Guidance on the Safe Use of Excavator Quick-hitch Devices
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OPERC is a non-partisan and non-profit making organisation. Its main objective is to advance off-highway plant and equipment knowledge and share this among all interested parties. Funds generated by the association are used to help research, author, publish and make available information (such as this guide), that would otherwise be too time consuming and / or expensive for any single member to produce in isolation.

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Items of earth moving equipment, particularly excavators, often need a change of attachment to allow them to be adapted to different work tasks. This change may be from a large bucket to a smaller one, from a rip to a grapple or from a bucket to a breaker; the options are numerous, as are the number of changes in any typical working day. The time needed to carry out an attachment change can be extensive, so combined, these aspects often represent a considerable loss of machine productivity.

Excavator quick-hitch devices are therefore used extensively, because they can significantly reduce the time required to change an attachment. However, the number of workplace accidents related to the use of quick-hitches has increased of late, mainly due to their misuse or mismanagement. The accidents typically feature an attachment breaking free from a machine and falling on to a worker. Many of these accidents have been serious and unfortunately, several deaths have resulted.

OPERC’s *Guidance on the Safe Use of Excavator Quick-hitch Devices* aims to educate and inform on this subject. By engendering a safer approach to the use of quick-hitches it is hoped that this guidance will make some contribution to reducing the unfortunate accident statistics relating to them.
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Commonly Used Acronyms

BSI [The] British Standards Institution
HSE [The] Health and Safety Executive
ISO [The] International Organization for Standardization
OPERC [The] Off-highway Plant and Equipment Research Centre
SWL Safe Working Load
Introduction

What is this Guide About?

This is an informational guide on the safe use of quick-hitch devices that are designed for use with off-highway plant and equipment, specifically, earth moving and excavating equipment that needs to connect (and often change) attachments (such as excavating buckets) to the excavator’s dipper arm. The guide is aimed at managers and supervisors of work involving the use of quick-hitches but is also of relevance to anyone working directly with quick-hitches such as machine operators, ground workers and banksmen.

Over recent years there have been several workplace accidents (and regrettably some deaths) relating to the use of quick-hitches. This has led to increasing concern for the health and safety of workers who work with, or near to, plant and equipment that use these kinds of devices.

With this in mind, the aim of this guide is to raise awareness of the safe use of quick-hitches, while also helping educate and therefore encourage safer working with these items of mechanical work equipment. The guide will present an overview of present knowledge regarding quick-hitches, followed by guidance on their safe use in practice.

Specifically, this guide will:

- consider various classifications of quick-hitch and look at how these are designed to operate;
- make brief reference to relevant legislation;
- identify and discuss the risks associated with using quick-hitches; and
- offer broad guidance on how to use quick-hitches more safely in practice.

The list of references located at the end of the guide provides sources of further and more detailed information on many of the key issues discussed.

Quick-hitches are sometimes also referred to as quick-hitch couplers (JBS, 2007), quick couplers (Berndtson, 2005), quick release couplings, quick release couplers (Anon, 2007) or quick coupling attachment brackets (BSI, 2006). To avoid confusion of terms, only the description quick-hitch will be used throughout this guide.
What is a Quick-hitch?

A quick-hitch is a device designed to facilitate the efficient connection and removal of attachments (such as buckets, grapples and rock breakers) to plant and equipment. It is often affixed to the end of the dipper arm of an excavator, as a means of enabling different types and sizes of excavator bucket (for example) to be changed at will.

‘Direct’ connection of an attachment (i.e. without the use of a quick-hitch system) involves the use of pivot pins alone. Figure 1 shows examples of ‘direct’ attachment, where to disconnect a bucket from a machine, lynch pins or nuts and bolts have to be removed, so that the two pivot pins can be slid out (and vice-versa for bucket re-connection). There are certain issues associated with the direct method of attachment:

- changing an attachment can be very time-consuming;
- there may need to be a number of such changes in a typical working day;
- the pivot pins can become rusty and difficult to remove (hammer out); and
- some of the larger pivot pins can be very heavy and difficult to handle manually (Jackson, 2006)

The use of quick-hitches has come about in response to these issues, in particular to the length of time that can be spent during a working day in changing attachments using the direct method. Indeed, it has been suggested that use of a quick-hitch can reduce the time it takes to change an attachment from 45 minutes or an hour, to less than a minute in some cases (Berndtson, 2005).

Figure 1  Examples of ‘Direct’ Attachment Connection
Types of Quick-hitch

Quick-hitches are usually manufactured by independent companies, rather than the machine original equipment manufacturers. A list of quick-hitch manufacturers is provided at the end of this guide for informational purposes.

There are two broad classifications of quick-hitch, these being:

- the dedicated quick-hitch; and
- the ‘pin system’ quick-hitch.

Dedicated Quick-hitch
This type of quick-hitch is dedicated to a particular machine attachment or series of attachments, which will each have a receptive component fitted to match that specific quick-hitch design. The advantage of this system is that it does not significantly change the geometry in the relationship between the attachment and the dipper arm, so that the bucket tip radius and breakout force at the bucket is not greatly affected.

The practical disadvantage of the dedicated quick-hitch is that it is restrictive, in that a machine will only (should only) be able to use attachments that are compatible with the dedicated quick-hitch, resulting in a considerable investment in dedicated attachments. Manufacturers contend that this is actually the advantage of dedicated quick-hitches in that only those attachments specifically intended for use with a particular machine (quick-hitch) can be fitted.

Pin System Quick-hitch
The pin system quick-hitch takes advantage of the two pins that are used to attach a ‘standard’ type bucket to a machine’s dipper arm (refer Figure 1). Pins of this kind are fitted to all attachments that the machine intends to use and the quick-hitch connects to the attachments by engaging with (and retaining) these two pins.

The pin system is arguably the most versatile, and therefore the more commonly used, type of quick-hitch. This is because there is no need to purchase dedicated machine attachments and because the quick-hitch will normally adjust to different pin centres and / or diameters. However, a pin system quick-hitch does add length to the dipper arm, so it has a slightly negative effect on breakout force while also adding to dipper arm tip radius and weight (Jackson, 2006).
Depending on how a pin system quick-hitch is designed to mechanically operate in practice, it can be placed into one of three further classifications, which are:

- the manual system;
- the semi-automatic system; and
- the fully-automatic system.

