

Instruction manual: lifting aid for CRH12E/EL/EXL

Instruction manual for lifting of Sandvik CRH12E/EL/EXL
using a secondary lifting method

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Introduction

This instruction manual refers to product **Sandvik CRH12E/EL/EXL¹**, see Figure 1, and is specified for when the secondary lifting method must be used. The primary lifting method of the product is by means of lifting equipment attached directly to the stem². The purpose of the current manual is to provide the customer and user with instructions to properly lift the product in a correct and safe manner when the primary lifting method is not applicable.

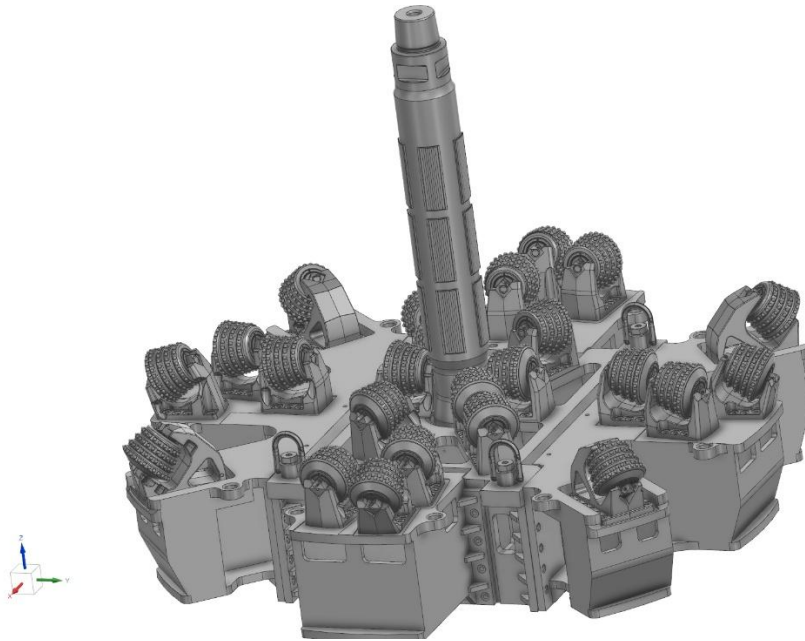


Figure 1. Product marking.

The manual is produced in accordance machinery directive 2006/42/EC and with relevant standards EN 13155.

Manufacturer and its authorized representative: Sandvik³

EC declaration of conformity⁴

Use and storage of the instruction manual

It is important to read the current instruction manual prior to any lifting of the product. For situations that are not covered by the current instruction or user manual, accepted safety regulations or measures are to be applied.

¹ Here and in Figure 1, the designation as marked on the machinery itself is to be used. It should allow the user to clearly identify that the current instruction is applicable for lifting of the reamer head.

² It is suggested to add a reference to an instruction describing this lifting method.

³ Name, address and contact details of the manufacturer and its authorized representative are to be detailed. This requirement may often be fulfilled when using a company template, where such details are already presented in the header or footer.

⁴ Here the EC declaration of conformity is referred to.

Product description

CRH12E/EL/EXL

Different parts of a reamer head

The product is part of a raise boring tool, called a reamer head. It is produced in different shapes and sizes (modular design). The product includes the following modules:

- Reamer base (CRH12E): Centre part of the construction, including lifting points for the secondary lifting method.
- Segments, with additional saddles and cutters: Either permanently or temporarily attached to the reamer base.
- Cutters: Attached to both reamer base and segments
- Saddles: Holds the cutters in place and allows them to rotate
- Stem: Axle used to pull up the reamer head during raise boring. Is also used as attachment for the primary lifting method.

All parts and their placements are presented in Figure 2 below. The illustration demonstrates a larger version of an assembled reamer head. Due to the modular design, the total weight of the assembled reamer head with reamer base CRH12E will vary, see accompanying product sheet of the reamer head. If any confusion arises contact Sandvik.

