

PRACTICAL ADVICE ON LOCK-OFF RECYCLING/RECOVERY MACHINERY

This information document is aimed at health and safety improvements in the waste management industry. It is endorsed by the Waste Industry Safety and Health (WISH) Forum.

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Introduction

This is one of a series of best practice information documents designed and facilitated by the Environmental Services Association's (ESA) Health and Safety Committee to help the waste management industry achieve improvements in critical safety areas. It is aimed at managers and supervisors of recycling and similar facilities. The information is a practical nature and should not be considered as comprehensive or a technical document on lock-off. Where there is any doubt regarding any aspect of lock-off or machine safety, advice should be sought from a competent person with an in-depth knowledge of the machinery involved. This guidance assumes that machinery is compliant with the required EU and national standards and that all safety devices are functioning and have been maintained in good order.

Dangerous machinery

Waste management operations, and particularly recycling sites and other similar waste treatment facilities, often use powerful and potentially dangerous machines such as:

- Balers and compactors
- Shredders
- Trommel and vibrating screens
- Conveyors, walking floors and other mechanical handling systems
- Electro-magnets, optical sorting and other specialist equipment

ALL have the potential to cause serious injury or to kill if they are not locked-off when being maintained, cleaned, blockages cleared from them etc. Each year people are killed because they tried to work on recycling and other similar machines without them being locked-off. Most of these serious and fatal accidents were in part caused by a failure to lock-off machinery effectively.

When do I need to lock-off?

Safeguards, guards and interlocks

All the above types of machine should have safeguarding fitted to protect their dangerous parts, such as guards, sensors, machine fencing etc. Many also have hinged doors, gates or hatches to allow access for cleaning, clearing blockages etc. These safeguards, gates, guards and doors can be:

- Bolted or otherwise permanently fixed in place (such as a 'fixed' guard)
- Hinged, sliding or otherwise moveable but with a padlock or similar lock fitted
- Hinged, sliding or otherwise moveable but with an interlocked fitted. That is fitted with a switch/switches which stop the machine if the guard, door etc is opened or fitted with a 'retained' key (sometimes called a captive or trapped key) which needs to be removed from the control panel to open a guard, door, hatch etc

These safeguards aim to prevent access to 'danger zones' while the machine is running. That is zones where a person can come into contact with a machinery hazard such as an in-running nip on a conveyor or a crush zone on a baler. Examples are shown below:

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Bolted on 'fixed' guard removed from the end-run of a conveyor for maintenance at a construction waste recycling plant (this guard also has a padlock fitted to prevent unauthorised access)



Hinged access door on baler to allow for blockage clearance protected by an interlock (the red box) on the access hatch. Some access hatches are also fitted with 'jailer's bars' inside the door or hatch to reduce the potential for access



Retained key lock type interlock on an access gate to a machine enclosure – a key needs to be removed from the control box (stopping the machine) and inserted in the lock before the gate can be opened

However, some types of machine cannot practically have access panels or guards fitted at all danger zones. For example, a baler with a chute down which waste falls to feed the baler. 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 into the baler. In this case the chute may be large enough to allow full-body access – that is a person could access the danger zone (in this case the baler chamber) without needing to open a guard or similar via the feed chute.

Such 'residual risks' should only be accepted after all practical safeguards have been considered first. For example, if the particle size of the material being fed to a danger zone is small then safeguarding preventing any part of the body accessing the danger zone may be possible. For example, the chute can be made too narrow to allow full-body access and long enough that arms, legs or other body parts cannot reach the danger zone.

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Or, for some situations a trap-door or similar could be put in place to allow batch-feeding of the machine – this is not always practical for waste management operations where feeds to machinery are often continuous.

Approaching residual risk danger zones such as large baler feed chutes must be considered to be the same as removing or opening a guard and lock-off must be in place – because the consequences are likely to be the same.

As stated above interlocks of various types are often fitted to recycling machinery. The vast majority of these interlocks are not intended to be used instead of formal lock-off and the general rule is that you should not trust interlocks. Interlocks may be suitable in situations where other safeguards are also in place, such as long chutes and guards which prevent parts of the body accessing danger zones. For other danger zones, in particular where full body access may be possible, interlocks are unlikely to be adequate. If you are in doubt about the level of safety provided by any interlocks on your recycling machinery you must gain competent advice – never assume that an interlock makes you safe.