In very broad terms, to make a connection a quick-hitch has to engage with an attachment and then retain it using some kind of a locking mechanism. A safety device, such as a safety pin or latch, will then need implementing to secure the retaining mechanism, thus preventing it from inadvertently opening and causing the attachment to disconnect from the machine. The process of making a connection can therefore be broken down into the three stages shown in figure 2.

**Figure 2** The Three Stages Typically Involved in Attaching a Quick-hitch Device
A manual quick-hitch system relies on the attachment, once engaged, being retained by the use of a manual mechanism, such as a screw operated latch (operated using a ratchet), or a sprung latch (operated using a detachable lever, called a ‘tommy-bar’). A safety pin will also need to be manually inserted as a means of stopping the retaining latch from opening inadvertently. Figure 3 shows two examples of the manual quick-hitch system.

**Figure 3** Examples of Manual Quick-hitch

- **Slot to insert tommy-bar**
- **Head of correctly located safety pin (showing in red)**
- **Ratchet being used to free retaining latch from rear pivot, prior to bucket removal**

(a) With tommy-bar operated retaining mechanism

(b) With ratchet operated retaining mechanism
With a **semi-automatic quick-hitch system** (see figure 4) the machine attachment is retained with a hydraulically operated latch, but the safety pin must still be manually fitted as additional security.

**Figure 4  Example of a Semi-automatic Quick-hitch**

The **fully-automatic quick hitch system** (see figure 5) not only retains the attachment with a hydraulically operated latch, but also engages a safety device as part of the hydraulic function. This safety device may take the form of a hydraulic check valve and / or a sprung mechanism to stop the retaining latch from inadvertently opening.

**Figure 5  Example of a Fully-automatic Quick-hitch**

The rear pivot pin is retained via a hydraulic mechanism – see the hydraulic pipes above the quick-hitch

The safety pin is manually inserted into this hole after the pivot pin is retained hydraulically

Hydraulically operated pivot pin retaining mechanisms (in orange)- the hydraulic hose connections can be seen at the top of the picture.
The fully-automatic quick-hitch system can therefore be operated entirely from within the machine cab, while the other two systems require some kind of human intervention outside of the machine to complete the engagement (safety) process. Table 1 summarises the main characteristics of these three classifications of quick-hitch system.

Table 1  Classifications of Pin System Quick-hitches

<table>
<thead>
<tr>
<th>Type of quick-hitch system</th>
<th>Typical method of engagement</th>
<th>Typical locking/security system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>Manually retained e.g. by sprung latch operated with a lever</td>
<td>Manually inserted safety pin</td>
</tr>
<tr>
<td>Semi-automatic</td>
<td>Hydraulically operated retaining latch mechanism</td>
<td>Manually inserted safety pin</td>
</tr>
<tr>
<td>Fully-automatic</td>
<td>Hydraulically operated retaining latch mechanism</td>
<td>Hydraulically operated safety mechanism (may incorporate hydraulic and/or sprung safety system).</td>
</tr>
</tbody>
</table>
What Legislation is Relevant?

This section provides a brief overview of some of the more pertinent items of legislation and standards relating to the design, manufacture, provision and use of quick-hitch attachments. Depending on the specific equipment and the circumstances surrounding its deployment, there may be many legislative controls that are relevant, so what is discussed below should be considered as indicative to the subject only and by no means a definitive listing.

The Health and Safety at Work etc. Act 1974

The Health and Safety at Work etc. Act 1974 (HASWA) places general duties of care on everyone at work, in accordance with their role in the workplace, including employers, employees, manufacturers, suppliers and so on. Under section 2 of the Act:

“It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.”

Amongst other things, this duty extends to providing safe systems of work, including systems that involve the use of plant and equipment, and therefore the use of quick-hitches. The employer must also ensure that employees are provided with sufficient information, instruction, training and supervision to carry out their work safely.

Section 7(a) of the Act states that:

“It shall be the duty of every employee while at work to take reasonable care for the health and safety of himself and of [any] other persons who may be affected by his acts or omissions…”

So, for example, with respect to the use of quick-hitches, this places a responsibility on workers to ensure that attachments are properly connected to quick-hitches and to ensure that safety mechanisms, such as locking pins, are employed as intended by design. One reported prosecution was successful for breach of section 7(a), where significant injury was caused to a worker by the omission of the quick-hitch safety pin (HSE, 2003A).
The Management of Health and Safety at Work Regulations 1999

The Management of Health and Safety at Work Regulations 1999 emphasise proactive health and safety management. They work alongside HASWA by specifying in more depth what employers must do to manage health and safety in the workplace.

- **Regulation 3** requires employers (and the self employed) to formally assess the risks associated with their work, in order to identify workplace hazards and eliminate them through the application of risk controls. This applies equally to mechanical equipment and its use.

- **Regulation 5** places a duty on employers, as part of their health and safety arrangements, to ensure that employees are instructed in the principles of accident prevention. For example, this may be with regard to the consequences of fitting a quick-hitch incorrectly or failing to implement a quick-hitch locking or safety system.

- **Regulation 21** identifies that an employer cannot avoid criminal health and safety liability because of an act or default of an employee. However, a recent legal precedent suggests that an employer may be able to do so where the risk was unforeseeable and all reasonably practicable precautions had been taken (by the employer) to minimise risks\(^1\). The indication is therefore that employers need to ensure that their operators have been fully briefed and trained in all aspects of safe quick-hitch use, or they may be criminally liable for any accidents occurring from their acts or defaults in this respect.

The Provision and Use of Work Equipment Regulations 1998

All equipment provided for use in the workplace must be safe and meet the requirements of the Provision and Use of Work Equipment Regulations 1998 (PUWER). The regulations define work equipment as any machinery, appliance, apparatus or tool used at work, so this would include excavators, quick-hitches and their attachments.

