engcon®

User manual

TILTROTATOR

EC204 | EC206 | EC209 | EC214 | EC219 | EC226 | EC233

Language

Country

Article 9000113 | Version 1.25 | 2024-03-18

Original Instructions

Preface

Dear Customer,
Thank you for choosing a product from engcon.

engcon is the market leader in tiltrotators and tools for excavators. We represent innovation, knowledge and experience, and we develop our products with a focus on the customer's needs. Please visit our website for contact information and details about the rest of our product range.

www.engcon.com

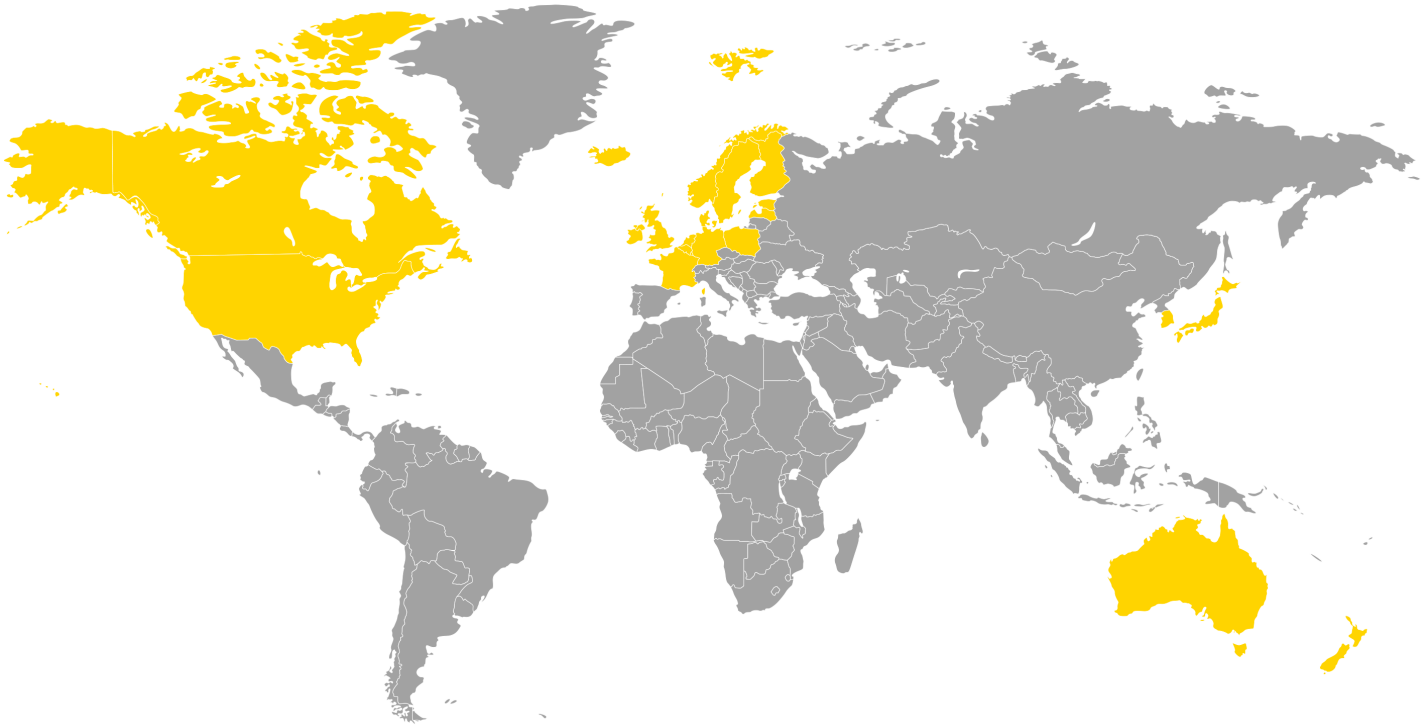


Table of Contents

1. Introduction

1.1. General

This user manual contain important information about your product's functions and characteristics, and how to use it in the best way. Before you begin using the product, it is important that you read and understand the content of these instructions, especially the sections that address safety.

In addition to these instructions, you must study and understand the applicable safety information for the relevant base machine as well as any other equipment involved.

The user manual is supplied with supplementary documentation providing more detailed descriptions of the installation, fitting, operation and maintenance of control systems and custom modifications for your specific product.

Information, images, illustrations and specifications used in the instructions are based on product information that was available at the time of going to press. Images and illustrations used in the instructions are typical examples and not intended to be exact depictions of various part of the product. We reserve the right to make changes without prior notice.

Always store the user manual together with any other supplementary information in a safe manner and such that it is always available.

1.2. Scrapping and recycling

engcon makes constant efforts to reduce its environmental impact. engcon's products comprise at least 99 per cent recyclable material. All assembly and service work must take place in compliance with legislation and ordinances governing the environment, health and occupational safety. This refers to all work with residual materials including handling, storage and processing. To prevent contamination of soil and water, spillages must be avoided. Should a spillage occur, it must be dealt with.

Hazardous waste may only be disposed of by those authorized to do so. All waste produced must be disposed of in compliance with applicable legislation and ordinances:

- Metal and plastics to be recycled.
- Hydraulic hoses are normally used for energy recovery (sort as hazardous waste).
- Oils and greases are normally used for energy recovery (sort as hazardous waste).
- Electronic components to be recycled for materials (sort as hazardous waste).
- Packaging to be sorted at source and recycled for materials.
- Paper to be sorted at source and recycled for materials.

If in doubt, contact the environmental manager at engcon.

1.3. Transport and storage

There are no lifting or attachment points on the tiltrotator. The tiltrotator may only be handled, moved or transported while strapped to a pallet.

In case of prolonged storage, a cylinder’s piston rod should be treated with corrosion protection or nested in the cylinder.

1.3.1. Temperature during operation and storage

Description	Temperature
Operating temperature	-22° to +122°F

Description	Temperature
Temperature range during storage	-22° to +122°F

1.4. Warranty

All customers receive a 2-year warranty on their tiltrotator.

We encourage you to register your tiltrotator to enjoy faster service. Visit www.engcon.com and search for "register your product".

1.5. Technical support and spare parts

Contact information for support and spare parts can be found at www.engcon.com.

1.6. Product approval

1.6.1. EU Declaration of Conformity

Manufacturer: engcon Nordic AB
Address: Box 111, SE 833 22 Strömsund, SWEDEN
Telephone: + 46 670 178 00
Email: info@engcon.se

engcon hereby declares that the below is manufactured in conformance with Machinery Directive 2006/42/EU.

Type designation:	
Part no:	Serial No:
Max jacking point:	Max hydraulic pressure:
Date:	Other:

Because the following standards and regulatory directives are also applied, the product complies with the requirements for CE marking.

- EMC Directive 2014/30/EU
- SS-EN ISO 12100:2010, SS-EN 474-1:2006+A5:2018 and SS-EN 474-5:2006+A3:2013, SS-ISO 13031:2016
- ISO 10567:2007, SAE J2506:2012, SAE J1362:2018

This declaration and engcon's warranties will cease to be valid immediately if spare parts other than engcon original spare parts are used, or if any changes or other interventions are made without engcon's permission.

Krister Blomgren - Signatory for engcon Nordic AB

Qualified person authorized to compile the technical documentation:

Fredrik Jonsson, Head of R&D, engcon AB

2. Safety

2.1. General

It is important that you read and understand all warnings prior to installation work on this product or before you use it and any accessories supplied. The warning texts highlight potential risks and describe how to avoid them. The following warning levels are used in this user manual:

DANGER
Indicates that an accident will occur if the regulation is not followed.
Risk of personal injury or death.

WARNING
Indicates that an accident may occur if the regulation is not followed.
Risk of personal injury or death.

CAUTION
Indicates that an accident may occur if the regulation is not followed.
Risk of personal injury.

IMPORTANT
Indicates that an accident may occur if the regulation is not followed. Risk of damage to property, process or the surroundings.

REMARKS
Specifies additional information that may make performance or understanding of specific operations easier.

3. Design and function

3.1. General

The engcon tiltrotator adds flexibility and efficiency to an excavator and allows it to be used for more operations. The product provides the ability to both tilt and rotate a tool.

3.2. Tools

engcon's tiltrotators are designed to be used with engcon's hydraulic tools and tools that are type-approved in the base machine's operator's manual.

DANGER
Do not exceed tipping load limits. The weight of the product and the increased reach may impair stability. Risk of personal injury and damage to property.

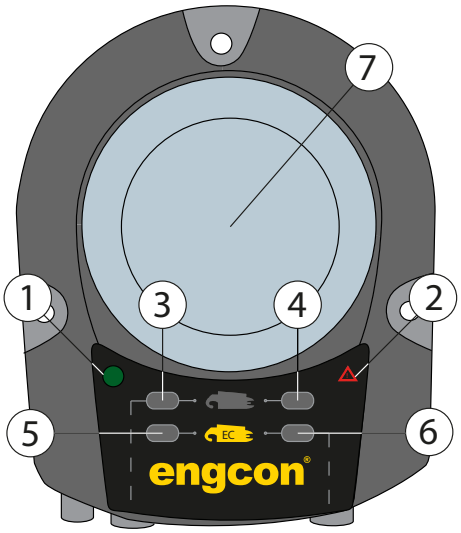
3.3. Q-Safe

Q-Safe is a warning system that monitors the connection of tools to the machine quick coupler and/or the quick coupler beneath the tiltrotator. It uses a double mechanical lock to prevent the tool coming loose from the coupler, even if some part of the locking system should fail. The alarm outputs are connected to a QLM module mounted on the stick. It uses sound and light warning signals when a tool is incorrectly connected, as the primary safety purpose of the quick coupler is to protect personnel nearby. The operator must inform personnel concerned what the alarms mean.

WARNING
Stop work immediately and begin troubleshooting if the system warns of a faulty tool connection during operation. Risk of personal injury and damage to property.

CAUTION
Use hearing protection when close to or handling the Q-Safe quick coupler when it is connected. Risk of hearing damage.

3.3.1. Overview



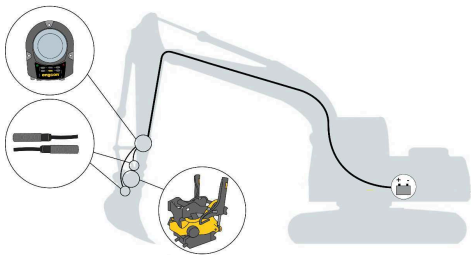


Figure 1.

Position	Description
1	Power supply
2	Alarm indication
3	Sensor, machine coupler hook
4	Sensor, machine coupler ejector
5	Sensor, quick coupler hook
6	Sensor, quick coupler ejector
7	Warning lamp

Table 1.
For indications, see section 7.1.1. Indications.

