bolts and other fixings are in place and secure
15. Include instruction that lock-off **MUST NOT** be released until checks have been carried out
16. Detail the process for releasing lock-off and any tests which need to be carried out before normal operation of the machine re-commences
17. Include warnings that workers who do not follow lock-off will be disciplined and may be dismissed – failing to follow lock-off has resulted in fatal accidents and discipline is essential because of the reliance on individuals to apply and take-off their personal padlocks

7.2.2 The above is guidance only and may need adding to or modifying dependent on the type of machine. Likewise, for some types of simple recycling machine control issues such as multiple lock-off may not be relevant.

7.2.3 Note that although some machinery may include a ‘trapped key’ or key exchange guard control (such as balers) as part of their construction, this is only a single key exchange and so is **NOT** intended where multiple persons may be working. In these circumstances the key exchange will need to be integrated into your lock-off system (see section 6.5).

7.2.4 In the end secure isolation/lock-off procedures need to be comprehensive but should also be as simple as practical. Once you have written your lock-off procedure check it with those workers who actually operate the machine to ensure it is practical and understandable – do they understand it and is it clear and is it practical.

7.2.5 Finally, you must review your lock-off procedure periodically to ensure it remains valid. In particular if a machine is modified or added-to you must review your lock-off procedure to ensure it remains effective.

8. Training, enforcing lock-off and monitoring

8.1.1 Many machinery accidents occur not because a secure isolation/lock-off procedure was not in place, but rather that one was in place but followed. Often those who do not follow lock-off believe they are helping with a presumed time saving, which is frequently false. It is also possible that they were not trained adequately with an emphasis on the importance of lock-off and the potential consequences of failing to follow the procedure. Culture and leadership are essential here, as are training and monitoring. Interventions may be perceived as 'only being quick' but it should always be remembered that if not properly isolated and locked off, there may be a possibility of somebody else also being 'quick' to start/restart the machine.

8.2 Check, test, lead, and monitor

8.2.1 You **MUST** make sure that lock-off is followed strictly 100% of the time. Make sure that as a manger or supervisor that your employees are clear how important this is to you. Lead by example - never pass by poor practice on lock-off and always intervene when required, and when you see good practice on lock-off give praise.

- Inspect and monitor regularly to ensure lock-off is being used
- Inspect and monitor regularly to ensure that padlocks, lock-off plates etc are in place
- Check and monitor in detail that your lock-off procedure is being used – is the lock-off procedure understood or are there practical problems with it?
- Monitor how frequently and where lock-off is being used – has the pattern of blockages, cleaning requirements etc changed?

8.2.2 You must also ensure that any safeguarding is maintained and is effective. There is little point in having a firm lock-off procedure in place if guards are routinely left off or machinery has been tampered with. Your inspections should include checking to ensure that all safeguards, interlocks, retained key systems etc are working and have not been altered.

Some organisations use a secure isolation/lock-off log sheet. Typically this is in table format on which each secure isolation/lock-off is recorded: date and time, location, who initiated the lock-off, what was locked-off, why was lock-off put in place, nature of the intervention etc. This allows interventions requiring lock-off to be tracked and any changes in frequency of any intervention can be easily seen and processes and physical measures revised to keep them up to date. Log sheets may also be useful in ensuring that lock-off is actually used – if someone has to write down that they have locked-off each time they may be more likely to actually lock-off.

8.3 Training

8.3.1 Your lock-off procedure must be trained-out to all involved. This should include a practical demonstration of how to lock the machine off – lock-off training cannot be purely a classroom training exercise. Training should also include the person being trained demonstrating that they know how to lock off and when to lock-off, and always assess that lock-off training has been understood clearly. This is particularly important where a worker's first language may not be English or where literacy may be an issue.

8.3.2 Ensure that any new employees are trained and that temporary workers and others who may be involved are also trained. You should also repeat lock-off training periodically.

8.4 Enforcing lock-off

8.4.1 Lock-off is a critical control. Ineffective secure isolation/lock-off or not locking-off at all risks serious and fatal accidents. Machinery safety accidents are the most common cause of fatalities on British waste management sites. This is an issue which you cannot take a 'soft line' on. If a worker has been trained in lock-off and knows how to lock-off but fails to do so you must act - if required up to and including dismissal.

Disclaimer and WISH

Nothing in this guidance constitutes legal or other professional advice and no warranty is given, nor liability accepted (to the fullest extent permitted under law) for any loss or damage suffered or incurred as a consequence of reliance on this guide. The guidance is not a substitute for duty holder judgment and/or professional safety advisor's judgment, Notwithstanding the good practice in this guidance, duty holders are responsible for ascertaining the sufficiency and adequacy of their internal and independent procedures for verifying and evaluating their organisation's compliance with health and safety law. WISH accepts no liability (to the fullest extent permitted under law) for any act or omission of any persons using the guidance.

The Waste Industry Safety and Health (WISH) Forum exists to communicate and consult with key stakeholders, including local and national government bodies, equipment manufacturers, trade associations, professional associations, and trade unions. The aim of WISH is to identify, devise and promote activities that can improve industry health and safety performance.

Further information and links

This guidance is issued by WISH to help control safety and health risks. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance. This guidance was originally produced via ESA (Environmental Services Association) Health and Safety Committee and was first published as a WISH information sheet in 2013. This guidance, and all WISH documents, is available free to download from the WISH web site https://wishforum.org.uk/.

The links and documents below may be of use:

PD 5304:2019. Guidance on safe use of machinery. General machinery safety guidance, available from BSI at https://shop.bsigroup.com/ProductDetail?pid=000000000030390353

BS 14100:2020. Control of hazardous energy on machinery. Specific secure isolation/lock-off guidance, available from BSI at https://shop.bsigroup.com/ProductDetail?pid=000000000030363909

L22 Safe use of work equipment, approved code of practice to the Provision and Use of Work Equipment Regulations, available as a free download at: https://www.hse.gov.uk/pubns/books/l22.htm

Index page for the HSE's work equipment and machinery pages: https://www.hse.gov.uk/work-equipment-machinery/index.htm