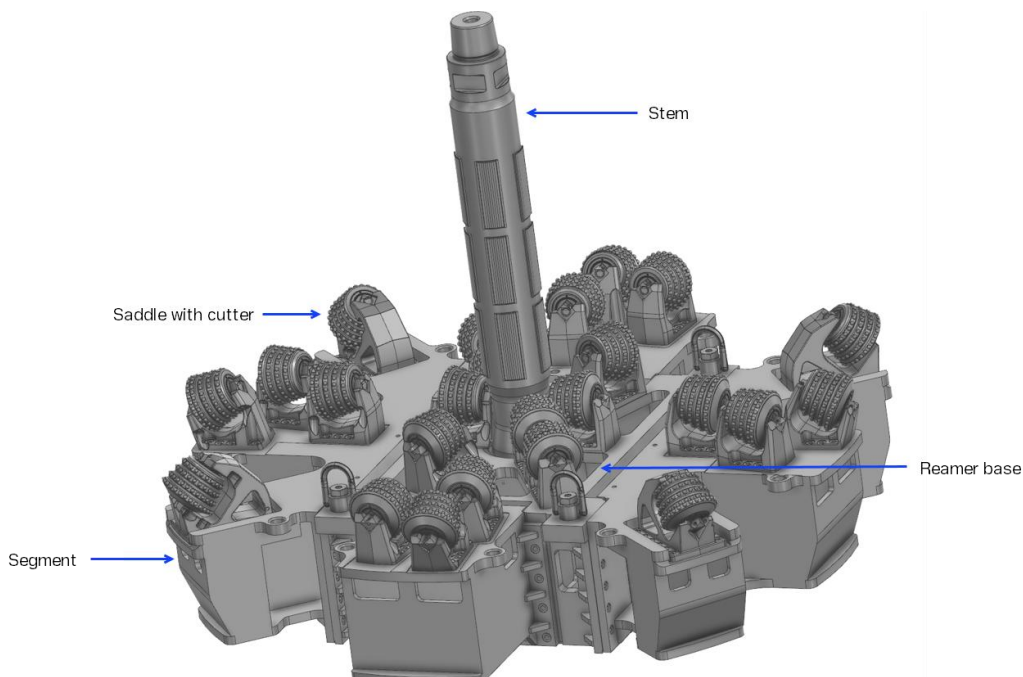


Figure 2. Illustration of the reamer head, base with extension block and supporting plate.

Size: The product's diameter ranges between approx. 3 m to 8 m.

Lifting points

For lifting, the reamer base provides, besides the stem, four lifting points. These points are to be used whenever the stem is not possible for usage (primary lifting method). They are also used when securing the reamer head at the top of the bored hole if needed. The lifting points are located at four extension blocks as threaded holes.



Technical features

External lifting eyes are installed in the four lifting points.

- The size of the bolt of the lifting eye is M64.
- The construction is verified for usage of external lifting eyes with a WLL (Working Load Limit) of 28 ton.
- The construction is verified for usage of external lifting eyes that can rotate 360° and be angled 230°.

Each load configuration refers to different angles, α – lug angle and β – lug rotation, see Figure 3.

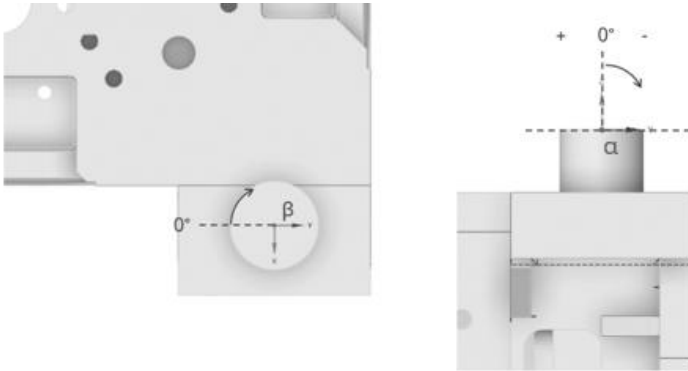


Figure 3. Definition of angles α and β .

