

Excavator 360

Note: It is recommended that you read the Supporting Information page before you read this factsheet.

Preparation for work *(Preparation)*

- The excavator 360 is commonly used across a variety of sectors, including construction, demolition, piling and extractives and is available in a wide variety of sizes. The majority of excavators carry out work using a bucket, but numerous attachments are available that widen the scope of this machine, such as grabs, breakers and shears. 360 excavators are either tracked or wheeled and this factsheet covers both types.
- Daily and periodic checks form part of the operator's duties, for which they need to follow manufacturer's instructions. Where any defect is noticed by the operator, they need to report it immediately and before the machine is used, and seek the appropriate expertise who can decide whether the machine can be put to work.
- An operator could incorrectly diagnose what they consider to be a minor fault, such as a small leak from the latch cylinder in a quick-hitch coupler, where in fact it could be severe possibly leading to the injury as the machine's performance may significantly deteriorate or a component fail. For example, an oil leak in the quick-hitch coupler could cause a loss of pressure and release the attachment.
- As 360 excavators use a wide variety of tools and attachments, it is now common through ease-of-use to use a quick hitch coupler to connect an attachment to the machine's dipper arm. However, buckets and other attachments have been known to detach unintentionally during work, causing injuries and death.
- On semi-automatic types, a locking pin is used to prevent the latch or lock from opening and this needs to be inserted into the correct hole. Investigations into attachments that have become detached have shown that the locking pin was missing or inserted into the incorrect hole.
- The suitability of a working tool must be checked before it is attached to the machine using a quick-hitch coupler. Some tools, such as hydraulic breakers, - may not be recommended by some quick-hitch manufacturers, as vibration can cause rapid wear on the coupler's components, increasing the risk of failure.
- On fully automatic quick hitch couplers, it is vital that the operator, immediately after coupling the attachment, ensures that full hydraulic pressure is applied to the coupler's locking system.
- For all types, the operator must further exit the cab and check both visually and physically to ensure that all locking pins are inserted correctly and are retained and secure, or that latches are fully engaged and locked.
- If a tool that requires pressurised oil has been used, care must be taken when removing the tool, particularly when disconnecting the oil feed and return lines. High pressure oil may be within the hydraulic lines and must be exhausted or relieved and the engine stopped before the lines are disconnected.
- Manufacturers guidance as to depressurising the relevant part of the hydraulic system must be followed as unscrewing a coupler to release any oil pressure must not be undertaken as an injury can occur through the ejection of high pressure oil. Protective gloves should be worn as the oil and couplers could be very hot, and burn unprotected skin.
- On machines where a bucket or attachment is directly coupled to the machine's dipper arm, changing an attachment means that the holes of both the attachment and the dipper need to be aligned to allow the pins to be inserted, requiring a level of skill from the operator.
- It is common to use an assistant to guide the operator in aligning the holes. The operator remains responsible for the operation and must not allow the assistant, as has occurred, to insert their fingers into the pin holes to check alignment. Any small movement of the dipper or attachment can cause an injury.

Working efficiently

- 360 excavators are used by a wide number of plant hire companies and contractors, with fuel costs now forming a major part of production overheads. The operator can minimise the fuel they used by working the machine efficiently without the need to use maximum engine speed. In nearly all cases, manufacturers indicate in both the operator's manual and on the machine's rev counter the optimum engine speed or range that will ensure the engine, transmission and hydraulic systems to run efficiently.
- The majority of 360 excavators are now fitted with selectable working modes that optimise the engine speed and hydraulic settings for different types of work, such as grading or heavy excavation. Operators should familiarise themselves with each setting and select the one that ensures the machine is working most efficiently for that operation. This reduces the fuel used, aids production and makes the machine easier to operate as there is generally better control of the hydraulics.
- Due to the reliability of modern machines, the operator should switch off the excavator's engine when they leave the cab, even for a short break, to further reduce the consumption of fuel.

Lifting and using attachments *(Working tasks)*

- 360 excavators are commonly used to lift a suspended or slung load, for which certain precautions need to be taken. Before a load is to be lifted, the lifting operation needs to be properly planned and the operator or other relevant person needs to ensure that the machine is approved and equipped to lift a suspended load.
- The manufacturer's lifting capacities chart or data must be read in order to determine the maximum load that can be lifted at a particular reach and height. The reach is usually the horizontal distance from the centre of the slew ring to the vertical centre line of the lifting hook.
- However, if the manufacturer's data is not known, guidance states that the excavator must not be used for lifting duties.
- The majority of lifting charts for 360 excavators also show the weight that can be lifted, both over the front and rear of the machine, and over the side. Due to the narrower chassis (tracked or wheeled) the lifting capacity is, in most situations, reduced. On wheeled machines, the lifting charts indicate lifting capacities in variety of situations when stabilisers are fitted.
- Boom lowering control devices, commonly known as check valves, prevent the boom from lowering in case of hydraulic failure, such as a burst hose, and these need to be fitted along with an overload warning device on excavators where the maximum lifting capacity exceeds 1 tonne.
- According to regulations, all lifts have to be properly planned by a trained and experienced person and should take into account all factors in order to minimise a risk of an overturn or failure.
- When a lift is being planned, the weight of the lifting accessory (gear), such as the lifting chains, needs to be added to the weight of the load and including any packing.
- If the bucket is to remain attached to the machine, the lifting capacity needs to be reduced to take into account the weight of the bucket and the quick-hitch coupler, if fitted.
- When a lifting accessory, such as a two-legged chain, is attached to the hook mounted on a quick-hitch coupler, the operator needs to tilt the coupler (by extending the bucket ram) sufficiently to ensure that the chains hangs freely and does not foul any part of the coupler.
- Before any attachments are fitted or used, their intended use, their weight and the required working radius needs to be known. Although the machine may be able to use an attachment at minimum radius, its overall weight may mean it can become unstable if it is used beyond the intended working reach, meaning the reach of the machine is restricted.
- The operator must have had sufficient training on the attachment and be aware of any issues that can cause stability or damage to the machine.