Whatever the safeguards you have, you **MUST** understand your machinery in detail. Where its danger zones are, what safeguards have been provided, where any residual risk zones are. If you do not understand these details it will be very difficult to produce a meaningful and effective lock-off procedure.

So, when do I need to lock-off?

Having considered the safeguarding on your machine, and any residual risk zones, machines must be locked off for **ANY** task which may expose a person to a danger zone, such as:

- Maintenance and adjustments
- Cleaning and clearing blockages and 'bridges'
- Repair work

Where:

- A fixed or padlocked guard, gate, hatch etc which allows access to a danger zone needs to be removed or opened **OR**
- Access needs to be made to an unguarded chute or similar residual risk danger zone – **EVEN** when fitted with sensors or similar equipment

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- 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 or retained key system, unless you have gained absolute, competent advice to the contrary **OR**

LOCK-OFF MUST BE USED

In brief, any task which involves a person potentially being exposed to a danger zone requires lock-off to be in place.

What is lock-off?

Lock-off is turning a machine off and securing the switch so that no one can turn it back on without using a key or a dedicated tool. Lock-off is **NOT**:

- Simply turning the machine off – someone could turn it back on while you are working
- Using an emergency stop to turn the machine off – someone could restart the machine while you are working
- Relying on an interlock or similar equipment such as sensors, pressure mats or electric eyes – interlocks can and have failed
- Putting a sign or tag on the switch warning that some is working on it – someone could remove the sign and turn the machine back on while you are working

To be true lock-off a key or tool needs to be used to turn the machine back on – if the machine can be turned back on without using a key or dedicated tool it is **NOT** locked-off.

How do I lock-off?

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. For example:



Main switch on a control panel at a recycling plant – padlock placed through switch preventing it being turned back on (note – a lock-off plate has been used here which allows more than one padlock to be used – see below)



Barrel type switch – when the switch is turned to off two holes line-up and a padlock can be inserted to lock-off and prevent the switch being rotated and turned back on

Some machines have ‘barrel’ type switches where two holes line-up when the switch is off allowing a padlock to be placed. Others have lever type switches with tags which pop-out or can be pushed to one side allowing a padlock to be fitted, Make sure you know exactly how your machine locks off and where to place the padlock.

You must also be sure that the switch you are using to lock-off removes all power from the machine. Beware multiple switches required to lock-off a machine or switches which do not remove all power – if in doubt get competent advice and do not assume.

For example, it is common for recycling machinery to be modified or added to over time, such as a shredder being added to an existing sorting system. If at all practical such additions should be integrated so that there is only one isolation switch. If they are not, then more than one switch may be needed to turn the machine off. This adds complexity and has been a contributory factor in several serious and fatal machinery accidents.

If you have machinery with multiple isolation switches you should:

1. If at all practical integrate the systems so that there is only **ONE** lock-off point
2. If this is not practical then you **MUST** ensure that the use of multiple switches is incorporated into your lock-off procedures and safe systems of work

Whichever type of switch is fitted the essential point is ‘can the machine be restarted without the padlock being removed?’ You must be familiar with the exact method of lock-off to be used and how the main switch works. Beware:

- Some switches **DO NOT** turn off all of the machine just a part of it – **MAKE SURE** you know what the switch used for lock-off turns off – **NEVER** assume it turns the whole of the machine off

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- Does someone else have a copy of the key? All copy keys **MUST** be safely locked away
- Is the switch loose or damaged so that it can be turned back on without the key? Check to make sure (see below on test restarts)
- Is it obvious when the switch is in the off position? Are any labels for 'on' and 'off' worn and cannot be read – do they need replacing?

When you are working on a machine, cleaning, repairing, clearing a blockage etc, you **MUST** have your lock-off padlock key with you at all times (keep it secure in your pocket). **NEVER** give your key to anyone else – do not trust them with your life.

More than one person working

There have been fatal accidents when more than one person has been working on a large machine all of which cannot be seen from the control panel and lock-off has been released **BEFORE** everyone is accounted for.

For example, an operative was killed when lock-off was released while he was working on a shredder. Six people were working on the machine, but only one padlock was used to lock it off. The supervisor removed the padlock because one of the operative's workmates said that he had finished and was having a cup of coffee – **BUT** he was actually still working.

Lock-off plates allow more than one padlock to be used (see photograph above). 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 and all six keys are needed to remove all six padlocks to unlock the plate and allow the machine to be restarted.

Where a larger number of people are working on a machine 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. 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.

Whatever the system 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.