For exemplification of load directions for different angles of α and β , see Figure 4. Different associated load configurations are defined below and presented in Figure 5:

- Load configuration A: lifting with a lug rotation angle $\beta = 150^\circ$
- Load configuration B: lifting with a lug rotation angle $\beta = 0^\circ$
- Load configuration C: lifting with a lug rotation angle $\beta = 90^\circ$

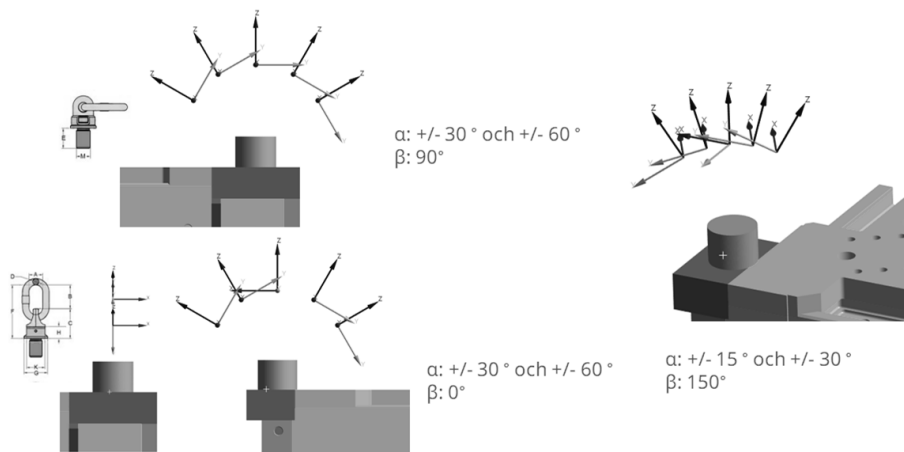


Figure 4. Different examples of load directions.