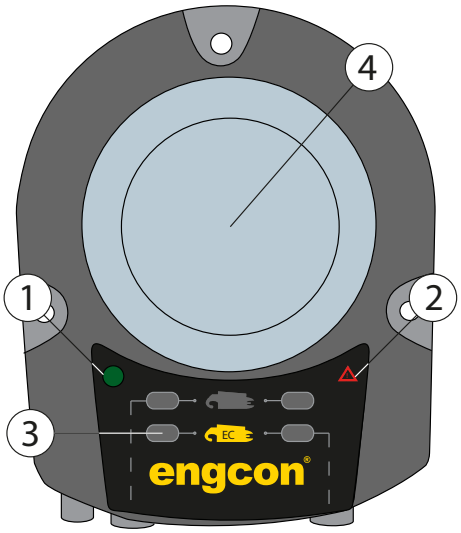
3.4. HS and SW quick coupler with sensor

The HS and SW quick coupler with sensor monitors whether or not the quick coupler is in the open position. The alarm output is connected to a QLM module mounted on the stick. It uses sound and light warning signals when the tool's locking cylinder is open, as the primary safety purpose of the quick coupler is to protect personnel nearby. The operator must inform personnel concerned what the alarms mean.

WARNING
Stop work immediately and begin troubleshooting if the system warns of a faulty tool connection during operation. Risk of personal injury and damage to property.

CAUTION
Use hearing protection when close to or handling the Q-Safe quick coupler when it is connected. Risk of hearing damage.

3.4.1. Overview



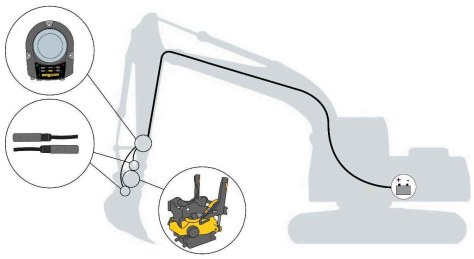


Figure 2.

Position	Description
1	Power supply
2	Alarm indication
3	Indication for open quick coupler
4	Warning lamp

Table 2.
For indications, see section 7.2.1. Indications

3.5. EC-Oil

engcon's system for more efficient tool changes. It provides the ability to switch hydraulic tools without leaving the cab. The system is designed for maximum reliability in harsh environments. It is a fully hydraulic system that handles the connection of tools under full system pressure.

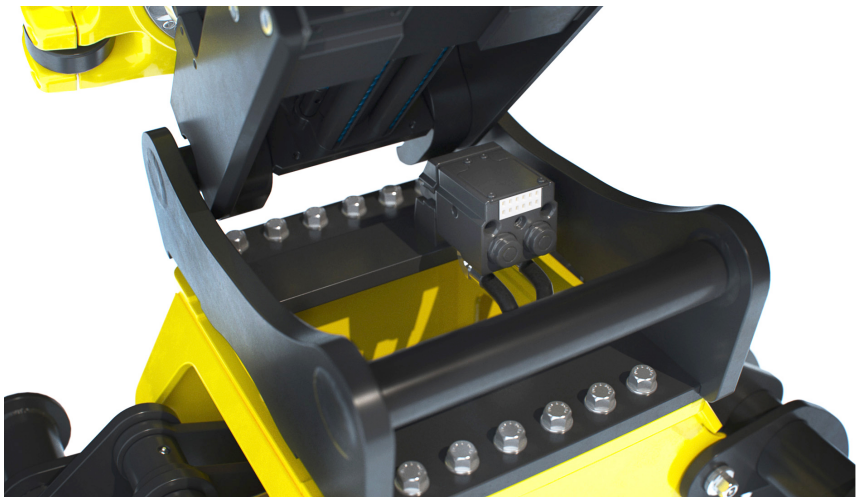


Figure 3.

3.6. ePS/C2C

Together with the tiltrotator, engcon's ePS rotation sensor creates an ePS-compatible excavator guidance system – a concept that provides the selected system with more functions. It provides full control of the bucket and the ability to see its exact rotational position. C2C acts as a connection point between two different systems.

3.6.1. Overview

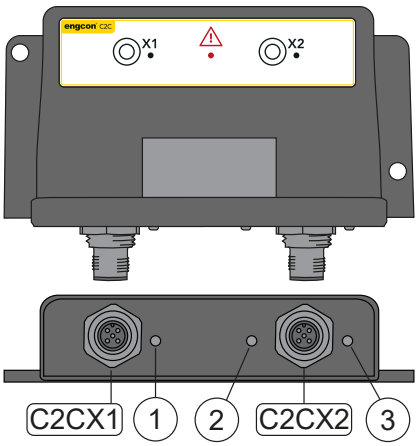


Figure 4.

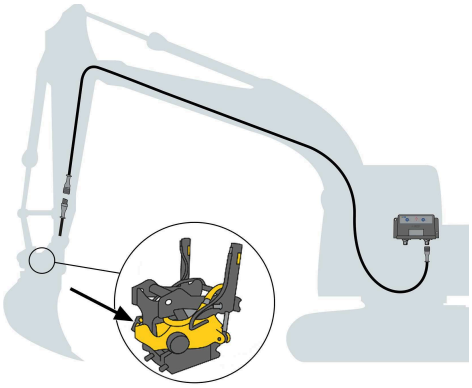


Figure 5.

Position	Description	Remarks
CMX1	CAN Excavator guidance system	
CMX2	CAN Rotation sensor	
1	Traffic indication, Excavator guidance system	Green LED
2	Status C2C (Alarm indication)	Red LED
3	Traffic indication, Rotation sensor	Green LED

Table 3.
For indications, see sections 7.3.1. Indications.

4. Installation

It is important to check the necessary additional documentation before installation. At time of delivery, your product and supplementary documentation are as far as possible adapted to your base machine.

WARNING
Never attempt to increase the maximum capacity of the equipment by modifications not approved by the supplier. Risk of personal injury and damage to property.

WARNING
Welding is not permitted. It can have a negative impact on safety. Risk of personal injury and damage to property. For welding, contact your dealer or engcon Nordic AB.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

4.1. Oil

On delivery, your product is filled with Fuchs Hydraway White 46, a white oil-based hydraulic oil.

An oil drain pan must be available during installation.
T and P are labeled with:

IMPORTANT
Ensure miscibility with the base machine's hydraulic oil prior to installation. If you are in any doubt, contact your lubricant supplier. An incorrect mixture could damage hydraulic components.

4.2. Identification

Check that your product's rating plate matches the information on the EC Declaration of Conformity. If there is any deviation, contact the supplier before you begin initial installation.

The rating plate is located on the tiltrotator's yellow body or its black protective cover.

Rating plate content:

Part number
Type designation
Serial number
Year of manufacture
Weight
Max jacking point
Max hydraulic pressure

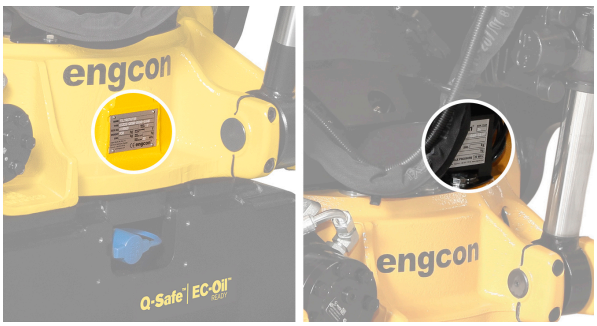


Figure 6.

4.3. Mechanical

The following assembly and installation instructions refer to direct attachment of the tiltrotator.

If the tiltrotator will be installed on a machine coupler, use the user manual for connecting tools.

DANGER
Do not exceed tipping load limits. The weight of the product and the increased reach may impair stability. Risk of personal injury and damage to property.

WARNING
If you have any doubts concerning the safety aspects of your knowledge, the equipment or work, contact a dealer or engcon Nordic AB. Incorrect installation affect safety.

IMPORTANT
Assembly and installation may only be carried out at a workshop authorized by the manufacturer. Changes to the assembly may not be carried out without the manufacturer's consent.

4.3.1. Attaching the tiltrotator

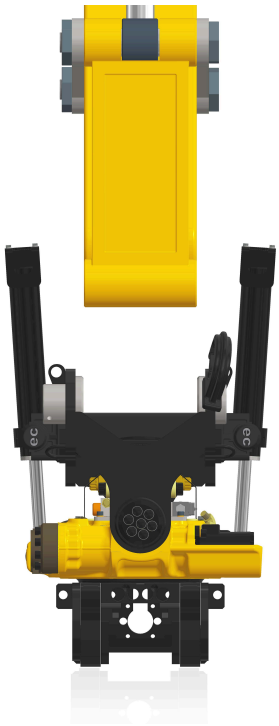


Figure 7.

Before installation

1. Check the tipping load limits. Take tiltrotator weight and the extended risk area into account. Installation may entail a necessary reduction in the volume of the tool.
2. Position the base machine and the tiltrotator on a flat, non-slip surface. Make sure the tiltrotator is upright and in line with the stick and dog bone linkage.
3. If necessary, use a firmly planted ladder.

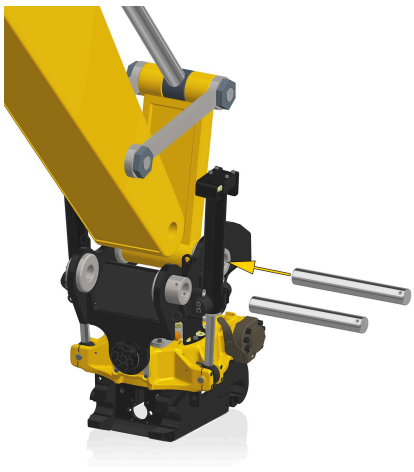


Figure 8.

Installation

1. Fit any O-rings if such must be used.
2. Position the dog bone linkage to align with the appropriate holes in the upper section of the tiltrotator.
3. Shim the width if necessary.
4. Insert the intended shaft journal.
5. Fit the shaft journal lock and make sure it locks correctly.

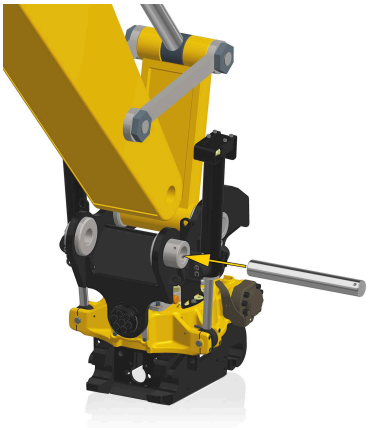


Figure 9.

6. Align the break link such that it corresponds to the holes in the upper section of the tiltrotator/rotator.
7. Lower the stick carefully; make sure that no shear forces occur.
8. Shim the width if necessary.
9. Apply plenty of grease in the cavity and bushings.

Figure 10.

IMPORTANT
Fill the bushings and the cavity in the stick with grease. Central lubrication only provides top-offs.

10. Insert the intended shaft journal.
11. Fit the shaft journal lock and make sure it locks correctly.

4.4. Electrical and hydraulics

For electrical and hydraulic hose installation, refer to the separate installation instructions supplied with the selected control system. Also available on the website or by contacting engcon.

IMPORTANT
Maintenance and repair of the electrical system may only be carried out by professionally qualified persons.

WARNING
Switch off power when working on the electrical system and remove any live objects before starting work Risk of personal injury.