- **Regulation 4** requires that work equipment is constructed or adapted so as to be suitable for the purpose for which it is used. It should be selected taking account of the working conditions that exist and any additional risk that might be posed by its use.

- **Regulation 5** requires that work equipment is maintained so that it works efficiently and safely.

Regulation 6 requires work equipment to be inspected at suitable intervals to ensure its safety and so that any defects found can be remedied in ‘good time’. This would include inspection of quick-hitches as part of plant pre-start or pre-shift checks. Any suspect quick-hitch or attachment should not be used and be immediately withdrawn and reported to the appropriate authority.

Regulations 8 and 9 place duties on employers to ensure that anyone who uses, supervises or manages work equipment has access to adequate information, instruction and training relating to the use of that equipment.

The Lifting Operations and Lifting Equipment Regulations 1998

Lifting equipment provided for use in the workplace is subject to the requirements of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) as well as PUWER (1998). According to LOLER, lifting equipment refers to: “…work equipment for lifting or lowering loads and includes its attachments used for anchoring, fixing or supporting it”. Where a quick-hitch has a dedicated lifting eye manufactured into it, it becomes an item of lifting equipment (it also forms part of the load) and LOLER will apply.

Regulation 4 states that lifting equipment should provide adequate strength and stability for the load, taking into account the stress induced at its mounting or fixing point. Every part of a load and anything attached to it (such as straps, chains, slings) must also be of adequate strength.

Regulation 6 requires that lifting equipment must be positioned or installed to minimise risks from either the equipment or load striking a person, or from the load drifting, falling or being released unintentionally.

Regulation 7 states that machinery and accessories for lifting loads must be clearly marked to show their safe working loads.

Regulation 9 requires lifting equipment to be thoroughly examined (at specified periods) to ensure its safety and so that any deterioration found can be remedied in ‘good time’. For equipment accessories, this examination must take place at least every six months and / or each time an ‘exceptional circumstance’ occurs (this is a circumstance that is liable to have jeopardised the safety of the lifting equipment). Inspections should also be carried out at suitable intervals between these examinations. Quick hitch inspections could be combined with the daily PUWER pre-start or pre-shift checks mentioned above, but note that ‘thorough examination’ is a much more formal inspection with very specific meaning under LOLER.
The Construction (Design and Management) Regulations 2007


The aim of the CDM regulations is to ensure that health and safety is a fundamental part of all construction work. They place legal duties on virtually everyone involved in that work, whether client, planner, designer, contractor or worker. The role of worker will include machine operators, for example when undertaking excavations for foundations or carrying out other earth moving activities on a construction project.

The regulations require that all workers:

- consider and check their own competence (more detailed discussion of competence follows in the guidance chapter later);
- co-operate with others on health and safety matters (for example, by complying with quick-hitch guidance that has been issued to them);
- co-ordinate their work with others so as to ensure the health and safety of construction workers and others who may be affected by the work; and
- report obvious risks (such as when a defect is noticed in a quick-hitch or where it is noticed that a quick-hitch is being used without the safety pin having been fitted).

Contractors are required (among other things) to:

- check the competence of all their workers; and
- provide all construction workers under their control with the training and information they need to do their job safely.

British Standard BS EN 474-1

This standard (BSI, 2006) describes common safety requirements for earth moving plant and equipment and this includes some reference to quick hitches (albeit limited in terms of safety principles) through the following definitions:

- an attachment is defined in clause 3.2 as: “a component or assembly of components, which can be mounted onto a base machine”; while
- an attachment bracket is defined in clause 3.3 as: “…device to facilitate quick interchange of attachments” (i.e. a quick-hitch).
The standard makes more detailed reference to the requirements of attachments and attachment brackets, by reference to an annex B.

With respect to attachments the standards state the following:

- It is the responsibility of the manufacturer of a machine, to define its range of appropriate attachments and their safe criteria for fitting and use.
- Attachments must be permanently marked with specified information, which includes its mass (Kg) and if relevant, its cubic capacity (M^3).
- It is the responsibility of the manufacturer of an attachment, to provide instructions concerning its mounting (connection) and use.

With respect to attachment brackets the standards state the following:

- Attachment brackets (quick-hitches) must have a locking system that:
  - keeps an attachment in a locked position by an engagement mechanism which remains locked under normal working conditions;
  - makes it possible to verify that the attachment bracket is locked either from the machine operator’s station or point of locking; and
  - shall not release the bracket by malfunction or release of engagement force.
- Attachment brackets with a hydraulically operated locking / unlocking system:
  - shall preferably have a separate control secured against inadvertent activation (particular requirements will pertain if activation is integrated into some other control functions); and
  - must include a continuous acoustic signal for the duration of activating the unlocking function.
- Certain information shall be given on the attachment bracket if this information is not permanently integrated into the machine.
- Mounting, locking and checking procedure information shall be provided by the attachment bracket manufacturer.

The remaining parts of BS EN 474 (parts 2 to 12 inclusive), relate to specific types of plant. For earth moving machinery, the most relevant of these will be BS EN 474-4 which relates to backhoe loaders (BSI, 1996A) and BS EN 474-5 which relates to excavators (BSI, 1996B).
The main risk arising from the use of a quick-hitch device is that the attachment, such as an excavating bucket, becomes disconnected from the quick-hitch and as a result works loose and falls from the machine.

Machine attachments such as breakers and large excavator buckets are very heavy (see Figure 6) and can therefore cause significant personal injury, or in the extreme death, if they become detached and fall upon anyone such as a ground worker. It has previously been reported that out of 16 incidents of workers being struck by a bucket in this way, in nine incidents, the resulting injuries were fatal (Berndtson, 2005).

Indeed, together with being struck by a moving machine or a swinging machine boom, being struck by disconnected quick-hitch attachments has been found the most common cause of excavator accidents and fatalities (NIOSH, 2003). Arguably, even these statistics under-represent the extent of the problem because many disconnections (near misses) will no doubt go unreported.