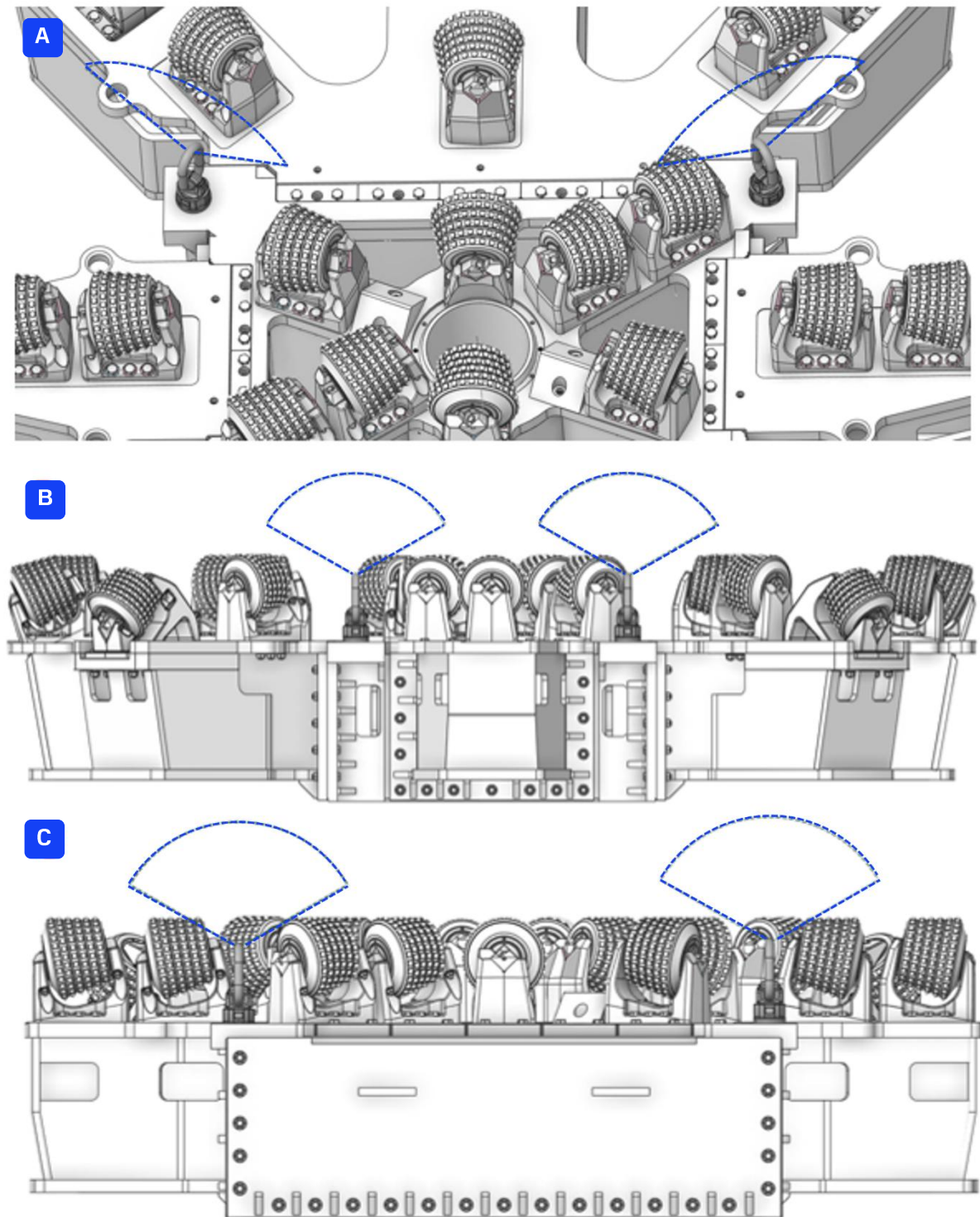


Figure 5. Illustration of load configurations A, B and C.



Overall usage information

The four lifting points are used when the primary lifting method is not applicable. Situations where the lifting points are used are as follows:

- Situations where the construction needs to be secured at the top of the drilled hole.
- The construction needs to be lifted out before the drilling process is finished:
 - Underground
 - At ground level.

Attachment of lifting devices is managed manually by qualified operators. All lifting devices used together with the product should be compatible with the load (total weight) to be lifted.

Maximum allowable loads

In Table 1, maximum loads for different load configurations are presented, see Section 0 for specifications of angles α and β . The total weight of the reamer head to be lifted is detailed in the product sheet of the reamer head. If any confusion arises contact Sandvik. The total weight of the reamer head to be lifted shall not exceed the values specified in Table 1.



Table 1. Allowed maximum loads, assumed all lifting eyes are equally loaded.

Load configuration	Description	β [°]	Maximum allowable load as function of the lug angle α .											
A	Centre line	150	$\alpha < -60^\circ$	$-60^\circ \leq \alpha < -45^\circ$	$-45^\circ \leq \alpha < -30^\circ$	$-30^\circ \leq \alpha < -15^\circ$	$-15^\circ \leq \alpha < 0^\circ$	$\alpha = 0^{**}$	$0^\circ < \alpha \leq 15^\circ$	$15^\circ < \alpha \leq 30^\circ$	$\alpha > 30^\circ$			
			$\emptyset^*$	55 ton	100 ton	110 ton	110 ton	110 ton	90 ton	65 ton	$\emptyset^*$			
B	Parallel to shorter side of reamer base	0	$\alpha < -60^\circ$	$-60^\circ \leq \alpha < -45^\circ$	$-45^\circ \leq \alpha < -30^\circ$	$-30^\circ \leq \alpha < -15^\circ$	$-15^\circ \leq \alpha < 0^\circ$	$\alpha = 0^{**}$	$0^\circ < \alpha \leq 15^\circ$	$15^\circ < \alpha \leq 30^\circ$	$30^\circ < \alpha \leq 45^\circ$	$45^\circ < \alpha \leq 60^\circ$	$\alpha > 60^\circ$	
			$\emptyset^*$	45 ton	110 ton	110 ton	110 ton	110 ton	85 ton	65 ton	45 ton	30 ton	$\emptyset^*$	
C	Parallel to longer side of reamer base	90	$\alpha < -60^\circ$	$-60^\circ \leq \alpha < -45^\circ$	$-45^\circ \leq \alpha < -30^\circ$	$-30^\circ \leq \alpha < -15^\circ$	$-15^\circ \leq \alpha < 0^\circ$	$\alpha = 0^{**}$	$0^\circ < \alpha \leq 15^\circ$	$15^\circ < \alpha \leq 30^\circ$	$30^\circ < \alpha \leq 45^\circ$	$45^\circ < \alpha \leq 60^\circ$	$\alpha > 60^\circ$	
			$\emptyset^*$	80 ton	110 ton	110 ton	110 ton	110 ton	110 ton	110 ton	100 ton	75 ton	$\emptyset^*$	
* Lifting is not allowed.														
** Vertical lifting of the reamer head.														