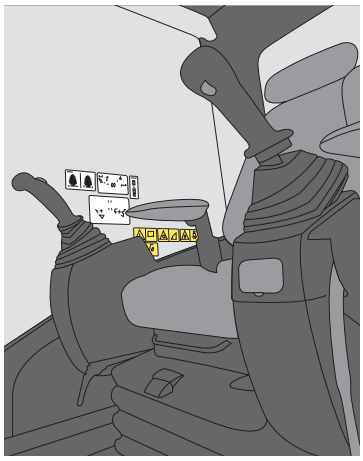
WARNING
Be meticulous with the insulation of electrical conductors and components when installing/fitting electrical equipment. Short circuits in electrical wiring can result in fires.

4.4.1. Q-Safe

See separate installation instructions. Also available on the website or by contacting engcon.

4.5. On completion

4.5.1. Affixing decals



Affix the warning decal supplied in a conspicuous place in the cab where it does not distract the operator.

WARNING
Replace damaged or illegible signs and decals before using the machine. Risk of personal injury and damage to property.

4.5.2. Function checks

Carry out a function test according to the following items.

- Run all the tiltrotator functions a few times to remove any air from the system. Important for preventing uncontrolled movement.
- Check that the tiltrotator functions according to section 5.5. Maneuvering.
- Make sure the tool operates when the hydraulics are activated.
- Check that hoses and cables are not exposed to wear or pinching.

5. Operation

5.1. Before and during use

Check your base machine manufacturer's recommendations for calculating tipping loads, and be sure to include the increased weight and reach the product entails.

DANGER
Do not exceed tipping load limits. The weight of the product and the increased reach may impair stability. Risk of personal injury and damage to property.

The tiltrotator may be used only for the brackets and tools it is intended for.

See additional information in the separate user manual for each tool.

WARNING
Take care when handling long objects. Take dynamic load and the extended risk area into account. Risk of personal injury and damage to property.

WARNING
Always make sure of a good grip when lifting objects. Risk of personal injury and damage to property.

WARNING
Using the tiltrotator to lift people or work platforms is prohibited. Risk of personal injury and damage to property.

IMPORTANT
Check the base machine's specified max capacity. Any use of the product in excess of base machine max capacity may damage the machine.

5.2. Lifting points

Approved

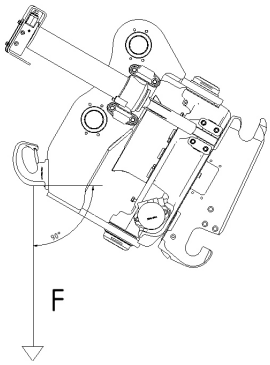


Figure 11.

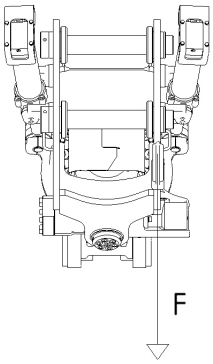


Figure 12.

Not approved

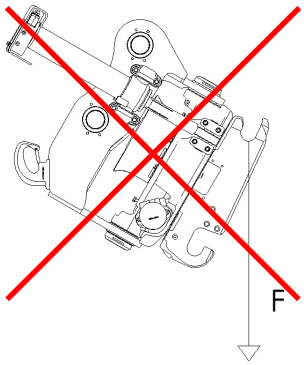


Figure 13.

Check the maximum permitted load for the jacking point as stamped on the lifting hook / lug and rating plate. Designed with safety factor 5:1.

WARNING
The base machine must be equipped with a load-holding valve on the boom/stick and an overload warning when using a jacking point on the tiltrotator. Risk of injury and damage to property.

5.3. Integrated grabber

The grabber is not designed for lifting with chains, straps or similar.

WARNING
Use dedicated lifting equipment when lifting objects. Risk of personal injury and damage to property.

WARNING
Do not use the grabber for work using directional forces, e.g. piling. Risk of personal injury and damage to property.

WARNING
When lifting, make sure the load burdens both grab arms. Make sure the load cannot shift and only burden one grab arm. When all force is exerted by only one arm, the grab is at risk of opening. Risk of injury and property damage.

Figure 14.

5.4. Tools

5.4.1. Hydraulic hammers

The use of hydraulic hammers together with the tiltrotator is not recommended as this leads to increased wear.

5.4.2. Augers

The use of augers together with the tiltrotator is not recommended as this leads to increased wear.

IMPORTANT
Avoid rotation for extended periods; it can cause the worm gear to overheat. Risk of property damage.

5.4.3. Pallet forks

When using pallet forks, the tiltrotator's cylinders must be fitted with hose break valves. If uncertain, contact your supplier.

To avoid overloading the quick coupler locking pins, the pins must be turned away from the forklift tines.

WARNING
The excavator arm system cylinders must be fitted with valves to prevent the load from dropping in the event of a hose failure. Risk of personal injury and damage to property.

WARNING
When using pallet forks together with the tiltrotator, exercise caution and maneuver carefully. The load can easily fall off during rapid rotation or tilting.

5.4.4. Crane boom

The tiltrotator may not be used together with a crane boom. During crane boom operation, the tiltrotator must be disconnected from the carrier.

5.5. Maneuvering

The functions described for each control system apply to the recommended installation/configuration. Deviations may occur depending on the user's preferences for alternative button functionality and configuration.

5.5.1. DC2 control system (for machines with double-acting hydraulic circuit)

The engcon control system allows simultaneous operation of all functions.

Refer to separate user manual supplied on delivery. Also available on the website or by contacting engcon.

5.5.2. Control system 10 (for machines with proportional control hydraulic circuits)

The external control system allows simultaneous operation of all functions.

Refer to the instructions for mounted/installed, external control systems; contact/support apply accordingly.

5.5.3. Control system 9-2 (for machines with two or more proportionally controlled hydraulic circuits)

Allows simultaneous operation of two functions.

Refer to separate user manual supplied on delivery. Also available on the website or by contacting engcon.

5.5.4. Control system 1 (for machines with double-acting hydraulic circuit)

Has two functions, tilt and rotation.

Refer to separate user manual supplied on delivery. Also available on the website or by contacting engcon.

5.5.5. Control system 15 (for machines with double-acting hydraulic circuit)

Allows simultaneous operation of two functions, tilt and rotation.

Refer to separate user manual supplied on delivery. Also available on the website or by contacting engcon.

5.5.6. Externally controlled quick coupler lock – SQ/QSC

See separate user manual for quick coupler lock operation.

- SQ – separate locking hydraulics. User manual available from system supplier.
- QSC – Separate engcon locking system. User manual is available for download on the website or through direct contact with engcon.

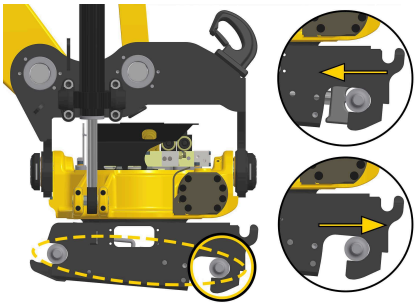
5.6. Changing tools

The following instructions concern general operation of the engcon quick coupler. For further information and instructions, refer to the separate user manual for the quick coupler concerned.

To ensure correct operation of the quick coupler lock when connecting/disconnecting a tools; the quick coupler lock switch must be activated or deactivated and the hydraulics activated in the proper manner. The procedure for these steps differs between the various control systems.

5.6.1. Connecting the tool, hydraulic lock

1. Activate the quick coupler lock function.
2. Activate the hydraulics to operate the locking bolts.



HS/SW with sensor: The sound and light warning signals are activated when the locking cylinder is in the open position.

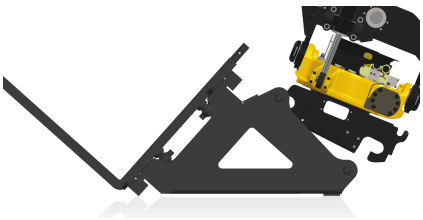
3. Check that the indicator rod is out. Indicator rod location may vary depending on the tiltrotator model.

ECPUP: Check that the red hook is in the open position.
QSM40: Quick coupler QSM40 lacks an indicator rod.

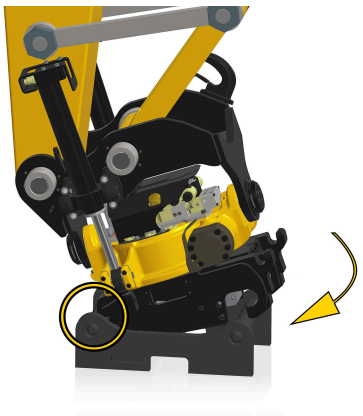
4. Move the quick coupler towards the tool.

EC-Oil: Make sure the tool is positioned such that the shaft with the EC-Oil block is located closest to the base machine. If the tool is positioned correctly, the block will be visible on the left side of the shaft as seen from the cab.

Pallet fork: To avoid overload when connecting, the quick coupler locking pins must face away from the forklift tines.

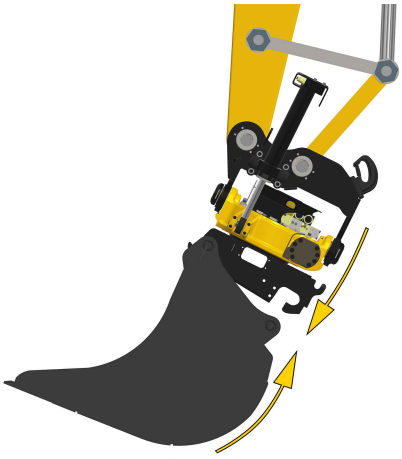


5. Connect the tool by moving the machine coupler toward one axle on the tool.



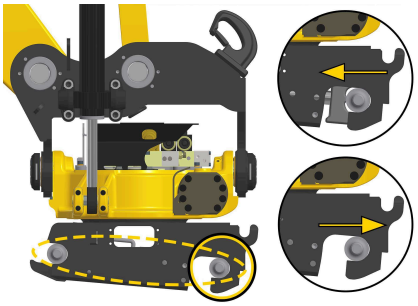
Q-Safe: The sound and light warning signals are activated.

6. Raise the tiltrotator very slightly above the ground so that the tool moves towards the quick coupler.



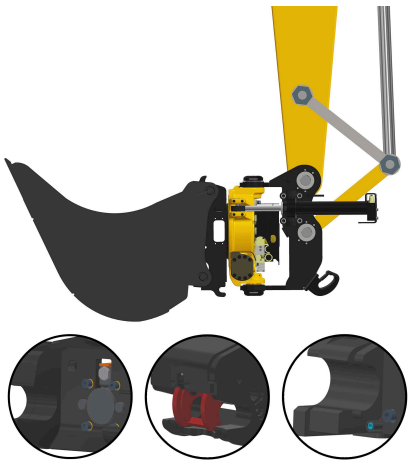
IMPORTANT
The machine may only be operated with the quick coupler lock switch in the activated position when connecting and disconnecting tools.

7. Activate the quick coupler lock function. The quick coupler lock is not fully connected to the attachment point until the hydraulic system is activated and the "open" indicator is no longer visible.
8. Activate the hydraulics to operate the locking bolts.



IMPORTANT
Always pressurize the tiltrotator to activate the locking cylinder after changing tools.

9. Check that the quick coupler lock function engages and that the indicator rod no longer protrudes from the quick coupler.