Figure 6  Some Excavator Attachments can be Very Large and Heavy Adding to the Risks Resulting from Inadvertent Detachment

(a) Typical heavy duty toothed excavator bucket  (b) Breaker (stand mounted for demonstration purposes)
There are other risks that can be encountered when working with quick-hitches. These are:

- manual handling risks, when attempting to move an attachment;
- cuts, abrasions and other injury to hands, for example when conducting maintenance or changing attachments, particularly when attempting to insert a pin using a hammer;
- injury to eyes, in the same instances; and
- injury to feet, limbs and so forth, through attachments falling on personnel in the work area when being connected or disconnected.

Due to the severity of the risk from an attachment disconnecting unintentionally, the remainder of this section will focus upon this type of accident, although the other risks mentioned are acknowledged and will be referred to in the next section.

### The Reasons that Accidents Happen

Jackson (2006) identified that the causes of quick-hitch accidents involving the unintentional release of the attachment can be summarised in terms of:

- an operator, due to carelessness or being in a hurry, failing to engage the quick-hitch properly;
- an operator failing to actuate any secondary locking device;
- primary or secondary locking mechanisms failing due to wear or poor maintenance;
- the quick-hitch and / or the attachment being overloaded;
- the quick-hitch and / or the attachment being run (used) to point of failure in an application they are not designed for; and
- any combination of these.

The principal reason for attachment disconnection results from the quick-hitch safety pin not being fitted (OSHA, 2005). Therefore, these kind of accidents tend to be associated with manual and semi-automatic variants of quick-hitches, which typically rely on this type of manual safety pin locking mechanism.

Fully-automatic quick-hitches, while not requiring a manual locking pin to be inserted, can still be prone to accidents involving unintentional disconnection. In such instances disconnection is generally (but not exclusively\(^2\)) due to a mechanical failure associated with the hitch (such as a loss of hydraulic pressure), rather than omission to apply a locking mechanism.

\(^2\)For example, one practitioner offering technical input during compilation of this guide, commented: “The first incident I investigated was a hydraulic system where a stone had become lodged in the socket and when the hydraulic ram was pushed home, it rode up and over the socket resulting in the quick-hitch falling off when the machine slewed”.
Consideration of some real life examples (company names, etc. omitted) confirm this type of accident (unintentional release of the attachment), or potential accident scenario:

“…the bucket fell from the machine…the employee suffered two broken legs…it is unlikely that he will be able to work again…investigation revealed that the safety pin had not been inserted in the quick-hitch and the warning buzzer on the quick-hitch was not working…” (HSE, 2003A).

“…notice served…relating to…use of quick-hitch [because] measures were not taken to prevent uncontrolled release of excavator attachment from [a] quick-hitch mechanism” (relating to HSE prohibition notice).

“…in a number of [accident] cases investigated…involving quick-hitch devices, it was found that the safety pin had not been inserted [into the quick-hitch] and [that therefore] the bucket became detached from the quick-hitch [resultantly] striking the worker” (HSA, 2007).

**Root Causes of Quick-hitch Accidents**

Although the reasons for accidents would at first appear obvious, there are a number of root causes that underpin these reasons. These include:

- inadequate, or lack of, operator training on the subject;
- inadequate supervision by supervisors and site management;
- poorly trained banksmen or ground workers; and
- a tendency for workers to encroach into an excavator’s operational envelope whilst it is working.

The issue of needing to insert a safety pin as a ‘final stage’ in the process of connecting a quick-hitch attachment, is perhaps perceived as a ‘burden’ by those working on site. The following comment was made by a respondent to a survey on construction accidents and seems to highlight this perception:

“[the] two-stage quick-hitch [currently] in use, could make use of a one-stage system instead which would ensure that all [the quick-hitch connection] work could be done by one person in [the machine] cab. This would remove the need for a second person [to help with connecting the quick-hitch] and the need to jump from the [machine] cab.” (BOMEL, 2003, p144).

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3Words in square brackets inserted by author.

4While beyond the remit of the present discussion, an operator should never jump from a cab because this can cause injury, especially back injury.
Notwithstanding that this excerpt also raises a separate issue of whether the quick-hitch connection process should be a one- or two-person activity (see guidance later), the aspect of safety pin insertion being a ‘burden’ is apparent. As Jackson (2006) reported, a machine operator “…is not going to get out of his cab on a cold frosty morning to look for a safety pin and insert it”\(^5\).

Such perception may be because of the time it consumes and the (real or perceived) pressure on workers to ‘get the job done’ as soon as possible (for example, Wong et. al. (2005) found that time constraints on construction workers were responsible for 1 in 10 accidents relating to falls from a height).

Alternatively, or in addition, it may simply be due to apathy or ignorance. Wong (op. cit.) found that these kind of reasons were the cause of almost one-third of construction fall accidents; while Saurin et. al. (2005) highlighted that approximately half of all accidents on construction sites they studied were due to human ‘violations’. More recent Health and Safety Executive research (HSE, 2003B) reported that 70 per cent of construction accidents in the UK were directly attributable to worker actions and capabilities – particularly, resulting from inadequate supervision, education and training.

Regardless of the reasons, addressing the failure of operators to fully implement quick-hitch safety systems and in particular the inserting of safety pins, would appear key to encouraging their safe use and reducing quick-hitch accident statistics.

With respect to supervisors and managers, there is a need for more formal qualification. Many construction and civil engineering degree qualifications provide only basic material on plant and equipment management, often focusing on equipment costs, purchasing and selection. Health and safety aspects, such as all-round awareness, operator training and safe machine operation are not generally covered.

\(^5\)The following chapter will confirm that adequate supervision might ensure that locking pins are correctly located. Regardless of the type of quick-hitch, a full check is required at time of attachment connection to ensure it is (safe and) secure. This might be performed by someone in the ground work gang, but OPERC advocate that the machine operator and no-one else accepts ultimate responsibility for the safe operation of all aspects of their work equipment.
In line with HSE direction for safe operation of other types of workplace transport – safe driver, safe vehicle, safe site (HSE, 2006) – specific guidance for safety relating to the use of quick-hitches on plant can be conveniently grouped under the following three headings (see figure 7):

- the ‘people’ aspect;
- the ‘mechanical’ aspect; and
- the ‘workplace’ aspect.