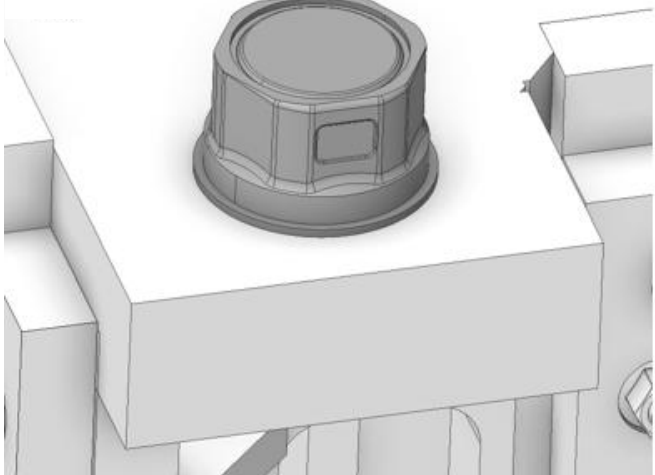
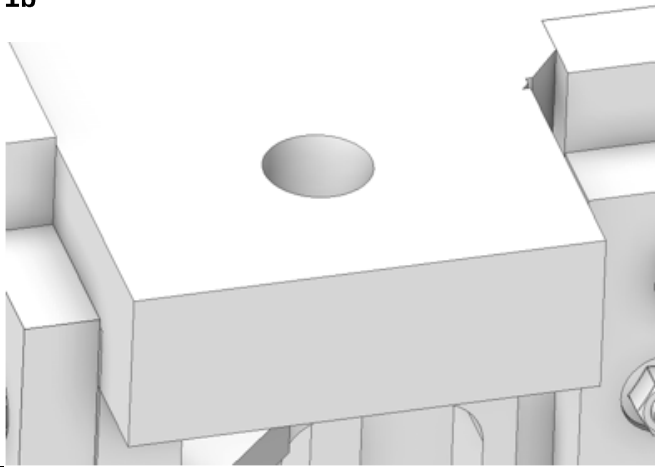


Instructions

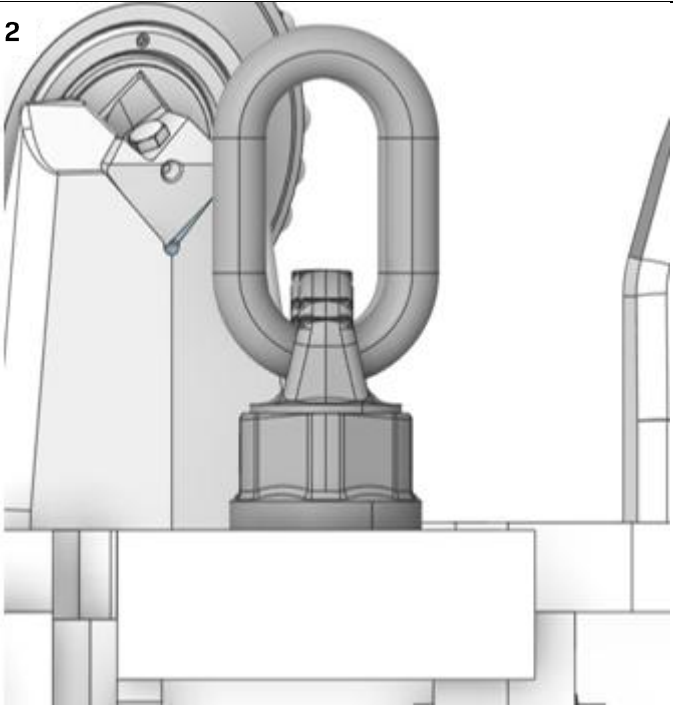
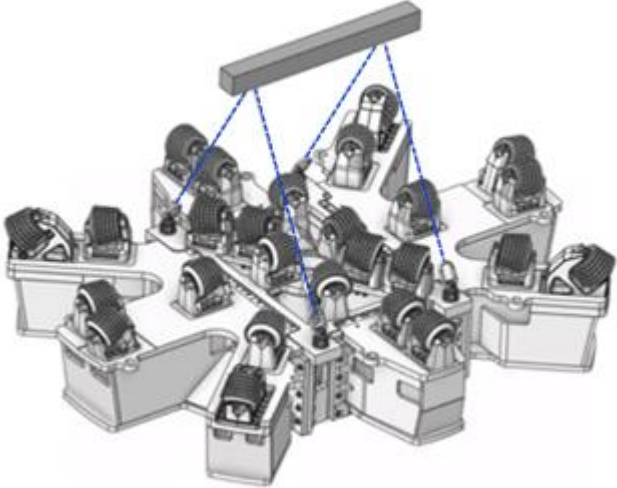
Before installing the lifting eyes in the provided lifting points, all guidelines provided in Section 0 and 0 should be completed and taken into consideration. It is required that the construction is lifted within the allowed lifting angles provided in Section 0 to avoid risk of sudden failure due to uneven loading or overloading of lifting eyes and extension blocks.