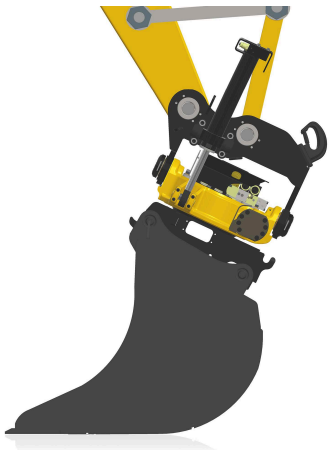


Q-Safe: The sound and light warning signals are deactivated when the coupler is correctly connected.
HS/SW with sensor: The sound and light warning signals are deactivated when the locking cylinder is in the closed position.
ECPUP: Check that the red hook is in the closed position.
QSM40: Quick coupler QSM40 lacks an indicator rod.

For other quick couplers, check that the lock function has engaged as specified for the quick coupler concerned.

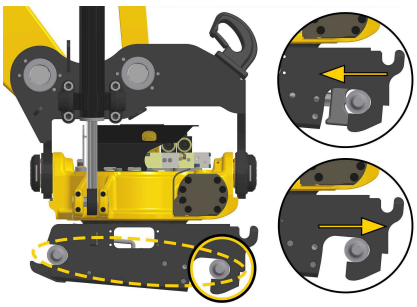
5.6.2. Disconnecting the tool, hydraulic lock

1. Place the tool on the ground, with the locking bolts pointing away from the cab.



2. Activate the quick coupler lock function.

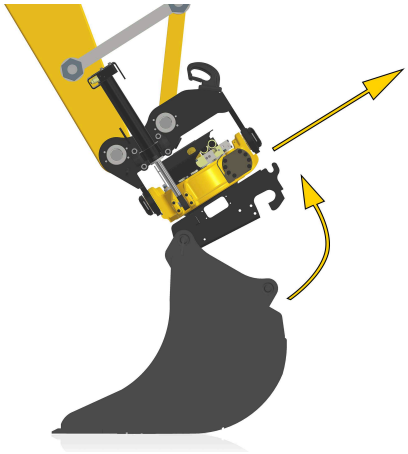
3. Activate the hydraulics and the locking bolts.



4. The locking cylinders are activated and open position is reached when the indicator rod is visible.

Q-Safe: The sound and light warning signals are activated.
HS/SW with sensor: The sound and light warning signals are activated when the locking cylinder is in the open position.
ECPUP: Check that the red hook is in the open position.
QSM40: Quick coupler QSM40 lacks an indicator rod.

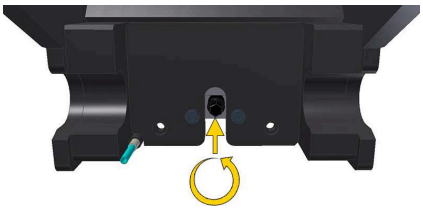
5. The locking bolts are now in the open position and the tool is released. Carefully lift the machine coupler away from the tool.



IMPORTANT
The machine may only be operated with the quick coupler lock switch in the activated position when connecting and disconnecting tools.

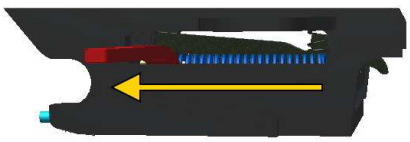
5.6.3. Connecting the tool, mechanical lock

1. Open the quick coupler lock with a suitable tool.



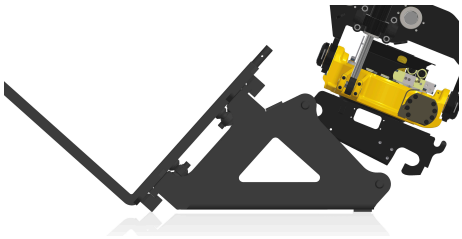
On models fitted with a screw, turn the screw counterclockwise until the locking bolts engage and the indicator rod* is in its outermost position.

On models with a lever, use an extension pipe and move the lever to its end position. The indicator rod* will then be in its outermost position and the lock clamp will keep the locking bolts open.

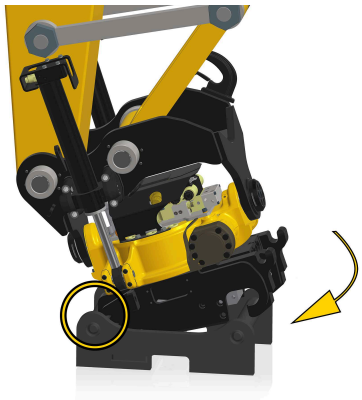


2. Move the quick coupler towards the tool.

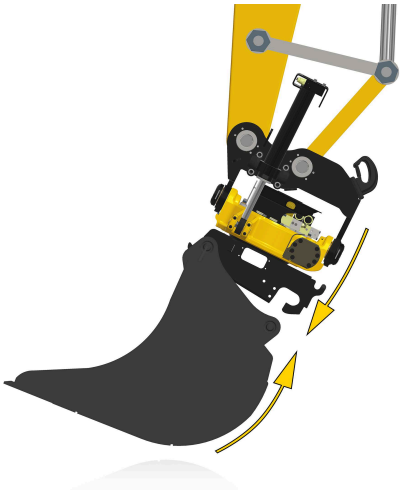
To avoid overloading the quick coupler during use, turn the quick coupler locking pins to face away from the forklift tines when connecting.



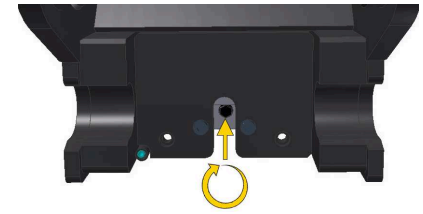
3. Connect the quick coupler to the tool.



4. Raise the tiltrotator very slightly above the ground so that the tool moves towards the quick coupler.

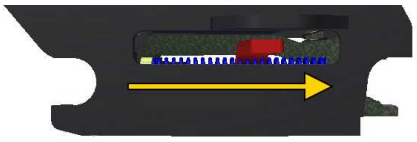


5. Close the machine coupler with an appropriate tool.

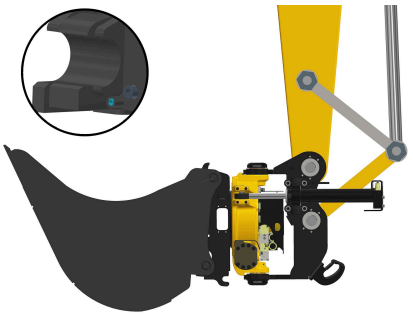


On models with a screw, turn the screw clockwise until the locking bolts are retracted and the indicator rod* is in its innermost position.

On models with a lever, the lock closes automatically when the adapter axle forces the lock clamp up.



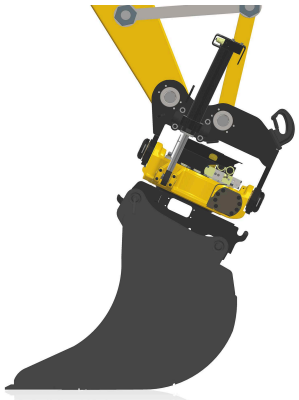
6. Check that the quick coupler's lock function has engaged.
   On engcon's other quick couplers, the blue indicator rod will no longer protrude from the hitch. Indicator rod* location may vary depending on the tiltrotator model.



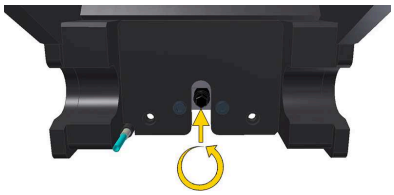
**Quick coupler QSM40 lacks an indicator rod.*

5.6.4. Disconnecting the tool, mechanical lock

1. Place the tool on the ground, with the locking bolts pointing away from the cab.



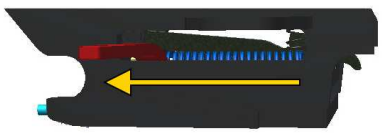
2. Open the quick coupler lock with a suitable tool.



On models fitted with a screw, turn the screw counterclockwise until the locking bolts engage and the indicator rod* is in its outermost position.

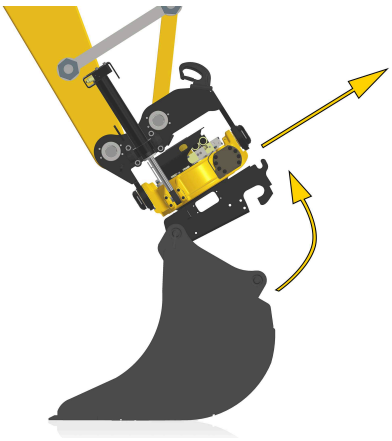
On models with a lever, use an extension pipe and move the lever to its end position. The indicator rod* will then be in its outermost position and the lock clamp will keep the locking bolts open.

In this position the tool is free !



3. The locking bolts are now in the open position and the tool is free. Carefully raise the tiltrotator from the tool.

**Quick coupler QSM40 lacks an indicator rod.*



5.7. Fitting and setting up quick coupler locks

DANGER
Check the attachment points regularly and be alert for the formation of cracks. Risk of personal injury and damage to property.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

Shim the quick coupler and the tool for minimum play. Check that minimum locking wedge engagement is not below the minimum value:

Quick coupler S30-S80

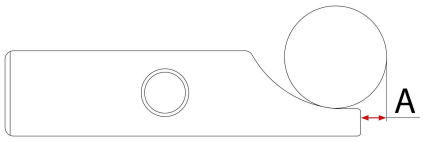


Figure 15.

Quick coupler	A (max)
S30	0.2 inch
S40	0.39 inch
S45	0.39 inch
S50	0.39 inch
S60	0.79 inch
S70	0.87 inch
S80	0.98 inch

Table 4.

Quick coupler S1-S3

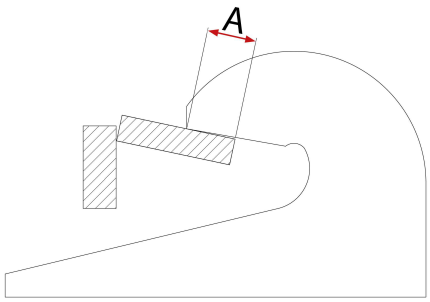


Figure 16.

Quick coupler	A (min)
S1	1.2 inch
S2	1.2 inch
S3	1.2 inch

Table 5.

Quick coupler RF40-90 (PUP)

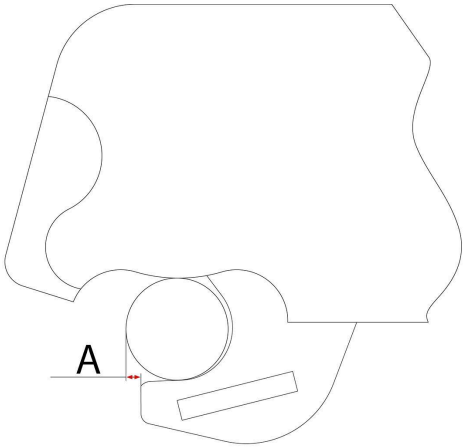


Figure 17.

Quick coupler	A (max)
PUP40-90	0.55 inch

Table 6.