**Figure 7 The Three Aspects of Safe Quick-hitch Use**

**Guidance: The ‘People’ Aspect**

The impact of the ‘people’ aspect on the safe operation and use of quick-hitches is of the utmost importance. As highlighted throughout this guide, the majority of quick-hitch accidents (and one can reasonably infer therefore, near misses) can be related to ‘people’ actions or omissions, such as failure to activate locking devices or fit safety pins.

Workers must use quick-hitch equipment properly and in full compliance with all of its necessary design and health and safety considerations. This will be encouraged by appropriate worker training and education on safe working practices, along with accessibility to necessary information such as the relevant quick-hitch manufacturer’s maintenance and performance handbook.
Operator Training and Competence

Plant and equipment operators should be appropriately trained in all aspects of their equipment. They should not, under any circumstances, attempt to operate any equipment without valid qualification to do so, such as might be demonstrated by holding a certificate of competence recognised by the HSE or an accredited training body. Operator competence in this respect can be defined as:

“A standard at which an operator is certified [i.e. trained] to operate plant and / or equipment and has acquired sufficient job specific knowledge and experience of that specific item [including the use of safety features, attachments, machine controls and any other electrical or mechanical features], operating in that specific environment in order for the machine to be operated safely and efficiently”. (OPERC, 2002)

The training received by an operator to support a recognised certificate of plant operation competence should include, where appropriate, specific guidance on the safe use of quick hitches. There are some indications that this is currently not always the case. However, any training that does not consider the important aspects of this device and its safe operation could prove fatal. Suitable training should at least include the following:

- the risks associated with using quick-hitches and how they arise;
- the operator’s legal duties with respect to the use of quick-hitches;
- safe working practices for the use of quick-hitches;
- procedures for connecting and disconnecting attachments;
- when and how to conduct visual inspections of the quick-hitch equipment;
- how to maintain the quick-hitch equipment;
- appropriate methods for testing connections; and
- the importance of following manufacturers’ specifications for the use, inspection and maintenance of the quick-hitch.

Even after basic training, because of the variety of quick-hitch systems available, it may be necessary to provide the operator with additional ‘on-the-job’ training for the specific quick-hitch to be used. Further instruction and information may also be required by the operator if a different type of quick-hitch is to be used or one produced by a different manufacturer.

In developing appropriately trained operators, the role of plant and equipment instructors is pivotal. As OPERC’s Best Practice Guide for Plant Instructors states, all instructors must be: “…professionally qualified and occupationally competent in both plant and equipment theory and operation and [be able to] effectively and efficiently convey such knowledge to plant and equipment operators” (OPERC, 2003).
Operator training and competence may be progressed in line with the seven fundamental stages as described in OPERC’s *Voluntary Code of Practice for Operator Training* (OPERC, 2002), which begin with operator recruitment and progress through the various levels of training until a status of periodic evaluation is reached. Operator training on quick-hitch usage should be included as part of ‘basic training’ which is the third stage of this progression. The fifth stage of ‘conversion training’ is the appropriate time for further instruction when a different quick-hitch system or attachment is to be used. Figure 8 shows graphically how quick-hitch training can be accommodated into the OPERC operator training model.

The process of achieving operator competence should be managed over an adequate timescale and take account of operational experience on that machine. The requirements of ‘individual competence’ set out in the *Construction (Design and Management) Regulations* (2007) and their Approved Code of Practice, suggest that plant operator training is but one component of overall health and safety competence development, that starts with an unskilled worker and produces a competent one over a period of maybe 18 months, or two years (HSE, 2007).

**Figure 8** Incorporating Quick-hitch Education into the OPERC Operator Training Model

1. Operator recruitment
2. Induction training
3. Basic training
   - Theory and practice
4. Job training
   - Introduction to the work environment
5. Conversion training
   - For new equipment and responsibilities
6. Testing and record keeping
7. Periodic Evaluation
   - Evaluation successful?
      - Yes
      - No
      - Back to Stage 3.
Operator Responsibility
The machine operator should take ultimate responsibility for the safe use of the quick-hitch equipment. This responsibility extends to changing quick-hitch attachments and making sure that locking bars and pins are fitted after each change. While in practice it may be helpful for a banksman or ground worker to help the operator with changing an attachment, final responsibility for fitting the safety pin (or other safety mechanism) should rest with the operator and nobody else. If this is not the case, then there is always the risk that one person will assume that the other has fitted a safety device, when actually, neither of them have done so.

Safe Working Practices

All-round Awareness
All-round awareness is particularly important in the safe operation of plant and equipment, especially those machines with a large swing area such as 360° excavators. The term all-round awareness mainly refers to the level of awareness that plant operators have of their immediate work surroundings, and any objects, especially persons, within those surroundings. The more aware operators are of people nearby, then the less likely they are to bring their machine into contact with them. For example, the plant operator should not swing an attachment over other workers, such as slewing a bucket of gravel over ground workers to discharge it into a trench. Neither should they let people work or otherwise get within the safe operational envelope for that machine.

However, maintaining a safe distance between a machine (such as an excavator) and any persons working near to that machine, is a dual responsibility. Although the operator must be aware of people in the vicinity, other workers should also be aware of the machine and keep out of its working area. The overriding concern must be to prevent people from entering the safe operational envelope of the machine; if no-one is there than no-one can get injured. Comprehensive guidance on this subject is given in OPERC’s publication called Enhancing the All-round Awareness of Plant Operators (OPERC, 2004).

Safe Working Load
When using a machine fitted with a quick-hitch to assist lifting operations, only designated quick-hitch lifting eyes should be used for slinging or attaching a load. Safe working load (SWL) capacities should never be exceeded and machines fitted with safe load indicators will prove invaluable in this respect. Equipment, including accessories, must be marked with the safe working load.
Changing Attachments

Guidance on how to connect an attachment to a quick-hitch so that it is ‘mechanically’ safe to use is given later in this section. However, there are several associated hazards which the worker may be exposed to when changing an attachment and which therefore require some guidance.