Installation and deinstallation – step by step

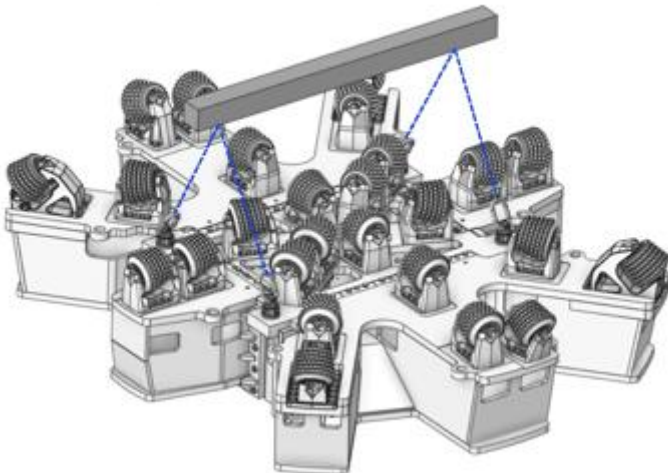
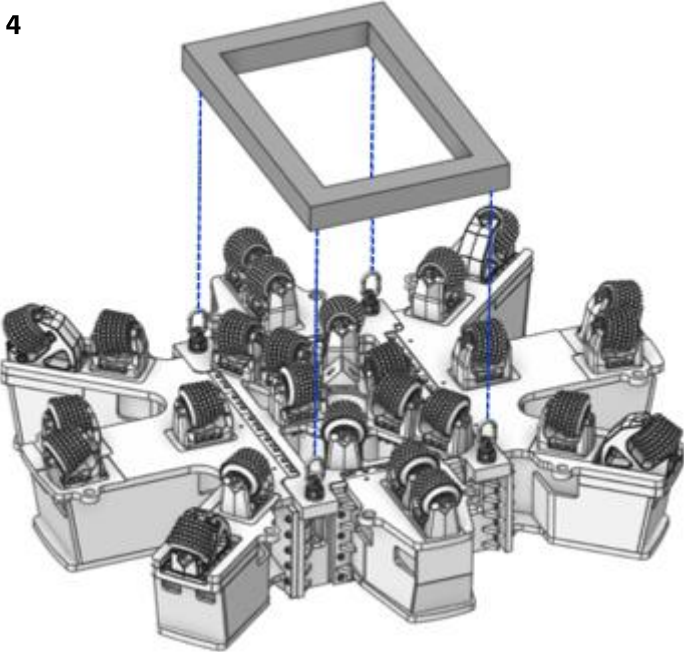
In the current section a detailed step-by-step description of preparing the reamer head for lifting and further use is presented. Further details regarding recommended usage are found in Section 0.

Instruction	Illustration
Step 1: Remove bolt and washer 1.a. Remove the bolt, 7008-9823, and washer, 7008-9824, from the extension block's hole. 1.b Make sure there is no dirt stuck between threads. If the bolt and/or washer is damaged, make sure to replace it with a new one in step 5.	1a  1b 