Quick coupler ECPUP

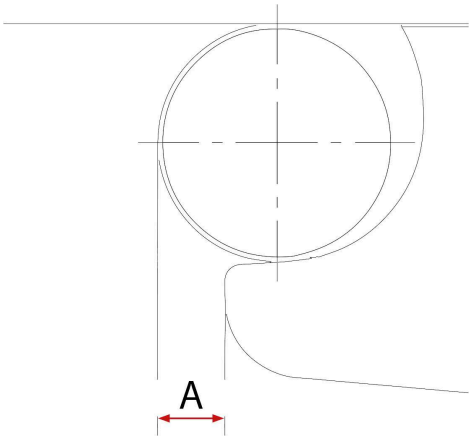


Figure 18.

Quick coupler	A (max)
ECPUP45	0.08 inch
ECPUP50	0.2 inch
ECPUP60	0.87 inch
ECPUP65	0.98 inch
ECPUP70	0.98 inch
ECPUP80	1.2 inch

Table 7.

Quick coupler CW10-45

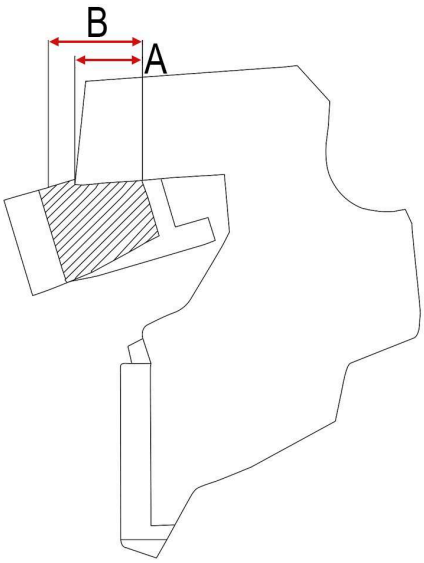


Figure 19.

Quick coupler	A (max)
CW10-45	A ≥ B * 0.75

Table 8.

Quick coupler HS

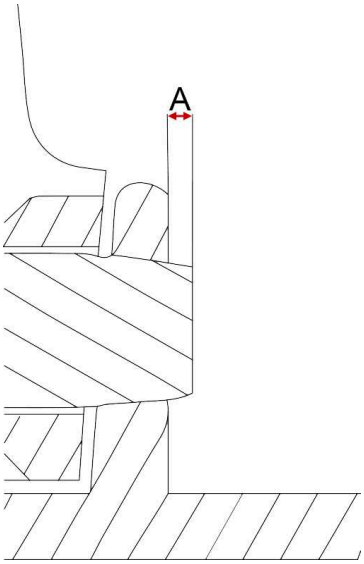


Figure 20.

Quick coupler	A (max)
HS08	0 to 0.55 inch
HS10	0 to 0.2 inch
HS20/21/25	0.39 to 0.2 inch

Table 9.

5.8. Work under water

We do not recommend work under water as this leads to increased wear and risks reducing tiltrotator service life. Work in brackish or salt water will reduce the service life of EC-Oil electrical connectors by more than half.

5.8.1. Before performing work under water

- Fill the tiltrotator with grease as described in section 6.3.4. Worm gear lubrication. Ideally, use grease that is more water repellent. Always check with your dealer to ensure miscibility.
- Fill all connectors with contact grease. Ideally, use contact grease that is water repellent.
- Check the condition of the O-ring between the rotator frame and the quick coupler. See section 10.2. Tiltrotator overview.

5.8.2. After performing work under water

- Always finish the working day by rotating, tilting and filling grease via the central lubrication to expel water from bearings.
- Apply oil to shiny surfaces.

6. Maintenance

DANGER
Check the attachment points regularly and be alert for the formation of cracks. Risk of personal injury and damage to property.

WARNING
Make sure that service and maintenance is carried out according to the manufacturer's recommendations. Inadequate maintenance may cause defects on the base machine and its equipment.

WARNING
When changing hoses, only hoses with press couplings may be used. Screw connections may not be used. Risk of personal injury and damage to property.

6.1. General

Intervals for greasing and inspections to be performed by the operator:

- **Daily:** To be performed according to section 6.2 before the working day is begun. Daily service.
- **Every 8 operating hours:** Lubrication according to section 6.3. Lubrication every 8 operating hours.
- **Every 250 operating hours:** Perform according to section 6.4. Service every 250 operating hours.

In addition to the above, service must be performed by a service technician during the first machine service or no later than 500 operating hours. Then at 500-hour intervals according to section 11.1. Service schedule.

Fill in section 11.2. Service record after completed service.

IMPORTANT
Review the personal and environmental risks of hydraulic oil and grease by reading the safety data sheets for the hydraulic oil and grease in use. Risk of personal injury and damage to surroundings.

IMPORTANT
Be sure to keep your product clean. Inadequate cleaning can cause damage to your equipment.

6.2. Daily inspections

Check that:

- Visible fasteners are tightened (see section 6.9. Tightening torque).
- The shaft journal lock attachment points are not loose.

- No damage or cracks are present.
- The tiltrotator is correctly attached to the machine and tool.
- Warning decals are present and legible.
- The quick coupler is clean, without visible damage and is functioning normally.
- No breakout play or rotational play is present (see section 6.6. Checking axial and radial play).
- There are no hydraulic leaks.
- No grease leakage is present on hoses or in connectors.
- The QLM electronics modules signals correctly when attaching and detaching tools.

WARNING
Avoid contact with hydraulic oil. Risk of burns.

WARNING
Never use your hands to search for leaks in the hydraulic system. Use the necessary protective equipment. Pressurized hydraulic oil can penetrate the skin. Risk of personal injury.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

WARNING
The hydraulic system must be de-pressurized before work on the system is begun. Risk of personal injury and damage to property.

6.3. Tiltrotator lubrication

The tiltrotator has sliding bearings that require daily greasing; it is fitted with a progressive central lubrication system.

The integrated grabber and quick coupler beneath the tiltrotator have their own grease points and are not connected to the lubrication system. See the relevant images for lubrication points for the quick coupler and integrated grabber beneath the tiltrotator. During refilling, a certain amount of spillage may occur between the body and the coupler's ring.

Blockage in one grease channel will entail blockage of the entire lubrication system. Use pre-filled hoses when replacing lubrication hoses; this is especially important when the tiltrotator is connected to the base machine’s lubrication system.

For troubleshooting, contact your service partner or engcon AB.

6.3.1. Grease recommendation

The tiltrotator’s worm gear is factory filled with the recommended lithium-based universal grease (NLGI 2). This grease is often miscible with other greases of similar type.

Always check with your dealer to ensure miscibility. The use of inferior grease categories will lead to increased consumption.

IMPORTANT
Do not use greases containing solid particles such as molybdenum, graphite or copper. Such particles can lead to failure of the lubrication block.

IMPORTANT
Ensure the highest possible cleanliness when greasing or connecting the lubrication system. The lubrication system is sensitive to dirt.

IMPORTANT
Grease with a higher base oil viscosity will be required in greater quantities during heavy excavation and when using hydraulic tools.

6.3.2. Lubrication every 8 operating hours

IMPORTANT
Never add greater quantities of grease via central lubrication as over lubrication will damage the seals in certain places.

IMPORTANT
The quantities of grease specified refer to the minimum quantity that must be added.

6.3.2.1. Manual lubrication

EC204: 0.35 oz | EC206: 0.35 oz | EC209: 0.53 oz | EC214: 0.71 oz | EC219: 0.71 oz | EC226: 0.71 oz | EC233: 1.2 oz

Grease the tiltrotator by removing the protective cap from the grease nipple and connecting a grease gun. Grease the tiltrotator until grease forces its way out at all axles and bearings. Wipe the grease nipple and nozzle thoroughly clean before attaching the grease gun.

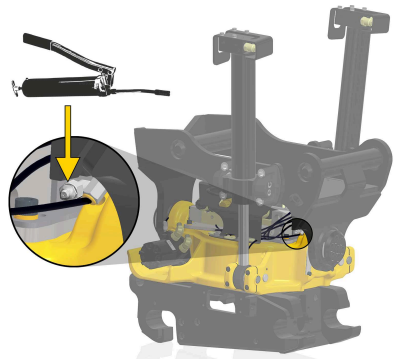


Figure 21.

6.3.2.2. Automatic lubrication

The distribution block on the tiltrotator is of progressive type and distributes the grease to all connected grease points automatically. The distributor delivers the grease to the grease points one by one. This makes sure no grease point goes without. The system can be connected to the base machine's automatic lubrication system.

Replace the grease nipple on the distribution block with a suitable hose connection (the thread in the distributor is M10x1) and connect the hose from the base machine's lubrication system. To deliver grease to the tiltrotator, always check that the valve supplied and the pump's operating settings provide the correct volume and that system pressure is sufficiently high (max 4350 psi).

IMPORTANT
In winter, a higher system pressure is required for tiltrotator lubrication.

IMPORTANT
Check regularly that new grease is supplied to the tiltrotator.

6.3.3. Greasing the quick coupler

Grease quantity: 3-4 pump strokes per nipple.

Grease nipples on both sides, applies to all examples.

The arrows show the location of the grease nipples.

Example, S80

Figure 22.

Example, S70

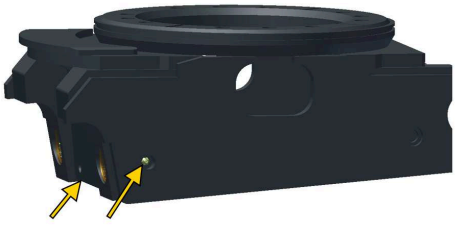


Figure 23.

Example, HS

Figure 24.

Example, ECPUP

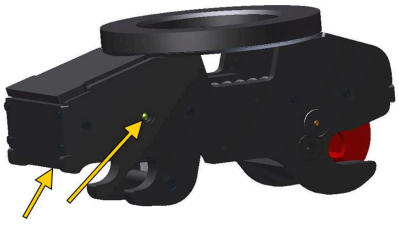


Figure 25.

6.3.4. Worm gear lubrication

1. Remove the protective cover on the left side of the tiltrotator and the plug on the bolted joint.
2. Clean and remove all grease from the hole where the plug was installed.
3. Rotate the worm wheel and note if grease accumulates in the hole.
4. If grease accumulates in the hole, no grease need be added. Otherwise add grease (while rotating if possible) and repeat step 3.

WARNING
Beware of moving parts. A lack of awareness may lead to crush injuries. Risk of personal injury.

6.3.5. Lubrication, integrated grabber GR10, GR20

Grease quantity: 3-4 pump strokes per nipple.

The arrows show the location of the grease nipples.