When an attachment is being disconnected, care should be taken as to where and how it is placed. It should be:

- positioned to facilitate later reattachment – to avoid the need for the attachment to be moved around manually, which is particularly important in the case of heavier attachments that pose a significant manual handling risk;
- located on level ground - machine attachments should never be disconnected on sloping ground or near to excavations, because they might roll down the slope or fall into the excavation; and
- placed where plant has easy access to it – to avoid excessive travel and manoeuvring of the plant, which would increase the maintenance costs of tracked machines and the risk of accidents.

Workers should be aware that after disconnecting a bucket, it may rock or move, so feet should be kept clear and a safe distance maintained to avoid crushing injuries.

Hand tools, such as tommy-bars or ratchets, should always be used as instructed or as intended by design and the correct personal protective equipment worn. Alternative ‘make-do’ tools should never be used and tools should always be stored safely after use so that they can be readily found later. Quick-hitch locking pins and lynch pins should always be replaced in their original holes.

Guidance: The ‘Mechanical’ Aspect

‘Mechanical’ guidance relates mainly to ensuring the safety of the quick-hitch equipment itself. This should be considered at all times, whether this be during its selection, use, inspection or maintenance and it is essential that the manufacturer’s own specifications and instructions are followed.

Attachment Selection

With some dedicated or manufacturer-specific quick-hitch equipment it may be possible to connect attachments that were not intended to be used with, or that are not suitable for, that particular dedicated quick-hitch system. For example, the use of a heavy breaker attachment might not be permitted by the quick-hitch manufacturer. Care must therefore be taken to only use compatible quick-hitches and attachments or an unsafe connection may result.
Inspection, Maintenance and Replacement

All quick-hitch equipment should be routinely inspected, and periodically thoroughly examined, as per good operator practice and in accordance with relevant legislative requirements (e.g. PUWER 98, LOLER 98).

Damaged equipment should never be used and should be instantly taken out of service prior to being replaced or repaired as appropriate. Particular attention should be paid to the proper functioning of safety alarms such as those employed on fully-automatic quick-hitch systems.

Where a quick-hitch manufacturer has introduced retrofits to aid or improve safety then these should be obtained and installed. In some instances it may be preferable, especially in the case of older quick-hitch equipment, to replace the device with a more modern system if this can offer better inherent safety features.

Connecting an Attachment - Manual Quick-hitch

The exact procedure for connecting an attachment using a manual quick-hitch may vary slightly (to that described here) depending on the quick-hitch manufacturer. The manufacturer’s guidance must be strictly followed and take precedence to any ‘general’ advice given here.

The ‘general’ procedure to connect an attachment using a manual system is:

1. Remove the safety pin from the quick-hitch.
2. Position the quick-hitch over the attachment and gently manoeuvre the front fixed jaw of the quick-hitch so that it engages the front pivot pin on the attachment.
3. Use machine controls to ‘roll’ the quick-hitch onto the attachment so that the rear jaw of it engages with the rear pivot pin on the attachment.
4. Be sure that the latch hook has fully engaged (retained) the rear pivot pin. To achieve this, it may be necessary to apply a load on the attachment with the machine or it may be necessary to use a tommy-bar to lever the latch off so that the pivot pin can fully locate in the jaw.
5. **FIT THE SAFETY LOCKING DEVICE AS PER MANUFACTURER INSTRUCTION** (e.g. safety pin and lynch pin).

The series of photographs in figure 9 show the sequence for detaching a bucket using a manual quick-hitch (detachment is shown in order to demonstrate the tommy-bar in use, which is a requirement of detachment procedure on this particular system). Bucket attachment is a reverse procedure to that shown.
Figure 9  Sequence for Detaching a Bucket Using a Manual System

(a) Position the bucket such that the lynch pin and safety pin are accessible (on this model positioned at the rear of the quick-hitch)

(b) Remove the lynch pin and store it safely

(c) Remove the safety pin and store it safely

(d) Insert the tommy-bar

(e) Use the tommy-bar as a lever to free the rear pivot pin retaining mechanism…rear pivot pin is released from quick-hitch jaw

(f) Lower the bucket to the floor

(g) Raise the dipper arm to release the front pivot pin from the front quick-hitch jaw… (the bucket has rolled back in this instance due to its rounded exterior shape – keep feet a safe distance away!)
Connecting an Attachment - Fully-automatic Quick-hitch

The exact procedure for connecting an attachment using a fully-automatic quick-hitch may vary slightly (to that described here) depending on the quick-hitch manufacturer. The manufacturer’s guidance must be strictly followed and take precedence to any ‘general’ advice given here.

The ‘general’ procedure to connect an attachment using a fully-automatic quick-hitch system is:

1. If applicable, remove the safety pin from the quick-hitch.

2. Activate the switch to the ‘ON’ position.

3. Fully crowd the quick-hitch and pressurise the hydraulic system to open the locking mechanism.

4. Position the quick-hitch over the bucket and gently manoeuvre the front fixed jaw of the quick-hitch so that it engages the front pivot pin on the bucket.

5. Crowd the quick-hitch fully until the bucket is in position on the quick-hitch and the rear jaw has engaged (retained) the rear pin.

6. Return the switch to the ‘OFF’ position and pressurise the hydraulic system to lock the bucket in position.

7. FIT THE SAFETY LOCKING DEVICE AS PER MANUFACTURER INSTRUCTION (e.g. safety pin and lynch pin).

The stages involved when connecting a J. B. ‘Multi-coupler’ fully-automatic quick-hitch system are broadly demonstrated in Figure 10. Bucket removal is a reverse procedure to that shown.

Follow Manufacturer Recommendations!

Regardless of any ‘general’ guidance, the fundamental rule for the safe use of a quick-hitch is to follow all stages of the manufacturer’s recommendations for its use. While each manufacturer might have their own safety procedure or checklist, the underlying intent must be to confirm that a secure locking mechanism has been engaged prior to deploying any attachment (Berndtson, 2005).