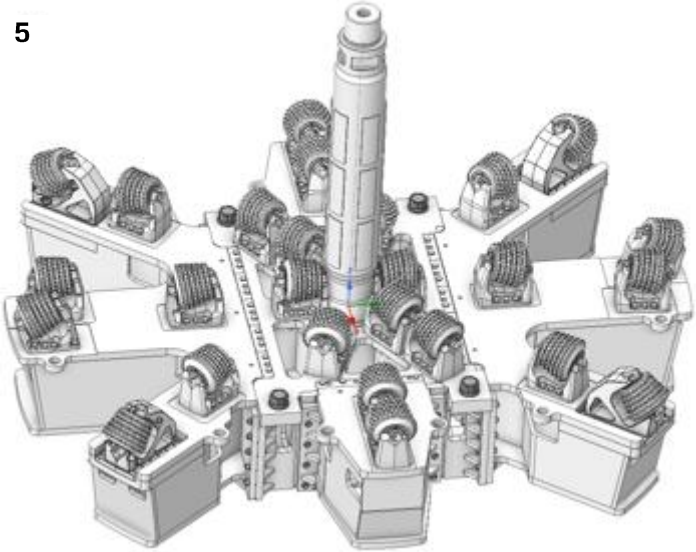


Step 2: Install lifting eye Before installing a lifting eye, make sure it is intact, without fractures, cracks, or excessive wear (see Section 0). Insert the lifting eye, M64, with given torque. The eye is correctly installed when the head has an even, plane contact against the structure. The lifting eye should be installed with given torque 500-1000 Nm.	2 
Step 3: Install other lifting equipment Install lifting equipment in lifting eye. Such as chains, slings, hooks etc. Make sure the load is acceptable for the lifting configuration of your choice, see requirements for different load configurations in 0. Before installing make sure the lifting equipment does not present any damage. Make sure that the lifting devices do not make contact or damage the cutters or saddles on the reamer head. 3.a Shows $\beta = 0^\circ$ and 3.b shows $\beta = 90^\circ$.	3a 



	3b 
Step 4: Start lifting Make sure you are lifting the reamer head or product as evenly as possible. It is required that each lifting eye is equally loaded. This applies throughout the whole lifting process. Depending on the lifting situation, this requirement is ensured by making sure each sling or chain has the same length. If lifting from the reamer base centre, make sure that the hook is aligned with the stem's hole. If you are securing the reamer base by the edge of the drilled hole, make sure the securing points at the edge are at equal distances from the reamer base. These situations refer to negative α angles. Illustration shows vertical lifting, $\alpha = 0^\circ$.	4 



Step 5: After lifting Remove all lifting equipment and lifting eyes from the structure. Make sure the threaded hole in the extension block is clean from dirt, etc. before installing the protection bolt. Install the bolt, 7008-9823, and washer, 7008-9824. The bolt should be installed with given torque 500-1000 Nm. Add grease when changing from bolt to lug and vice versa. See step 1.a for a correctly installed bolt.	5 
Step 6: Transport and storage Follow instructions under Section 0.	

Maintenance

- Maintenance must be performed by qualified personnel with good knowledge of the product.
- Maintenance must be documented.
- During all maintenance the construction needs to be placed, stable and secure, on the ground.
- Maintenance must always be performed before usage when taken from storage.
- Additional inspection of lifting points must be performed after the boring process and before installation of lifting eyes.

Reamer base

- If the product contains any cracks, the part must be repaired or replaced.
- If the product is deformed in an excessive way or in a way that it no longer fits with the lifting equipment, it must be replaced or repaired.
- If the product shows excessive wear, the product must be repaired or replaced.



Lifting eye and lifting device

Besides guidelines from manufacturer's instructions for the lifting eyes or other lifting equipment, the additional requirements below must be followed:

- If the lifting eyes or other devices contains any fractures, the equipment must be replaced.
- If the lifting eyes or other devices are deformed in an excessive way or in a way that it no longer fit, the equipment must be replaced.
- If the lifting eyes or other devices show excessive wear, the equipment must be replaced.
- Recommendations and guidelines from user manuals for lifting eyes and other devices are to be followed.

Storage and transport

- When not used, the reamer base should be stored protected from outer conditions such as weather, that could cause damage and/or wear to the product.
- The reamer base should be stored placed on the ground, not hanging from any of the lifting points nor stem. The product should be stored on a plane surface to avoid tipping. The tilting angle should not exceed 10° in any direction, according to requirements from EN 13155:2021.
- Segments and cutters are recommended to be removed from the reamer base when stored.
- The reamer base is best transported unattached to its segments and cutters, due to space limitations and to avoid damaging any parts.
- If the construction is rented, transport back to the owner should be arranged in accordance with guidance from the owner.



Recommended usage

Before usage, following points shall be met:

- The lugs and reamer base need to be visually inspected by qualified operators.
- All operators who will be managing the lifting operation are obligated to read and understand the instructions as well as the safety regulations.

Conditions

At inspections, the following deviations are to be considered:

- Cracks
- Deformation
- Excessive wear

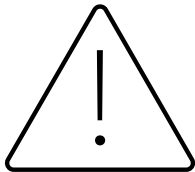
These deviations should especially be looked for at the surrounding welds, the contact surface between an extension block and lifting eye/washer and bolt and the extension block and supporting plate in general.