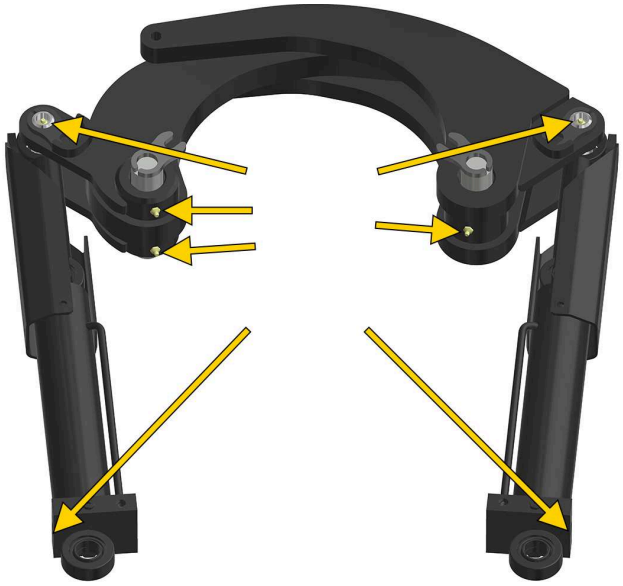


Figure 26.

6.3.6. Lubrication, integrated grabber GR20RR

Grease quantity: 3-4 pump strokes per nipple.

The arrows show the location of the grease nipples.

Figure 27.

6.4. Service every 250 operating hours

To be checked by the operator; complete section 11.2. Service record.

- Review check items according to section 6.2. Daily inspections.
- Check the grease level according to section 6.3.4. Worm gear lubrication.
- Check the central lubrication system for any leaks at connections.
- Check the tilt axles according to section 6.4.1. Shimming, tilt upper section.

6.4.1. Shimming, tilt upper section

1. Make sure the tilt upper section abuts the base machine by using a suitable tool as a wedge. Insert the tool between the rotator body and the tilt upper section where the tilt axle points away from the cab.
2. Undo the tilt axial washer's two bolts.
3. Install shims on the inside of the tilt thrust washer where the tilt axle points towards the cab.
4. Reinstall the tilt axial washer.

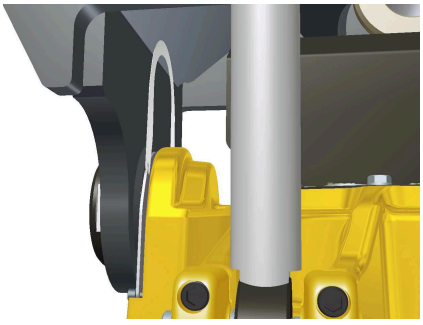


Figure 28.

6.5. Special maintenance

6.5.1. EC-Oil

Cleaning

- Clean oil connections, electrical connectors, grease connections and dirt guards before and after use in order to avoid oil or grease leakage and safeguard EC-Oil function.
- If oil or grease leakage occurs despite cleaning, we recommend face seal replacement.
- Clean electrical connectors daily and spray with water repellent.

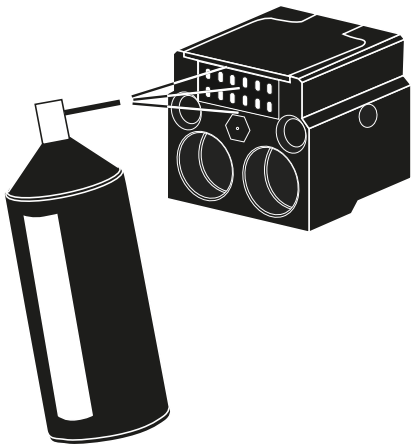


Figure 29.

Replacing face seals

Applies to hydraulic connectors on quick couplers.

1. Remove the existing face seal with the aid of a sharp tool.
2. Carefully install the new face seal by hand.

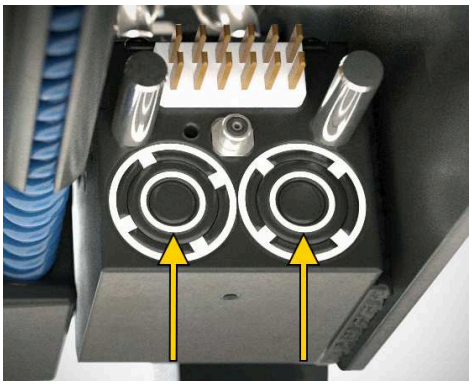


Figure 30.

EC-Oil	Face seal	Part number
ECO40-50	3/8"	1052976
ECO60	1/2"	1050018
ECO70	3/4"	1050580
ECO80	1"	1056072

REMARKS
Install the tapered face seal with a narrow edge outward.

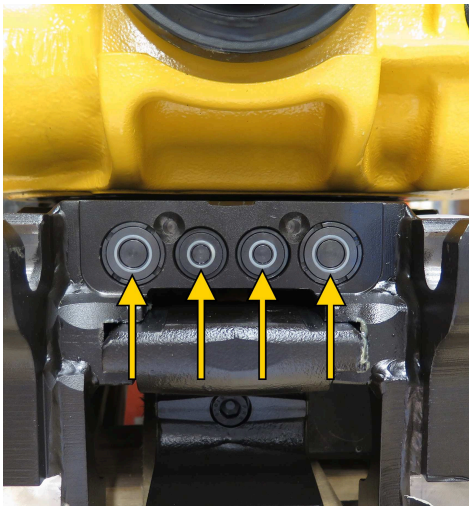


Figure 31.

6.6. Checking axial and radial play

IMPORTANT
No tool may be connected during checks.

The following tools are required for checking lateral and rotational play:

- Extended 10 mm Allen key.
- Dial indicator with magnetic base.
- Long hexagonal socket
- Crowbar.

6.7. Checking lateral play

1. Raise the tiltrotator to a comfortable working height and switch off the machine.
2. Remove the protective cover on the left side of the tiltrotator and the plug on the bolted joint.
3. Clean and remove all grease from the hole where the plug was installed.
4. Rotate the worm wheel until a free surface without a bolt head is visible.
5. Lower the tiltrotator and press it against firm, level ground.

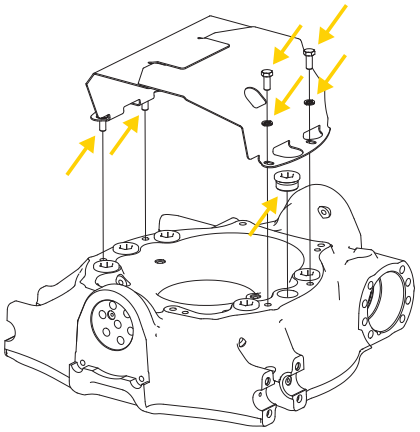


Figure 32. Remove the protective cover.

6. Insert the hex socket into the hole, making sure it connects with the worm wheel.
7. Mount the dial indicator with the magnetic base and zero the dial gauge to the top of the hex socket.
8. Carefully raise the tiltrotator off the ground and read the clock.

Figure 33. Free surface without bolt head.

EC206B	EC209-233	Remarks
< 0,10mm	< 0,10mm	Requires action immediately.
0,10-0,15mm	0,10-0,25mm	Correct lateral play
0,16-0,20mm	0,26-0,35mm	Requires action soon.
>0,20mm	> 0,35mm	Requires action immediately.

Figure 34. Prise apart using a prybar.

9. Using the crowbar as a lever, read off any changes on the dial gauge.

6.7.1. Checking rotational play

1. Use the crowbar to move the quick coupler to the left.
2. Remove the motor bolts and the motor.
3. Clean the worm screw thoroughly and remove all grease.
4. Mount the dial indicator on the rotator body and reset the dial gauge.
5. Use the crowbar to move the quick hitch to the right and read off the clock.

Figure 35. Rotate the quick coupler to the left.

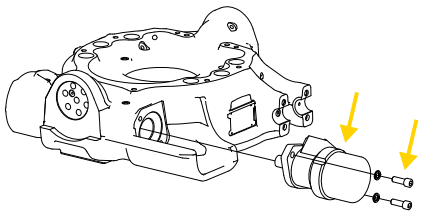


Figure 36. Remove the motor.

EC206B	EC209-233	Remarks
<0,05mm	< 0,12mm	Adjustment required
0,06-0,15mm	0.12-0.25 mm	Correct rotational play
>0,15mm	> 0.25 mm	Adjustment required

Figure 37. Rotate the quick coupler to the right.

REMARKS
We recommend adjustment be carried out by a specialist in a workshop.

6.7.1.1. Significance of rotation play

Play of less than 0.12 mm will cause early overheating. Play greater than 0.25 mm will have a leverage effect causing impact and shocks to destroy the lubrication film between the thrust washers.

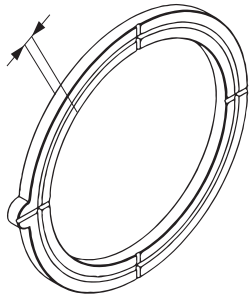
REMARKS
Lack of lubrication can deform the thrust washers.

6.7.2. Thrust washers

Check that the thrust washers are flat.

Max wear: Min 4.5 mm

We always recommend the installation of new thrust washers before adjusting.



6.7.3. ePS

Your tiltrotator is fitted with an engcon rotation sensor; it must be calibrated after service.

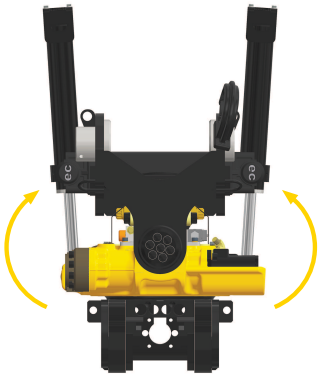
6.8. Testing load-holding valves

A lever is required when testing load-holding valves.

Load the tilt function in both directions; it must not move.

If it moves, replace the load-holding valve on the cylinder that can be extended (on the side where the tilt upper section moves away from the rotator body).

See also section 10.2. Tiltrotator overview.



6.9. Tightening torque

The rotator section is dimensioned to cope with major shear loads and torsional loads. For reasons of strength, it is essential that certain fasteners be torque tightened.

Bolts and threaded holes must be thoroughly clean.

EC204

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M10	12.9	4	58 lb-ft
Quick coupler	M12	12.9	12	100 lb-ft
Yoke bracket	M12	12.9	4	100 lb-ft
Tilt axle	M12	12.9	8	100 lb-ft
Hydraulic motor	M8	12.9	3	30 lb-ft

Table 10.

EC206

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M10	12.9	8	58 lb-ft
Quick coupler	M14	12.9	12	160 lb-ft
Yoke bracket	M12	12.9	4	100 lb-ft
Tilt axle	M16	12.9	8	246 lb-ft
Clamping half	M10	12.9	4	58 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 11.

EC209

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M10	12.9	8	58 lb-ft
Quick coupler	M14	12.9	12	160 lb-ft
Yoke bracket	M12	12.9	4	100 lb-ft
Tilt axle	M16	12.9	8	246 lb-ft
Clamping half	M10	12.9	4	58 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 12.

EC214

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M12	12.9	8	100 lb-ft
Quick coupler	M16	12.9	12	246 lb-ft
Yoke bracket	M16	12.9	8	246 lb-ft
Tilt axle	M16	12.9	14	246 lb-ft
Clamping half	M10	12.9	8	58 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 13.

EC219

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M12	12.9	8	100 lb-ft
Quick coupler	M20	12.9	12	479 lb-ft
Yoke bracket	M16	12.9	8	246 lb-ft
Tilt axle	M16	12.9	14	246 lb-ft
Clamping half	M12	12.9	8	100 lb-ft
Railroad grabber, grabber axle	M20	12.9	2	479 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 14.