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6 J. B. Multi-coupler, sole distributor for UK and Eire is CJM Engineering, see: www.cjmengineering.co.uk.
Guidance: The ‘Workplace’ Aspect

Every workplace is different and so can present its own range of hazards. Accordingly, these should be recognised and controlled appropriately, based upon a suitable and sufficient risk assessment. However, with regard to the use of quick-hitches, some general ‘workplace’ guidance can be given.

Site Induction and Training
A safe workplace is one that encourages a good health and safety culture; a culture that embraces everyone and expects everyone to comply with it. This can begin on site with well designed induction talks that reinforce messages such as those to do with safe quick-hitch operation and the dangers associated with entering the machine’s safe operational envelope.

Ongoing reiteration of the safety information delivered at induction can be achieved at training sessions or tool-box talks. This can be further reinforced through the circulation of DVDs, information bulletins and instruction sheets. OPERC also encourages distribution of this publication (Guidance on the Safe Use of Excavator Quick-hitch Devices) to all plant or site managers and supervisors.

Figure 10  Sequence for Attaching a Bucket Using the J.B. ‘Multi-coupler’ Fully-automatic Quick-hitch System

(a) Front quick-hitch jaw engages with front pivot pin on bucket

(b) Hydraulic ram in quick-hitch (shown yellow) is sent fully back to set auto-lock (shown red) onto front pivot pin

(c) Quick-hitch is moved in to engage with rear pivot pin.

(d) Hydraulic ram is sent forward to retain rear pivot pin – note that auto-lock remains on front pivot pin

(e) Bucket is safely lifted

Source with permission: C.J.M. Engineering Ltd. (see list of quick-hitch manufacturers)
Site Layout and Design
The strategic placing of information about the workplace can also help reiterate key safety messages to workers. This could include:

- Warning signage – such as identification of dedicated safe machine maintenance areas or warnings to remind workers not to encroach on a machine’s safe operational envelope.

- Poster campaigns – for example, highlighting the importance of installing quick-hitch safety pins or providing bullet-point guidance on connection of attachments.

- Labelling of plant and equipment – such as placing hazard warning stickers and simple attachment instructions in all operator cabs and ensuring that equipment, including accessories, is marked with the safe working load.

Other good practice for safety associated with workplace machinery and transport includes: dedicated traffic and construction plant routes; dedicated parking, loading and maintenance areas; suitable and level travel surfaces particularly when parking and servicing the machine; appropriate security for visitors to prevent untrained members of the public from becoming injured; appropriate site lighting to assist with maintenance during winter months or out of hours.

Supply Chain Management
Contractors should engender good working partnerships with their supply chain such as with quick-hitch and attachment manufacturers. This can encourage specialised training and education that is supported by quick-hitch suppliers who can help demonstrate appropriate and safe use of their equipment to workers. Contractors should consider requesting such ongoing after sales support as part of their quick-hitch and attachments procurement strategy.
The quick-hitch device allows the efficient connection and disconnection of machine attachments, such as buckets, to plant items, particularly excavators. Quick-hitches are mainly used because they can vastly reduce the time it takes to change an attachment, a benefit which increases in value the more changes there are in a working day.

There are two main types of quick-hitch system - the dedicated system and the pin system. In the dedicated system only attachments that are compatible with a specific quick-hitch device can be used. This is not the case with the pin system, which uses the pins found on a ‘standard’ type bucket and is, as a result, the more versatile and commonly used of the two systems.

The pin system quick-hitch can be a manual, semi-automatic or fully-automatic system, depending on how it makes a connection, i.e. how it engages and retains the attachment and how it then employs the safety device to lock it. Manual types retain an attachment with a manually operated latch, whereas semi- and fully-automatic types retain it with a hydraulically operated latch.

Both manual and semi-automatic types require a safety pin to be fitted manually as added security, whereas the safety device for the fully-automatic type is operated hydraulically. The main advantage of the fully-automatic system is, that in contrast to the former two types, it can normally be operated entirely from within the machine cab.

There are many items of legislation appropriate to the use of quick-hitches, most of which stress the importance of providing workers with sufficient information, instruction and training to carry out their job safely.

The *Health and Safety at Work etc. Act (1974)* states that employers must provide safe systems of work, but also that employees must take reasonable care for the health and safety of themselves and any other person affected by their acts or omissions at work. The *Management of Health and Safety at Work Regulations (1999)* require employers to assess the risks associated with their work in order to control or eliminate any hazards identified. They also require employers to give clear general guidance to employees on accident prevention.
The **Provision and Use of Work Equipment Regulations (1998)** require that work equipment is suitable for the purpose for which it is intended, maintained in an efficient state and inspected at suitable time intervals. The **Lifting Operations and Lifting Equipment Regulations (1998)** require that lifting equipment is of adequate strength and thoroughly examined at predetermined intervals to ensure its safety.

The **Construction (Design and Management) Regulations (2007)** require workers to consider their own competence, co-operate with others in health and safety matters and report obvious health and safety risks. There is also a **British Standard BS EN 474-1 (2006)** relating to quick-hitches, which sets standards for their manufacture, including their safety features.

The main risk encountered when using a quick-hitch is that the attachment can become disconnected and fall, causing injury to a person. This type of accident has been one of the most common causes of excavator accidents and fatalities over recent years. Other risks include injuries to eyes, hands, feet, limbs or back from manual handling of the attachment whilst changing attachments or conducting maintenance.

Accidents involving the unintentional release of attachments may be caused through failure to fit the safety pin (due, for example, to operator ignorance or carelessness), failure of the quick-hitch locking mechanisms (due, for example, to wear or poor maintenance) and incorrect use of the quick-hitch (for example, overloading it or using it in a way not intended by design).

The most common cause of quick-hitch accidents is that the safety pin has not been fitted on a manual or semi-automatic system where fitting it is a manual task. This may be because workers consider fitting the pin to be a ‘burden’ or that they rush to complete jobs more quickly, or even that they are unaware of the need to fit the pin. Whatever the reason, the underlying root cause would appear to be inadequate or insufficient training and education on the safe use of quick hitches. If the human failure to operate safety systems such as pins could be addressed, then this would probably represent the most effective way of reducing disconnection accidents.