- For example, sudden and harsh use of the controls can, if using a suspended clamshell bucket, cause the bucket to swing excessively and both strike part of the machine and also create instability, particularly when loaded.

Working safely and with other *(Working safely)*

- When the operator needs to leave the cab, even if it just to check something externally, it is good practice and important that they switch off the engine and lower all equipment to ground level, even if it just to check something externally.
- It has been known for operators when leaving cab to keep the safety bar in the active position, and have inadvertently moved an operating lever which has caused unintentional machine movement.
- Accidents have also happened when the operator has chosen to operate a lever from outside the cab, for example to change a bucket, leading to unintentional movement and injury.
- After entering the cab but before starting the engine, the operator must check that any clothing is not caught on the operating levers, as assistants or those within the operating radius have been injured as the machine starts to slew unintentionally when the engine was started.
- Assistants or banksman are commonly used to assist in excavating and lifting operations. The hazardous area for any 360 excavator whilst working is within the operating radius over 360 degrees.
- The operator must ensure that all assistants and others must be clear of the working area and be in a safe place when work is being carried out. For example, when loading a machine such as dump truck or forward tipping dumper, the excavator operator should never load the machine unless the driver is in a safe place.
- In the case of a dump truck, the driver can stay inside a protective cab, but in the case of a forward tipping dumper, the operator must leave the driving seat and stand in a safe place so that they cannot be struck by the excavator's bucket or by any overspill from the bucket.
- If the excavator is working within a restricted or enclosed area, the operator must take into account both the working radius (reach and slew) and height of the boom, particularly where operations are close to pedestrians or moving vehicles, when appropriate methods to prevent contact must be taken.
- If a signaller/banksman or any other person enters the boom's working area, the operator must immediately stop all hydraulic movements until the area is clear. Workers and others have been trapped between the boom components and a structure.

Stability

- Although 360 excavators are designed to be stable, operators need to be aware of the safe parameters as the machine can become unstable if they are exceeded.
- Although the majority of machines can travel with a suspended or slung load providing certain requirements are followed, travelling on uneven ground with a suspended load can cause the load to swing, making the machine less stable.
- If slewing a suspended load too fast, particularly if operating near to maximum radius, the momentum of the load can cause the load to overshoot its intended placing point, and has been known to strike structures or other machines.
- When travelling the machine up and down slopes, in principle the majority of the excavator's weight should be kept up hill.
- Travelling up an incline normally means extending the dipper and keeping the bucket close to the ground. If the boom and dipper are fully crowded back, the weight bias is towards the rear of the machine, and this has caused excavators to roll backwards.
- In most cases, best/good practice suggests that the lifting of loads on slopes is not recommended as this cause instability. If the excavator does lift a load whilst on a slope, or is travelling down a steep slope with a suspended load, the potential increase in radius means the machine is less stable and could overturn.

Sample questions

The following questions are based on the text within this factsheet and indicate how the questions and answers are structured. Based on the factsheet, there is only one correct answer. The correct answer to each question is indicated at the end of this factsheet.

Q1. When an attachment has been fitted using an automatic quick-hitch coupler, what must be checked immediately after coupling up the attachment



Ensure that hydraulic pressure is released from the coupler locking system



Ensure that full hydraulic pressure is applied to the coupler locking system



Visibly check that the latch is at an 90 degree angle to the coupler



Ensure the attachment is within the working capacity of the machine

Q2. Why is an excavator travelling forward with a suspended load down a steep slope hazardous?



Extra strain is placed on the track motors causing possible failure



The radius of the load increases affecting stability



The operator can lose sight of the load



The additional weight can cause the upper structure to slew round and create instability

Study checklist

This checklist aims to act as a study aid to ensure that the reader has identified and understood the relevant parts of this factsheet.

Do you know?

1. The actions to take if a defect on the machine is found.
2. Why operators should not ignore any faults found.
3. The precautions to take when fitting an attachment using a quick-hitch coupler.
4. Why and how the operator should thoroughly check that a quick-hitch coupler is correctly fitted.
5. Why some attachments are not suitable for quick-hitch couplers.
6. The precautions to take when disconnecting or connecting high-pressure oil lines.
7. Why a machine's fuel consumption is becoming important.
8. What procedures must be taken when lifting suspended loads with the excavator.
9. Why the understanding of the manufacturer's lift capacity charts is important.
10. What needs to be taken into account when planning to lift a load.
11. What to consider when selecting an attachment.
12. The precautions to be taken before the operator leaves the cab of the machine.
13. Why operating levers should not be operated from outside the cab.
14. The precautions to be taken when working with and near to others.
15. What to take into account when loading vehicles.
16. The precautions to be taken when working in confined or restricted areas.
17. The effects that uneven ground can have when the machine is being travelled.
18. How travelling and working on inclines can cause machine instability.

Answers to sample questions: Q1: B and Q2: B