EC226

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M14	12.9	8	160 lb-ft
Quick coupler	M20	12.9	12	479 lb-ft
Yoke bracket	M16	12.9	8	246 lb-ft
Tilt axle	M16	12.9	18	246 lb-ft
Clamping half	M20	12.9	8	100 lb-ft
Railroad grabber, grabber axle	M20	12.9	2	479 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 15.

EC233

Fastener	Dimension	Quality	Quantity	Torque
Screw cap	M12	12.9	12	100 lb-ft
Quick coupler	M20	12.9	20	479 lb-ft
Yoke bracket	M16	12.9	8	246 lb-ft
Tilt axle	M20	12.9	16	479 lb-ft
Clamping half	M14	12.9	8	160 lb-ft
Railroad grabber, grabber axle	M20	12.9	2	479 lb-ft
Hydraulic motor	M12	12.9	2	100 lb-ft

Table 16.

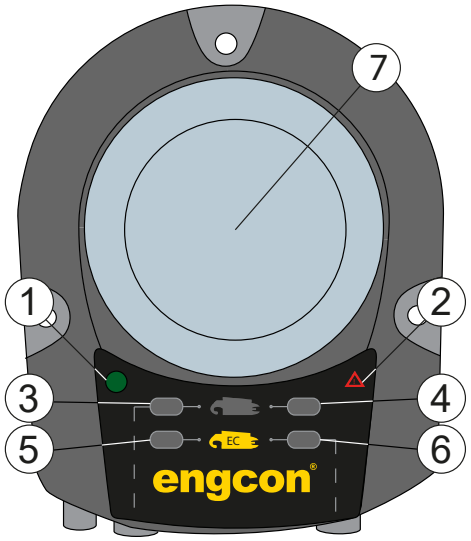
EC-Oil hydraulic connectors

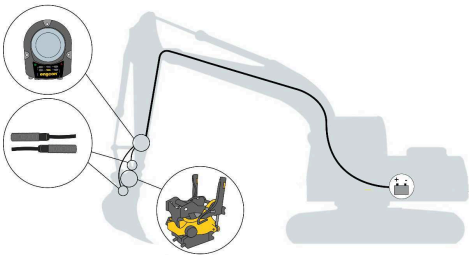
Fastener	Dimension	Quantity	Torque
Hydraulic connector ECO	ECO40-80	2	44 lb-ft

Table 17.

7. Troubleshooting

7.1. Q-Safe





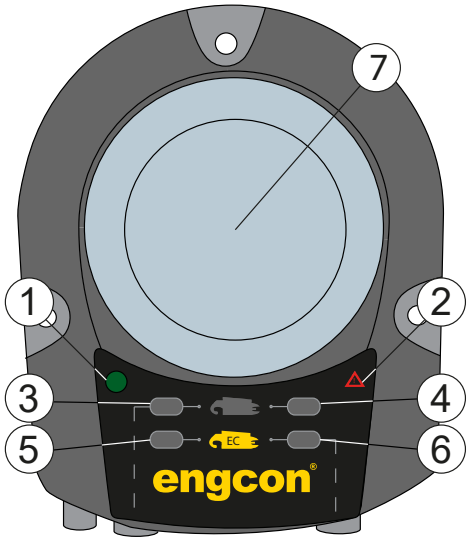
7.1.1. Indications

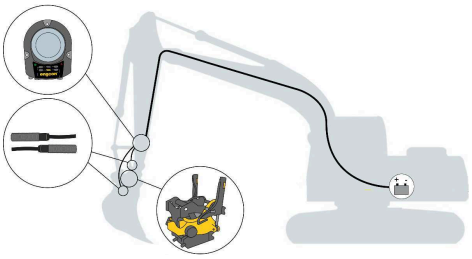
Position	Behavior	Indicates	Remarks
1	1 flash * _ * _ * _	Power supply OK	Applies to DC2 without QSC
	2 flashes ** _ ** _ ** _	Power supply OK	Applies to QSC
	Constant light	Power supply OK	Applies to SS0-SS9 without QSC
2	1 flash * _ * _ * _	CAN time out	Applies to QSC
	2 flashes ** _ ** _ ** _	Short circuit, power to sensor in EC	Applies to SS0-SS9 without QSC and QSC during start
	3 flashes *** _ *** _ *** _	Short circuit, power to sensor in RF	Applies to SS0-SS9 without QSC and QSC during start
	3 flashes *** _ *** _ *** _	Short circuit, power to sensor in EC	Applies to DC2
	Inactive	No fault	
3	Constant light	Connected tool	Hook sensor for machine quick coupler
4	Constant light	Connected tool	Ejector sensor for machine quick coupler
5	1 flash * _ * _ * _	Tiltrotator removed	Applies to DC2

Position	Behavior	Indicates	Remarks
	Constant light	Connected tool	Hook sensor for the quick coupler under the tiltrotator
6	1 flash * _ * _	Tiltrotator removed	Applies to DC2
	Constant light	Connected tool	Ejector sensor for the quick coupler under the tiltrotator
7	Flashing white light and pulsating siren (normal behavior during coupling sequence)	Unsafe tool connection	Check attachment

Table 18.
For overview, see section 3.3.1. Overview

7.2. HS and SW with sensor





7.2.1. Indications

Position	Behavior	Indicates	Remarks
1	Flashing light	Power supply OK	DC2 Other control systems with QSC
	Constant light	Power supply OK	Other control systems without QSC
2	1 flash *_*_*_	Short circuit, power to sensor in RF	Applies when starting the system
	2 flashes **_**_**_	Short circuit, power to sensor in EC	Applies when starting the system
	Inactive	No fault	
3	Constant light		Not applicable
4	Constant light		Not applicable
5	Constant light	Quick coupler in closed position	Quick coupler beneath the tiltrotators
6	Constant light		Not applicable
7	Flashing white light and pulsating siren	Open locking cylinder	

Table 19.
For overview, see section 3.4.1. Overview

7.3. ePS/C2C

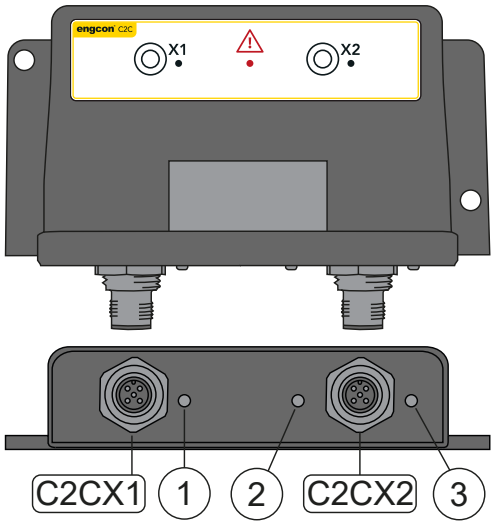


Figure 38.

7.3.1. Indications

Position	Sign	Indicates	Remarks
1	Off	No power supply	
1	Constant light	No communication in X1	
1	Flashing	CAN communication with the unit connected to X1	
3	Off	No power supply	
3	Constant light	No communication in X2	
3	Flashing	CAN communication with the unit connected to X2	
2	Off	No fault or no power supply	
2	1 flash	No communication with rotation sensor	*__*__*__
2	2 flashes	Short circuit, rotation sensor X2	**__**__**__

Table 20.
For overview, see section 3.6.1. Overview

8. Decals

Machine instructions, decals and warning signs must be kept clearly legible. Contact your supplier to order replacements.

WARNING
Replace damaged or illegible signs and decals before using the machine. Risk of personal injury and damage to property.

8.1. Decal disposition

8.1.1. Control systems 9 and 10

For decals, refer to separate user manual supplied on delivery.

8.2. Warning decals

8.2.1. Warning decals in cab

The decals are usually placed to the right of the operator in clearly visible locations.

8.2.1.1. 9000352

Figure 39. Warning decal to the right of operator.

8.2.2. Warning decals on product

8.2.2.1. 9000343

Figure 40. Warning decal on the tilt cylinder.

8.2.2.2. 9000338

Figure 41. Warning decal on locking cylinder.

9. Technical data

Technical data may vary. We reserve the right to make changes without prior notice.

9.1. Tiltrotator

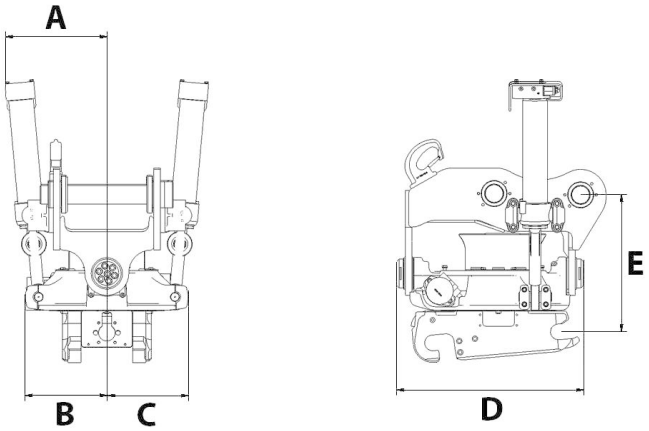


Figure 42.

Description		EC02	EC204	EC206	EC209	EC214	EC219	EC226	EC233
Max machine size	lbs	7,700	8,800	13,200	19,800	30,900	41,900	57,300	72,800
Standard bracket		S30	S40	S40, S45	S45	S45, S60	S60	S70	S70, S80
Width (A)	inch*	7.1	11.0	11.4	13.5	14.0	15.0	17.6	19.7, 22.9
Width (B)	inch*	6.1	6.3	8.7	9.8	11.2	12.4	13.4	15.2
Width (C)	inch*	6.3	6.7	8.6	10.7	11.9	12.2	13.4	15.2
Overall length (D)	inch*	17.1	18.2	19.7	22.1	26.2	29.0	29.9	34.6
Construction height (E)	inch*	from 9.6	from 12.2	from 15.0	from 16.7	from 18.0	from 18.9	from 19.7	from 26.5
Weight	lbs*	170	256	375	633	849	985	1393	1790
Rec hydraulic flow DC2/ss10	gal/min	6.6	8	11	16	21	32	32	32
Rec hydraulic flow ss9 tilt/rotation	gal/min	2/5	3/7	4/8	9/11	9/13	17/18	18/18	18/18
Max hydraulic pressure	psi	3200	3200	3200	3200	3200	3200	3200	3600
Tilt angle	°	2x40	2x45	2x45	2x45	2x45	2x45	2x45	2x45
Rotation		∞	∞	∞	∞	∞	∞	∞	∞
Electrical system	V	12	12	12/24	12/24	12/24	12/24	12/24	12/24

*Table 21. *Standard attachment*

Description		EC02	EC204	EC206	EC209	EC214	EC219	EC226	EC233
Max breakout torque	lb-ft	14,750	20,652	33,190	54,580	92,933	137,187	199,142	250,771
Max bucket width	inch	35.4	39.37	47.24	51.18	62.99	66.93	78.74	86.61
Tilt time from end position to end position	s / gal/ min	3/2	3/2	3/4	3/9	3/11	3/17	5/11	5/17
Rotation duration for one rotation under hydraulic flow	s / gal/ min	7/5	7/6	6.5/8	7/11	7/13	6.5/18	7/18	10/18
Rec hydraulic flow ss15	gal/min	N/A	7	8	N/A	N/A	N/A	N/A	N/A
Rec unlock/lock pressure SQ S30-S3, HS03/08	psi	3050/ 435-870	3050/ 435-870	3050/ 435-870	3050/ 435-870	3050/ 435-870	3050/ 435-870	3050/ 435-870	3050/ 435-870
Rec open/close pressure SQ ECpup	psi	N/A	N/A	3050/ 1450-3050	3050/ 1450-3050	3050/ 1450-3050	3050/ 1450-3050	3050/ 1450-3050	3050/ 1450-3050
Rec open/close pressure SQ Q-Safe	psi	N/A	3050	3050	3050	3050	3050	3050	3050
Rec max return line pressure	psi	360	360	360	360	360	360	360	360
Standard dimension, extra port**		N/A	1/4"	3/8"	3/8" + 1/4"	1/2" + 1/4"	1/2"+ 1/4" (3/8")*	3/4"	3/4"
Swivel channel extra function, number of ports		2	2	4	4	4	4	4	4
Swivel channel locking function, number of ports		2	2	2	2	2	2	2	2
Max hydraulic flow EXTRA	gal/min	4.8	3/NA	9/NA	11/13*	18/26*	18/26*	18/26*	18/26*
Max hydraulic flow standard (extra)***	gal/min	N/A	5	9	13	26	26	26	26

Table 22.
** [l/min] with High Flow*

***Standard configuration*

****If equipped with integrated grabber*

See separate instructions for use for EC02. Technical data is only included for comparison.