If one or more of these conditions are present, the maximum allowable loads presented in Section 0 are no longer applicable.

Preparation

The following steps should be followed in order when using the four lifting points, either located on the top surface or side surfaces:

- Confirm that the construction is steady, secured and turned off before inspection and installation of the lifting eyes.
- The reamer head needs to cool down before any operator may perform work on the product.

	The reamer head is hot after use, do not touch any of the surfaces to avoid burning injuries.
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- A general, visual inspection of each threaded hole is performed:
 - Any stone, packed sand or similar debris needs to be removed.
 - If any cracks are found, the lifting point is not permitted for usage
 - If any larger deformations have occurred during the reaming process, the lifting point is not permitted for usage
- Lifting eyes are installed following the instructions provided in Section 00.



Equipment

Used equipment, such as chain slings, lifting beams, lifting yoke, etc. must meet the requirements according to EN 13155.

- Lifting eyes: installed to designated lifting points on the reamer base.
- Shackles: attached to the lugs. The size and allowed load must correspond to other associated devices and lifting eyes.
- Slings/chains/ropes: connection between shackles and lifting eyes. Diameter of slings must be in accordance with shackles. For relevant utilization factor, for the chosen lifting device, see machinery directive 2006/42/EC.
- Slings shall be in accordance with the applicable requirements of relevant parts of the following standards: EN 818, EN 1492, EN 1677 and EN 13414.

Operation and limitations

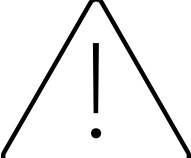
- The construction is manufactured to perform up to 16 000 load cycles (lifting).
- The construction is best lifted from the centre of gravity to avoid risks. The centre of gravity of the crane hook and reamer head must be aligned.
- Uneven load distribution must be avoided for maximum allowable loads to be fulfilled. If the construction is lifted, when the load is not evenly distributed between the four lifting points, risks of sudden failures are increased.
- No individuals or other items are allowed to be placed on top of the reamer while lifting.
- During lifting a surrounding area of at least 2 times the reamer heads diameter must be cleared.
- To avoid risk of collision, the construction should not be lifted at the same time as other constructions are moved by lifting.
- Lifting of heavy loads to higher heights must be performed by certified crane operators. Using temporary operators, who are not meeting the requirements, is not allowed, to perform the work.
- It is not allowed to leave the area and machines while machines are running.
- The crane's lifting capacity must not be exceeded.
- The hook of the crane needs to be secured with a locking device.
- Make sure that there are no gaps between the lifting lugs and the plat surface at the lifting points. Gaps may induce overloading of the lifting lugs.
- Clear communication between operators during lifting should be ensured. Crane operator (or similar personnel managing the actual lift) must be able to have contact with outer operators during lifting.
- Make sure lifting eyes or lugs are correctly installed and secured in each lifting point, see Section 4.1.



Safety regulations

In the current section general safety requirements are detailed.

- Operators must always wear assigned safety gear and equipment specified at the workplace.
- An assigned supervisor is responsible for that all operators have read and understood this manual.
- Only certified lifting equipment is to be used.
- The maximum allowed load, see Section 0, assigned for each lifting angle, should never be exceeded.
- During lifting, the following must be accounted for:
 - Risk of collision
 - Risk of crushing
 - Risk of falling material or construction parts
 - Risk of the lifting device to release from any of the lifting points due to breakage or incorrect installation.
- Lifting is only allowed to be performed during controlled conditions. If any external conditions such as excessive wind, rainfall, snowfall or other that could affect the safety, prevail, then lifting is not allowed.
- Precautions need to be taken to prevent any personal from being under the product during lifting. The work area is to be marked with signs, construction tape or other adequate delimitations to prevent the presence of unauthorized individuals in the work area.
- The product is during lifting not allowed to pass outside the delimited work area.
- Uneven loading between the lifting points could lead to sudden failure of one or more lifting points or lifting devices.

	No individuals should be in the vicinity of a lifted reamer head, to avoid accidents that could lead to injuries.
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- Measures in case of failure:
- If any kind of deviation, mishap or failure is suspected during lifting, the construction must immediately be lowered to ground level and inspected.