General guidance on the safe use of quick hitches can be grouped in terms of the ‘people’, ‘mechanical’, and ‘workplace’ aspects of quick-hitch use, but the fundamental rule must always be to follow the manufacturer’s guidelines and recommendations for safe use and maintenance.
The ‘people’ aspect requires that operators are appropriately trained and competent in all aspects of their equipment. Ideally they should be certified as such having undertaken formal training, which should include the associated risks of quick-hitch use, safe working practices, legal duties, maintenance, inspections and so forth. Additionally, where ‘basic’ training has been undertaken, further training and/or information may still be required if a different quick-hitch system is to be used or one manufactured by a different company.

The machine operator should take full responsibility for the safe use of the quick-hitch and not rely on others, such as a ground worker, to fit the safety device. They also need to follow safe working practices, such as maintaining a clear operational envelope around the machine (all-round awareness), not exceeding the machine’s safe working load and following correct procedures when changing attachments, such as taking care of where and how the attachment is positioned for later reattachment.

The ‘mechanical’ aspect of quick-hitch guidance requires that dedicated quick-hitches are only used with compatible attachments. All quick-hitch equipment and their associated attachments should be routinely inspected, and thoroughly examined, as per legislative requirements, such as PUWER and LOLER. Damaged equipment should be instantly taken out of use and repaired or replaced and preferably, modern equipment should be used with good inherent safety features.

Guidance on the ‘workplace’ aspect of quick-hitches includes encouraging a good health and safety culture on site that reaches and embraces everyone. The message of safe quick-hitch use can be delivered in various ways, for example at site induction, training sessions and tool-box talks, and using information bulletins and instruction sheets. Contractors might also work more closely with quick hitch manufacturers and suppliers, for example, in delivering specialist safety training on site.

The effective layout and design of the workplace is also important, such as the strategic placing of information to help reinforce safety messages. This could include warning signs (for example, to remind workers not to intrude into a machine’s safe operational space), poster campaigns (to emphasise the importance of quick-hitch safety) and effective labelling (such as placing hazard warning stickers and attachment instructions in operator cabs). More general workplace transport health and safety also applies to the use of quick-hitches and excavators, including dedicated maintenance areas, dedicated and safe parking areas, segregation of plant from workers and stated site speed limits.
References


Quick-hitch Manufacturers

The following is presented in alphabetical order and is for information only. It does not purport to be an exhaustive listing. Note that OPERC does not endorse or specifically recommend any products or services.

**C & D Equipment (USA)**

‘Allu OilQuick Coupler’. Dedicated quick-hitch system. 5351 NW 44th Avenue, Mark III Complex, Ocala, Florida 34482.
Website: http://www.aggregatepros.com/index.html

**C & P Attachments (USA)**

Couplers and excavator attachments. 8822 Apison Pike, Ooltewah, Tennessee 37363.
Website: http://www.cpattachments.com/index.asp

**C.J.M. Engineering Ltd. (UK)**

Sole UK / Eire distributor for the J.B. ‘Multi-coupler’. Unit 16, Derryloran Industrial Estate, Sandholes Road, Cookstown, Co. Tyrone, BT80 9LU.
Website: www.cjmengineering.co.uk

**CWS Industries (Mfg) Corp. (Canada)**

Website: http://www.cwsindustries.com/index.htm

**Fleco Attachments (USA)**

Hydraulic couplers. 10290 Stringfellow Road, St. James City, Florida 33956.
Website: http://www.fleco.net/Index.cfm

**Geith International Ltd. (UK)**

Website: http://www.geith.com/Default.asp
Hill Engineering Ltd. (Northern Ireland)

‘Auto-loc’ and ‘Quick Coupler’ systems. Unit 6, Carnbane Business Park, Newry, Co. Down, BT35 6QH
Website: http://www.hillengineeringltd.com/index.html

International Marketers (London) Ltd (UK)

Distributor of semi-automatic and fully-automatic quick hitch systems. The Workshops, Lower Norton Farm, Sutton Scotney, Winchester, Hampshire, SO21 3NE.
Website: http://www.inmalo.co.uk/index.html

J. B. Sales International Ltd. (New Zealand)

Hydraulically operated ‘autolock’ quick-hitch system. 22 Stonedon Drive, East Tamaki, Auckland, New Zealand.
Website: http://www.jbsales.co.nz/

JRB Attachments (USA)

‘Rotoloc’ reversible coupler. 820 Glaser Parkway, Akron, Ohio 44306.
Website: http://www.jrbattachments.com/rotoloc.asp

Kenco (USA)

Wedgebolt Coupler (mechanical and hydraulic). 170 State Route 271, Ligonier, Philadelphia 15658.
Website: http://www.kenco.com/index.html

Lemac Corp. (USA)

Hydraulic and manual system. Lemac Corp. 22909A Airpark Drive, Petersburg, Virginia 23803
Website: http://www.lemaceng.com/

Miller UK Ltd. (UK)

Mechanical and hydraulic couplers. Bassington Lane, Bassington Industrial Estate, Cramlington, Northumberland, NE23 8AD.
Website: http://www.millerdirect.com/index.html
The Bucket Manufacturing Co. Ltd. (UK)
Hydraulic and manual ‘Klac System’ quick-hitches. Unit 6, Bulwark Industrial Estate Chepstow, Gwent NP16 5QZ.
Website: http://www.bmc-buckets.co.uk/default.htm

Wedgelock Global Attachments (New Zealand, USA, UK)
Hydraulic and mechanical couplers. Harford Manufacturing Ltd., The Old Coachworks, Burton Road, Norwich, NR6 6AX.
Website: http://www.wedgelock.com/index.cfm

Werk-Brau Co., Inc (USA)
Mechanical and hydraulic Z-Loc quick-couplers. 2800 Fostoria Avenue, Findlay, Ohio.
Website: http://www.werkbrau.com/