9.2. Integrated grabber cassette

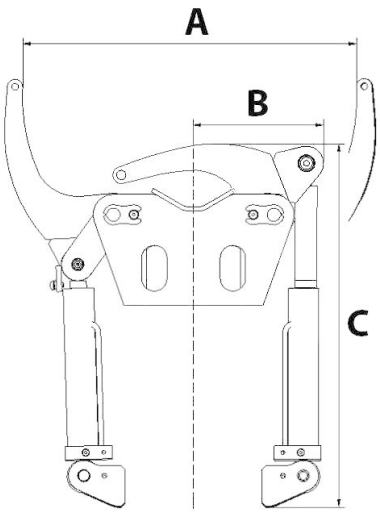


Figure 43.

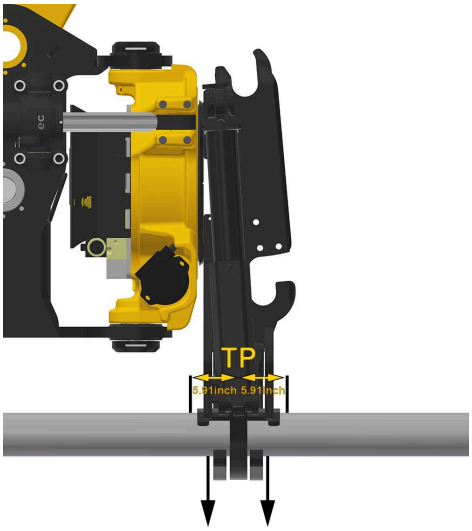


Figure 44.
Max center of gravity displacement 5.9 inch.

Description		GR05	GR10	GR20B	GR30	GR20RR/R2
Widest grabber width (A)	inch	13.8	24	32.3 - 37.4	42.5	32.3
Width (B)	inch	7.9	10.6	13.8	17.3	15.0
Length (C)	inch	23.0	29.9	35.8	38.6	*
Clamping force (tip - tip) at 21 MPa	lbs	3646	3300	4925	4312	3858
Max load	lbs	2205	3307	4409	4850	6614
Weight	lbs*	110	154	187	326	309
Max hydraulic pressure	psi	3200	3200	3200	3200	3200

Table 23.
**Depending on the attachment*

See separate user manual for detachable GRD. Also available on the website or by contacting engcon.

9.3. Load-holding valve

Listed below are the torques required to defeat the load-holding valves on the tilt cylinders.

Description		EC204	EC206
Torque	lb-ft*	3,690 (rotation right)	5,160 (rotation right)
Torque	lb-ft*	2,950 (rotation left)	4,430 (rotation left)

Description		EC209	EC214	EC219	EC226	EC233
Torque	lb-ft*	13,280	16,230	30,240	33,190	50,150

Table 24.
**Values calculated with universal tilt upper section; the values may vary depending on the tilt upper section.*

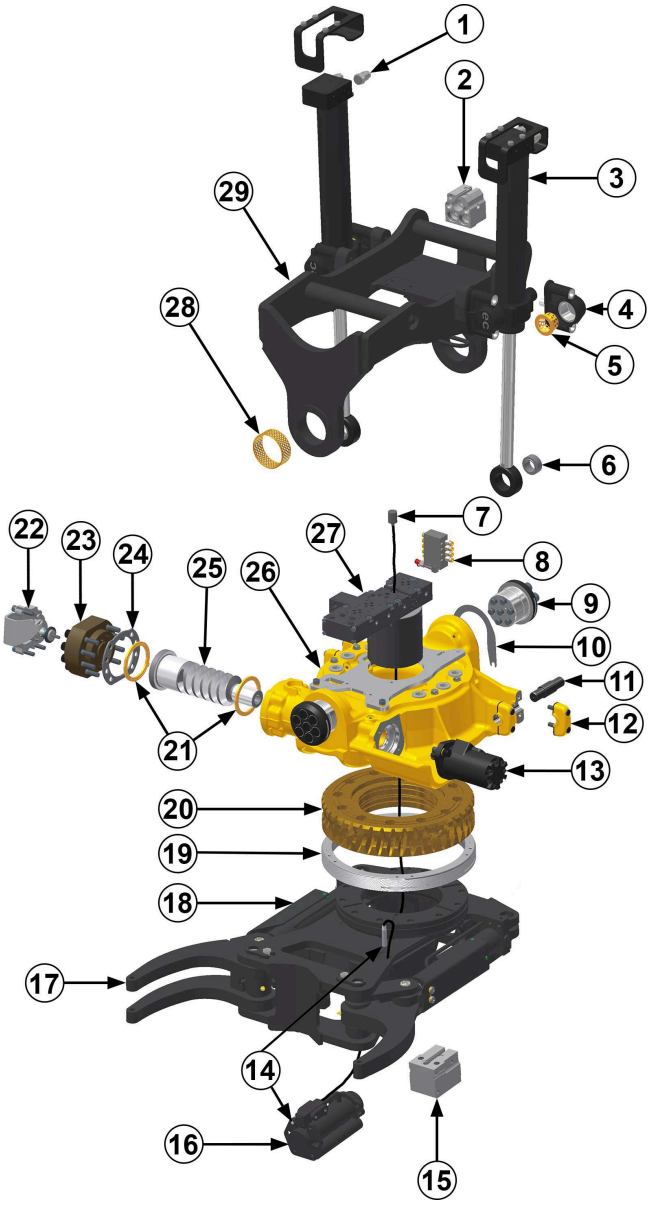
10. Glossary

10.1. Designations

Term	Description
Base machine	The machine carrying the equipment concerned. Excavator or backhoe loader.
EC-Oil	Automatic oil connection system for changing hydraulic tools from the cab. See section 3.5. EC-Oil.
EC-Oil block H (coupler)	Located in the machine or in the quick coupler.
EC-Oil block T (Top)	Located on the upper section of the hydraulic tool and/or the tiltrotator.
ECxxPS (e.g. EC219PS)	Tiltrotator when it is equipped with ePS.
ECxxR (e.g. EC219R)	Rotator, no tilt function.
ECxxU (e.g. EC219U)	Tiltrotator without the valve block and swivel.
ECxxW (e.g. EC219W)	Tiltrotator equipped with an extra-wide tilt upper section.
Dog bone linkage	The link between the breakout cylinder and the machine coupler or directly attached tiltrotator.
Dynamic load	Swinging/hanging load
Machine coupler	Quick coupler mounted directly on the excavator's stick
Quick coupler	The part of the tiltrotator that connects to the bucket or other tool.
Stick	The 'arm' at the very front of the excavator.
Tipping load	Specifies the maximum weight the excavator is able to lift without tipping forward.

10.2. Tiltrotator overview

Pos.	Designation
1	Load-holding valve
2	EC-Oil block T (Option)
3	Tilt cylinder
4	Yoke bracket
5	Bushing, yoke bracket
6	Spherical bearings
7	QS/Q-safe Slip ring (Option)
8	Single-point lubrication
9	Tilt axle
10	Shim set, tilt axle
11	Cylinder axle
12	Clamping half
13	Hydraulic motor
14	QS/Q-safe Sensor (Option)
15	EC-Oil block H (Option)
16	Locking cylinder
17	Integrated grabber cassette
18	Quick coupler
19	Bearing ring
20	Worm wheel
21	Axial washer
22	Rotation sensor ePS (Option)
23	Screw cap
24	Shim set, screw cap
25	Worm screw
26	Body
27	Valve block and swivel
28	Bushing, tilt axle
29	Tilt upper section



11. Service

WARNING
Make sure that service and maintenance is carried out according to the manufacturer's recommendations. Inadequate maintenance may cause defects on the base machine and its equipment.

WARNING
Make sure the locking cylinder is in its maximum extended position before removing the locking hook. Risk of injury and damage to property.

WARNING
Welding is not permitted. It can have a negative impact on safety. Risk of personal injury and damage to property. For welding, contact your dealer or engcon Nordic AB.

11.1. Service schedule

11.1.1. Service every 500 operating hours

To be performed by a service technician during the first machine service or no later than 500 operating hours. Then every 500 operating hours.

Fill in section 11.2. Service record.

- Check the product compliance with the rating plate and user manual.
- Complete check items according to section 6.2. Daily inspections.
- Tighten bolted joints according to section 6.9. Tightening torque.
- Check connectors and cabling for wear and pinching.
- Check hoses for wear and pinching.
- Perform tests according to section 6.8. Testing load-holding valves.
- Check the tilt axles according to section 6.4.1. Shimming, tilt upper section.
- Check lubrication according to section 6.3. Tiltrotator lubrication .
- Perform function checks according to section 4.5.2. Function checks.
- Perform checks according to section 6.6. Checking axial and radial play.
- Visual inspection of bushings and spherical bearings; see section 10.2. Tiltrotator overview.

11.1.2. Service every 250 hours

To be performed by the operator according to section 6.4. Service every 250 operating hours.

Fill in section 11.2. Service record.

11.2. Service record

On the service record, there is space to note actions performed on the product that these instructions for use refer to. Specify the date of the action, what was done and who did it. Service partners may also use a stamp in the space provided. This will make sure your product is a safe buy for any future owner.

Date	250 h	500 h	Remark/Action	Stamp/Signature
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	

Date	250 h	500 h	Remark/Action	Stamp/Signature
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	
.....	☐	☐	.....	

Date	250 h	500 h	Remark/Action	Stamp/Signature
.....	☐	☐	.....	.....
.....	☐	☐	.....	.....
.....	☐	☐	.....	.....
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.....	☐	☐	.....	.....

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