Retained energy

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 are:

- Hydraulic systems which retain pressure – parts could move under this pressure even after lock-off
- Sprung parts which could move after lock-off
- Heavy parts which could move under gravity after lock-off such as a conveyor which may move backwards if it is loaded, or a baler plate which could move under gravity
- Spinning and other moving parts which could continue to move for some time after the power has been turned off

When writing lock-off procedures the issue of retained energy must be considered. Scotch bars or pins may need to be inserted to prevent parts moving after lock-off or hydraulic systems depressurised before work commences.

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.

Test restart before working

Even if you are sure that the switch you will use for lock-off turns the whole machine off, are you sure that the machine is really off? There have been fatal accidents where switches have been faulty or did not turn off the whole of the machine.

After you have locked the machine off try a test restart **BEFORE** working. Test restarts only take a few seconds – seconds which could save your life.

In addition, some recycling machinery has multiple control panels. As for isolation switches this may be because additional components have been added to the system. As for multiple isolation switches you should seek to integrate the systems so that there is only one master control panel. If this is not practical, then a test restart at each control panel may be required.

Writing your lock-off procedure

Lock-off procedures need to be written down **AND** trained out to all who need to use lock-off.

When writing your lock-off procedure, first gather information from the operating manual, interviews with users, from your competent advisor etc. 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 tasks carried-out which involve removing guards, opening access hatches or any other work which involves accessing a danger zone
- Identify **ALL** of the danger zones which removing the guards, opening hatches etc may expose people to when working
- Identify any other issues such as retained energy, multiple isolation switches etc and take account of them

Then write your lock-off procedure:

1. List **ALL** the tasks lock-off is required for
2. Identify who is authorised to carry-out lock-off
3. List what equipment is required such as single key padlock, lock-off plate 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
6. Include any retained energy issues and the control measures which need to be taken into account
7. Include any multiple isolation switch issues – **AND** make it clear if more than one switch needs to be turned-off
8. Include a test restart before any guards are removed, gates opened etc and work commences to ensure that the machine really is off
9. 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
10. 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

11. If a permit to work system is being used include details of this and when a permit should be used and that it forms a final check before work commences
12. If a permit to work system is not being used include that an authorised person must check lock-off is complete **BEFORE** work commences
13. After work has been completed include a check procedure to ensure that all those working are clear of the machine
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 such 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 restarts
17. Include warnings that employees who do not follow lock-off will be disciplined and may be dismissed – failing to follow lock-off has resulted in many fatal accidents and discipline is essential

The above is guidance only and may need adding to dependent on the type of machine. Likewise for some types of simple machine issues such as multiple lock-off may not be appropriate.

In the end lock-off procedures need to be comprehensive, but should also be as simple as possible. Once you have written your lock-off procedure check it with those persons who actually operate the machine to ensure it is practical and understandable.

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.

Training and enforcing lock-off

Check and inspect

You **MUST** make sure that lock-off is followed strictly 100% of the time. Many fatal accidents with machinery are caused not because a lock-off procedure was not in place but because it was ignored. Often this is because the person thought they were being helpful or was trying to save time – whichever is the case ignoring lock-off is a prime cause of fatal accidents with machinery.

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- Inspect regularly to ensure lock-off is being used
- Inspect regularly to ensure that padlocks, lock-off plates etc are in place and available
- Check in detail that your lock-off procedure is being used – is the lock-off procedure understood or are there practical problems with it?
- Discipline employees who do not follow lock-off

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.

Training

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 a purely classroom training exercise. Training should also include the person being trained demonstrating that they know how to lock off and when to lock-off – always assess that lock-off training has been understood clearly.

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.

Lock-off saves lives

Make sure you and all your employees use it

NEVER work on machinery without lock-off being in place

NEVER restart machinery until you are sure everyone is clear and all guards, hatches, gates, doors etc have been closed and secured

ALWAYS – make sure the machine is really off **BEFORE** starting work

ALWAYS - inspect and check that lock-off is being used

Disclaimer and WISH

This information document has been prepared by health and safety practitioners to assist health and safety improvements in the waste management industry. It is endorsed by the WISH (Waste Industry Safety and Health) Forum. This information document is not formal guidance and represents good practice, which typically goes beyond the strict requirements of health and safety law.

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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. www.hse.gov.uk/waste/wish.htm

Useful links and further reading

Further information on lock-off is available on the Health and Safety Executive's (HSE) web site, both on the waste management industry specific pages and pages associated with machinery safety.